Assessing the Influence of Site Preparation and Management Techniques on Native Tree Stem Survival During Establishment of Riparian Buffers in Clayplain Soils of the Lake Champlain Basin

Practitioner and Landowner Report

Stever Bartlett Graduate Research Project

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NE IW PCC

Key Findings

Riparian forests play a crucial role in filtering nutrients, pesticides, and animal waste from runoff before they enter water bodies. Many groups are re-establishing riparian forests across the Lake Champlain basin. However, reed canary grass (RCG) has often hindered the survival success of these restoration efforts.

A two-year research study in the Champlain Valley of Vermont assessed native tree stem survival when RCG was chemically and physically removed prior to stem planting and subject to varied amounts of mowing over time. The study found:

There was no difference in survival of tree stems planted between sites prepared by mowing and tilling, and maintained by mowing four times in each of two growing seasons (treatment A) and those sites that were prepared by mowing, tilling, and glyphosate application, and maintained by mowing twice in each of two growing seasons (treatment B).

Percent RCG cover in treatment A plots was lower than in B plots after two years. This suggests non-herbicide options can be just as—or more—effective at removing RCG.

More frequent (monthly) mowing in treatment A plots seemed to suppress RCG growth, where fewer (every other month) mowing in treatment B likely gave the RCG enough continued vigor to expand and grow.

Recommendations for restoration

Mow RCG at least monthly during the growing season.

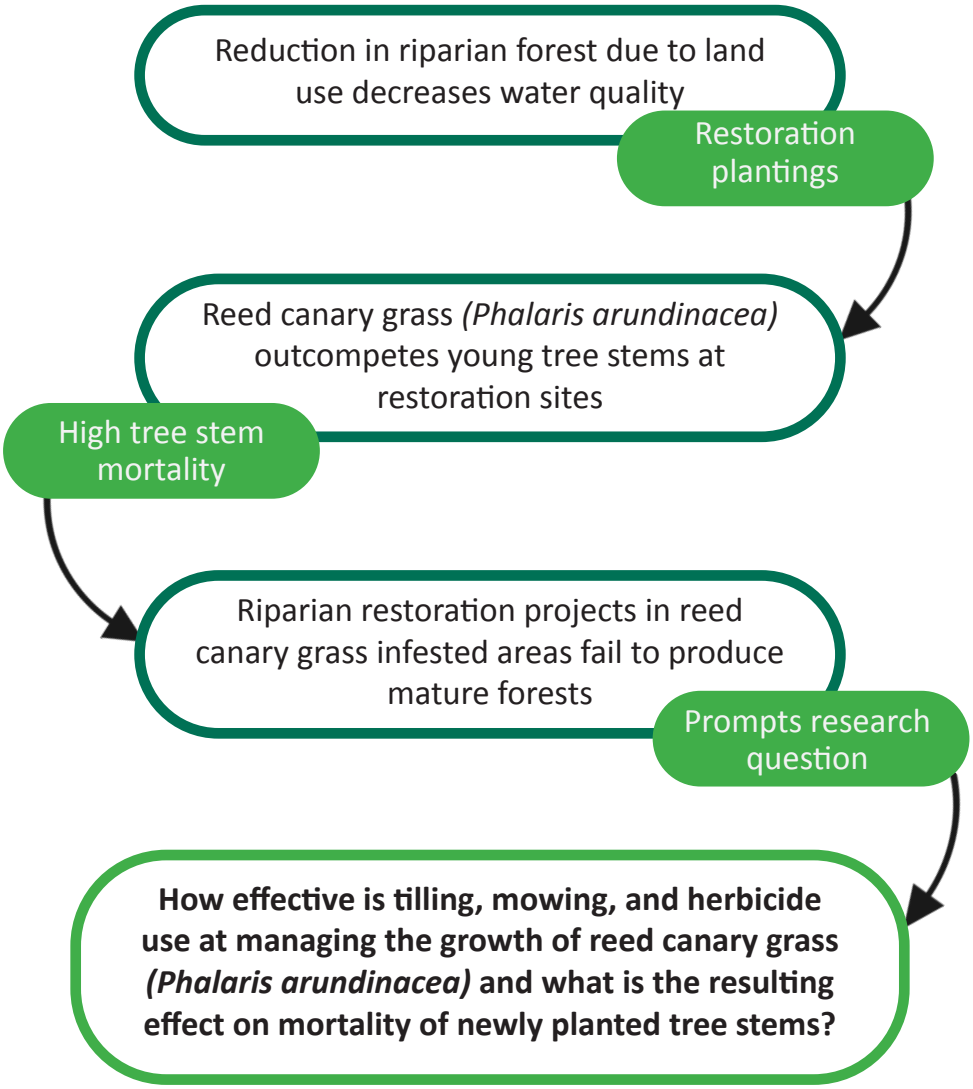
Choose restoration sites that have less RCG and shorter stands of grass for restoration plantings.

Future research could consider the efficacy of the need for tilling and seeding the bed with cover crops prior to planting.

Background and Problem

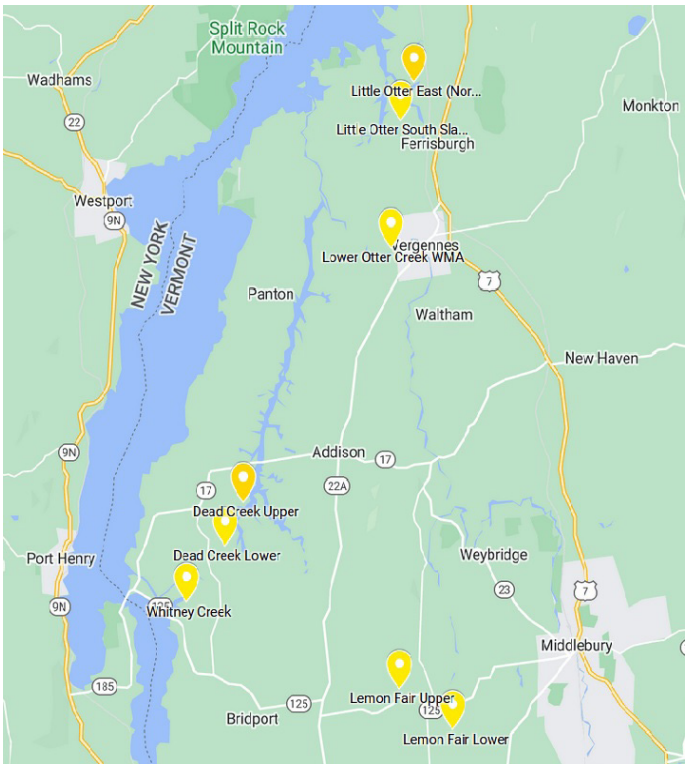
Through the restoration of riparian forests, native species and processes in portions of the landscape may return to a state of natural health and equilibrium.

The challenge of restoring altered or eliminated riparian forests to their prior existence through planting trees can be hindered by the presence of dense stands of reed canary grass *(Phalaris arundinacea)*.



Methods

The study took place on eight plots located in five Vermont Fish and Wildlife Management Areas in the Champlain Valley region of Vermont. The wildlife management areas were Little Otter Creek (locally known as Slang Creek) in Ferrisburgh, Lower Otter Creek in Vergennes, Dead Creek in Addison, Whitney /Hospital Creek in Addison, and Lemon Fair River in Cornwall.



- Little Otter East (North) Slang
- Little Otter South Slang
- Lower Otter Creek WMA
- Dead Creek Upper
- Dead Creek Lower
- Whitney Creek
- Lemon Fair Upper
- Lemon Fair Lower

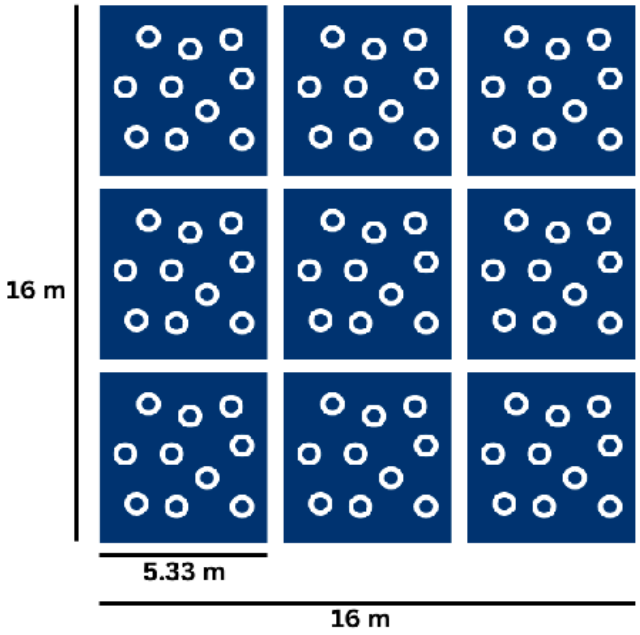
Map showing the geography of the 8 sites selected in Vermont.

These locations were chosen because they were identified as Champlain Valley clayplain floodplain areas that are predominantly dominated by reed canary grass.
Two pre-planting treatments were made for each of the eight sites in September through October of 2020:

	Mowing	Tilling	Herbicide	Mowings per growing season
Treatment A	x	x		4
Treatment B	x	x	x	2

Table 1. Treatment A plots were prepared in fall 2020 by mowing and tilling twice, separated by 16 days, and maintained by mowing four times in each of two growing seasons (2021-2022). Treatment B plots were prepared in fall 2020 by mowing, tilling and glyphosate application one week before each tilling date, and maintained by mowing twice in each growing season (2021-2022).

Collecting Data



Planting design. Each subplot within the treatment A and treatment B plots was planted with the same ten native species. Spacing between stems was 0.75 - 1 m and stems were planted in random locations within each subplot, not in lines or rows. Each treatment consisted of 9 subplots.

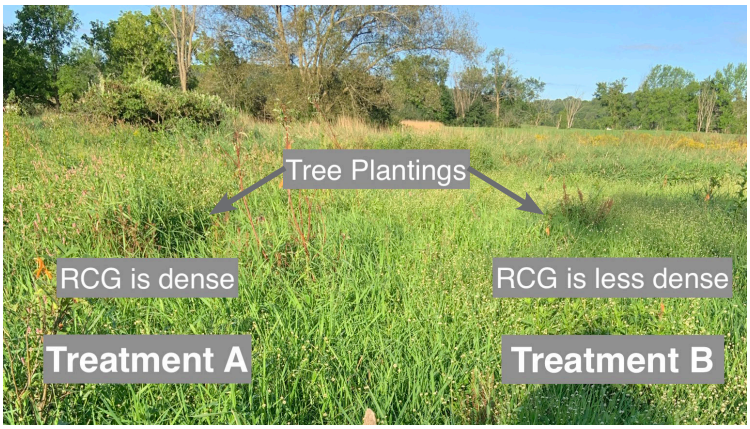
1,440 tree stems were planted by researchers and volunteers in the spring of 2021. The stems planted consisted of ten native species:

- Swamp white oak *(Quercus bicolor)*
- Burr oak *(Quercus macrocarpa)*
- Grey dogwood *(Cornus racemose)*
- Red osier dogwood *(Cornus sericea)*
- Silky dogwood *(Cornus amomum)*
- Red maple *(Acer rubrum)*
- Silver maple *(Acer saccharinum)*
- Nannyberry *(Viburnum lentago)*
- Arrowhead *(Viburnum dentatum)*
- American basswood *(Tilia americana)*

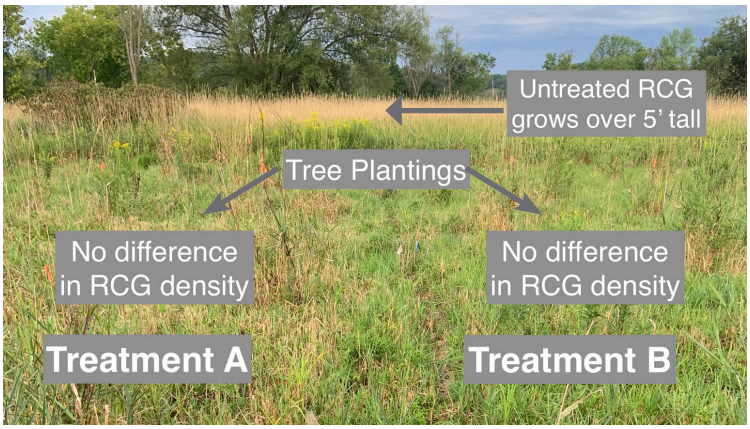
In total, 8 sites were managed in 2021 and 2022. For each site, researchers:

- Estimated the % cover of reed canary grass in each plot monthly (May-September).
- Counted dead and alive tree stems in each plot monthly (May-September).
- Mowed weeds with a weed eater monthly (four times) on Treatment A plots.
- Mowed weeds with a weed eater in June and August (twice) on Treatment B plots.

Results



Lemon Fair Upper site in first year of growth (September 2021). Treatment B (till,herbicide, mow two times/yr) shows greater reed canary grass control as expected.



Lemon Fair Upper site in second year of growth (September 2022). Treatment B (till, herbicide, mow two times/yr) and treatment A (till and mow 4 times/ yr), showed similar reed canary grass growth. Illustrating no difference in RCG growth between treatment A and B plots after two seasons of growth.

Reed Canary Grass % cover

	# N (plots)	Treatment A (%)	Treatment B (%)	Difference (%)	P-Value
2021	8	41	29	12	0.000*
2022	8	37	38	1	0.648
Difference		4	10		

*Mean percent cover of RCG by treatment for all sites in the first year and second year. P-values derived from independent samples T-test using treatment method as the grouping factor and RCG as the output. Adjusted for Bonferroni error rate of p < 0.0 0625. Significant differences between treatment A and B plots are indicated with a *.*

Mean % Stem Survival

Year	# N (stems)	Treatment A (%)	Treatment B (%)	Difference (%)	P-Value
2021	1440	92	92	0	0.849
2022	1440	78	81	3	0.169
Difference		14	10		

*Mean percent survival of stems after one growing season (2021) and after two growing seasons (2022). P-values derived from alive/dead crosstabulation chi-square test using Bonferroni adjusted error rate of p < 0.00625. $X^2(1, N= 1440) = 0.036$, p= 0.849 after one growing season. $X^2(1, N= 1440) = 1.89$, p= 0.169 after two growing seasons. Significant differences between treatment A and B plots are indicated with a *.*

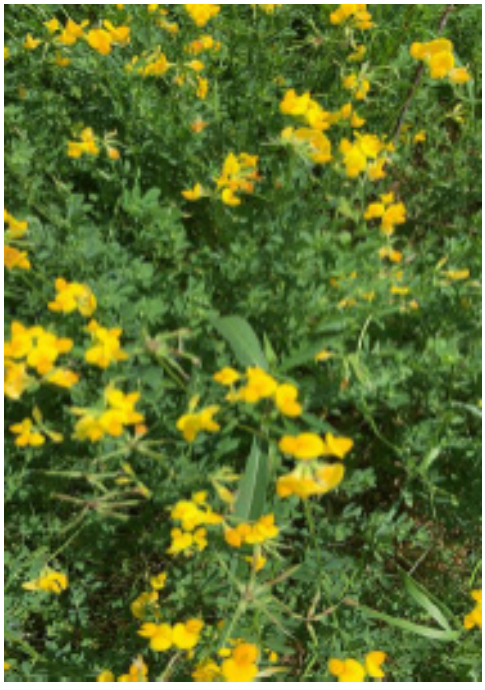
Results (cont)

- At six of the eight sites the establishment of a dense surface cover of the invasive species bird's-foot trefoil *(Lotus corniculatus)* occurred.
- Evidence of rapid rhizome growth of RCG from the perimeter was evident at all sites, but was more pronounced at the two sites that had higher density of reed canary grass prior to treatment.
- Herbivory was not a major contributor to mortality in this study.

Cause of Mortality for Planted Trees

Mortality Cause	Frequency (over 8 visits)	Valid %
Unknown	621	93
Predation	5	1
Cut/Weed eater	5	1
Planting mortality	31	5
Other	9	1
Total	671	100

The cause of mortality was recorded during each of eight data collection visits



Birds-foot trefoil (Lotus corniculatus) in research plots in August 2021 and August 2022.

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