Invasive Vine Management

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Contents

Introduction

Whether it is Japanese honeysuckle, Oriental bittersweet, Mile-a-minute weed, or any of the other invasive vines present in northeastern U.S. urban forest systems, vines present a continuous burden on urban forest edges. The effects of invasive vines range from mere nuisances to ecological damage, often by smothering native vegetation. In most cases, given their rapid growth and strong root systems, conventional physical removal may not suffice to resolve such issues.

The Columbia Association faces issues of fragmented and vine-covered urban forests, a lack of public understanding and support for reforestation, as well as budget restrictions that rule out many physically intensive solutions, and while invasive vines are not the only issue at hand, they are an integral part of the system supporting these negative factors. Invasive vines are not only a nuisance aesthetically, but are also a key factor in the perpetuation of many forest edge issues, including damage to trees and the choking out of native competitors.

Japanese Honeysuckle

Japanese honeysuckle (*Lonicera japonica*) has been an invasive nuisance since its introduction to North America in the early 1800s. In particular, it has a tendency to interfere with reforestation by smothering young trees (Regehr and Frey 1988). It is very hardy, tolerating a wide variety of soil conditions, though it thrives in well-drained woodland soils and is primarily limited by temperature to areas that do not experience average winter temperatures below -10ºC (Schierenbeck 2004).

As with all invasive vines, particularly those which are commercially available, sanitation by preventing their establishment in an area is the most effective initial control. However, once present, vines such as Japanese honeysuckle are tenacious in their ability to cover an area, and resistant to attempts at removal and eradication. Any control aimed at managing forested systems infested with invasive vines should be repeated frequently and maintained for several years. Generally, chemical treatments succeed most frequently when applied to actively growing vegetation, while physical removal must include the roots to be effective. While for some vines repeated mowing can be effective at killing the root systems by exhausting their energy reserves, it is not effective on Japanese honeysuckle and can even be counter-productive (Schierenbeck 2004).

A comparison of the effectiveness of two different herbicides on Japanese honeysuckle by Regehr and Frey in 1988 found both glyphosate and dichlorprop + 2,4-D to be effective at killing honeysuckle vines as well as suppressing regrowth six to 30 months after initial treatment. Both herbicides were found to be more effective when applied by October rather than in winter (Regehr and Frey 1988). Additionally, non-target effects were observed on some species of trees, most notably moderate but temporary stunting of growth for tuliptree and American beech, with pine tolerating both herbicides well. Again, October herbicide applications proved best, showing less damage compared to December applications (Regehr and Frey 1988).

Oriental Bittersweet

Introduced as an ornamental, and often used to make decorative wreathes in fall and winter, Oriental bittersweet is highly invasive and difficult to remove. Its plantings rapidly grow out of control and smother surrounding vegetation, and wreathes made of it contain viable seeds that can spread the vine as well. The most effective control is sanitation, specifically doing as much as possible to prevent its spread. As such, native alternatives such as American bittersweet should be encouraged for ornamental purposes, and education about the risks of Oriental bittersweet wreathes should be made available.

Research by Ellsworth et al. shows that leaf litter does act as an obstacle to Oriental bittersweet germination, but that the amounts found on an undisturbed forest floor are insufficient as a control. Instead, eradication of Oriental bittersweet in an area before fruiting occurs appears to be a more effective control strategy, as the relatively low germination of seeds in the seed bank decreases the likelihood of reemergence from that source relative to new and more viable seeds (Ellsworth et al. 2003). Further, they noted that thick and continuous oak leaf litter inhibited Oriental bittersweet germination by creating a physical barrier, and that a fragmented but otherwise identical litter layer had no such effect.

Additionally, McNab and Loftis found that certain topographies were present alongside increased Oriental bittersweet growth, specifically areas where water pooled or lingered, and ones where the canopy was patchy and lacked oaks as part of the forest composition (McNab and Loftis 2002). Disturbance of the forest floor also showed a significant relationship with bittersweet presence.

Mile-a-minute vine

Also known as Asiatic tearthumb, *Persicaria perfoliata* was first recorded in North America in the early 1900s. It is easily identified by its triangular leaves and thorns along its stems. Chemical controls and physical removal are similarly effective as with other invasive vines, but biological controls currently being tested also show significant promise. Hough-Goldstein et al. studied the biological control of mile-a-minute weed by an introduced herbivorous weevil, *R. latipes*, comparing varying degrees of sunlight on the effectiveness of such measures (Hough-Goldstein et al. 2011). They found that *R. latipes* tends to gather in higher densities, resulting in more plant damage, on the more vigorous vines in direct sunlight, rather than the shaded plants (Hough-Goldstein et al. 2011). As such, control was observed on those plants that most needed control, making *R. latipes* much more effective as a biological management tool.

Such biological vine controls may prove highly convenient for the Columbia Association as a self-sustaining control compared to current physical removal and chemical control techniques. Currently, *R. latipes* is present in the mid-Atlantic region primarily centered around Baltimore and Philadelphia, and has been released in many Maryland counties including Howard County. Furthermore, as of 2011, there were no non-target impacts by *R. latipes*, and while it has not managed to fully control the mile-a-minute weed alone, an integrated weed management approach tailored toward supporting it could see highly effective results (Hough-Goldstein et al. 2012).

Kudzu

Unlike many other vines which were introduced as ornamentals, kudzu was planted for its ability to stabilize slopes and soils, along with its usefulness as livestock feed. However, the same properties that make it suitable for such purposes, specifically its large and branching root system and its rapid growth, make it extremely invasive and highly difficult to remove. The structure necessary for kudzu to re-grow after cutting is the root crown, a large bundle of tissue where the roots and shoots meet. To remove kudzu from an area, all root crowns must be removed or killed along with the above ground vegetation (Enloe and Loewenstein 2014). Chemical treatments can also be effective, though the tendency of kudzu to wrap around trees and tangle itself in other vegetation makes foliar sprays undesirable unless full clearing of an area is the goal (Harrington et al. 2003). Cutting large vines near ground level and treating the stumps with herbicides is effective at controlling re-growth without non-target effects. For smaller plants such as saplings, separating the vines prior to spraying can reduce unintended effects with little effort (Enloe and Loewenstein 2014).

Weaver and Lyn tested a fungal biological control of kudzu and other invasive vines for use with traditional herbicides as an integrated control measure that would potentially be more effective than traditional herbicides alone, and less damaging to desirable plants as well. Compatibility was shown to be herbicide specific, with the fungal spores becoming nonviable immediately in some mixtures, to tolerating others quite well. The article provides critical information regarding bioherbicide controls, which could prove useful in creating an effective integrated management solution.

General and Multiple Target Controls

Howell's summary of New Zealand's 111 weed eradication programs provides insight into the successes, failures, and ongoing challenges of large-scale control and removal efforts, which can assist in forming a plan for similar and smaller scale controls by the Columbia Association (Howell 2012). Further, it may aid in assessing the viability of weed eradication to resolve certain invasive vine issues. While New Zealand differs drastically from Maryland, a study of the precedent for weed eradication in an area is critical for the evaluation of any such initiative in the future.

Fike and Niering's 1999 paper covers a long term *in situ* study of post-agricultural land in New England, comparing the plant communities that have emerged in that time, particularly the differences between two sites where old field succession has resulted in a completely different set of dominant species. Columbia's similar experience as a city built on post-agricultural land makes such a study, and the conclusions that can be drawn from it, very important.

However, rather than focusing solely on invasive vine eradication, it may be helpful to consider the emergent interactions between native and invasive plants that can arise over time (Leger and Espeland 2009). Leger and Espeland argue that, given time, large enough and diverse enough populations of native species can compete and co-evolve with invasives, and eventually result in some degree of control. Specifically, when the genetic diversity of a species population is high, the strong selective pressure presented by the invasives outcompeting the natives is more likely to result in the selection of traits suited to competing in successive generations (Leger and Espeland 2009). Increasing biodiversity is therefore proposed as a measure to elicit a natural and self-sustaining control of invasive weeds, with an end result more effective than simply attempting to remove them.

Mervosh and Gumbart's study conducted at several sites near Long Island Sound and Connecticut compares several control methods on three types of invasive plants, namely Oriental bittersweet, pale swallow-wort, and Morrow's honeysuckle, and contrasts their relative effectiveness. Basal bark applications and stump surface applications of different herbicides were combined with foliar sprays as well as hand pulling and cutting as control methods, showing the differing effectiveness of each technique. Their data showed that for Oriental bittersweet, high concentration cut-stump treatments were most effective regardless of vine size, and herbicide treatments of 0.75 ml on the cut stumps were sufficient for target results with no waste due to dripping (Mervosh and Gumbart 2015). They calculated that a gallon of herbicide used as outlined above could control more than 5,000 vines.

A similar management technique was tested on Morrow's honeysuckle, resulting in complete control when using glyphosate applications on cut stumps, while not affecting neighboring native plants (Mervosh and Gumbart 2015). In all cases foliar sprays and use of triclopyr instead of glyphosate were notably less effective.

Conclusions

While Columbia's rather unique composition of highly fragmented forest and abundant grass-covered public spaces makes a simple and permanent solution the ideal, all the research gathered reinforces the assertion that there is no single solution to invasive vine management. Instead, a wide range of approaches applied in a multi-year, concerted effort is necessary to alter the ecosystem dynamics of Columbia's post agricultural forests. However, as demonstrated in the studies mentioned above, when such approaches are applied consistently and intensively, they are highly effective with lasting positive results.

Works Cited

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11. Mervosh, Todd L., and David Gumbart. 2015. "Cutting and Herbicide Treatments for Control of Oriental Bittersweet, Pale Swallow-Wort and Morrow's Honeysuckle." *Natural Areas Journal* 35 (2): 256-265. doi:10.3375/043.035.0206.

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Annotated Bibliography

1. Ellsworth, Joshua W., Robin A. Harrington, and James H. Fownes. 2004. "Seedling Emergence, Growth, and Allocation of Oriental Bittersweet: Effects of Seed Input, Seed Bank, and Forest Floor Litter." *Forest Ecology and Management* 190, (2-3): 255-64.

    Ellsworth, et al. focus on the seed bank present in an area as well as the soil conditions, to understand their effects on the emergence of various plants, including Oriental bittersweet. They conclude with the possibility of further control measures suggested by their findings, providing critical information for the formation of an invasive vine control plan. The paper was published in 2004 in the *Forest Ecology and Management* journal and is well cited, suggesting it is a reliable source.

2. Enloe, Stephen F., and Nancy J. Lowenstein. 2014. "Kudzu Control in Residential Areas." Alabama Cooperative Extension System. http://www.aces.edu/pubs/docs/A/ANR-2168/ANR-2168.pdf

    This pamphlet from the Alabama A&M University and Auburn University extension provides simple background information on what chemical, biological, and physical controls are effective in managing kudzu. While it is not a scholarly article, it provides some practical information, specifically about the necessity of removing or killing the root crown when managing kudzu.

3. Fike, Jean, and William A. Niering. 1999. "Four Decades of Old Field Vegetation Development and the Role of *Celastrus Orbiculatus* in the Northeastern United States." *Journal of Vegetation Science* 10 (4): 483-492. doi:10.2307/3237183.

    Fike and Niering's 1999 paper published in the *Journal of Vegetation Science* covers a long term *in situ* study of post-agricultural land in New England, comparing the plant communities which have emerged over time, particularly the differences between two sites where old field succession has resulted in a completely different set of dominant species. Columbia's similar experience as a city built on post-agricultural land makes such a study, and the conclusions which can be drawn from it, very important. This article and its research are less current than any of the other articles, but the length of the study provides critical information.

4. Harrington, Timothy B., Laura T. Rader-Dixon, and John W. Taylor. 2003. "Kudzu (*Pueraria montana*) Community Responses to Herbicides, Burning, and High-Density Loblolly Pine." *Weed Science* 51 (6): 965-974. doi:10.1614/02-142.

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Hough-Goldstein, et al. studied the biological control of mile-a-minute weed by an introduced herbivorous weevil, *R. latipes*, comparing varying degrees of sunlight on the effectiveness of such measures. It provides information on biological vine controls for the Columbia Association as a self-sufficient measure rather than current physical removal and chemical control techniques. Similar biological controls may exist for the other major invasive vines, though they are not covered in this study. This is a recent article from the *Arthropod-Plant Interactions* journal, and is well written and cited.

6. Hough-Goldstein, J., E. Lake, and R. Reardon. 2012. "Status of an Ongoing Biological Control Program for the Invasive Vine, *Persicaria perfoliata* in Eastern North America." *Biocontrol* 57 (2): 181-189. doi:http://dx.doi.org/10.1007/s10526-011-9417-z. http://search.proquest.com/docview/925946200?accountid=14696.

    This article reports on the state of mile-a-minute in the Northeast U.S., from its current spread to programs examining the biological control by the weevil *R. latipes*. Currently *R. latipes* appears to be spreading well, controlling mile-a-minute significantly, and showing no non-target effects.

7. Howell, Clayson J. 2012. "Progress Toward Environmental Weed Eradication in New Zealand." *Invasive Plant Science and Management* 5 (2): 249-258. doi:10.1614/IPSM-D-11-00001.1.

    Howell's summary of 111 weed eradication programs in New Zealand provides insight into the successes, failures, and ongoing challenges of large scale control and removal efforts that can assist in forming a plan for similar and smaller scale controls by the Columbia Association. Further, it may aid in assessing the viability of weed eradication to resolve certain invasive vine issues. The article was sourced from the *Invasive Plant Science and Management* journal published by the Weed Science Society of America.

8. Leger, Elizabeth A., and Erin K. Espeland. 2010. "PERSPECTIVE: Coevolution between Native and Invasive Plant Competitors: Implications for Invasive Species Management." *Evolutionary Applications* 3 (2): 169-178. doi:10.1111/j.1752-4571.2009.00105.x.

    Leger and Espeland argue that large enough and diverse enough populations of native species can compete and co-evolve with invasives given time, and eventually result in some degree of control. Increasing biodiversity is therefore proposed as a measure to elicit a natural and self-sustaining control of invasive weeds, with an end result more effective than simply attempting to remove them. As a perspective rather than a study it is less objective, and the conclusions should be scrutinized before application.

9. Leicht-Young S.A., Pavlovic N.B., and Grundel R. 2013. "Susceptibility of Eastern US Habitats to Invasion of Celastrus Orbiculatus (oriental Bittersweet) Following Fire." *Forest Ecology and Management* 302: 85-96. doi:10.1016/j.foreco.2013.03.019.

Though the Columbia Association does not engage in land management by prescribed fires for urban forests, the study conducted by Leicht-Young, et al. examines the effect of disturbance of the forest litter layer on Oriental bittersweet germination, information which can aid in understanding the mechanisms by which oriental bittersweet has come to be such a nuisance. Like the paper by Ellsworth, et al., this article was published in the *Forest Ecology and Management* journal, and appears reliable.

10. Mcnab, W. Henry, and David L. Loftis. 2002. "Probability of Occurrence and Habitat Features for Oriental Bittersweet in an Oak Forest in the Southern Appalachian Mountains, USA." *Forest Ecology and Management* 155, (1-3): 45-54.

    The final article from the *Forest Ecology and Management* journal examines the invasive character of Oriental bittersweet, and the features of areas both covered by and not covered by significant populations of the invasive vine. A model for predicting the probability of Oriental bittersweet overwhelming a location is proposed and supported by the data. The most significant indication is the effect of an Oak-dominated canopy on suppressing bittersweet populations.

11. Mervosh, Todd L., and David Gumbart. 2015. "Cutting and Herbicide Treatments for Control of Oriental Bittersweet, Pale Swallow-Wort and Morrow's Honeysuckle." *Natural Areas Journal* 35 (2): 256-265. doi:10.3375/043.035.0206.

    Mervosh and Gumbart's study conducted at several sites near Long Island Sound and Connecticut compares several control methods on three types of invasive plants and contrasts their relative effectiveness. Basal bark applications and stump surface applications of different herbicides were combined with foliar sprays as well as hand pulling and cutting as control methods, showing the differing effectiveness of each technique. It is a well-cited scientific journal article published in *Natural Areas Journal*, which can be regarded as a reliable source.

12. Minogue, Patrick J., Stephen F. Enloe, Anna Osiecka, and Dwight K. Lauer. 2011. "Comparison of Aminocyclopyrachlor to Common Herbicides for Kudzu (*Pueraria montana*) Management." *Invasive Plant Science and Management* 4 (4): 419-426. doi:10.1614/IPSM-D-11-00024.1.

    An understanding of the differing effectiveness of several herbicides in controlling kudzu is this study's main contribution. Specifically, the effectiveness of a newer herbicide, Aminocyclopyrachlor, was tested at three different concentrations. The experiment sites were located in Alabama and Florida, and were monitored for percent kudzu cover both one and two years after the initial annual herbicide application.

13. Regehr, David L., and David R. Frey. 1988. "Selective Control of Japanese Honeysuckle (*Lonicera japonica*)". *Weed Technology* 2 (2). http://www.jstor.org.proxy-um.researchport.umd.edu/stable/3987404.

This study compares the effectiveness of the herbicides glyphosate and dichlorprop + 2,4-D at differing concentrations applied in October and in December. The lasting effectiveness from six to 30 months post treatment for the differing methods and timing is the focus. An examination of non-target effects, specifically on several tree species including American beech and Scotch pine, concludes the study.

14. Schierenbeck, Kristina A. 2004. "Japanese Honeysuckle (*Lonicera japonica*) as an Invasive Species; History, Ecology, and Context." *Critical Reviews In Plant Sciences* 23 (5): 391–400. doi:10.1080/07352680490505141.
    Schierenbeck's article provides critical background information on the conditions Japanese honeysuckle prefers, its history, and ecological details helpful in integrating invasive vine management with other topics such as wildlife management. A simple overview of control methods and effectiveness is included at the end alongside an economic perspective.

15. Weaver, Mark A., and Margaret E. Lyn. 2007. "Compatibility of a Biological Control Agent with Herbicides for Control of Invasive Plant Species." *Natural Areas Journal* 27 (3): 264-268. doi:10.3375/0885-8608(2007)27[264:COABCA]2.0.CO;2.
    Weaver and Lyn tested a fungal biological control of kudzu and other invasive vines for use with traditional herbicides as an integrated control measure that would potentially be more effective than traditional herbicides alone, and less damaging to desirable plants as well. Compatibility was shown to be herbicide specific, with the fungal spores becoming nonviable immediately in some mixtures, to tolerating others quite well. The article provides critical information regarding bioherbicide controls, which could prove to be very effective in creating an effective integrated management solution. As with Mervosh and Gumbart's article, this article was published in *Natural Areas Journal*, and is quite current.