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SUGARBUSH RESTORATION POST HURRICANE

Hurricane Fiona greatly impacted the maple syrup industry in Nova Scotia. Some maple producers have reported that more than half of their crop has been damaged or completely lost due to high winds from the hurricane. Many trees were uprooted and/or damaged, and many fell on tubing systems which stretched, broke and damaged the lines.

Damage like this has not been seen in sugarbushes in Nova Scotia, and therefore, the steps to recovery are not well understood. Experts from the northeastern North America region were contacted, including a mix of forestry, sugarbush and agriculture experts. Based on this, some options for sugar producers are outlined here.

The priorities for reestablishing a sugar bush damaged by high winds are as follows:

1. Site clean-up
2. Tubing system reestablishment
3. Evaluating losses
4. Fertilization and building resilience in a sugar bush

Site clean-up and tree removal

Safety is the most important part of site clean-up. Trees are most likely under a lot of tension from other trees leaning on them, which can be extremely dangerous when cutting. This should only be done by someone who knows how to operate in these conditions safely. Work with a professional forester or logger to assess the value of the timber that can be salvaged and assess what remains to create a strategy for moving forward.

Here are some recommendations from the Nova Scotia Woodlot Owners and Operators Association for hiring a contractor:

https://www.nswooa.ca/uploads/5/9/6/9/59690537/nswooa_hiring_a_contractor.pdf

There are several options for clean-up:

- **Salvage whole trees** - Whole trees can be sold as lumber if they can be safely removed from the woodlot. Hardwood lumber can often be valuable; however, some mills are hesitant to take hardwood lumber from sugarbushes due to damage from tapholes and hardware. Be sure to communicate with potential buyers about the product before selling. Leave the root masses of uprooted trees when clearing; this will minimize disturbance and reduce the amount of soil removed from the lot.
- **Cut trees** - The tree can be further cut and used as firewood. This is recommended for trees that need to be removed but are not valuable for lumber because of damage.
- **Leave trees** - This is a viable option if a tree can safely be left on the ground. As long as trees are not interfering with tubing lines and access, they can be left to decompose. This will help return nutrients to the soil and support organic matter enrichment.

- **Restore trees** - Another option would be to attach cables to some trees to try and stand them up. This was conducted in some areas of Quebec after the 1998 ice storm; however, we are not sure of the outcome. Trees that have only been slightly uprooted and still have approximately 75% of their root system may be salvageable and fine roots may reestablish if the damage is not too severe. However, these trees will likely be more vulnerable to additional stresses.

If producers are bringing in machinery to cut and remove trees, some considerations should be taken into account to help reduce the amount of damage to the site:

- Maple operations are often on steep slopes; some areas should be avoided if soil erosion is present.
- Avoid areas with exposed mineral soil or a shallow duff layer (forest floor).
- Avoid seeps and streams or other wet areas.
- Mark off any areas where there might be promising regeneration and try to avoid these.
- Be aware of overhead dangers.

Some other information about site clean-up can be found in the Maple tour section below.

Tubing system re-establishment

Trees that remain standing after trees are cleared should be assessed for crown damage before they are tapped. Trees that have severe damage may suffer from additional stresses such as tapping. Separate the forest into blocks (forest stands) that makes sense based on past management, topography, forest type, the severity of the damage, or maple tubing sections. Estimate the damage within each section by grouping the trees into categories of less than 25% canopy damage, 25-50% canopy damage, 50-75% of canopy damage, 75% or more canopy damage and total loss (trees not standing).

The general rule of thumb:

- Trees with more than 75% damage should be removed altogether, if possible to do so safely.
- Trees with 50-75% damage should be assessed and determined whether they are needed for seed trees or shade to reestablish maple regeneration. Maple seedlings typically want partial shade for regeneration. Full sun will promote other species. These trees can remain within the sugarbush but should not be tapped for several seasons.
- Trees with 50% or less damage should recover and can be left within the stand. More severely damaged trees would probably be best not to tap for a year or two.
- Trees with less than 25% damage can be tapped.

For more information on how to assess crown damage in sugar maple, visit:

https://www.uvm.edu/femc/attachments/project/999/reports/related/68_pdf_2001NAMPManual.pdf

More information about establishing a tubing system can be found in the maple tour section below.

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Evaluating a Sugar stand

Producers who have suffered from hurricane Fiona should evaluate their losses; this can prove to be difficult and will fluctuate over the years. Producers should assess the average per tree production over the past few seasons to estimate the value of losses in their stand. If unknown, producers could use approximately 1L per tree. The value of syrup should be based on the bulk price (barrel price) per pound and not the retail value, as there are added expenses unrelated to the forest in creating the elevated per bottle retail price. The bulk price would essentially be the replacement value if a producer needed to buy a barrel of syrup from someone else to fill jugs and meet their market demand. Losing one tappable tree would create a gap in the forest that would not be replaced with another tree for nearly
50 years.

For example, if the price is CAD 3.50 per pound, that would be approximately a loss of $10.50 per tree per year. Therefore, the loss of one tree could have a financial impact of upwards of $525 without accounting for any inflation. Inflation should be considered, and be sure to identify what inflation rate was used when evaluating your stand. Additionally, a 1% increase in production over time should be accounted for because of increases in tree growth and better tapping techniques. If the tree is sold for wood, that number should be subtracted from the total potential value lost.

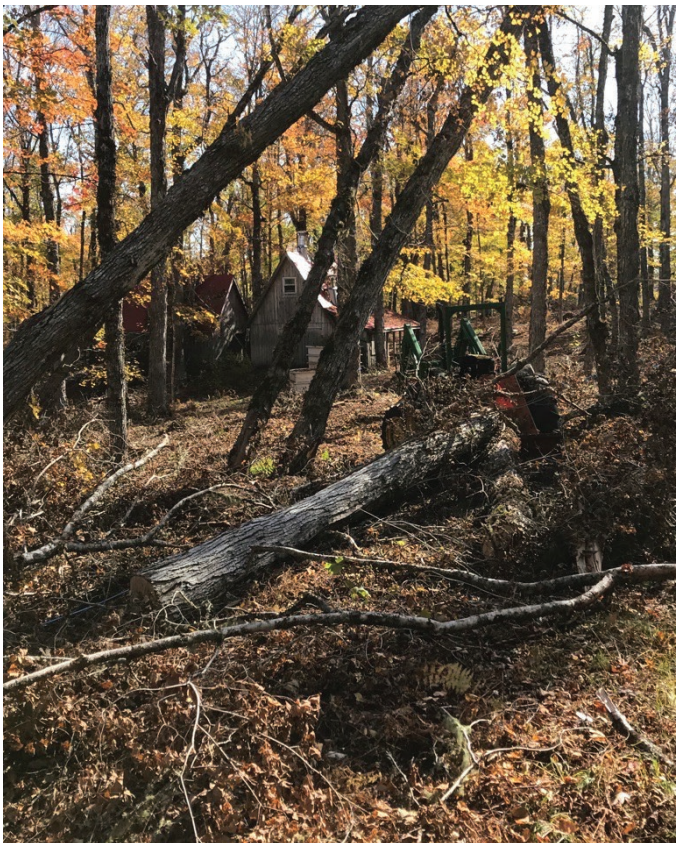
The cost of cleanup and tubing replacement should be considered as well. The tubing would likely need to be completely replaced in severely damaged areas. Tubing costs can be sourced from your local provider. The cost of cleanup can be estimated based on the amount of time and labour required for cleanup.

Keep track of your hours, receipts, and anything else to help evaluate losses.

Fertilizing a sugarbush

After major damage to a sugarbush, they can be susceptible to additional stress agents such as pests and diseases. Therefore, mitigating further damage and building resiliency in the stand is important. Liming can help increase soil and tree calcium, which can help with regeneration and promote long-term resiliency. Liming can help reduce soil acidity and increase calcium concentrations in the soil and trees. Trees with greater calcium concentrations can often recover more quickly from damage (Noland et al., 2006; Robitaille et al., 1995). Also, liming has shown increases in sugar maple regeneration (Sullivan et al., 2013). Calcium is often the limiting nutrient in sugar stands, followed by nitrogen. Therefore, the addition of nitrogen may be beneficial
as well.

Soil amendments are logistically difficult to spread in forested production systems and may require trails through your lot and additional gear. For further information on fertilizing a sugarbush, use the contact information below.



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FAQ

The following questions were often asked in response to hurricane Fiona and are answered here:

1. Some producers would like to produce this year; however, their evaporator is too large to compensate for the number of trees they have lost. Is there anything they can do to compensate for the decreased production?
   - Producers can concentrate less highly with RO.
   - Producers may be able to add water to a section of the evaporator to keep it from burning and only cook on another section. This is not highly efficient and requires more extensive monitoring.
   - Consider partnering with a neighbouring sugarhouse to boil sap together on one evaporator.
2. As producers are clearing their lots, is it important to leave other species behind besides maple? Is there any benefit to leaving other species?
   - Typically, you would like to see approximately 20% non-maple species. However, spruce and fir are not ideal to leave because they can shade out the tubing lines and attract squirrels. Try to encourage any birch, cherry, or ash that may be on your property.
3. What is the minimum number of trees that can feasibly be tapped along a lateral line?
   - It is possible to have 1 tap per lateral line, which can be better for a vacuum system. However, it can increase the tubing cost, especially if trees are spaced farther apart.
4. What is the minimum number of total taps to feasibly continue production?
   - This answer will likely change depending on the size of the operation; however, typically, you want at least 30-40 taps per acre. This will further depend on the productivity of the trees.

Maple Tour 2022

MPANS hosted a tour and meeting on October 22nd in Antigonish County, NS. The following is some information from the tour that may be helpful to producers.

Adam Wild, Director at Cornell University Uihlein Maple Research Forest, gave a talk on Setting up a MapleTubing System. The link to the talk can be found here: **Maple Tour 2022 Webinar - YouTube**.

A Forester discussed some considerations for your woodlot following hurricane Fiona. Some key points that arose from that discussion are listed here:

- Any trees that fell as a result of the hurricane should be cut from the root mass as soon as possible so that the roots may spring back into place, reducing the amount of soil and forest floor lost.
- Clearing your sugarbush is difficult without further damaging standing trees or the underlying soil. Using a skidder or other heavy machinery can be damaging to the underlying soil as it can impact the mycorrhizae and lead to a reduction in tree vigour. Additionally, caution must be taken for hiring private contractors to clear the lot because they may not take care not to scar and damage standing maple trees. Much of the equipment in Nova Scotia may be too large to avoid further damage in a sugarbush. You can consider using a bumper tree when removing logs from your bush.
- Leaving brush on the ground where possible is a good option. The remaining brush can be used as a brush mat for easier access and to help avoid soil compaction.
- Minimize the damage to the forest floor as much as possible. Sugar maple seedlings will not thrive in areas where the forest floor has been removed.
- Observe the regeneration on your lot. Make sure that sugar maple are being regenerated. Some areas may be subject to raspberry regeneration which can outcompete sugar maple and often grow when the soil is disturbed.
- There may be some large gaps in the canopy or wind pockets. This can make your stand vulnerable to further damage in the winter.
- If you want to expand, assess your site's drainage. Sugar maple do not like to regenerate in wet areas.
- There is no one size fits all solution, and your site will need a site-specific prescription.

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Funding Post-Fiona

There are several streams of funding that can be accessed after Fiona.

- Disaster financial assistance for small businesses: Hurricane Fiona: **https://beta.novascotia.ca/disaster-financial-assistance-small-businesses-hurricane-fiona**
- Farm Emergency Response Grant Program: **https://novascotia.ca/programs/farm-emergency-response-grant/**
- Also, the Nova Scotia Federation of Agriculture (NSFA) has a new website page just for Fiona. Please visit this link to search for useful information for your purposes: **https://nsfa-fane.ca/fiona/.**
- More information about these programs can be found here: **https://novascotia.ca/hurricane-fiona-support/**
- Funding may also be available for woodlot owners, this effort is being coordinated by The association of Sustainable Forestry, and the request form can be found here: **https://www.asforestry.com/hurricane-fiona-woodlot-assistance-request-form-2/**

For more information, please contact

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Additional Resources

North American Maple Syrup Producers Manual (2022): **http://157.245.92.171/wp-content/uploads/NAMSPM3sm.pdf**

Noland, T. L., McVey, G., & Chapeskie, D. (2006). Ice storm and fertilization effects on root starch, sap productivity and sweetness, diameter growth, and tap hole closure in sugar maple stands of eastern Ontario. Forest Research Note - Ontario Forest Research Institute, 6-6.

Robitaille, G., Boutin, R., & Lachance, D. (1995). Effects of soil freezing stress on sap flow and sugar content of mature sugar maples (Acer saccharum). Canadian Journal of Forest Research, 25, 577-587.

Sullivan, T. J., Lawrence, G. B., Bailey, S. W., Mcdonnell, T. C., Beier, C. M., Weathers, K. C., . . . Bishop, D. A. (2013). Effects of acid deposition and soil acidification on sugar maple trees in the Adirondack Mountains, New York. Environmental Science and Technology, 47(22), 12687-12694.