

Integrated Vegetation Management Program Enhancements

Final Report

SPR Research Project No. C-06-24



Prepared For:
New York State Department of Transportation
(NYSDOT)

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DISCLAIMER

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16. Abstract: From 2010-2015, the State University of New York College of Environmental Science and Forestry conducted a series of research and development projects to enhance New York State Department of Transportation's vegetation management program. NYSDOT has committed to using an Integrated Vegetation Management (IVM) approach to meeting roadside right-of-way objectives and was looking to strengthen capacity in that regard. The primary focus of the research was to develop vegetation management procedures and planning specific to New York State Department of Transportation. Roadside vegetation management is of high interest to transportation and resource agencies nationally. Such agencies are struggling to balance the need for clear sight distances and obstacle-free roadside; control the spread of invasive species through the right-of-way corridor; and minimize the potential environmental impacts from vegetation control. Five research tasks related to roadside right-of-way (ROW) vegetation management were conducted, including two on developing strategic plans, one on updating an existing IVM procedure document, two on field testing natural herbicides, and another on field testing cut stump herbicide methods for controlling oriental bittersweet. These research and development studies were accompanied by technology transfer, including the development of workshops and factsheets. New York State Department of Transportation has already incorporated results from the field studies in terms of changing vegetation management practices. Elevated efforts in planning are expected over the next few years.			
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EXECUTIVE SUMMARY

Integrated Vegetation Management Program Enhancements

Roadside rights-of-way (ROWs) are important landscape features. They are managed to balance the need for safe and efficient transportation with a host of environmental issues. Tens of thousands of miles of such ROWs traverse New York. The New York State Department of Transportation (NYSDOT) is responsible for an estimated 30,000 miles shoulder miles of ROWs, including 3,000 miles of guiderails.

Roadside vegetation is managed for multiple objectives: (1) to provide motorists with adequate sight distances; (2) to control visibility of signs and guiderails; (3) to prevent the presence of deadly fixed objects (usually trees that cars leaving the roadway may hit or trees that cause guiderail not to bend or deflect and absorb vehicle impact); (4) to maintain pavement by controlling drainage problems and prevent pavement breakage by plants; and (5) to control noxious vegetation such as poison ivy and giant hogweed that could hurt highway workers and travelers.

NYSDOT has committed to using an Integrated Vegetation Management (IVM) approach to meeting roadside ROW objectives and constantly looks to strengthen capacity in that regard.

In the Request for Proposals (RFP) associated with this project, NYSDOT defined their specific interest in enhancing its application of IVM over the project duration as follows (modified after RFP Number: C-06-24; dated April 2, 2009, page 1).

NYSDOT's IVM Program/Plan was prepared in 1999. The plan requires updating to reflect changes in work practices; include information previously omitted on tree work; and to reflect new environmental mandates, challenges and opportunities. Additionally, the IVM plan needs revisions to provide simple decision support tools that roadside vegetation managers can use to decide which vegetation management treatments are most suitable for their roadsides and transportation assets.

The primary focus of this research is to develop vegetation management procedures and planning specific to NYSDOT. Roadside vegetation management is of high interest to transportation and resource agencies nationally. Such agencies are struggling to balance the need for clear sight distances and obstacle-free roadside; control the spread of invasive species through the ROW corridor; and minimize the potential environmental impacts from vegetation control.

Five research tasks related to roadside right-of-way (ROW) vegetation management were conducted by the State University of New York College of Environmental Science and Forestry (SUNY-ESF) to help the New York State Department of Transportation (NYSDOT) enhance their vegetation management program.

Project Objectives

General objectives for the research were as follows (as presented in the problem statement provided by the NYSDOT / University Transportation Research Center [UTRC] RFP [RFP Number: C-06-24; dated April 2, 2009] [shortened from original text]) (NOTE: there are only four objectives, generally one for each of the first four Tasks – Task 5 was about reporting and technology transfer and did not have a specific objective other than to write and provide other accessible research materials, e.g., workshops, factsheets, presentations at meetings).

- Objective No. 1: Update the Department's Integrated Vegetation Management Plan to reflect changes in work practices.
- Objective No. 2: Develop simple decision support tools that NYSDOT roadside vegetation managers can use to decide which vegetation management treatments are most suitable for their roadsides/transportation assets and to help schedule treatments for maximum effectiveness.
- Objective No. 3: Undertake field research on the effectiveness of alternatives to herbicides in controlling unwanted roadside vegetation on a sample of State highways.
- Objective No. 4: Undertake research on whether cut stump applications of glyphosate-based herbicides, such as Accord and Roundup, control Oriental bittersweet (*Celastrus orbiculatus*) in a manner that is efficacious, consistent with regulations and safe to workers and the environment.

SUNY-ESF began meeting these objectives in 2010 by working on five tasks, each with a sequence of sub-tasks and associated deliverables. The current report is a synthesis of the research study task findings, recommendations and implementation activities. Six executive summaries and key products or discoveries from the final reports associated with Tasks 1 through 4 are presented, along with a summary of the project education and outreach efforts from Task 5. Users of this report will learn about the goals, objectives, methods and results of all the tasks performed in the IVM Program Enhancement project, and make directed inquiries to the SUNY-ESF or NYSDOT for further information on the research.

Project Benefits

Various projects benefits were produced from the different tasks and studies, including the following: 1) elevated understanding and awareness of the value of strategic planning for vegetation management; 2) elevate understanding of Integrated Vegetation Management as the philosophical and principled underpinning for NYSDOT's roadside right-of-way vegetation management; 3) improved vegetation management planning and associated documentation that may help schedule treatments for maximum effectiveness, allowing for better communication with stakeholders about decision-making processes in roadside right-of-way vegetation management; and 4) elevated knowledge and technical abilities with herbicides that may allow NYSDOT to produce continued cost-effective vegetation management, continued safe, efficient and effective transportation corridors, and improved interactions with publics and regulators.

Rationale

Various rationales were used for the different tasks, including the following: 1) strategic and related planning would lead to more efficient and effective meeting of mission and achievement of goals and objectives through strategic planning; and 2) increased knowledge and improved technique with herbicide use would improve interactions with stakeholders on the use or non-use of organic, natural and synthetic herbicides to control vegetation on roadside rights-of-way, and improve the efficiency and effectiveness of herbicide treatment methods.

Methods

Various methods were used, from literature and web searches (Tasks 1 and 2) to manipulative field experiments (Tasks 3 and 4).

Outcomes

Each of Tasks 1 to 4 was completed to produce a total of six final reports, as follows:

TASK 1:

Nowak, C.A. 2015. *Brief Survey of Strategic Planning Elements for Department of Transportation Vegetation Management Programs*. Final Report for SPR Research Project No. C-06-24, for the New York State Department of Transportation, Albany, NY.

Nowak, C.A. 2015. *Updating New York State Department of Transportation's 1997 Integrated Vegetation Management Program Document*. Final Report for SPR Research Project No. C-06-24, for the New York State Department of Transportation, Albany, NY.

TASK 2:

Nowak, C.A. 2015. *A Guidebook for Developing Highway Maintenance Vegetation Management Plans as Part of Strategic Planning for the New York State Department of Transportation*. Final Report for SPR Research Project No. C-06-24, for the New York State Department of Transportation, Albany, NY.

TASK 3:

Nowak, C.A. 2014. *Testing the Efficacy of Alternatives to Herbicides in Controlling Undesirable Plants on NYSDOT Roadside Rights-of-Way*. Final Report for SPR Research Project No. C-06-24, for the New York State Department of Transportation, Albany, NY.

Nowak, C.A. 2015. *Monitoring Vegetation Response to Operationally-Applied Scythe Herbicide on NYSDOT's Route 80 Right-of-Way Along Otsego Lake, near Cooperstown, New York*. Final Report for SPR Research Project No. C-06-24, for the New York State Department of Transportation, Albany, NY.

TASK 4:

Nowak, C.A. 2014. *Large Oriental Bittersweet Vines Can Be Killed By Cutting Alone*. Final Report for SPR Research Project No. C-06-24, for the New York State Department of Transportation, Albany, NY.

Future Work

The New York State Department of Transportation has already incorporated results from the field studies in terms of changing vegetation management practices. The research undertaken with planning is expected to be used over the next few years.

TASK 1-1 – A BRIEF SURVEY OF STRATEGIC PLANNING ELEMENTS FOR DEPARTMENT OF TRANSPORTATION VEGETATION MANAGEMENT PROGRAMS

Study Objectives

Three objectives were set to complete the task:

Objective No. 1: Define core, basic elements of a vegetation management strategic plan and logically organize them into both a rubric and model for planning.

Objective No. 2: Apply the planning rubric and model to all available state departments of transportation (DOT) plans in the 50 states. Assess in detail those plans that were most complete with reference to accounting for core, basic planning elements. Present highlights of each, to affirm and illustrate the meaning and value of each planning element.

Objective No. 3: Account for those core, basic elements of strategic plans that NYSDOT is currently using to guide vegetation management work on roadside rights-of-way, and conversely, define which elements are missing from NYSDOT work.

Study Benefits

Results from this task can be used to elevate understanding and awareness of the value of strategic planning for DOT vegetation management. This could lead to more informed vegetation managers, and improved interactions with publics and regulators.

Rationale

Strategic planning, as with all levels of planning, is important for organizations to efficiently and effectively meet their missions and achieve their goals and objectives. In planning, a variety of plan, decision making, and management implementation components are assembled in one or more documents. With documentation, the plan becomes accessible to stakeholders so that shared vision and understanding of organizational management can develop across scales of space and time, and with that, among various people. Sustainable management is predicated on having full and robust management plans.

Methods

A set of core planning elements was assembled from the literature and the experience of the Principal Investigator (C. Nowak). These elements are shown in Figure 1-1 on Page 2-4. These core elements are common across many professions and disciplines, and were assembled in this

report so that existing vegetation management plans from State DOT's from across the country, and with a focus on NYSDOT, could be assessed and evaluated for completeness and opportunities for improvement.

These core planning were then summarized in a checklist to both evaluate and assess strategic vegetation management plans for all DOTs across the United States (Table 1-1).

Outcome

Three plans were found to be most complete for core elements (aside from NYSDOT's plans, which are similarly complete) – Montana, Nebraska, and Washington State. Only the Washington State plan addressed to some degree all of the core planning elements. Yet all elements were fully addressed by one or more of the evaluated DOTs.

Montana's, Nebraska's and Washington State's plans could be used as models for other DOTs who do not have strategic vegetation management plans. However, these plans are not complete themselves and improvements are possible, especially in developing more SMART objectives, providing full management context as a basis for management planning, decision making and implementation, and formalization of a program in monitoring and evaluation.

NYSDOT's planning documents were found to be relatively complete compared to other DOTs. NYSDOT has strong planning components in place for management direction and activity, including standards and guidelines. NYSDOT also has some important elements of planning in place for both "desired condition" and "monitoring" elements. This coverage of planning elements is similar to other DOTs across the country.

Future Work

Planning takes time and effort, and presents the developer with the challenges and opportunities of being open and accountable for decision making and planning with vegetation management. Yet, for an organization to truly be progressive and sustainable, it is imperative that complete plans with all elements be developed and codified in writing. It is only with this effort that the full benefits of planning can be secured.

A variety of published sources are available to aid NYSDOT and other DOTs in their development and presentation of these missing or partially fulfilled elements of planning, including the DOT vegetation management plans from Montana, Nebraska and Washington State. Specific to DOTs, a variety of DOT-specific "how to plan" documents are available from various national organizations, including the American Association of State Highway and Transportation Officials' and the National Roadside Vegetation Management Association.

The National Forest Systems planning at all levels, including strategic, is excellent and is probably the best model of natural resources management planning in in the world. While National Forests are not roadside rights-of-way, much can be learned by comparing and contrasting what has been done with plan writing on National Forests with what can be done with DOTs.

NYSDOT and SUNY-ESF Report

Nowak, C.A. 2015. *A Brief survey of strategic planning elements for Department of Transportation vegetation management programs*. Final Report for SPR Research Project No. C-06-24, for the New York State Department of Transportation, Albany, NY.

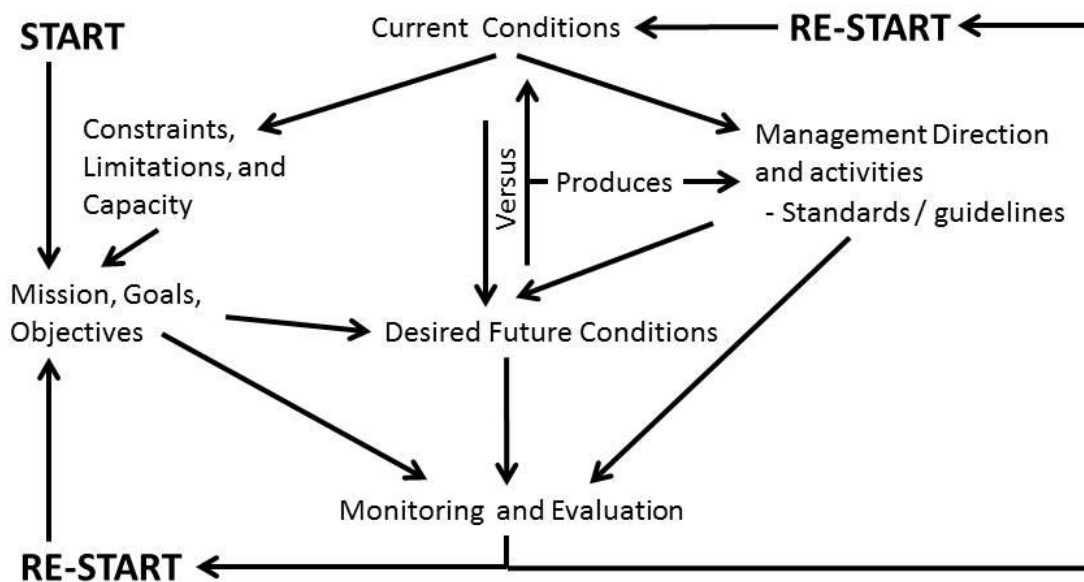


Figure 1-1. Basic elements used to construct and implement a strategic vegetation management plan that shows the flow (following the arrows) of management planning and implementation over time.

Table 1-1. A strategic management plan element checklist used by SUNY-ESF in 2010-2011, and again in 2014-2015, to evaluate coverage of the basic elements of plans in Department of Transportation strategic plans from across the United States.

Evaluation sheet for review of strategic and I/M plans for roadside management					
Document reviewed (citation):					
Author(s):					
Reviewer: C. Nowak, SUNY-ESF					
Date:					
	Presence				
<u>Core element</u>	Yes/No/Partial	Comments:			
Mission / Vision					
- purpose of organization					
Goals					
Objectives					
Background					
- historical / contemporary context of ROW system in environmental and socioeconomic terms					
history of ROW management					
Management Issues / Constraints / Opportunities					
- administration (personnel, machines)					
- laws, regulations, ordinances					
- special, unique features (protection)					
- stakeholders (landowners)					
- legal rights (easements, fee ownership)					
Current Conditions of the ROW System					
- vegetation: maps, management zones					
Desired Future Conditions					
Management Direction					
- schedule, resources					
Standards and Guidelines					
- procedures, management zones					
Monitoring					
General comments:					

TASK 1-2 – UPDATING NEW YORK STATE DEPARTMENT OF TRANSPORTATION’S 1997 INTEGRATED VEGETATION MANAGEMENT PROGRAM DOCUMENT

Study Objectives

This task had one objective, as follows:

Assess the existing New York State Department of Transportation’s Integrated Vegetation Management Program document (dated 1997)

Study Benefits

This task will elevate understanding of Integrated Vegetation Management as the philosophical and principled underpinning for NYSDOT’s roadside right-of-way vegetation management. This could lead to more informed vegetation managers, and improved interactions with publics and regulators.

Rationale

NYSDOT’s first Integrated Vegetation Management Program document was at the forefront of the right-of-way vegetation management industry when it was first written in 1997. Since that time, IVM as a philosophy and a framework of principles and practices for ROW management has evolved, with relatively new industry best practices guidebooks and standards. An assessment of the current NYSDOT IVM Program document was undertaken to form the basis of a revision of the 1997 NYSDOT IVM Program document.

Methods

Three new, nationally-renowned IVM documents – the International Society of Arboriculture’s best management practices 2014 book entitled *Integrated Vegetation Management*, the American National Standard Institute’s 2012 ANSI A300 standards, and the Right-of-Way Stewardship Council’s 2014 Accreditation Standards for Assessing IVM Excellence – were used to assess the 1997 NYSDOT Integrated Vegetation Management Program document. Assessment outcomes were portrayed as suggested minor and major edits to the document.

Outcome

The existing NYSDOT document was edited, with edits provided via “tracked changes” to the original document, to elevate conceptual and technical language to be more consistent with contemporary ideals. Included in this edit and critique was new information on NYSDOT management of hazard trees. Comments are provided on how to update and improve the NYSDOT IVM document.

One of the more significant recommendations was to reorder the document format. As shown in Figure 2-1, the researcher recommended starting the IVM process steps with setting tolerances instead of a discussion of the preventative steps for keeping undesirable vegetation off of the right of way. Prevention is moved next to the treatment step since it is achieved by undertaking treatments - - or by not undertaking treatments.

Future Work

The intent of this report was to provide NYSDOT some ideas and direction on how to revise and update their circa 1997 Integrated Vegetation Management Program document. This intent was met with this report through an editing of the existing document to enhance the portrayal of concepts and technology of Integrated Vegetation Management, and commenting on larger issues associated with the basic components. These suggested ideas and directions can be used as a foundation for NYSDOT’s future work to improve the document. The current IVM document is strong and still very much applicable to current management of NYSDOT rights-of-way, but a revised and updated document could serve NYSDOT better in terms of shared understanding of what IVM is, and elevate the application of IVM across the New York State roadside system.

NYSDOT and SUNY-ESF Report

Nowak, C.A. 2015. *Updating New York State Department of Transportation’s 1997 Integrated Vegetation Management Program Document*. Final Report for SPR Research Project No. C-06-24, for the New York State Department of Transportation, Albany, NY.

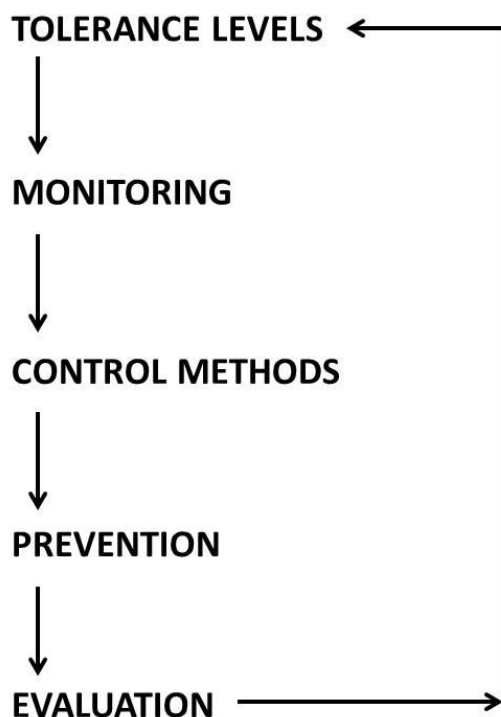


Figure 1. Components of Integrated Vegetation Management (IVM) re-ordered for NYSDOT roadside rights-of-way. Re-ordering was based on other IVM systems (ANSI, International Society of Arboriculture, Right-of-Way Stewardship) and the normal flow of vegetation management considerations and decision making.

TASK 2-1 – A GUIDEBOOK FOR DEVELOPING HIGHWAY MAINTENANCE VEGETATION MANAGEMENT PLANS AS PART OF STRATEGIC PLANNING FOR THE NEW YORK STATE DEPARTMENT OF TRANSPORTATION

Study Objective

Task 2-1 had one objective: to develop an advisory paper on how to undertake local plans and work plans to strengthen vegetation management. The paper was developed in a way that reflects general vegetation management best practices for planning and treatment. The information reflects safety, infrastructure preservation, budgetary, environmental and socioeconomic factors that influence roadside vegetation management.

Study Benefits

The guidebook can be used by NYSDOT to guide vegetation management planning and documented choices, help schedule treatments for maximum effectiveness, and better communicate with stakeholders about decision-making processes in roadside right-of-way vegetation management.

Rationale

Task 1 addressed the processes and issues with preparing an agency-wide strategic vegetation management plan. However, transportation agencies need plans for shorter time horizons and smaller organizational units than those expected to be in an agency-wide strategic plan.

Methods

This New York State Department of Transportation (NYSDOT) *Highway Maintenance Vegetation Management Guide* (VMP) is a tailored compilation of existing guidebooks and selected other planning and performance references. The guidebook is organized around key components of a resource management plan, principally from the Department of the Interior Bureau of Reclamation's 2003 *Resource Management Plan Guidebook*. Additionally, a variety of other right of way vegetation management guidebooks and texts were reviewed for relevant ideas.

Outcome

A framework for the development of a VMP was developed (see Table 1, Page 3-11) and includes a suggested format that contains certain planning components. This framework,

including descriptions and definitions of the planning components, is intended to provide direction, consistency and uniformity in the preparation of a VMP.

Future Work

A region or residency could use this guidebook to produce the first VMP, which would test the guide components and their validity and usefulness. A model plan, demonstrating how each of the components are formatted and completed, would be a useful companion to this guide in its application. This guide is really a first draft based on research on best practices. It is expected that it will be revised in the near future with use and application.

NYSDOT and SUNY-ESF Report

Nowak, C.A. 2015. *A Guidebook for Developing Regional and Residency Vegetation Management Plans as Part of Strategic Planning for the New York State Department of Transportation*. Final Report for SPR Research Project No. C-06-24, for the New York State Department of Transportation, Albany, NY.

Table 1. Suggested format of the components of a Highway Maintenance Vegetation Management Plan.

-
1. Cover
 2. Inside Cover
 3. Preface (optional)
 4. Executive Summary (optional)
 5. Abbreviations and Acronyms
 6. Table of Contents
 7. Essential Components Included in a Resource Management Plan
 - A. Introduction
 - B. Purpose Statement
 - C. Authority
 - D. Plan Organization and Scope
 - E. Management History
 - F. Location / Setting
 - G. Management Framework
 - H. Planning Process
 - I. Opportunities and Constraints
 - J. Issues and Issue Categories
 - K. Existing Resource Inventory / Existing Condition
 - L. Goals and Objectives
 - M. Desired Future Condition
 - N. Management Action(s) / Direction(s)
 - O. Implementation Procedure (Prescriptions, Monitoring, Plan Revision or Amendment and Standards and Guidelines)
 8. List of Preparers
 9. List of References / Bibliography
 10. Glossary of Terms
 11. Attachments / Appendices
-

TASK 3-1 – TESTING THE EFFICACY OF ALTERNATIVES TO HERBICIDES IN CONTROLLING UNDESIRABLE PLANTS ON NYSDOT ROADSIDE RIGHTS-OF-WAY

Study Objective

Determine the efficacy and cost of natural herbicides for controlling roadside ROW vegetation.

Study Benefits

Continued cost-effective vegetation management; continued safe, efficient and effective travel; informed vegetation managers and others; improved interactions with publics and regulators.

Rationale

Vegetation managers could use results from this study to better interact with stakeholders on the use or non-use of organic, natural and synthetic herbicides to control vegetation on roadside rights-of-way. Needs for future research would also be informed by the current study.

Methods

An emphasis of vegetation management on rights-of-way is to minimize environmental impact. For many people this means excluding the use of chemicals to kill and control vegetation, particularly synthesized products of chemicals that normally do not occur in nature (i.e., are artificial). An important part of Integrated Vegetation Management (IVM) is to research and to demonstrate local effects of treatments, even those with chemicals that may not work. A field trial of natural herbicides – which are perceived as chemicals that are acceptable to a broad spectrum of stakeholders – was conducted on New York State Department of Transportation roadside rights-of-way in 2010-2012. Randomized complete block experiments were established across New York State to test BurnOut II (citric acid and clove oil active), C-Cide (citric acid), EcoEXEMPT HC (2-Phenethyl propionate and clove oil), Finale (glufosinate ammonium) and Scythe (pelargonic acid).

Outcome

Percent kill of undesirable plants generally ranged from near zero to nearly 100% across the different natural herbicide treatments (see partial results portrayed in Figure 1), and was related to the mode of action – herbicides that were contact-only in action resulted in the least degree of kill and control, whereas the one systemic herbicide was generally efficacious and effective. Costs of natural herbicide treatments were determined to be orders of magnitude greater than conventional herbicides. However, through the use of bulk purchasing and possible reduction of treatment rates, there is potential for significant cost reduction.

Another concern with using organic and natural herbicides is that they typically require multiple treatments, increasing the likelihood that highway workers or travelers could have an accident with property damage or injury.

Information on cost-effectiveness from this study allows ROW vegetation managers an opportunity to better understand and explain the ramifications of using natural herbicides.

Future Work

To realize the full benefit of the study, results of the current study should be used to elevate interactions with stakeholders on the possible use of natural herbicides on NYSDOT rights-of-way. Future research could build on the current study by:

1. Testing combined applications of natural and synthetic herbicides (e.g., glufosinate mixed with glyphosate or organic herbicides followed every other year with glyphosate); and
2. Installing test trials in various other ecological areas across New York.

NYSDOT and SUNY-ESF Report

Nowak, C.A. 2014. Testing the Efficacy of Alternatives to Herbicides in Controlling Undesirable Plants on NYSDOT Roadside Rights-of-Way. Final Report for SPR Research Project No. C-06-24, for the New York State Department of Transportation, Albany, NY.

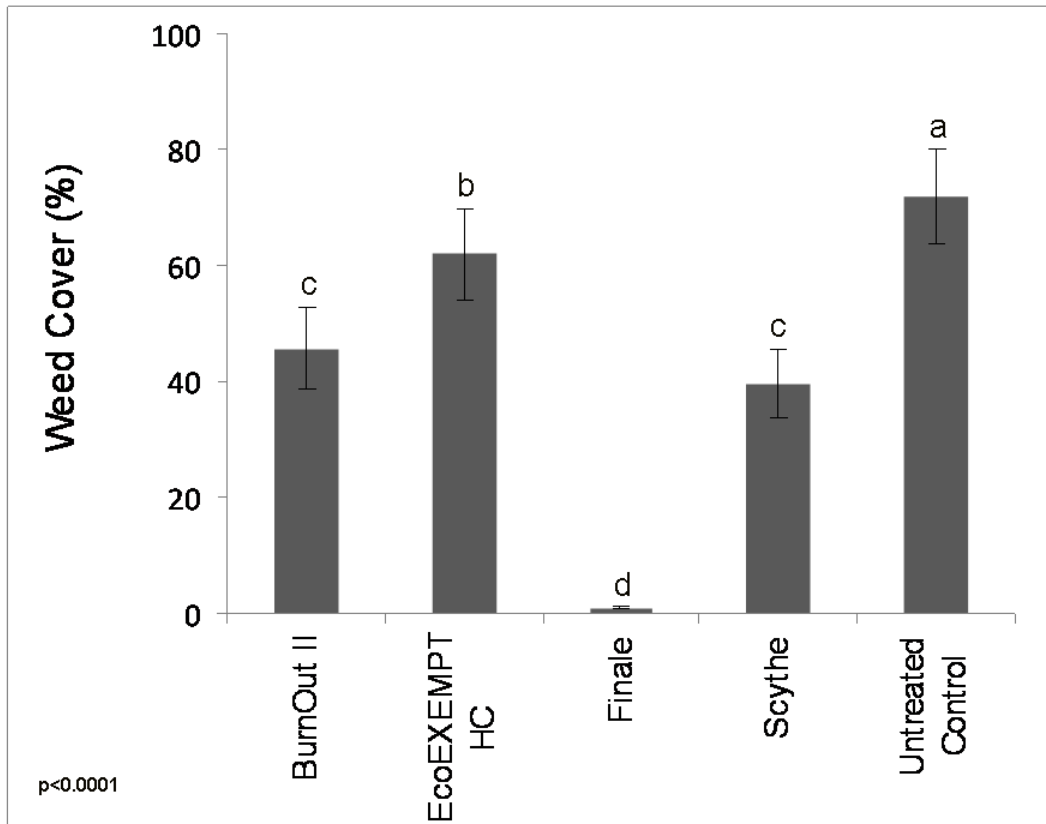


Figure 1. One-month post-treatment weed cover among four different natural herbicide treatments as compared to an untreated control. The tails associated with each bar are \pm one standard error. Bars with the same letter are statistically equivalent (Analysis of Variance p-value indicates a significant treatment effect: $p<0.0001$).

SUMMARY: Cost effectiveness patterns

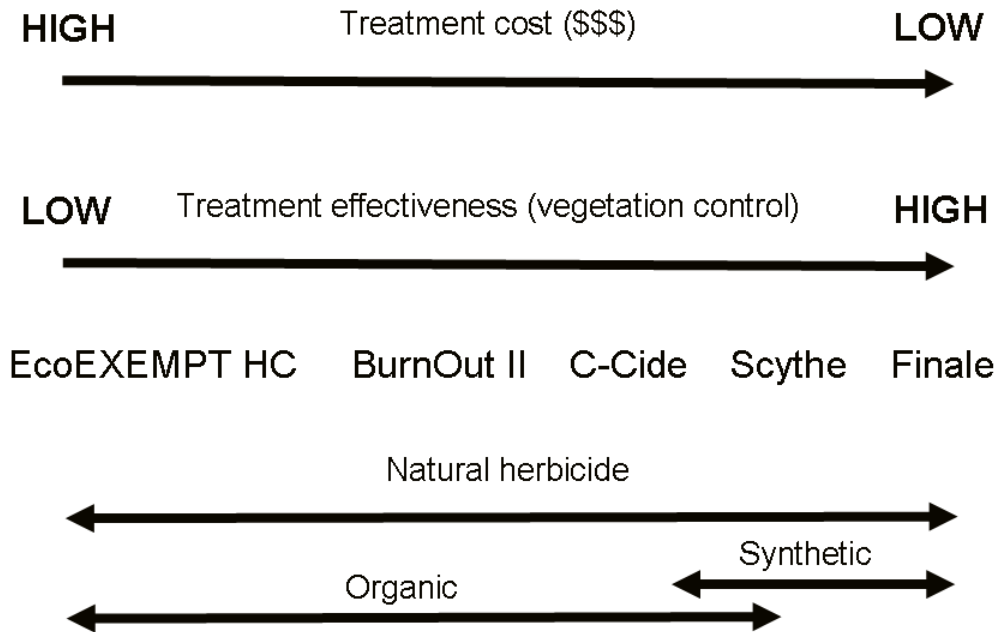


Figure 2. Synthesis of the cost effectiveness of organic, natural and synthetic herbicides.

TASK 3-2 – MONITORING VEGETATION RESPONSE TO OPERATIONALLY-APPLIED SCYTHERBICIDE ON NYSDOT’S ROUTE 80 RIGHT-OF-WAY ALONG OTSEGO LAKE, NEAR COOPERSTOWN, NEW YORK

In this task, SUNY-ESF tested a select set of vegetation control methods in 2010-2012 for areas where synthetic herbicides cannot be used. Methods tests focused on non-synthetic herbicide treatments, commonly referred to as “natural herbicides” (bioherbicides, mycoherbicides). A final report, published in early 2014¹, included recommendations on what natural herbicides could be effectively, operationally used on NYSDOT rights-of-way. While no natural herbicide tested was as cost effective as conventional herbicide treatment with glyphosate-based products (e.g., Accord XRT II, which is the most common foliar herbicide treatment used by NYSDOT), two natural herbicides were recommended for further consideration and trial: Finale (glufosinate ammonium) and Scythe (pelargonic acid). NYSDOT used the final report to work with outside-agency stakeholders in the Otsego Lake watershed, near the Village of Cooperstown in Central New York. These stakeholders were concerned that continued conventional use of glyphosate herbicides would degrade water quality in Otsego Lake. Glyphosate herbicide use was suspended in 2013 along an 8 mile section of Route 80, part of which is along the western shore of the Lake. At the request of the Otsego Lake Watershed Committee and the Village of Cooperstown, NYSDOT operationally applied Scythe herbicide under and around guiderrails in the Route 80/Otsego Lake corridor. Operational application of Scythe herbicide had associated important, basic, unanswered questions.

- How much would it cost to purchase and apply Scythe?
- How well would Scythe work?
- Would Scythe produce levels of control with monitoring at an observational scale as observed in earlier field research?

Study Objective

Determine materials cost and monitor herbicide effectiveness for controlling roadside right-of-way vegetation in association with operational application of Scythe, a natural herbicide.

¹Nowak, C.A. 2014. Testing the efficacy of alternatives to herbicides in controlling undesirable plants on NYSDOT roadside rights-of-way. SPR Research Project No. C-06-24, final research report for the New York State Department of Transportation, Albany, NY.

Study Benefits

Four study benefits can develop from this work: 1) continued cost-effective vegetation management; 2) continued safe, efficient and effective travel; 3) informed vegetation managers and others; and 4) improved interactions with publics and regulators.

Rationale

Scythe, with pelargonic acid as the active ingredient, is a contact herbicide, which means it kills only those plant cells that come in contact with the chemical. The type of plant cells killed are usually those that are green and photosynthesizing, and not brown and protected by bark or other waxy or cork-like (suberized) structures. Annual plants, as mostly green in color in leaves and stems, can be killed completely aboveground, but perennial woody plants usually only have leaves killed. Roots are not killed by Scythe as it is not translocated throughout the plant – it only kills what it contacts. Plants treated with contact herbicides can resprout or continue growing from undamaged parts of the plant.

Methods

A set of 30 2x2 foot vegetation measurement plots were used in 2014 to monitor plant cover before (May and July), during (July) and after treatment (July and September) with Scythe herbicide under and around guidrails. Variable coverage of treatments, ranging from measurement plots that were completely missed (zero percent treatment coverage) to 95% treatment coverage, caused the data analysis to focus on regression techniques. End-of-growing-season percent plant cover, and percent of initial vegetation controlled, was related to percent coverage of treatment, as observed as percent of plants damaged by the Scythe herbicide using simple linear regressions with various combinations of plot data.

Outcome

Cost: Cost information was/is readily accessible, e.g., materials cost for the current operational work was \$1,954 for Scythe.

Effectiveness: In nearly all combinations of the plots treated by Scythe, a similar pattern of plant community reduction was found – a statistically significant downward trend, which means a significant decrease in end-of-growing-season plant cover with increased damage from Scythe herbicide. Vine- and Japanese knotweed-dominated plots were not affected by Scythe herbicide, and had an average end-of-growing season plant cover at 75 percent. Excluding the vine/knotweed plots, average end-of-growing season percent cover associated with full Scythe effect ranged from 6 to 12 percent.

Future Work

To realize the full benefit of the study, results of the current study should be used to elevate interactions with stakeholders on the possible use of natural herbicides on NYSDOT rights-of-way. Conversely, results of the current monitoring work could heighten awareness of the limitations of natural herbicides, and define better the importance of using other more cost effective treatments.

NYSDOT and SUNY-ESF Report

Nowak, C.A. 2015. Monitoring Vegetation Response to Operationally-Applied Scythe Herbicide on NYSDOT's Route 80 Right-of-Way Along Otsego Lake, near Cooperstown, New York. Final Report for SPR Research Project No. C-06-24, for the New York State Department of Transportation, Albany, NY.

TASK 4-1 – LARGE ORIENTAL BITTERSWEET VINES CAN BE KILLED BY CUTTING ALONE

Non-native, invasive (NNI) plants are of high concern for vegetation managers because of their environmental and socioeconomic impact. On roadside rights-of-way, NNI plants can produce a broad spectrum of problems.

A NNI of special concern for NYSDOT is oriental bittersweet (*Celastrus orbiculatus* Thunb.). It is a liana (vine) introduced to the United States in the mid- to late-1800s from East Asia as an ornamental plant. For the roadside ROWs manager, bittersweet can grow into the crowns of roadside trees, killing them by girdling tree trunks and increasing weight on the tree's canopy. A tree besieged by oriental bittersweet causes a danger to motorists due to increased risk of branches and stems breaking and falling.

Study Objective

Determine the efficacy of herbicide treatment (glyphosate) for controlling oriental bittersweet using cut stump application methods.

Study Benefits

Continued cost-effective vegetation management; continued safe, efficient and effective road travel; informed vegetation managers and other practitioners; improved interactions with publics and regulators.

Rationale

Oriental bittersweet is a problem plant that is being managed by NYSDOT. Most problem vines are large and twined to the top of hardwood trees, making foliar spray of herbicide on climbing vines impossible without damaging or killing the tree. Cut stump application of herbicides – where the vine is cut near ground line and herbicides applied at high concentration to the cut surface – is commonly recommended, but its efficacy is unknown. Efficient and effective use of herbicide treatment methods to control large oriental bittersweet can only be achieved with a rigorous research and development project, such as reported herein.

Methods

Two manipulative field experiments were conducted across the Hudson Valley of New York State in 2011-2013 to test relative effectiveness of:

- controlling the vines with cutting alone or cutting with an application of herbicides to the cut surface; and
- different herbicide application dates and herbicide amounts used in cut stump applications.

These two studies were established along field/forest and roadside right-of-way edges. A randomized block factorial design was used to test treatment effects on survival and growth of oriental bittersweet at the Vanderbilt National Historic Site in Hyde Park, New York, with control by cutting alone and cutting and cut stump herbicide treatments, varying application date (June, August and October) and varying herbicide concentrations (26 and 53 percent of glyphosate as the active ingredient via Accord herbicide) as the tested factors.

A randomized complete block design was used to test the same herbicide treatments applied in October across the Hudson Valley. Treatment sites (blocks; n=3) were located near Lake George, Hyde Park and Stony Point/East Fishkill. All treatments were applied to sets of 10, large Oriental bittersweet vines (average diameter ranged from 1.2 to 2.0 inches) per treatment plot, for a total of 360 vines treated. Treated vines were evaluated in mid-Summer 2012 (1-year after treatment) for survival and sprouting, and again in Fall 2013 (2 years post-treatment) for survival. Treatment effects were evaluated using standard analysis of variance techniques.

Outcome

After the first year of the factorial experiment at Hyde Park, the herbicide treated vines had higher mortality (86 percent) than vines that were cut only (44 percent). The randomized completed block experiment across the Hudson Valley produced similar results after the first year – the herbicide treated vines had higher mortality (67 percent) than vines that were cut only (13 percent). By the end of the second year after treatment, nearly all of treated vines were dead – regardless if they were cut only or cut and treated with herbicides.

Future Work

Results of this study are ready for operational application. NYSDOT could begin to operationally treat large (> 1-inch vine diameter near ground line) oriental bittersweet vines growing in fully stocked forest (shaded cut stumps) with cutting alone – no herbicides are recommended for use in killing these vines.

Operational treatments of cutting vines without herbicide treatment should be monitored to affirm study results – that > 95 percent kill is expected with cut treatment alone. Monitoring of treatment effectiveness should occur for at least 2 years, as it took that long for the development of full treatment effects in the current study.

In the course of conducting this study, the researchers discovered that Oriental bittersweet is also widespread at the study sites as smaller diameter vines or shrubby growth. Because of their size, they are not amenable to cut stump herbicide treatment. While these small vines may take decades to produce problems similar to large vines, future study is recommended to determine how great a threat to trees oriental bittersweet is in these forms and what are the best control methods.

NYSDOT and SUNY-ESF Report

Nowak, C.A. 2014. *Large Oriental Bittersweet Vines Can Be Killed By Cutting Alone*. Final Report for SPR Research Project No. C-06-24, for the New York State Department of Transportation, Albany, NY.

TASK 5: EDUCATION AND OUTREACH IN SUPPORT OF NYSDOT AND SUNY-ESF RESEARCH AND DEVELOPMENT IN INTEGRATED VEGETATION MANAGEMENT

Study Objective

SUNY-ESF was to directly share new, ongoing, and recently completed research information on Integrated Vegetation Management with vegetation managers and related practitioners at the NYSDOT and with other stakeholders.

Methods

SUNY-ESF used four approaches to meet the above-stated objective: 1) presentations at training workshops; 2) single-page factsheets; 3) quarterly reports on all tasks; and 4) a single final report that synthesizes all of the results from Task 1 through Task 5 (this report).

Study Benefits

Informed practitioners ensure benefits from the research are achieved; informed practitioners ensure cost-effective vegetation management and continued roadside ROW services are achieved; improved public relations; pesticide certification credits (from Category VI workshops) for NYSDOT personnel and contractors.

Outcome

LIST OF EDUCATION AND OUTREACH MATERIALS IN SUPPORT OF NYSDOT AND SUNY-ESF RESEARCH AND DEVELOPMENT IN INTEGRATED VEGETATION MANAGEMENT

In association with Task 3 – Natural Herbicides:

Nowak, C.A. 2011. ESF YouTube Video for “Going Green”, *Natural Approach to Vegetation*, July 2011, <http://www.esf.edu/goinggreen/view.asp?newsID=1320>

Nowak, C.A. (volunteered paper). 2012. *Natural herbicides are generally not efficacious or effective at controlling roadside right-of-way vegetation*. 10th International Symposium on Environmental Concerns in Rights-of-Way Management, October 1, 2012, Phoenix, AZ.

Nowak, C.A. (invited presenter). 2013. *A study of alternatives to chemical herbicides on the right-of-way*. Category Six Pesticide Training, Right-of-Way Recertification Training, October 18, 2013, Auburn, NY.

Nowak, C.A. 2014. *Natural herbicides are generally not efficacious or effective at controlling roadside right-of-way vegetation*. Paper published as part of the Proceedings from the 10th International Symposium on Environmental Concerns in Rights-of-Way Management, October 1, 2012, Phoenix, AZ.

Nowak, C.A. (invited presenter), 2014 Annual Herbicide Update Class with a presentation entitled “*Alternatives to chemical herbicides on NYSDOT ROW*”, hosted by the New York State Department of Transportation, April 24, 2014, Binghamton, NY.

Nowak, C.A., and J. Rowen. 2015. *Rigorous monitoring of natural herbicide cost and effectiveness on an operationally-treated roadside right-of-way in Upstate New York – the vehicle for communication and cooperation among stakeholders in the Otsego Lake watershed*. 11th International Symposium on Environmental Concerns in Rights-of-Way Management, September 20-23, 2015, Halifax, Nova Scotia, Canada.

In association with the two studies in Task 3, the Researcher spent a significant amount of time briefing NYSDOT staff and interested stakeholders on the results of the tests.

In association with Task 4 – Oriental Bittersweet:

Nowak, C.A. (invited presenter), and C.J. Peck. *Oriental bittersweet ... it may not be controllable in the Hudson Valley*. Utility Arborist Association – New York Regional Meeting, October 18, 2012, Auburn, NY.

Nowak, C.A., organizer and lead (sole) presenter of a workshop entitled “*Integrated vegetation management to control oriental bittersweet*”, hosted by the National Park Service and the New York State Department of Transportation, September 26, 2013, Hyde Park, NY.

Nowak, C.A., and C.J. Peck. In press. *Large oriental bittersweet vines can be killed by cutting alone*. Journal of Arboriculture and Urban Forestry.

Peck, C.J. 2014. *Controlling oriental bittersweet using cut stump glyphosate herbicide treatments in the Hudson Valley*. Master of Science Thesis, State University of New York College of Environmental Science and Forestry, Syracuse, NY.

Peck, C.J., and C.A. Nowak. 2013. *Control of oriental bittersweet in the Hudson Valley using cut stump herbicide treatments*. New York Society of American Foresters and New England Society of American Foresters Annual Winter Meeting, January 30, 2013, Saratoga Springs, NY.

Factsheets

Six draft factsheets for NYSDOT personnel, contractors and stakeholders were developed in support of the “how’s and whys” of vegetation management on roadside ROWs. Ultimately each factsheet will be used as quick primers/refreshers to be used in the field to guide and improve vegetation management practice. Each draft is single-paged (some wrapped to the back of the page), and included a central idea (thesis statement or theme), a 250 to 750 word essay on the topic, and supporting graphics and photos.

Topics (titles) of the six factsheets are:

- 1) Hazard tree management
- 2) Herbicide use on roadside rights-of-way
- 3) Mowing on roadside rights-of-way
- 4) Natural herbicides for roadside rights-of-way
- 5) Noxious plants on roadsides
- 6) What is Integrated Vegetation Management

STATEMENT ON IMPLEMENTATION

Here is a summary of implementation steps for tasks in this Project:

TASK 1

Develop an agency-wide strategic plan that guides regional and residency vegetation management work on roadside rights-of-way. While NYSDOT vegetation management plans as they currently exist are consistent with all of the “best” plans examined from across the United States, there are areas for improvement.

Revise and update the existing Integrated Vegetation Management Program document. While the current IVM document is strong and still very much applicable to current management of NYSDOT rights-of-way, a revised and updated document could serve NYSDOT better in terms of shared understanding of what IVM is, and elevate the application of IVM across the New York State roadside system.

TASK 2

A region or residency can use the guidebook to develop a Highway Maintenance Vegetation Management Plan (VMP). A model, strategic plan at this level could be used by NYSODT to demonstrate how each of the written planning components should be formatted and completed so that other regions and residencies can follow suite.

TASKS 3 and 4

Since these Tasks were focused on manipulative field experiments that produced practically useful results, the implementation work is to apply the results to vegetation management operations (e.g., see Task 3-2 work with Scythe herbicide). Results have been actively shared with NYSDOT practitioners through workshops and other means, as shown in the Task 5 narrative. NYSDOT and SUNY ESF expect to share the study results in the future with interested parties. It is hoped that further research will provide more options and insights on using so-called natural herbicides and control of Oriental Bittersweet.

ACKNOWLEDGEMENTS

Each of the six final reports associated with Tasks 1-4 had individual “Acknowledgements”. Common to all six reports is the following acknowledgement statement:

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Each report also had additional acknowledgements. A summary of these is provided below.

TASK 1

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TASK 2

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TASK 4

- NYSDOT managers and staff in the Albany and Poughkeepsie regional offices and the Dutchess South, Rockland and Warren Residencies provided study test sites and logistical support for this research.

- Collin Bartholomew, Ian Freeburg, Gavin MacKellar, Quincey Oliver, Juliana Quant, William Van Gorp, Danielle Wilder, and Ryan Wynne as SUNY-ESF as Research Aides, Research Analysts, and Research Project Assistants
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