Yellow Iris Management - Lewis Creek/Little Otter Creek Confluence

Final Report

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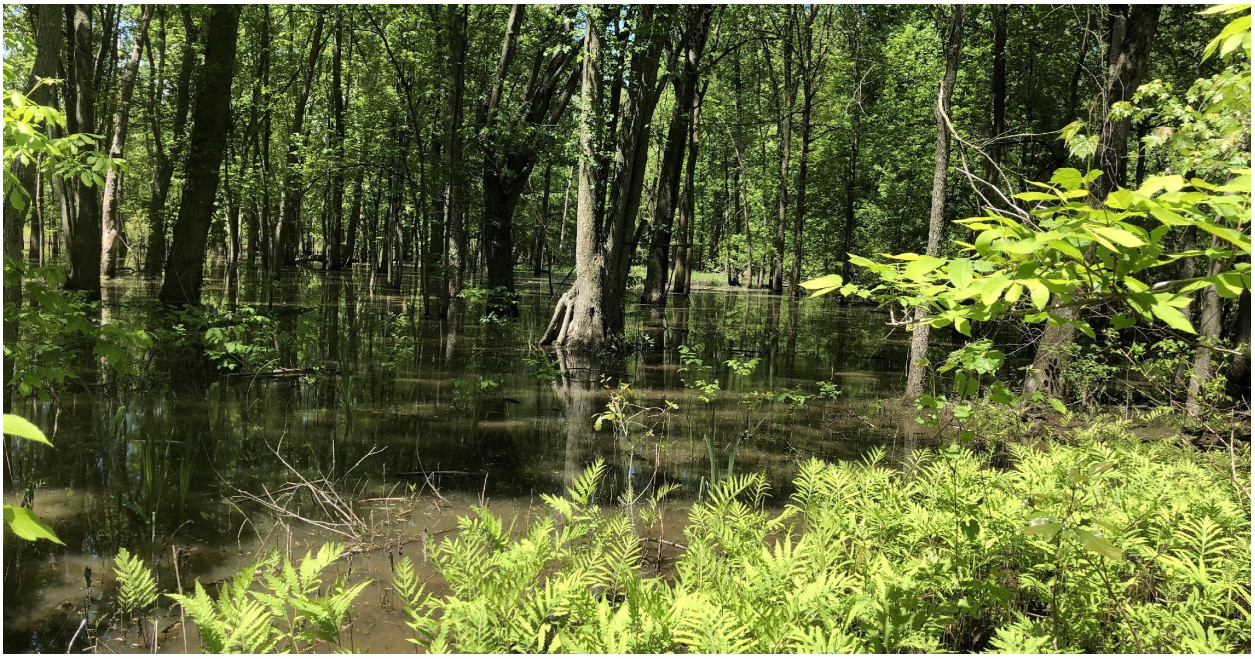
Introduction

The lake-influenced floodplain forests bordering Lewis Creek within the Little Otter Wildlife Management Area (WMA) host a dynamic herbaceous layer under a mature canopy, subject to wide hydrology fluctuations tied directly to Lake Champlain levels. The herbaceous layer is a mix of native and non-native plants. Different growing seasons bring different components to prominence. In addition to the herbaceous plants, woody seedlings (almost all native, dominated by silver maple) ebb and flow as well.

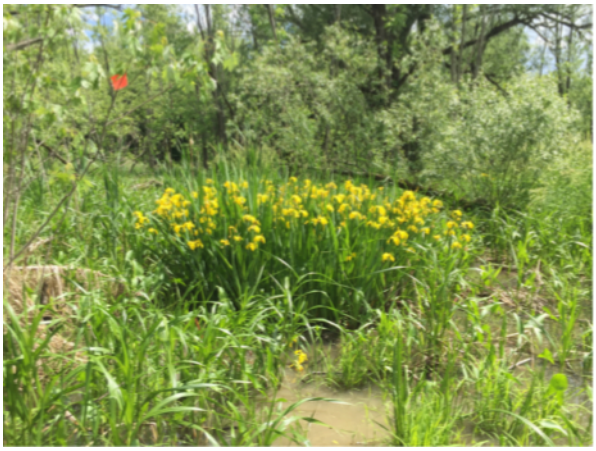


Iris pseudacorus, or yellow flag iris, is a prominent non-native component. Its growth habits are similar to native northern blue flag iris (*Iris versicolor*), only with much higher growth and reproductive rates. It is estimated that blue flag iris makes up < 5% of the iris present in the 12-acre Little Otter Creek WMA survey area. Over the course our three seasons of survey and remediation, we (LCA and consultant Robert Hyams of Habitat Restoration Solutions, along with 23 volunteers) removed on average 38 yellow iris clumps per acre (estimated 193 individual plants per acre).

While yellow iris was found throughout the management area, density was not uniform. Yellow iris (more so than blue) favored areas with high light penetration. In these areas, iris were robust, with leaves extending up to 4 ft in height, multiple flowers and well-formed seed pods. Some clumps covered an area of 16 ft^2. Plants found in low-light conditions were smaller, sparse, and showed little evidence of seed production.

We believe most of the geographic spread of iris is a result of seed propagation. Colonies are formed when an established plant reproduces vegetatively through rhizomatous tubers (rhizomes) to form iris clumps.

Survey



Conventional wisdom would indicate that the optimal time to survey is during peak bloom, which can be any time from late May to mid-June. In 2019, persistently high lake levels kept the site underwater, then extremely wet well into July. In 2020 field work was delayed due to COVID-19 considerations. As a result, our site surveys have been performed in conjunction with our remediation efforts in early fall. In 2021, we did survey early season (in late May). We found that larger established clumps did show bloom color. However, as this was year 3 of our work, most plants were 'singles', not in clumps, and showed no signs of inflorescence.

Each survey option offers advantages:

In-Bloom Survey

Advantages: Positive ID, flowers can be removed, precluding any seed production

Disadvantages: timing of bloom is variable from year to year and can be hard to predict without frequent site visits, plants have to be physically flagged for chemical removal, non-blooming iris may be difficult to discern (with eyes/brains focused on flowers), area may be very wet rendering foot navigation difficult, and biting insects can make work unpleasant.

Fall Survey

Advantages: no specific timing required, more comfortable environment (drier, fewer biting insects), greatly reduced need for physical flagging as all remediation can take place concurrently.

Disadvantages: relying on plant form and foliage tint to identify yellow from blue, likely resulting in some yellow iris being identified as blue iris and not being removed, seed pods may have formed and dispersed by time of survey.

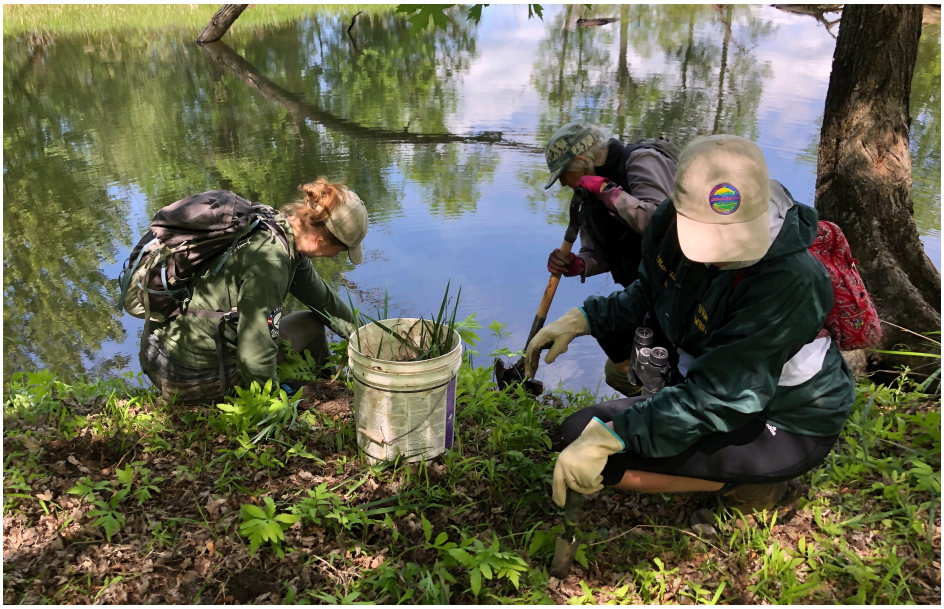
Treatment

For the reasons above, manual removal was moved from June to September for 2019 and 2020. This also allowed us to use the volunteer help of UVM students. In June 2021 we did perform manual removal with a volunteer crew (see manual removal below). Our herbicide treatments were scheduled for, and conducted in the fall. Upon the guidance of Jim Andrews (Vermont Reptile & Amphibian Atlas), fall treatment was selected to minimize impacts upon amphibians, which would be less active at that time, and tadpoles would have metamorphosed and left the water. We treated a total of 12 acres of the WMA. The majority of plants (335 clumps and 710 single plants) were removed by mechanical/manual means, while 126 larger clumps were treated chemically. This treatment (over three seasons) was performed with the help of approximately 125 volunteer hours of manual removal.

Manual/Mechanical Removal

This was conducted with volunteer labor. Efficacy was established in test plots and field observations in 2020 and 2021. This can be classified as moderate to heavy labor, determined by a number of factors:

- Clump size: single plants can usually be pulled or dug easily by hand. Larger clumps could require much more physical work, digging in multiple locations and pulling/shaking dirt from plants. When clumps increase in size above ground, their below-ground biomass is growing at a higher rate. Larger clumps become much more difficult to remove and the process creates much greater soil disturbance.
- Soil conditions: we found digging much easier in 2020 due to recent rains
- Tools: spades work, but a design marketed as 'Parsnip Predator' made the process significantly easier.



Chemical Treatment

This consisted of a foliar application of glyphosate and surfactant in water - both are approved for use in wetlands and near water. The foliar treatment was applied by a commercially licensed applicator. In 2019, a 2.5% glyphosate solution was used. In 2020 a slightly lower concentration was used as the foliage was in better condition at time of treatment. As with many foliar applications, there was some off-target damage observed in the west test plots. In 2020, an ash tree showed signs of impact (malformed leaves). In 2021 this damage was not perceptible.

In-bloom treatment is acknowledged as an acceptable practice by many in the conservation community; the advantages are obvious. We did not compile in-bloom treatment efficacy data from the project. A single clump was treated with herbicide in May 2021.

Geographic Extent

While we believe that the floodplain forests of the Little Otter WMA are impacted by seed dispersal upstream within the watershed, we have no empirical evidence to support this claim. We did survey the stream channel and associated floodplains beginning at the falls in Ferrisburgh to the floodplain forest of the wildlife management area downstream. See Task 1 documents for details. *Iris pseudacorus* was found sporadically throughout, and more frequently as we progressed downstream. There are seven locations that were identified in surveys of 2017, 2019 and 2021 displaying concentrations of large, robust, blooming iris clumps. We believe these likely serve as significant seed sources for points downstream (see Task 1 report and map).

Test Plot Results

Two major conclusions can be drawn from analysis of test plots: both control practices were effective in eliminating iris clumps, and the herbaceous layer within the floodplain forest is dynamic and can be highly variable year to year.

Treatment efficacy - within the test plots, both mechanical/manual and herbicide treatments were very effective, removing 100% of the clumps treated, with few remaining plants found in subsequent years survey. Those found in subsequent surveys were single or two-plant clumps, which we considered to be new growth or possibly small missed plants.

Treatment Limitations - mechanical/manual treatment clearly requires more time and effort on-site, as well as time/effort to coordinate volunteer labor. It also results in more soil disturbance. That disturbance was difficult to discern in the following growing seasons, as the floodplain forest is typically subject to inundated at some point during a calendar year. It should also be noted that the largest clumps within the WMA were not located in the test plots.

Herbicide treatment is a much quicker process on-site. It does require more preparation and planning, and can be constrained by weather. It also requires a licensed applicator to work on public lands and to acquire the herbicide formulations used in this work. While persistent off-target impacts were not evident, it would defy logic to deny all cumulative impacts to the soil biota and aquatic systems (see Test Plot Report for more details).

The test plots were key in validating our process. Our field days; both survey and treatment, offer great insights into what works and what doesn't as these initiatives continue:

What Works

Volunteer Labor: the task of digging iris from a forested floodplain is well-suited for volunteer labor. It appeared to require the right level of effort...not too hard, but still a sense of work performed. Asking volunteers to remove full-sun clumps would likely be too challenging.

Control Methods: both methods were effective, and both resulted in minimal collateral damage. The 'parsnip predator' tool really facilitated digging.

What works, with Challenges

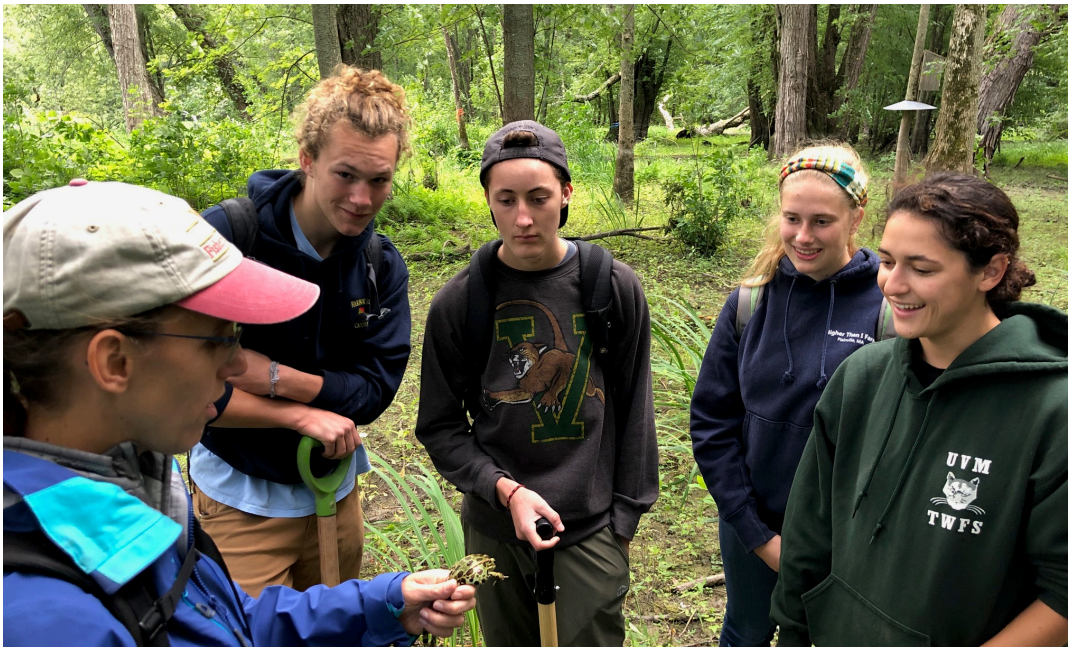
Managing dug rhizomes: digging yellow iris generates a lot of biomass. We minimized it by collecting only rhizomes and flowering parts, and discarding leaves. Still, over three seasons, hundreds of pounds of plant parts had to be managed.

Identifying Iris by leaf base tint: We believe this is a viable strategy, and benefits from practice. Volunteers embraced the challenge, and we believe generally succeeded in proper identification.

Understanding the full infestation extent within the watershed: Lower Lewis Creek proved challenging to survey. Herbaceous growth can be very dense, and iris blooms on different schedules based on hydrology and light exposure. The watershed has a number of features whose hydrological connectivity varies with water levels, season to season and year to year.

What Doesn't Work

Trying to time blooms: The early summer bloom period is difficult to predict, and scheduling volunteer work crews to coincide was difficult.



Conclusion and Next Steps

The Little Otter WMA floodplain forest is an intact plant community, providing a range of functions and values. The *Iris pseudacorus* population has been increasing since first noted in 2015. As a result of this work, the yellow iris population has been reduced in terms of number of plants present, number and size of clumps present, and capacity to flower and produce seeds. A combination of volunteer and professional labor proved effective in addressing this infestation.

While yellow iris in this community has been on the rise, we cannot describe its growth as 'exponential', a term that would be used to describe other herbaceous non-native invasive plants (i.e. parsnip, garlic mustard, reed canary grass.) As a result, we believe that iris can be effectively held in-check with regular surveys and manual removal. If a year of survey and control is missed due to high water or another uncontrollable circumstance, we believe it can be 'recovered' in the following year, and the positive trajectory can be maintained.

Observations for ongoing control of yellow iris:

1. Early season surveys of yellow iris make sense; that said, there are particular challenges as it applies to this work. First, the bloom dates and bloom persistence are highly variable year to year. This is exacerbated in the floodplain forest due to the impacts of seasonal swings in lake levels and highly variable light levels across the WMA. If relying on volunteers, it is difficult to optimize the survey date as work days will typically have to be scheduled in advance. If an early season survey is executed, blooms can be removed to preclude currents season's seed production and large clumps can be flagged for fall treatment.
2. Using leaf form and tint to determine yellow vs native blue has some inherent inaccuracies which are amplified by the inexperience of most volunteers.
3. Fall proves a more comfortable season for volunteers to undertake this work, and mechanical/manual removal in fall is effective. Early summer removal is likely also effective (although we cannot draw this conclusion since we only did early summer removal in 2021, our last season).
4. Herbicide control in fall is effective.

Bigger picture, it would make sense to work to control iris from the seven identified 'hot spots' upstream of the WMA. This would likely require a significant landowner outreach and field operation.

Within the WMA floodplain forest, there are other non-native invasive plant species that merit monitoring, and potentially, control:

Phalaris arundinacea (reed canary grass) is colonizing higher, drier soils, particularly if sun exposure is adequate. In some lower-lying areas, it recedes and advances based on variations in seasonal lake levels. Year-to-year fluctuation aside, over the course of five years it has sustained an increased presence. Unfortunately, there is an ample and persistent seed source on the north bank of Lewis Creek.

Butomus umbellatus (flowering rush) is an herbaceous plant that is invading wet meadow and shallow emergent plant communities. It is found along the banks of Lewis Creek within the WMA and beyond. When flowering, it is very easy to identify. When not in bloom it is difficult to discern from native *Sparganium* (burr reed), unless burr reeds' characteristic seed pod is present.

Woody invasives, particularly *Rhamnus cathartica* (common buckthorn) has become endemic in the Champlain Valley. It is found in very low levels in the floodplain forest. It has colonized some

extremely wet sites throughout the Champlain Valley; removing it from the floodplain would make sense.

There have been some recent (in a forest sense) blow downs and resultant canopy openings. It will be interesting to see how those areas are recolonized by native and non-native plants alike.

Supporting Documents

File Name	Description	Task
Corridor Report	Report documenting yellow iris infestation in Lewis Creek corridor	Task 1
Lewis Creek Survey	Locator map for concentrations of yellow iris	Task 1
Management Plan 2019	Plan for monitoring and control of yellow iris	Task 2
Management Units 2019 - resolution 1	Map of Management units	Task 3
Management Units 2019 - resolution 2	Map of Management units	Task 3
Management Units 2020	Map of Management units	Task 3
WestTestPlots 2019	Initial test plot survey results	Task 4
East Test Plots 2020_21	Initial test plot survey results	Task 4, 14
Treatment Report 2019	Report documenting 2019 treatment	Tasks 5, 7
Summary Year 1	Summary of first season field work	Task 6
WestTestPlot2020_21	Evaluation of iris control and plant cover in west test plots	Task 9
TreatmentReport2020	Report documenting 2020 treatment	Tasks 10,12
Summary Report2020	Year end summary of field work	Task 11
Test Plot Report	Evaluation of Treatments conducted in 2019, 2020	Tasks 8, 13
Treatment Report 2021	Report documenting 2021 treatment	Tasks 15, 16