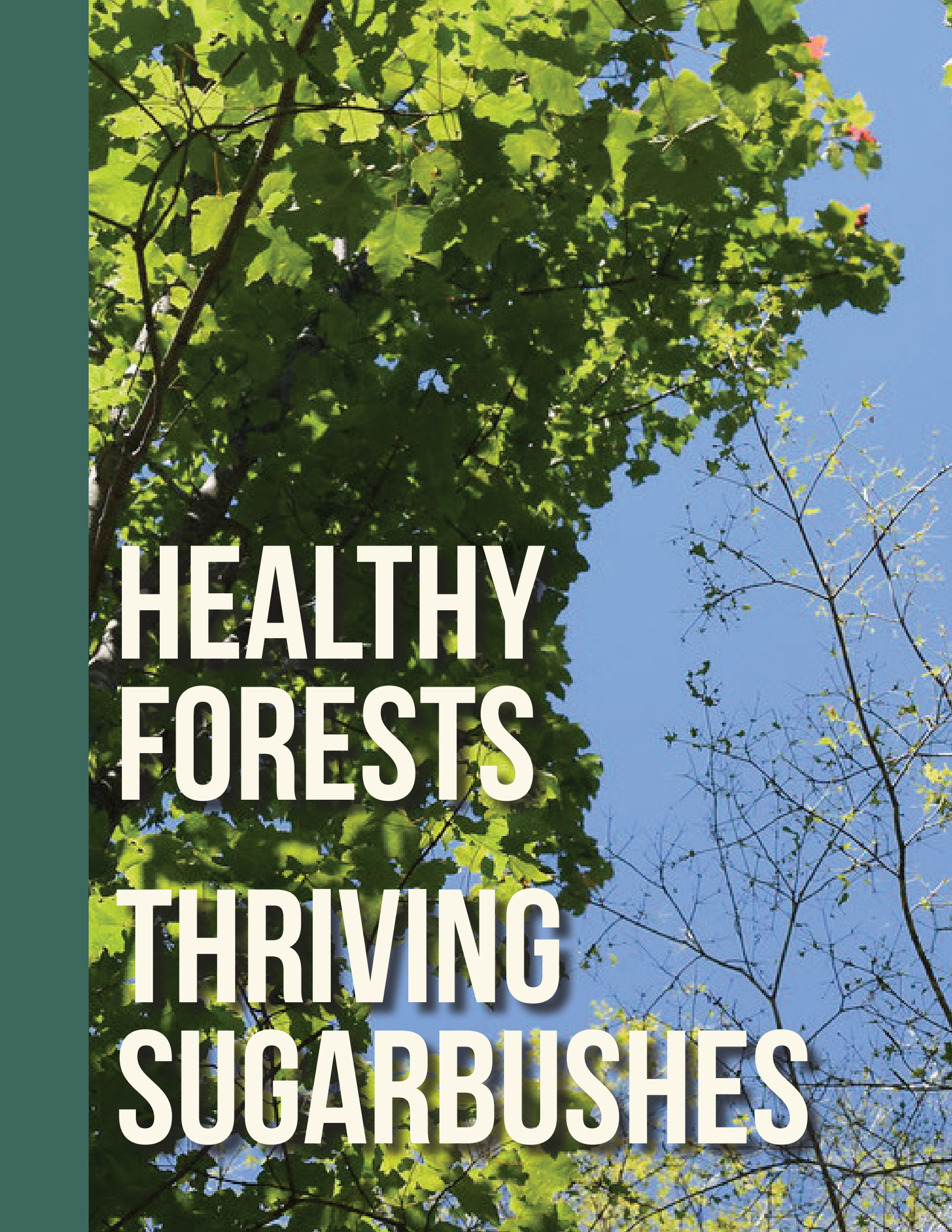




HEALTHY FORESTS THRIVING SUGARBUSHES

USE STANDARDS UPDATE	11
----------------------------	----

ACCESS TRAILS & WATER QUALITY	12
-------------------------------------	----

BIODIVERSITY IN THE SUGARBUSH	16
-------------------------------------	----

ACCESS MANAGEMENT	18
-------------------------	----

CASE STUDIES

BACKWOODS ALCHEMY	23
-------------------------	----

BRANON FAMILY MAPLE	24
---------------------------	----

MEADOWSEND TIMBERLANDS	25
------------------------------	----

PROCTOR MAPLE RESEARCH CENTER	26
-------------------------------------	----

RUNAMOK MAPLE	27
---------------------	----

CONTRIBUTERS:

KEITH THOMPSON

VT Dept of Forests, Parks, and Recreation

MOLLY WILLARD

VT Dept of Forests, Parks, and Recreation

DR. ANTHONY "TONY" D'AMATO

University of Vermont

MARK ISSELHARDT

University of Vermont Extension

STEVE HAGENBUCH

Audubon Vermont

NICOLE DEHNE

NOFA-VT/Vermont Organic Farmers

ALLISON HOPE

Vermont Maple Sugar Makers' Association

A COLLABORATIVE STATE EFFORT TO SUPPORT HEALTHY FORESTS & HEALTHY SUGARBUSHES

Sap isn't the only thing flowing from a well-managed sugarbush. Clean water, carbon storage, wildlife habitat, and recreational opportunities are just a few of the additional benefits a healthy sugarbush can provide—right alongside quality sap production. But these benefits don't happen by accident. They depend on careful, long-term stewardship.

Some common practices used to develop or maintain a sugarbush for sap production can unintentionally reduce tree health, forest structure, species diversity, or soil stability—things that are critical not just to forest health, but also to the long-term success of sugaring operations.

Today, only a small percentage of Vermont's maple trees are tapped, leaving plenty of room for growth here and across the Northeast. As the industry expands, there's a growing need for practical, science-based guidance that supports both sap production and forest health.

Vermont Forest Parks and Recreation secured a USDA Forest Service Eastern Region State and Private Forestry Landscape Scale Restoration Grant, titled Healthy Forests, Healthy Sugarbushes. The grant has supported a collaboration between VT Forests, Parks and Recreation, Vermont Maple Sugar Maker's Association, University of Vermont, Vermont Organic Farmers, Vermont Audubon, and University of Vermont Extension to support sugarbush management in a manner that advances forest health, biodiversity, and the goals of Vermont's State Forest Action Plan. Well managed sugarbushes are a critical part of our economy, culture, forest health, and our future.

The resources developed through the project are designed to support on-the-ground management of sugarbushes and the maintenance of healthy forests. We hope that the resources will have lasting value for the sugaring community. Beyond the resources produced through the project, the process helped build relationships between collaborating organizations to extend beyond the grant and into shared understanding and messaging.

Thanks to VMSMA for supporting the development of this special issue of their newsletter. We're excited to share a few of the new tools developed through this project to support healthy, productive sugarbushes.

Highlights include:

- » A **Best Management Practices (BMP) guide** focused on enhancing biodiversity in sugarbushes
- » A practical guide for **forest management in sugarbushes with tubing in place**
- » **Five case studies** highlighting how biodiversity connects to tree health and wildlife habitat

These resources were created with input from sugarmakers, foresters, and biologists to offer science-based, practical guidance you can apply in your woods. VMSMA will continue to share this work in future newsletters, at their annual conference, and through other outreach efforts.

Few people care more about their woods than the sugaring community. And it takes dedication to manage both for today's sap and tomorrow's forest. We hope that these resources help you reach your goals in the woods – to keep your forest healthy, productive, and resilient.

Thanks for everything you do to make Vermont such a sweet place to live!

UPDATES COMING TO CURRENT USE SUGARBUSH STANDARDS

Maple sugaring is truly part of Vermont's identity. It is important to Vermont's economy, its culture, and its heritage. One important tool that helps sustain sugaring in Vermont is the Use Value Appraisal program, also called Current Use. Current Use is widely celebrated as one of the state's most successful conservation programs.

Established in 1978, it helps keep Vermont's working forestland affordable by enabling land to be taxed at its use value as opposed to its fair market value, often saving enrolled landowners thousands of dollars per year. Part of what makes Current Use so successful is its combination of tax savings, planning, protection, and sustainable working lands requirements.

The forestland elements of the program are administered by the Vermont Department of Forests, Parks, and Recreation (FPR). More than 2,000,000 acres are enrolled in the forestland category of the program, and we estimate this includes roughly 800-1000 sugarbushes comprising more than 150,000 acres.

To maintain eligibility, forestland in the program is managed according to the Minimum Acceptable Standards for Forest Management established by the Commissioner of the Department Forests, Parks and Recreation and a Forest Management Plan that has been approved by the Department. These standards help to ensure that the purposes of the program are met. The purposes of the program outlined in 32 V.S.A. § 375 include:

- 1 Encourage and assist in the maintenance of Vermont's productive agricultural and forest land,
- 2 Protection of Vermont's natural ecological systems and services,
- 3 Prevent accelerated conversion of these lands to more intensive use by the pressure of property taxation.

The Minimum Acceptable Standards for Forest Management were last revised in 2010, and the Sugarbush Management Standards and Tapping Guidelines in Use Value Appraisal were added in 2014. FPR is currently in the process of revising these standards. The current standards can be found at fpr.vermont.gov/documents-and-forms. The "Manual" refers to broad standards applicable to the forest management and plans for all forestland, and the "Sugarbush Management Standards" refer to standards that apply specifically to enrolled forestland with trees tapped for maple sap.

The standards are getting revised to:

- 1 Consolidate previously separate standards into a single document for easier reference
- 2 Improve format and indexing to support efficient use
- 3 Enhance clarity to reduce back-and-forth during review
- 4 Create a consistent template for plan review by FPR
- 5 Align program elements with statutory purposes and evolving forestry practices and stewardship principles

This summer (2025), a draft of the standards will be made publicly available with opportunities to provide feedback and discuss proposed changes before the final draft is developed.

Examples of changes relevant to sugarmakers with enrolled forestland:

1 Reference the latest tapping guidelines

The revised standards will reference the most up-to-date guidelines from the North American Maple Syrup Producers Manual, 3rd edition, 2022. The current UVA tapping guidelines are outdated and do not reflect the current state of the science or industry best practices. Referencing these guidelines helps to support a consistent approach within the sugaring and forest stewardship community.

2 Acknowledgment of current status of Acceptable Management Practices (AMPs) in the forest management plan

AMPs such as waterbars and well-designed stream crossings, are the strategies to minimize erosion on sugarbush access roads. While the AMPs are already required on Current Use-enrolled forestland, their implementation has historically been documented in management plans. Including this information will help document eligibility and help identify opportunities for improvements if needed.

3 Differentiation of tapped vs. untapped areas in plans and maps

Forest management plans and maps often combine tapped areas with areas managed for sawtimber. Separating these into distinct stands with different objectives will streamline plan review and better illustrate the role of Current Use in supporting sugaring. This is not intended to require micromapping of every tap but rather to encourage, for example, a 100-acre stand with 50 acres of tapped trees and 50 acres of sawtimber to be mapped and described as two separate management units.

Please stay tuned for more information on the draft standards and opportunities to review and comment.

In the meantime, if you have any questions or comments, please feel free to call Keith Thompson at 802-498-5169 or keith.thompson@vermont.gov.

Keith Thompson is a licensed forester and the Private Lands Program Manager with VT Department of Forests, Parks, and Recreation

SUGARING ACCESS TRAILS AND WATER QUALITY

Maple syrup production (or “sugaring”) is an important industry in Vermont, and a common use of forestland within the state. Though access road networks and maintenance strategies utilized in sugarbushes have many parallels with the road and trail systems associated with logging activity, access requirements for sugaring are unique and often differ from traditional patterns of forest access for timber production.

In most forests managed for timber production, logging occurs on regularly scheduled harvesting intervals ranging from 15-25 years. To control erosion and protect water quality, the Acceptable Management Practices (AMPs) are installed before, during, and after such harvesting activities. The specific practices used, whether on skid trails, forest truck roads, or stream crossings, are designed to function properly, and protect the site’s water resources until the time of the next harvest entry. This assumes the property will see minimal vehicle or equipment traffic until access is again required for forest management.

Alternatively, an actively managed sugarbush will see annual entries – generally with a different suite of equipment, such as ATVs, UTVs, or small tractors – to carry out the necessary activities required for sap collection. This might include tapping trees, installing or repairing sap lines, line inspection, or removal of trees on sugaring lines and trails. Though some activities associated with sugaring or sugarbush management are carried out in the summer or winter months (the most common seasons for forest management activities), the heaviest vehicle traffic on sugaring access trails is generally during the spring, when soils are saturated and vulnerable to damage from equipment. This combination of fragile soils, heavy annual traffic, and the use of different types of equipment requires a nuanced approach to protecting water quality.

While the AMPs were designed to be used on forest roads and trails when harvesting occurs, they are not always suited for roads and trails with the frequency and intensity of a modern sugaring operation. Consequently, there are a few variations or modifications to the Acceptable Management Practices (AMPs) that can be made to protect water resources and enhance the resiliency of sugaring access networks.

It’s important to note that this approach is not less stringent than AMP implementation during logging, but follows more durable standards to allow for the increased intensity and frequency of use during sugaring activities.

USE OF EXISTING TRAILS

It’s not uncommon for old skid trails, previously used for removing timber, to be converted to sugaring access trails when the site is converted to a sugarbush. If the trail is in a poor location, wasn’t closed out properly following logging, or hasn’t been maintained (and often a combination of these), the trail’s problems will likely only get worse – sometimes much worse – with management for sugaring operations. Therefore, it’s important to decide whether use of the trail should continue, prior to making any necessary improvements.

Use the following questions to assess whether the existing skid trail is a good option for sugaring access.

- » Does the trail run on very steep slopes (>20%), when a more gradual route to access the area exists?
- » Does the trail unnecessarily encroach on the forested buffer, or the area of continuous forest cover along a stream, wetland or other water feature? See AMP Table 4 to determine required forested buffer widths.
- » Are large sections of the trail very wet, or sit on seasonally saturated soils? Soil stabilization measures such as corduroy or armoring with stone can sometimes be used to improve operability in these circumstances. However, if normal operation on the trail consistently causes large ruts, rerouting may be the best option for both operability and protection of water and soil resources.
- » Are there unnecessary or poorly sited stream crossings on the trail? Because of the intensity of traffic by ATVs/UTVs and other equipment during sugaring operations, it is critical that stream crossings are properly located to minimize risk of water quality impacts.
- » Does the trail fall within a jurisdictional wetland? Maple sugaring does not fall under the silvicultural exemption in the Vermont Wetland Rules and any maintenance or rehabilitation of the trail will require a wetland permit.

If the answer to one or more of these questions is yes, closing and relocating the trail to a route with fewer operability or water quality concerns is likely the best option, both for long-term sugaring access and protection of water resources.

LAYING OUT AND CONSTRUCTING NEW SUGARING ACCESS TRAILS

Because sugarbush access trails are long-term landscape features, their location must be carefully chosen to meet the landowner's need for safe and reliable access to the sugarbush; avoid long-term maintenance problems; reduce potential for water quality impacts; and minimize costs. During the planning phase of sugaring access trail construction, consider the following:

- » Where will main lines be sited within the sugarbush? Consider how primary trails can provide reasonable access to main lines and key locations within the collection system. These trail sections will likely receive the heaviest traffic throughout the sugaring season,
- » Spur trails (shorter trail sections which branch off primary trails) can provide access to sections or stands within the sugarbush for tapping as well as installation or maintenance of lateral lines. Spur trails should be laid out strategically and only as necessary to avoid excessive trail networks within the woods, with the appropriate water quality practices in place.

WATER RESOURCES

Document the location of water features on the property, including intermittent and perennial streams, wetlands, vernal pools, or areas of concentrated flow. Design the trail system to reduce the necessary stream crossings and to avoid wet areas, steep slopes and other locations where soil stabilization measures or additional diversion structures will be necessary. Proper layout of trails will reduce installation and maintenance costs, as well as provide for both operational efficiency and long-term resiliency of the trail network.

Though taking the most direct route from point A to point B within the woods can save a small amount of time during sugaring operations, it may lead to additional costs relating to trail restoration or equipment repairs if site factors are not accounted for. Implementing turnouts and designing trails to follow more gradual side slopes and contours rather than running directly uphill will reduce the number of water diversion structures needed.

EROSION CONTROL

Any forest road or trail, whether it's a skid trail or sugaring access trail, interrupts the natural flow of water on the landscape, and as a result concentrates flow. This concentrated flow can cause erosion, damage infrastructure and carry sediment down the trail and potentially create a discharge to a waterway. Two of the key principles of the AMPs are to spread the water back out and disconnect surface waters from streams.

- » AMP table 1 will show the correct distance between water diversion structures based on the slope of the trail. Installing waterbars at this spacing is key to spreading water back out and enhancing trail resiliency.
- » A disconnection waterbar should be located 25 feet back from the streambank on every approach to a stream crossing. This will turn surface water off the trail and into the forest buffer where the sediment will be filtered out before entering the stream.

Other practices can be employed to reduce erosion and increase the reliability of access trails in difficult areas such as water crossings and wet ground. These practices are modifications of the AMPs that are well suited for sugaring access trails.

- » Shape trail surface to shed water by out-sloping where possible
- » Harden trail surface with stone or corduroy
 - » If using stone:
 - Install woven road fabric where the hardening will take place
 - Apply and compact 3" clean stone to a depth of 6" for the width and length of trail as needed
 - » If using corduroy:
 - Utilize on-site trees of low quality, ranging in size from 6-10" dbh, to create corduroy
 - Cut the corduroy to a length equal to the trail's width. Make sure the trail is a few feet wider than the equipment being used on it.
 - Set 6-10" diameter corduroy side-by-side and perpendicular to the trail for as long as needed



Wet section of trail hardened with stone.



Example of log reinforced waterbar



Example of corduroy section of trail

- » Where soils aren't suitable for building durable waterbars, consider bringing in materials that will better hold up to sugaring operations.
- » Build waterbars out of material such as crushed gravel or plant mix. This will create a more durable structure that will also be easier to build.
- » Utilize logs to reinforce waterbars, or create waterbars made with materials such as guardrail or conveyor belts. These structures take more time to install, but can work well in key locations.

DITCHING

Ditching is typically a practice that we see only on forest truck roads, or roads that have material brought in to support the travel surface and hold a crown which sheds surface water into the ditch. Ditching can lower the water table around the road and move water off the site so that it doesn't create wet spots. When ditches are created, they require additional practices like cross drain culverts or turn outs to get the water out of the ditch and away from the road.

Sugaring access trails that are laid out and drained properly with waterbars will often not benefit from ditching. While ditching is a common practice for forest truck roads, creating ditches on sugaring access trails damages roots and can induce stress to the stand which often causes crown dieback. In addition, unless gravel is installed on the trail surface, native material will not hold a crown and therefore the trail surface will continue to become rutted and water will not shed into the ditch. Along with the added expense of installing and maintaining the ditching, you will need to install cross drain culverts based on table 1 of the AMPs.

STREAM CROSSINGS

The first step to building a good stream crossing is choosing the right location. Given that stream crossings include the stream channel, stream banks, and the trail approaches within the forest buffer, choosing the right location is important. This will reduce impacts on water quality and will reduce repair and maintenance costs. When choosing an appropriate crossing site, look for the following conditions:

- » Relatively straight and narrow stream channel with well-defined banks
- » 90° crossing angle with approaches less than 10% slope
- » Unobstructed flow with low stream gradient
- » Stable stream banks with good soil drainage on the approaches
- » When selecting a ford crossing, choose a site with a hard stream bed (gravel, cobble, or ledge) and shallow water.

Most stream crossing sites used in sugaring will not support a ford crossing because of the high spring flows and regular traffic. These conditions are likely to create a discharge and will be constant trouble spots and cause access limitations.

Once the right location has been chosen, the next step to building a good stream crossing is selecting an appropriate structure that best matches the site and stream characteristics. All culvert and bridge crossings shall be sized according to Table 2A and Table 2B in the AMP Manual. Site-specific information about the stream (bank full width, active channel width, watershed size, type of streambed) will be needed to properly size and correctly install the appropriate crossing structure. When installing stream crossing structures, refer to the Stream Crossings section of the AMP manual. The manual can be found searching for “Vermont Acceptable Management Practices in a search engine, or at: <https://fpr.vermont.gov/forest/managing-your-woodlands/acceptable-management-practices>

If you are working on a trail with an existing crossing, use these steps to evaluate the crossing and determine if it requires improvement.

For culvert crossings, the culvert should be sized appropriately to the drainage area of the stream (see table 2A in the AMPs). If the culvert is perched or has an “hourglass” shape as it meets the road, the culvert is likely too small. Culvert end-treatments are important in protecting the structure, and they should be constructed with stone. This helps identify where the crossing is located, and also stabilizes the road material around the culvert ends.

For bridge crossings, the bridge should be sized appropriately to the drainage area (see table 2B in the AMPs). Bridges should span the stream channel and abutments should not be located within bankfull width. Bridges are preferred to culverts in many instances because they provide a natural stream bed substrate and provide aquatic organism passage.



Example of bridge crossing with disconnection practice

MAINTENANCE

Monitoring and maintenance of sugaring access trails is crucial to the overall health of the sugarbush and spreading out the water as designed. An investment was made to build a trail network; therefore, efforts should be made to protect that investment. When trail networks are properly built and maintained, impact from storm events is minimized, directly reducing the cost of repairs. The type and cost of maintenance will be determined by the intensity of the use, the type of structure being maintained, and characteristics of the site.

Periodic monitoring and maintenance is also required to ensure that stream crossings continue to function properly. All crossings should be inspected yearly to ensure that they are not damaged or failing. Also, observe the water traveling through the crossing and determine if it is flowing under or around the structure. Culverts especially are prone to piping if not installed properly, and this can create sedimentation to the stream, as well as weakening the culverts strength and reduce the life span of the culvert. All crossing structures should be checked for debris and blockage every spring and after storm events.

Dave Wilcox is the Watershed Forester with the Vermont Department of Forests, Parks and Recreation. For questions about your forestland, you can reach out to your county forester <https://fpr.vermont.gov/forest/list-vermont-county-foresters>. You can also reach to the AMP forester contacts at <https://fpr.vermont.gov/forest/managing-your-woodlands/acceptable-management-practices/AMPcontacts>.

MORE THAN SYRUP: SUPPORTING BIODIVERSITY IN THE SUGARBUSH

Steve Hagenbuch (Audubon Vermont), Nicole Dehne & Nick Sibley (Vermont Organic Farmers LLC)

Maple sugaring is one of Vermont's most culturally and economically significant traditions. This sweet endeavor enriches our communities and strengthens our economy. It brings people together, connects us to the land, provides employment opportunities, and contributes to our tourism industry. Maple sugaring also preserves our working landscape and keeps forests intact. When good practices are followed, sugarbush management can support healthy forest ecosystems and encourage biodiversity.

WHAT IS BIODIVERSITY?

Biodiversity (or biological diversity) refers to the variety of life on Earth. It encompasses living organisms at all scales—plants, animals, fungi, and microorganisms—and the ecosystems they inhabit. Biodiversity can also include genetic diversity, or the biological variation that occurs within a species. More than that, it covers the full range of processes, such as nutrient cycling, carbon and nitrogen fixation, pollination, and beneficial predation. Ultimately, viable maple syrup production, now and in the future, can best be realized by promoting diversity in the sugarbush today.

WHY IS BIODIVERSITY VALUABLE?

Sugarbush biodiversity fosters resilience. Forests with greater diversity are more resilient to disturbances caused by pests, disease, and climate change. Forests with a variety of species and genetic variation can better adapt to shifting conditions. Each species has a unique niche and plays specific roles within an ecosystem. If one species declines, another with similar traits may be able to step in and play a similar role, thereby maintaining the function of the ecosystem in the face of change. For sugar makers, biodiversity is important because the success of your business depends on the resilience of your forest.

Awareness of biodiversity is increasing amongst consumers. Many consumers are choosing to support businesses that protect and support natural resources. Demonstrating your commitment to promoting forest health and biodiversity may help your products stand out in the marketplace and give your business a competitive advantage.

HOW CAN YOUR SUGARBUSH SUPPORT BIODIVERSITY?

Maple production is well-suited to addressing a number of the main threats to biodiversity. Sugaring keeps forest as forest thereby preventing the loss of habitat and sustainable sap harvesting does not inherently lead to overexploitation of the forest resource. However, a sole focus on any one management objective, such as sap production, can have unintended consequences if other forest values are disregarded. Thoughtful sugarbush management can improve

habitat, increase resilience to climate change and other stressors, remove invasive species, and promote clean water.

For most operations, opportunities exist to accommodate the needs of local species with only minor changes to activities. Many sugarmakers are already contributing to biodiversity with some of their practices.

BEST PRACTICES FOR IMPROVING BIODIVERSITY

Control interfering vegetation. Interfering plants are either native or introduced invasive plants that interfere with achieving forest management objectives. They can impede efforts to establish seedlings of maple and other desirable tree species - the future sugarbush.

Strategies and techniques to control interfering plants depend on the species, its abundance, how thoroughly the maple producer wants to control the plant, and the producer's use of herbicides or organic strategies. As one of the greatest threats to biodiversity, knowing if you have an issue with introduced invasive plants, and then taking steps to mitigate their impacts, is one of the most important sugarbush management actions that can be taken.

Regenerate the future forest. Sugar maple can be a long-lived tree, capable of reaching 300 to 400 years of age. Mature and maturing (~40 yr old) trees are essential to a sugaring operation as they are the trees that can be sustainably tapped today. Tending those trees can ensure their long-term health and vigor. As an industry that relies on a natural ecosystem to be viable, it should not be overlooked to consider both the short and long-term future of the forest so the next generation of maple producers has a resource available to them. It is therefore essential to plan for regenerating the forest and following up with implementation at the appropriate time.

A forester should be consulted to determine the most appropriate regeneration techniques and timeframe for each particular situation. When and where possible regeneration treatments are best implemented during dry or frozen ground conditions and avoided during the forest bird nesting season, typically May - mid-July.



Birds such as Wood Thrush are indicators of sugarbush biodiversity
(Photo: Linnet Tse/Audubon Photography Awards)

Carefully layout woods roads and trails. While tree boles and crowns are often the focus of attention for maple producers (ie “looking up”), leaf litter, soils, and tree root systems (ie “looking down”) should not be overlooked. Leaf litter and mineral soil provide the germination substrate for sugar maple seeds. Roots anchor the tree, pull water from the ground, and extract nutrients necessary for tree survival.

Damage to soils and roots by mechanized equipment, such as tractors, skidders, and ATVs, can cause irreparable damage. Although sugarbush access is critical during the production season, minimize the number of trails and position them in areas that are stable, dry, and on gentler slopes. When designing and installing tubing systems, consider doing so in ways that minimize conflicts with large mammal movements, thereby maintaining habitat connectivity.

Support vegetative diversity in all forest layers. Your sugarbush will generally be healthier, support greater biodiversity, and be more resilient to stressors if there is a variety of tree, shrub, and other plant species. Increased tree species diversity in sugarbushes significantly reduces the presence and impact of sugar maple insect pests and disease.

When thinning a sugarbush to provide more growing space to desirable trees, avoid the temptation of creating a monoculture by removing all species besides sugar and red maple. Providing adequate space and resources to keep a maple tree healthy may be best accomplished by cutting another maple. Yes, it is okay to cut a maple tree! When cutting trees in the sugarbush, set a target for the main canopy to be no more than 75% sugar maple as measured by basal area, a common forestry measurement. Consideration of vegetative diversity should also extend to herbaceous plants that may support native pollinators as well as midstory and understory forest layers as these will ultimately comprise the future forest canopy.

Maintain current and recruit future deadwood. Standing dead trees (snags) and logs and branches on the forest



Standing dead trees (snags) provide valuable habitat to birds and other wildlife (Photo: Steve Hagenbuch)

floor are components of a healthy forest. Live trees with natural or excavated cavities are also important as nesting and denning sites. Consider retaining at least two snag and cavity trees per acre that are greater than 10” in diameter.

Once snags have fallen to the forest floor they provide coarse woody material. This downed woody material provides protective cover for salamanders and a wide array of invertebrates. Large logs serve as drumming display sites for Ruffed Grouse. In addition a “messy” forest floor with abundant downed wood helps to slow, spread, and sink water during heavy rainfall events. Strive for 3-5 logs > 18” diameter and 10 logs >14” diameter per acre to be left on the forest floor. Prioritize logs that are > 16’ in length.

For the greatest biodiversity benefit, all tops of felled trees (material <4” in diameter) should be left in the forest.

To support Vermont’s maple industry as a solution to addressing the global biodiversity crisis, Vermont Organic Farmers (VOF) and Audubon Vermont have created sugarbush biodiversity best practices resources. These include a set of reference cards that will help sugar makers assess biodiversity within their woods. Biodiversity benchmarks are listed within this pocket-sized resource and can be carried as you walk your woods to evaluate current conditions and consider opportunities for improvement. In addition, a more comprehensive sugarbush biodiversity best practices guide includes management actions that producers can engage in to assist with continual biodiversity improvement. These resources will be available on both the VOF and Audubon VT websites in the near future.

Funding for this project was made possible by a grant from the U.S. Department of Agriculture (USDA) Agricultural Marketing Service and the Vermont Agency of Natural Resources (ANR) Department of Forests, Parks and Recreation. Its contents are solely the responsibility of the authors and do not necessarily represent the official views of the USDA or ANR.



Softwood trees provide an important contribution to species diversity (Photo: Steve Hagenbuch)

FOREST MANAGEMENT ACCESS IN THE MODERN SUGARBUSH

Sam Schneski, County Forester, Vermont Department of Forests, Parks and Recreation

Research into the direct impact of forest management activity on the production of sap in the short and long term does not exist. However, there are operational, economic, and ecological reasons to actively manage forests both in and around sugarbushes. Accepted forest management practices for northern hardwood stands can be adapted to promote the long-term health and productivity of a sugarbush and may balance multiple objectives.

Through the 1800s and mid-1900s sugarbushes were often a collection of maple trees where sap was harvested using buckets. These were often close to the homestead as part of a farm. While there were more sugarbushes back then, they were often smaller, differing from today's sugarbush in operations, scale, and forest characteristics. Most sugarmakers now use tubing systems to bring maple sap to a collection point. There are many benefits to tubing systems, however, one potential drawback is that in some cases tubing can cause barriers for access to forest management. This guide is intended to help sugarmakers, landowners, and forest managers consider the why, when, what, who, and how of managing a forest where tubing is present.

WHY MANAGEMENT?

In a sugarbush where timber production is not the primary goal, active forest management is implemented for long-term sap production and can also include additional goals such as:

- » Increasing Biodiversity
- » Promoting Climate Resilience
- » Enhancing Wildlife Habitat
- » Improving Forest Health and Productivity
- » Reducing Hazards
- » Periodic Removal of Forest Products

Uneven aged management is often preferred over even-aged management by foresters and managers. There is no acceptable measure for "rotation age" or "financial maturity" as it relates to trees tapped for sap production. A sugarbush that contains trees with a range of ages, sizes, and species is more resilient to natural disturbances, more closely matches forest dynamics, and benefits crop tree productivity by reducing competition among trees.

A goal of uneven aged management is to have a high proportion of large diameter trees (historically the primary objective in the sugarbush), while still promoting a diversity of age classes. This type of management approach includes lighter, more frequent entries in a forest stand, typically retaining 75% - 85% trees post-harvest. The two most practiced uneven aged management approaches in sugarbushes are crop tree release and single tree selection. Another outcome of uneven aged management is regeneration of portions of the forest at multiple intervals. This helps ensure the establishment of the next generation of trees for sugaring and enhanced forest biodiversity. Supplemental planting and protecting seedlings where canopy gaps are created can be one way to increase the chances of successfully establishing young trees especially if in an area with high deer/moose populations.

WHEN TO MANAGE?

Forest management should occur in a stand when there is a silvicultural basis for it. Research on the direct impact of silvicultural treatments on sap production is lacking. Therefore, forest managers are left to adapt approaches developed for other forest products (high quality sawlogs for example) as well as generally accepted crop tree management practices. This could mean thinning to reduce competition, removal of trees that are financially mature or declining in health, or salvage following a weather event or insect outbreak.

Ideally, active management is best conducted prior to the installation of tubing. Every sugarbush presents different opportunities and challenges. There may be no need for management today but eventually in 10, 20, or 30 years there will be a need. Road design, tubing layout, and the tubing system that is installed, all factor into future management. The design of a tubing system in an individual sugarbush should attempt to align the tubing replacement schedule with the schedule of management activities. It is generally accepted that the frequency of replacement increases the closer you are to the tap. Annual sap yield is generally highest when: Spouts are replaced annually, droplines are replaced every 3-5 years, lateral lines roughly 10-15 years, and mainlines are replaced ≥ 20 years.

A sugarmaker should consider the timing and need for future management and balance this with sap productivity to maximize both yield and accessibility. Timing forest management work with these tubing replacement timelines can feel daunting and impractical. Often producers don't have the time or ideal conditions for management work to perfectly align with tubing replacement. If sugarmakers want to get the most out of their sugarbush, it is worth considering how tubing installation can minimize barriers to management activity that supports a variety of goals, from tree vigor, to hazard reductions, to biodiversity.

SITE/TOPOGRAPHY – The most productive tubing systems are designed to be tight, straight, and downhill.

SCALE – The management schedule on a 25-acre sugarbush is very different from a 500-acre sugarbush. The smaller sugarbush would require fewer entries as the objectives of active management may be accomplished in a shorter time interval, allowing for alterations to the tubing network to only occur once. The larger sugarbush may involve larger sections that are accessed for management at different times in a management cycle, so there is never a point that all tubing would be taken down at the same time. Instead, various sections of the tubing network may be addressed at differing intervals.

EXISTING ACCESS - Access is essential for forest management as well as tubing maintenance and management. If there is existing access, it may help you determine the layout of your tubing and your management approach. If developing new access is required, it's essential that roads and trails be laid out prior to developing a plan for the tubing network, as equipment access generally faces a greater number of limiting factors than line placement does. Good road system design and water diversion will keep access open, as good sugarbush management incorporates the proper use of Acceptable Management Practices (AMPs) to protect water quality. Some sugarbushes have "legacy" road systems that were not established with water management in mind. Areas with significant slope, poor construction, or other defects should be reviewed and rerouted whenever possible.

WHO CONDUCTS ACTIVE MANAGEMENT?

Forest management decisions are often guided by licensed professional foresters. Many sugarmakers have their own equipment available for silvicultural implementation in their sugarbush. This may include a UTV, a tractor with a winch, a bulldozer, a skidder, or an excavator. Sugarmakers equipped with the right tools and expertise can incrementally manage their sugarbush throughout the forestry management cycle by incorporating design elements (described below) that ensure access to various sections. Sugarmakers who don't actively manage their sugarwoods should also work with a forester and a logging contractor to accomplish management goals. This often means treating a large area (or the whole parcel) at one time to create the economy of scale necessary for a commercial operation. In this case, the entire tubing network may need to come down all at once. In either case, careful advanced planning will prevent future challenges when the time comes.

FOREST MANAGEMENT ACCESS CONTINUED...

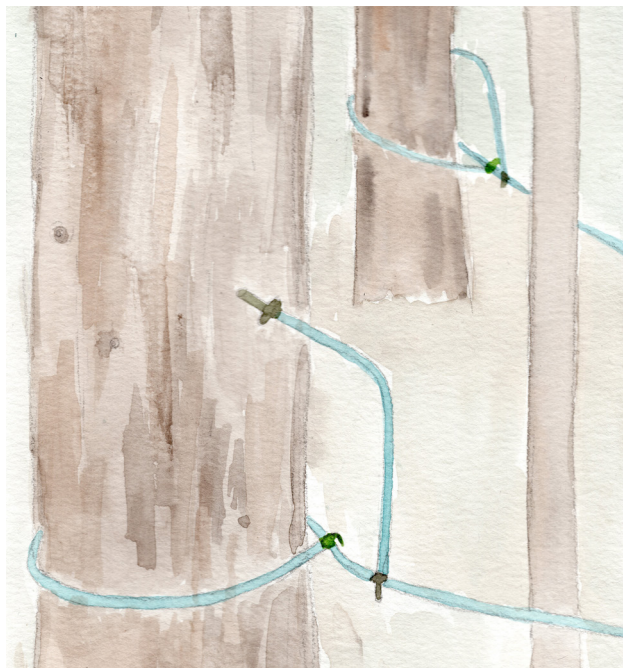
HOW TO DESIGN A FUNCTIONAL SYSTEM?

Installation of tubing to ensure the ability of future management of your forest can employ the following techniques:

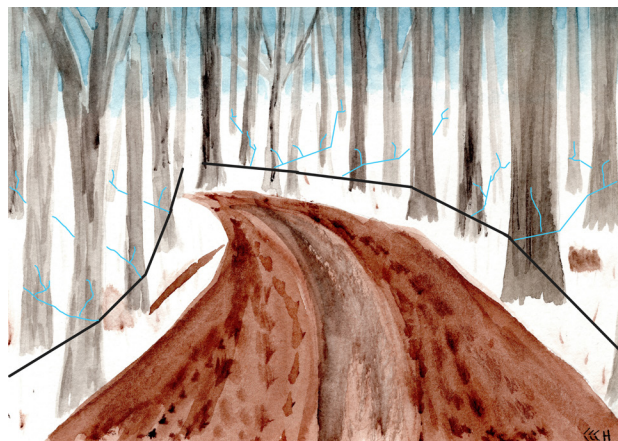


Lateral lines can be lowered or rolled up to allow for felling and retrieval of trees. Laterals should never be nailed to trees.

Whether they're short runs of 5/16th tubing or long runs of 3/16th tubing, all tubing systems should be installed with fittings that allow for easy removal and reinstallation and cause minimal to no harm to the trees. Lateral lines should be able to be easily rolled up and temporarily stored during forest management work at a mainline or at the sap collection site. Temporary removal can be facilitated by using end fittings that can be easily disassembled and reassembled, such as end hooks, slide fittings, or braided rope.



Mainlines and/or conductor lines should be installed in a way that allows movement along main skid roads with forestry equipment. Strive for parallel layout to woods roads with minimal, yet strategic, points of crossing.



When crossing trails with mainline, consider the following approaches being successfully applied by a few resourceful sugarmakers in Vermont:

- **Raising or lowering the mainline:** Temporarily loosening a mainline to elevate it or dropping it on the ground and protecting it from equipment with a half-culvert (or half-pipe) that is sturdy enough to support machine weight is likely the best option.
- **Positioning mainlines and conductor lines** through properly sized culverts. To avoid freezing, the lines should not rest directly on the ground. Producers using this approach should be aware of potential issues with freezing and may want to install an alternate line to be used as back-up if the original line freezes.



- **Removable tubing at crossings:** This allows for a short section of the mainline to be temporarily removed or pulled aside to access other parts of the sugarbush or forest. This approach would represent a compromise between ease of access and sap production as the removable section of mainline would need to come with additional fitting breaks that could lead to vacuum leaks. When properly installed these crossings employ anchors on either side of a given road. With any fitting arrangement at a trail crossing, leave just enough slack in the line to ensure that you can easily reconnect fittings later, but not so much slack that would allow the pooling of sap in the tubing.



- **Burying mainlines under access roads:** This involves important well-thought-out planning and access to the right equipment for the job. Depending on the depth of the line buried, it may need to be insulated at a minimum with 2" foam insulation on the top of the line prior to backfilling. Lines also need to be insulated where they go into and come out of the ground. This approach may work for a few producers who have the necessary equipment and understanding of potential problems with running tubing below grade.



All images credit to Hannah Dallas

FOREST MANAGEMENT ACCESS CONTINUED...

- **Elevating Tubing Over Roads:** In tubing systems using a vacuum pump, sap may be “lifted” or pumped over a road or trail to allow for permanent access without disassembly or movement of the tubing system. Sap ladders, lifters or pumps can be used to elevate sap vertically from a low point on one side of a trail to a sap line mounted high enough to allow vehicles and equipment to pass below.



The height of the crossing mainline should be determined by the type of vehicle or equipment that will be using the road: 14' for trucks and large equipment or 12' for smaller vehicles and forestry equipment. Ladders and lifters utilize vacuum suction to elevate sap, while tank pumps and electric releasers will require some type of power source. Consider access for power and maintenance when determining which type of structure to use. Producers should be aware of the potential adverse effect on vacuum, sap quality, and multiple tubing connections needing to be maintained.

CONCLUSION

The options and approaches presented here depend on well-planned management and tubing layout. They may be suitable for some producers on some sites, but not for others. It is better to design a sugarbush layout with periodic forest management and tubing replacement in mind, rather than depending on replacement of the entire system at once. By incorporating accessibility into sugarbush design producers can keep management opportunities available. Forest management can help sugarmakers foster ecological and economic values compatible with, and complimentary to, their sugaring operation.

Thank you to Hannah Dallas for her illustrations and Mark Isselhardt, Mark Raishart, Charlie Hancock, Keith Thompson and Steve Hagenbuch for their contributions and editing.

From the Sugarbush for Biodiversity Best Practices Guide: “When designing and installing tubing systems, consider doing so in ways that minimize conflicts with large mammal movements, thereby maintaining habitat connectivity. One way to do this is in areas where there is evidence of heavy wildlife use, is to install tubing systems at a height that easily permits wildlife travel underneath.”

All images credit to Hannah Dallas



CASE STUDY:

BACKWOODS ALCHEMY

Located in Enosburg, VT, Joanne and Richard Carr and their family have been operating Backwoods Alchemy since 2006. They started out by selling sap with 3,900 taps. They've since expanded their operation to 6,200 taps and began boiling in 2014, using an RO and heating their evaporator with wood pellets. This family forest is adjacent to a large and unfragmented forest block, stretching over 40,000 acres in Northwestern Vermont, which provides important habitat and connectivity for wildlife in the region.

Backwoods Alchemy is certified organic through Vermont Organic Farmers (VOF), and they participate in the Bird Friendly Maple (BFM) program with Audubon Vermont. While organic certification provides a small premium for the sale of their syrup, their participation in these programs is mainly driven by a desire to be good stewards of the land and to support the long-term sustainability of their business. Maintaining tree species diversity in their sugarbush is a key component, critical for sustaining forest health and providing wildlife habitat.

Biodiversity Practices in the Sugarbush

The overstory of Backwoods Alchemy's sugarbush is approximately 66% sugar maple and 14% red maple, with a mix of ash, beech, butternut, ironwood, hemlock, and white pine among other species. Their long-term goals are to keep at least 25% of the canopy in non-sugar maples. In addition to releasing prime maples for sap production, management has retained high-quality non-maples, like yellow birch, and released mast species, including apple and black cherry. The release of mast species often takes place in the margins of the sugarbush, where it is easier to justify cutting maples, rather than in the heart of the production area. These practices are vital to meeting their species diversity goals, reducing the threat of potentially damaging pathogens and forest insects, like forest tent caterpillars, and providing habitat for a wide range of species.

Portions of the current day sugarbush are part of a historic sugarbush, which was pastured and subsequently abandoned about 50 years ago. This has created a forest with more complex and varied structure, replete with large, decadent sugar maples. These veteran trees are significant sources of large cavities that over time will become large snags and then downed woody material. Cavities, snags, and downed logs provide critical forest habitat and structure. Past land use has also facilitated the development of a robust understory and midstory, composed of maple, ash, black cherry, and yellow birch. Maintaining this mix of species and forest structure over time will support wildlife habitat and vegetative diversity in all layers of the forest.

Their target for the sugarbush is to retain and recruit 4 or more snag/cavity trees per acre with at least one tree greater than 24" DBH, along with 3 to 5 downed logs greater than 18" DBH and 10 greater than 14" DBH per acre, all at least 16' long. As tubing limits access to the sugarbush, much of what falls in the woods stays on site. It is necessary both to maintain current levels of deadwood and to retain trees that can develop into large snags and downed wood over time.

Property wide, management has focused on creating wildlife habitat through the generation of early successional forest, keeping meadows open via brush hogging, and softening edges between forest and open areas to increase their utility for wildlife species. The forest access network has also been improved through the installation of waterbars to prevent erosion. Several of these activities were facilitated through the NRCS EQIP program.

Why manage for biodiversity?

Managing biodiversity in their sugarbush is important to the Carrs to ensure a healthy forest that is less susceptible to damage from insects and pathogens. Keeping a greater diversity of tree species and sizes provides a better opportunity for the forest to stay sound and to replenish itself, especially as they anticipate the decline of species like ash in the near future. It also ensures a more hospitable environment for many species of wildlife, including the bears, owls, and bobcats who they've come across in the woods. The Carrs see biodiversity as integral to the long-term sustainability of their forest and business. Working with their consulting forester and the county forester, along with participation in Cold Hollow to Canada and the Natural Resources Conservation Service EQIP program, has connected the Carrs to valuable support and resources, including educational programming and cost-share funding. While Richard doesn't see himself as a particularly good birder, he is happy to participate in programs like Bird-Friendly Maple and to see evidence of wildlife in the sugarbush, just not the squirrels.

Project Partners:

Audubon Vermont – Audubon Vermont administers the Bird-Friendly Maple Program and provides expertise and management recommendations to enhance priority bird habitat in the sugarbush.

Cold Hollow to Canada – Cold Hollow to Canada is a community-led organization that supports sustainable stewardship and forestland conservation to maintain a resilient and connected Northern Forest ecosystem, especially in the face of a changing climate.

Natural Resources Conservation Service – The Carrs received some funding for management planning, wildlife habitat improvement, and erosion control from NRCS.

Vermont Organic Farmers – Vermont Organic Farmers is a USDA accredited certification program that verifies practices within sugaring operations and maple product integrity.



AT A GLANCE

Property: 138 ACRES

Sugarbush: 74 ACRES

Taps: 6,200

Location: ENOSBURG, VT

Forest Management Practices:
CROP TREE RELEASE & MAST TREE RELEASE

Partners:
AUDUBON VERMONT, COLD HOLLOW TO CANADA (CHC), NATURAL RESOURCES CONSERVATION SERVICE (NRCS), VERMONT ORGANIC FARMERS (VOF)

CASE STUDY:

BRANON FAMILY MAPLE

Tom and Cecile Branon are part of a rich history of sugaring on their home farm in Fairfield, VT. In fact, Tom is the 4th generation of his family to tend to and work in these woods, a tradition the Branons have passed on to their children and grandchildren. Just on their home farm property, there are about 20,000 taps. This is part of a larger network of properties tapped by the Branon Family. They use an RO and heat their evaporator with oil. This property is conserved with the Vermont Land Trust and provides essential interior forest habitat and wildlife connectivity.

The Branons find that participation in the Bird-Friendly Maple (BFM) program and their organic certification through Vermont Organic Farmers (VOF) aligns with their desire to be good stewards of their land. It is a way to share with consumers the pride they take in their operations and the care they take of their land, reflecting their belief that in taking good care of the land, it can then reciprocate and take good care of us.

Biodiversity Practices in the Sugarbush

The sugarbush on the home farm extends across four stands, with about 65% of the canopy in red maple and 21% in sugar maple, with pockets of eastern hemlock and eastern white pine, along with a scattering of white ash, American basswood, and black cherry among many other species. Previous management focused on removing mature and low-quality trees, especially hardwoods to supply firewood. However, this practice has slowed with the transition to oil use for the evaporators. Some improvement cutting has taken place in the understory as well, removing low-quality poles and releasing high-quality sugar maple poles. The Branons aim to retain 2 snags per acre. Low-quality trees that fall in the woods are generally left to rot, adding to downed woody material pools. This management, along with past land use history as a pastured sugarbush, has allowed the development of a more complex and variable uneven-age structure in the main sugarbush area, including decadent legacy maple trees from earlier versions of the sugarbush. The structural and species diversity this forest provides is important for wildlife habitat.

The non-native invasive species (NNIS) common buckthorn (*Rhamnus cathartica*) is present in two areas of the property. Management has focused on mechanical removal, digging the plant up, and monitoring for reappearance. Organic standards limit the use of pesticides. NNIS represent a serious threat to high-quality wildlife habitat, as well as future desired regeneration and forest diversity. Treatment can be costly and labor intensive, making it prudent to tackle this issue early and be vigilant for reappearance or new populations.

The Branons have also been working with NRCS Environmental Quality Incentives Program (EQIP) to improve their road network. They have been ditching, grading, and building up forest roads to maintain their access and to prepare for the more intense rain events Vermont has been experiencing. Road washouts are costly, disrupt access, and can negatively impact water quality and aquatic habitats.

Why manage for biodiversity?

The woods that provide delicious maple syrup for us all to enjoy are also home to many species of wildlife and it is important to the Branons to manage with this in mind. They treasure their woods and work hard to maintain the health of the forest and the habitat it provides. They also recognize that the woods have a life of their own and are currently appreciating all the thinning naturally created by recent windstorms. They want to manage their woods to provide a high-quality product while maintaining forest health, wildlife habitat, and preparing for what the future may hold, especially by maintaining and improving their trails. Consulting foresters and NRCS programs have been useful resources, providing expertise and cost-share funding for improvement work. And they find that the overlap of standards between UVA, BFM, and VOF organic certification makes it simpler to meet their requirements and do good work in the woods. While the paperwork isn't always a joy, a quick phone call usually gets things sorted.

Project Partners

Audubon Vermont – Audubon Vermont administers the Bird-Friendly Maple Program and provides expertise and management recommendations to enhance priority bird habitat in the sugarbush.

Natural Resources Conservation Service – The Branons received some cost-share funding for erosion control from NRCS.

Vermont Organic Farmers – Vermont Organic Farmers is a USDA accredited certification program that verifies practices within sugaring operations and maple product integrity.



AT A GLANCE

Property: 617 ACRES

Sugarbush: ~425

Taps: 20,000

Location: FAIRFIELD, VT

Forest Management Practices:
COMMERCIAL AND NON-COMMERCIAL
IMPROVEMENT CUTS & CROP TREE RELEASE

Partners:
AUDUBON VERMONT, NATURAL
RESOURCES CONSERVATION SERVICE
(NRCS), VERMONT LAND TRUST (VLT),
VERMONT ORGANIC FARMERS (VOF)

CASE STUDY:

MEADOWSEND TIMBERLANDS LTD.

Meadowsend Timberlands Ltd. started tapping their sugarbush on Duplissey Hill in Washington, VT in 2018. Previous management of the sugarbush area was timber focused but now they have about 19,300 taps across 327 acres, use an RO, and sell sap to Collins Maple, LLC. The forest has a history of agricultural use stretching back to the early 1800s, although more recently it was conserved using a Forest Legacy Easement in 2009, which prevents development and ensures continued forest management and public access. This property provides important interior forest habitat and landscape connectivity.

Meadowsend's sugarbush is certified organic and they participate in the Bird-Friendly Maple (BFM) program. By and large, their management already aligned with the standards of these programs, making enrollment easy. They appreciate the premium paid for organic certified sap and were especially interested in the educational opportunities that these programs present. Engaging in these programs supports their mission and provides an opportunity to share the value of management practices that increase forest species and structural diversity and create wildlife habitat, especially for songbirds. They found the bird-friendly assessment particularly valuable, as it provided information and expertise outside of their usual focus of timber management and sugaring.

Biodiversity Practices in the Sugarbush

Meadowsend's sugarbush is located on high quality soils and the overstory is 75% sugar maple, 8% yellow birch, and 5% eastern hemlock with lesser amounts of white ash, American beech, and red spruce. Interspersed are inaccessible pockets of steep ledge and patches of softwoods. Portions of the sugarbush abut wetlands and open land. Their goal is to maintain 20 – 30% of the overstory in non-sugar maple.

For Meadowsend, biodiversity functions on a variety of scales. At the tree level, they are thinking about managing a variety of species and at the stand level, they're working to create a range of age classes and structural components, like snags and softwood inclusions. At the property level, they're considering how management in adjacent stands impacts the sugarbush, as well as the connectivity and functionality of wildlife habitat and ecosystem services across the landscape.

Previous management used crop tree release to release high quality stems and group selection to promote regeneration pockets within the stand. Future management will coincide with tubing replacement to remove high-risk stems. Some of this treatment will occur in small groups to facilitate regeneration and favor non-sugar maple species, including cherry, yellow birch, and red spruce. These pockets of regeneration, which over time can develop into the mid- and overstory, advance species diversity targets, and reduce the threat from forest insects and pathogens. They contribute to patchiness, providing a range of tree sizes and ages available across the stand and its vertical structure, enhancing wildlife habitat and supporting the forests' ability to respond to novel and unanticipated developments resulting from climate change.

Their goal is to retain and recruit at least 2 snag/cavity trees and 4 downed logs per acre, standards already met within the sugarbush. Where snags are lacking, girdling will be used to create them. Management will also leave decadent and declining large maples to naturally develop into large standing dead and downed material over time. Trees that fall between entries can be left as downed logs and future harvesting activities will also leave downed logs, increasing and maintaining desired densities and contributing to available wildlife habitat, forest structural complexity, and nutrient cycling.

Why manage for biodiversity?

Managing for biodiversity is part of the mission and principles of Meadowsend Timberland Ltd., which prioritizes sustainability, forest health, and ecosystem function. As Ryan Kilborn, their Northern Regional Forester, says, there are very few people who don't enjoy listening to songbirds in the spring, so it's an easy way to relate with folks about the woods and open the door to discuss the benefits of management actions for wildlife and forest health. They've also found that it is valuable to cut low-quality trees, including maples, in the sugarbush. For them, having less trees with more growing space has maintained or increased sap potential with less infrastructure to keep up and less workers and person-hours, especially chasing leaks. They've also focused on tapping below the lateral, to minimize impacts to the bottom log and keep their options open in the future. While a heavy snowfall can present some issues, they haven't seen any decline in their production. Working with USDA Organic and NRCS programs has provided important support, especially as Meadowsend was starting up their sugaring operation. They've appreciated the opportunities to learn, collaborate, and educate that have resulted from their participation in BFM and organic certification.

Project Partners

American Tree Farm System – ATFS is a third-party certification organization that focuses on sustainable and multiple use management in family forests across the U.S.

Audubon Vermont – Audubon Vermont administers the Bird-Friendly Maple Program and provides expertise and management recommendations to enhance priority bird habitat in the sugarbush.

Natural Resources Conservation Service – Meadowsend received funding for management planning from NRCS.

Vermont Organic Farmers – VOF is a USDA accredited certification program that verifies practices within sugaring operations and maple product integrity.



AT A GLANCE

Property: 1,524 ACRES

Sugarbush: 327 ACRES

Taps: 19,300

Location: WASHINGTON, VT

Forest Management Practices:
CROP TREE RELEASE & GROUP SELECTION

Partners:
AUDUBON VERMONT, NATURAL RESOURCES CONSERVATION SERVICE (NRCS), VERMONT ORGANIC FARMERS (VOF), TREE FARM

CASE STUDY:

PROCTOR MAPLE RESEARCH CENTER

With more than 75 years of tapping under their belt, Proctor Maple Research Center (PMRC) is the oldest maple research center in the world. PMRC is an extension of the College of Agriculture and Life Sciences at the University of Vermont (UVM). Located in Underhill, VT, PMRC has a threefold mission to engage in research, education, and outreach surrounding the maple industry. They have 6,500 taps, allowing them to operate at commercial scale and better understand the needs of producers. They use an RO and heat their evaporators using oil, with about half of their yield supplying all the syrup on the UVM Campus.

Many of the practices required by organic standards and the Bird-Friendly Maple (BFM) program were already in place in the PMRC sugarbush, smoothing the path for enrollment. As part of their education and outreach mission, PMRC also saw it as an opportunity to demonstrate that enrollment in these programs doesn't need to be limited to the sugaring operation or production capacity and that good yields and healthy sugarbushes can be the result along with a premium price paid. It also allows PMRC to have first-hand knowledge of the challenges and opportunities presented by enrollment and implementation.

Biodiversity Practices in the Sugarbush

The sugarbush spans three stands across the property, with an average overstory of 54% sugar maple and 12% red maple, along with white ash, yellow birch, and American beech among others. There is one pocket of softwood inclusion. The land has a long agricultural history including areas of formerly pastured sugar woods. These areas especially have many decadent sugar maples, along with a diversity of tree age classes. Well-developed understories, midstories, and forest canopies provide important diversity in available forest structure and wildlife habitat. In addition to these decadent legacy trees, PMRC manage their woods to retain snag and downed woody material, leaving non-hazard snags and downed material in place. Legacy trees, snags, and downed wood all provide essential structural diversity across the forest and contribute to available wildlife habitat.

Long-term management goals are to keep at least 25% of the sugarbush in non-sugar maples. Future improvement cuts will remove mature ash, yellow birch, and softwoods, along with diseased beech and low-quality maples. This will concentrate growth on remaining sawtimber-sized maples, as well as releasing established stems in the understory, including sugar maple, yellow birch, American beech, and ironwood, which will support vegetative diversity targets over time. Having a diversity of species present in the forest is crucial for forest health, wildlife habitat, and to maintain the capacity of the forest to adapt to new and unforeseen developments arising from climate change.

Why manage for biodiversity?

For PMRC, there is a clear value to keeping forests as forests, especially while that forest produces maple syrup at a commercial scale. Biodiversity presents a very tangible economic benefit, contributing to ecosystem function and health while providing services like carbon storage and wildlife habitat. Areas that are more diverse tend to be more stable and resilient. For example, stands with a greater richness of species are buffered from the worst effects of forest tent caterpillars, which can wreak havoc in species poor sugarbushes. While the traditional image of a sugarbush may be of widely spaced and deep crowded maples tapped by buckets, the on-the-ground realities of sugarbushes have changed significantly over recent decades. With tubing, downed woody material no longer presents a major issue for access or indicates that a sugarbush is neglected. Now, it is a symbol of increased forest habitat and function. Sugar maples are long lived and, as all those who tap historic sugarbushes know, they can outlast the businesses that tap them. For such a long-lived crop, it is important to consider long-term health and sustainability and to support the many services that these forests provide. While they may feel the pain of some of their less successful experiments, like heavily thinning production areas with wet soils and losing crop trees to subsequent wind events, they're happy to share what they've learned with the sugaring community and plan to continue developing research and outreach that supports producers across the board and into a more uncertain future.

Project Partners

Audubon Vermont – Audubon Vermont administers the Bird-Friendly Maple Program and provides expertise and management recommendations to enhance priority bird habitat in the sugarbush.

UVM Maple Extension – the UVM Maple Extension Program supplies maple producers with educational programming based on research to support sustainable maple operations, resulting in high-yield, high-quality syrup.

Vermont Organic Farmers – Vermont Organic Farmers is a USDA accredited certification program that verifies practices within sugaring operations and maple product integrity.

**AT A GLANCE****Property: 206 ACRES****Sugarbush: 131 ACRES****Taps: 6,500****Location: UNDERHILL, VT****Forest Management Practices:
COMMERCIAL & NON-COMMERCIAL
IMPROVEMENT CUTS****Partners:
AUDUBON VERMONT, UNIVERSITY OF
VERMONT EXTENSION MAPLE PROGRAM,
VERMONT ORGANIC FARMERS (VOF)**

CASE STUDY:

RUNAMOK MAPLE

In 2019, tapping began in the sugarwoods of the Bolton, VT branch of Eric and Laura Sorkin's sugaring operation, Runamok Maple. Approximately 1,000 acres of the property are tapped with 43,000 taps. Sap is collected and concentrated on the property using an RO before being transported to the main sugarhouse in Cambridge, where the evaporator is steam heated using fuel oil. This property provides critical interior forest habitat and landscape connectivity and was conserved using a Forest Legacy easement, prohibiting development and ensuring continued public access and sustainable forest management.

Management of the property aligned with Vermont Organic Farmers organic standards and Bird-Friendly Maple practices, allowing Runamok Maple to participate in these programs with little additional work required. The premium paid for organic syrup is important to their bottom line and the practices required by these programs, like limiting the minimum DBH for tapped trees or requiring a certain amount of species diversity, are integral to forest health and the long-term sustainability of their business.

Biodiversity Practices in the Sugarbush

Sugaring takes place in three stands across the property. The overstory is approximately 41% sugar maple, 26% American beech, and 15% yellow birch, with red maple and pockets of eastern hemlock and red spruce, including a small deer wintering area. Long-term plans are to have more than 20% of the canopy in non-sugar maple. Previous management was timber focused and in the early 2010s about 45 acres were regenerated using group selection. Today, these areas are full of species like raspberries and aren't the most enjoyable to walk through. However, over time these regeneration cuts help to move the forest from simple even-aged condition to a complex and varied uneven-aged condition, increasing the range of tree sizes and wildlife habitat present across the forest. In the future, management techniques, like crop tree release, will be used to retain and release non-sugar maples and softwood inclusions in the sugarbush will be kept wherever possible. All these management actions will work to maintain or increase available wildlife habitat, reduce the risk from insect and disease outbreaks, and support the adaptive capacity of the forest to respond to novel and unexpected developments resulting from climate change.

Goals for the property include retaining 4 snags and 1 den tree per acre, concentrating them near streams wherever possible. They also plan to identify and retain 4 – 8 cull trees per acre greater than 10" DBH as a pool from which they can recruit future snags. Hazard trees and those that fall on the lines are cleared from interfering with the infrastructure and then left on the forest floor as downed woody material. These practices support current and future wildlife habitat including shelter, nesting, and display sites, increase the diversity of available structures in the forest, and benefit nutrient cycling.

The access network inherited with the property was steep, lacking in adequate and functioning erosion control structures, and causing sedimentation in streams on the property. Older culverts are undersized to hold up to the magnitude of water we are seeing in storms nowadays, leading to serious road washouts with resulting economic and ecological damage. Working with the Business Emergency Gap Assistance Program (BEGAP) after serious damage, including a bridge washout, to the access network following recent summer flooding, Runamok Maple was able to acquire the necessary equipment to repair and improve their access network. It also helped them get connected with the Natural Resources Conservation Service Regional Conservation Partnership Program (NRCS RCPP), again linking them to resources to reduce sedimentation and improve the access network. Trails on the property are also used by snowmobilers, mountain bikers, hikers, and skiers and it is valuable to Runamok Maple to maintain this community resource.

Why manage for biodiversity?

To Runamok Maple, the benefits of biodiversity are very clear both fiscally and ecologically. Following best practices in their sugarbush, like those laid out by BMF and VOF organic standards, results in healthier, longer-lived trees, greater yield, and more sugar. Connections with consulting foresters, local experts, state grant programs, and NRCS programs have provided Runamok Maple with critical support and resources. Educational programming, like that developed by the Proctor Maple Research Center, has also been useful for training their employees. Their management style reflects Aldo Leopold's admonition that "to keep every cog and wheel is the first precaution of intelligent tinkering". It is vital to Runamok Maple to keep the diversity already present within their sugarbush, which supports the health of their forest, community, and business both now and in the future, especially as tapping begins earlier each year and the weather remains unpredictable. They are glad to find such a large area of overlap between what makes economic sense for their business and what makes ecological sense for their sugarbush.

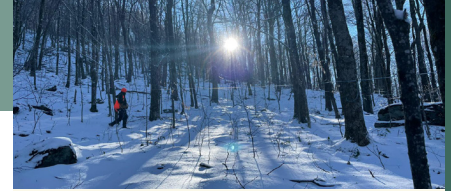
Project Partners

Audubon Vermont – Audubon Vermont administers the Bird-Friendly Maple Program and provides expertise and management recommendations to enhance priority bird habitat in the sugarbush.

BEGAP – the Business Emergency Gap Assistance Program is run by the State of Vermont Agency of Commerce and Community Development. It provides grant assistance for businesses and non-profits that suffered damage from major flooding events in 2023 and 2024.

Natural Resources Conservation Service – Received some funding for erosion control and access improvements from NRCS.

Vermont Organic Farmers – Vermont Organic Farmers is a USDA accredited certification program that verifies practices within sugaring operations and maple product integrity.



AT A GLANCE

Property: 1,516 ACRES

Sugarbush: 1,000

Taps: 43,000

Location: BOLTON, VT

**Forest Management Practices:
CROP TREE RELEASE & GROUP SELECTION**

**Partners:
AUDUBON VERMONT, NATURAL RESOURCES
CONSERVATION SERVICE (NRCS),
VERMONT ORGANIC FARMERS (VOF)**