

Plant material sourcing needs for riparian forest and wetland restoration in Vermont:

Survey results summary



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Introduction and background

Riparian forest and wetland restoration are key strategies to address water quality concerns, improve fish and wildlife habitat, and support climate resiliency in Vermont. As organizations and government agencies increase focus on green infrastructure—for example, by incorporating riparian forest restoration into the strategies targeted by Vermont’s Act 76—the number and scale of these projects is only expected to grow. Restoration practitioners prefer locally-grown, native plant material for restoration projects for many reasons: cross-state shipping can lead to invasive species concerns, locally-grown plants are better adapted to our landscape, and local nursery production contributes to the Vermont economy and supports workforce development in the agricultural sector.

However, as the number and scale of projects requiring locally-sourced native trees and shrubs increases, so does pressure on nurseries and growers. This supply and demand issue is not specific to Vermont; a [recent survey](#) by American Forests found that nursery production needs to more than double, from 1.3 billion seedlings per year to more than 3 billion per year, in order to meet even half of the reforestation potential in the lower 48 United States by 2040 (American Forests 2021). Furthermore, an increasing focus on native species in other management contexts, such as National Parks (H.R.1548, 2021), may further squeeze nursery production. Even restoration practitioners who purchase a large share of their plant material from out-of-state are likely to face supply shortages in coming years.



A reforestation site in Williston, VT. Photo courtesy of Annalise Carington, USFWS & The Intervale Center.

This report summarizes the results of a survey of Vermont restoration practitioners exploring the existing and projected demand for locally-sourced native seedlings over the next 5-10 years. It represents the first step in a project led by the Watershed Forestry Partnership (WFP) and the US Fish & Wildlife Service (USFWS) to address native tree and shrub stock shortfalls in Vermont.

Approach

The authors of this report collaborated to design the survey and distributed it to riparian forest restoration practitioners in Vermont using the Watershed Forestry Partnership email list. Inspired by the American Forests report and hoping to capture Vermont-specific data for this issue, the survey asked organizations who buy plants for riparian and wetland restoration projects the following: how much, what type (e.g. bare root, containers, etc.), what size, and what species they buy annually; whether they expect to buy more in the future and if so, how much; when they prefer to plant and why; and whether labor and/or plant material availability affect their planting plans. Responses were gathered in March and April 2021. A copy of the full survey can be found in the supplementary information (SI, pg iv).

“The number of projects needing plant material for regulatory and non-regulatory [purposes] is expanding on most all fronts. New funding programs, public awareness, and desire to restore natural features have all placed pressures on the current availability of materials.” -Responding organization



Volunteers work at the Champlain Valley Native Plant Restoration Nursery. Photo courtesy of Hilary Solomon.

Results

21 organizations from across Vermont, including government agencies, conservation districts, non-profit organizations, and private businesses, responded to the survey. Note that some organizations who do restoration work in Vermont did not reply to the survey, and of those that did reply, not every organization answered every question. As a result, we expect that many of our estimates--particularly those regarding total trees purchased and total acres restored--are low. See supplementary information (SI, pg ii) to view the results summary table and full list of respondents (SI, pg i).

Anticipated demand increase

Currently, the surveyed organizations plant approximately 600 acres per year in riparian buffers. The majority (n = 15) of organizations plant at a density of 300-400 stems per acre, for a total number of stems purchased between 66,000 and 78,050 annually. In the next 5-10 years, organizations reported an anticipated increase of 50%-62% over the current number of stems needed to complete their projects, to more than 140,000 stems. This represents a projected total market demand of \$250,000 to \$500,000 annually for native bareroot trees and shrubs. One responding organization explained the anticipated demand increase: “The number of projects needing plant material for regulatory and non-regulatory purposes is expanding on most all fronts. New funding programs, public awareness, and desire to restore natural features have all placed pressures on the current availability of materials.”

Plant material type

Bareroot stock continues to be preferred by planters due to its low price point and ease of transport; people like live stakes for similar reasons. Nearly twice as much bare root stock is purchased (~85,000 stems) than container material and live stakes/fascines combined (~17,000 and ~40,000 stems, respectively). Although there is still a market for container stock, and containers could be a way for nurseries to produce a higher value product, the overall consensus from respondents was that container stock is both too expensive and too difficult to transport to be used at scale in a restoration context.



Bare root seedlings of red osier dogwood, a popular species for riparian restoration plantings in Vermont. Photo courtesy of Annalise Carington, USFWS & The Intervale Center.

Developing longer term contracts with growers is a potential approach to address the volatility of plant material supply and demand, and is a strategy that has been employed in places facing similar concerns, such as the Chesapeake Bay region.

Plant material size

Overall, organizations prefer mid-size material (2-4') because it survives well while still being relatively easy to handle and cost-effective. All but three organizations selected one or both of the 2-3' and 3-4' size classes as a preferred size for plantings. Currently, limited availability of plant material is causing some to buy smaller or larger plants than they would prefer. However, preferred plant size does vary across species. The Poultney Mettowiee Natural Resources Conservation District wrote: “Some trees, like oaks, do well at 2-3' and the tap root is more manageable to plant, and others like elderberry tend to die back and

root sprout (so height is less of a factor than vigor), while others are much better to plant a little taller.” When planters buy large material (5'+), it is often to compete with tall herbaceous vegetation like reed

canary grass or to get above deer browse height. While it's species-dependent, larger material can suffer from greater transplant shock than smaller material. When organizations buy small plants (<1'), it is often due to budget constraints and/or the desire to have higher-density plantings.

Plant material species

The surveyed organizations stated that they would buy speckled alder (n=9), viburnums (n=7), and shrub willows (n=7) in larger quantities if availability allowed them to do so. Disease-tolerant American elm, silver maple, white pine, and chokecherry were each requested in larger quantities by three organizations. See the complete list of species desired in larger quantities in the supplementary information (SI, pg iii).

Contract growing

Developing longer term contracts with growers is a potential approach to address the volatility of plant material supply and demand, and is a strategy that has been employed in places facing similar concerns, [such as the Chesapeake Bay region](#). Responses about contract growing varied, with about half of organizations stating that they would be interested in pursuing longer-term contracts with growers.

“What is the plan to help growers achieve stability when prices for plant material are cheaper out of state and buyers don't want to pay what it actually costs to propagate, care for and maintain, remove and sell?” -Responding organization

Those who supported this approach stated that being able to rely on having the plant material needed for projects would be a benefit. The responding representative from the US Fish and Wildlife Service (USFWS) stated: “The ability to source a set number of species for future projects would greatly simplify project planning and would improve our ability to plant the species we're in most need of.” Those who did not support this approach for their own work stated that their needs were too variable and that they did not have enough advance knowledge of projects to enter into long-term contracts. Unpredictability of funding is a significant obstacle for organizations that operate on annual grant funding cycles.

Planting season and plant sourcing

Only one organization favored fall for planting, although several organizations said they split plantings evenly between spring and fall. Overall, organizations reported approximately 75% of plantings happening in the spring. Spring was the preferred planting season due to a longer planting window, more availability of plant

“It would be good to understand the capacity [of existing nurseries] to grow more trees - whether there are things partners can do to help increase existing capacity, or whether it makes sense to help start up new nurseries.” -Friends of the Winooski River

stock, and the comparative ease of recruiting planting volunteers in the spring. Still, others stressed that fall planting can help limit transplant shock and allow plants to settle into a site with a wet spring before their first summer. USFWS said they would consider doing a few fall plantings “if there was greater plant material availability in the fall,” despite the small window to schedule planting labor before the ground freezes.

Labor

Most of the responding organizations rely on a combination of in-house, contracted, and volunteer

labor for plantings. Those that contract labor expressed concern over future labor shortages, sharing that scheduling has become tighter in recent years among the few available contractors. It was suggested that creative partnerships with seasonal workers, such as off-season ski industry staff or trail crews, may be helpful to address labor shortages in the future.

Opportunities to Address Limitations

This section outlines limitations identified by the survey, and potential opportunities--offered by surveyed organizations and/or the authors of this report--to address those limitations. The ideas described here are neither exhaustive nor prescriptive, and instead represent starting points for future conversations about how to address the native tree stock shortage to better support restoration work in Vermont.

Limitation: Supply shortage for locally-grown, native plant material

Opportunity: Increase nursery capacity statewide

Opportunity: Subsidize or incentivize local production via new financial supports

Opportunity: Farm Viability consulting

- Provide business planning supports for nursery growers
- Strengthen regional networks

Opportunity: Diversify nursery business models by adding enterprises with more lucrative markets like agroforestry, landscaping, etc.

Opportunity: Other programmatic support

Opportunity: Identify strategic areas (gravel mines, fallow areas, etc.) for wild harvest of plant material, including live stakes and fascines

Limitation: Logistical constraints with storage and transport for large quantities of plant material

Opportunity: Identify potential tree storage facilities throughout the state to expand capacity

Opportunity: Expanded delivery service availability

Limitation: Plant material with desired specifications can be hard to source (size, species, etc.)

Opportunity: Closer communication between nurseries and conservation partners to inform supply

Opportunity: More contract growing

Opportunity: Build connections with specialized nurseries for certain species (i.e. willows)

Additional concerns and next steps

In addition to issues directly concerning the native tree stock shortage, other related challenges were mentioned by responding organizations and identified by the authors of this report. For example, as the number and extent of plantings increases, there will be a growing need for stewardship, maintenance, and monitoring--activities that are already



insufficiently supported by most funding sources. In addition, many organizations that responded to the survey identified increasing difficulty finding and scheduling labor for project implementation. These challenges are not described in detail in this report, but are critical areas for future discussion within the broader riparian restoration community in Vermont.

This report will be followed by a second report summarizing limitations and challenges for growers. Later this year we will convene a series of stakeholder conversations to discuss survey results and potential approaches to addressing the native tree stock shortage in Vermont.



Tree seedlings in containers at the Champlain Valley Native Plant Restoration Nursery. Photo courtesy of Hilary Solomon.

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The USFWS Partners for Fish and Wildlife Program works with private landowners and local stakeholders to restore and enhance wildlife habitat to benefit federal trust species including migratory birds, endangered, threatened, and at-risk species.

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References

American Forests. Ramping up Reforestation in the United States: A Guide for Policymakers, 2021. Washington, D.C.

H.R. 1548. 2021. To establish a pilot program for native plant species, and for other purposes. Introduced by Representative Matt Cartwright.

Supplementary information

List of responding organizations

Audubon Vermont
Black River Action Team
Connecticut River Conservancy
Franklin County Natural Resources Conservation District
Friends of the Winooski River
Interlace Agroforestry, LLC.
Lamoille County Conservation District
Lewis Creek Association
Missisquoi River Basin Association
Orleans County NRCD
Passumpsic Valley Land Trust
Poultney Mettowee NRCD
Redstart Forestry
U.S. Fish & Wildlife Service
Vermont Land Trust
VT DEC
VT DEC Wetlands Program
WindenWater LLC

Three additional organizations either did not wish to be listed or did not respond to our request for permission to list them.

Results summary table

| | | | |
|---|----------------|-----------------|--|
| Acres planted (n = 20) | | | |
| Average number of acres per organization per year | 29.4 - 32.1*** | stdev = 49 - 51 | |
| Total number of acres per year | 587 - 642* | | |
| Current number of stems purchased annually (n = 17) | | | |
| Total number of stems per year (all organizations) | 66000 - 78050* | | |
| Target planting density (n = 20) | | | |
| 200 | n = 1 | | |
| 300-400 | 15 | | |
| more than 400 | 1 | | |
| variable | 3 | | |
| 18 respondents expected that they will need to purchase more plant material annually within the next 5-10 years | | | |
| Anticipated increase (if any) (n = 11) | | | |
| Percent increase over current demand | 47.9% - 62.1%* | | |
| Anticipated number of stems purchased annually (next 5-10 years), by type | | | |
| Total number of bare root stems | 85130 | | |
| Total number of containers | 17200 | | |
| Total number of live stakes/fascines | 40830 | | |
| Preferred material size (n = 21; participants could select multiple options) | | | |
| 1-2 ft | n = 3 | | |
| 2-3 ft | 11 | | |
| 3-4 ft | 12 | | |
| 4-5 ft | 7 | | |
| 5+ ft | 3 | | |
| 11 respondents indicated that plant material availability does affect when they plant | | | |
| Planting seasonality (n = 19) | | | |
| Average proportion of plantings that happen in the spring | 74.7%** | stdev = 22 | |
| Average proportion of plantings that happen in the fall | 25.3%** | stdev = 22 | |
| 3 respondents stated that difficulty finding or scheduling labor affects their ability to complete planting projects | | | |
| Labor sources, proportionally (n = 19) | | | |
| Average proportion of labor that is in-house | 31%** | stdev = 35 | |
| Average proportion of labor that is contracted | 42%** | stdev = 37 | |
| Average proportion of labor that is volunteer | 26%** | stdev = 32 | |
| 10 respondents stated that they would be interested in pursuing longer-term contracts with growers | | | |

* Min/max given because many organizations provided a range

** High variability; standard deviation ("stdev") provided

Note: Many of the numeric estimates may be low because some organizations did not respond to the survey, and many of those that did respond did not respond to every question

Tree and shrubs desired in higher quantities by responding organizations

| Tree/shrub | Number of mentions |
|---------------------------|--------------------|
| alder | 9 * |
| shrub willows | 7 * |
| viburnum | 7 |
| disease-tolerant elm | 3 |
| silver maple | 3 * |
| white pine | 3 * |
| chokecherry | 3 * |
| balsam fir | 2 |
| red osier dogwood | 2 |
| sugar maple | 2 |
| cottonwood | 2 |
| birch (USFWS wants paper) | 2 * |
| tamarack | 2 * |
| highbush cranberry | 2 |
| serviceberry | 2 |
| northern white cedar | 2 |
| boxelder | 2 * |
| balsam poplar | 2 * |
| HBC(?) | 1 |
| cherry | 1 |
| hickory | 1 |
| basswood | 1 |
| fraser fir | 1 |
| grey stem dogwood | 1 |
| arborvitae | 1 |
| ironwood | 1 |
| sycamore | 1 |
| quaking aspen | 1 |
| elderberry | 1 |
| red maple | 1 |
| Eastern redbud | 1 |
| Bearberry | 1 |
| sumac | 1 |
| wild raisin | 1 |
| winterberry | 1 |
| mountain maple | 1 |

* Mentioned by one or more of the three largest consumers of plant material for restoration plantings

Full survey text

Q1 What organization or agency do you represent?

[Open response]

Q2 How many acres do you typically work with in a season? An approximation is fine.

[Open response]

Q3 What is your target planting density (stems/acre)?

[Open response]

Q4 How much plant material do you purchase in a typical season? If numbers for the 2020 planting season were abnormal due to COVID, use 2019 or 2018 numbers as a guide.

[Open response]

Q5 In the next 5-10 years, do you anticipate needing to purchase more plant material annually?

[Yes/No/I'm not sure]

Q6 If you anticipate needing to purchase more plant material annually, do you have a sense of how much more? Please describe.

[Open response]

Q7 If you would like to elaborate further on your expected plant material needs for the next 5-10 years, please do so here.

[Open response]

Q8 How much plant material would you ideally purchase for your riparian restoration work annually, considering your expected work for the next 5-10 years?

stems bare root [Open response]

tubes/containers [Open response]

live stakes or fascines [Open response]

Q9 If you favor a certain kind of plant material, please explain why. For example: "We use primarily bare root because it is more cost effective and easier to transport in large quantities."

[Open response]

Q10 If you buy in plant material for purposes other than riparian restoration projects, please describe how much and for what purpose(s) (e.g., for local tree sales or nursery starts).

[Open response]

Q11 If you purchase bare root material, what is/are the ideal size(s) for the work you do? (You may select more than one option)

[1-2 feet/2-3 feet/3-4 feet/4-5 feet/5+ feet]

Q12 Is there a reason you prefer this/these size(s)? If so, please explain.

[Open response]

Q13 Right now, bare root material is the most commonly purchased type of material for restoration projects.

Would there be another type of plant material you would want to be more available for your projects? e.g. tube stock, tree pots, live stakes, etc. If so, please explain.

[Open response]

Q14 For your organization's restoration projects, are there certain tree/shrub species you would buy more of if they were available? If so, please list them here.

[Open response]

Q15 Would you have interest pursuing longer-term contracts with growers? For example, reserving/committing to purchase certain plant material up to a few years in advance.

[Yes/No/I'm not sure]

Q16 Please explain why you would or would not be interested in pursuing longer-term contracts with growers.

[Open response]

Q17 What proportion of your plantings happen in each season?

% in the spring [Open response]

% in the fall [Open response]

Q18 If you favor a particular season, why?

[Open response]

Q19 Does plant material availability affect when you decide to do plantings?

[Yes/No/I'm not sure]

Q20 What proportion of your plantings are implemented with in-house labor, contracted labor, and volunteer labor?

% in-house labor [Open response]

% contracted labor [Open response]

% volunteer labor [Open response]

Q21 Do you have projects that can't be completed in a given season due to a lack of available labor or difficulty in scheduling labor?

[Yes/No]

Q22 If you'd like to explain more about seasonality and labor for plantings within your organization, please do so here:

[Open response]

Q23 What other plant material needs does your organization have that have not been touched on already?

[Open response]

Q24 Do you have any additional questions, concerns, or ideas related to plant material sourcing in Vermont?

[Open response]