Appendix B: Invasive Species Management Plan

DRAFT
Robert G. Wehle State Park
Invasive Species Management Plan

By: Robert O'Brien, Casey Holzworth, Pam Otis, and Edwina Belding

NYS Office of Parks, Recreation and Historic Preservation
Environmental Management Bureau
Agency Building One
Empire State Plaza
Albany, New York 12238
(518) 474-0409

July 2, 2010

This page intentionally left blank

Table of Contents

Table of Contents iii

Executive Summary v
- Introduction v
- Background v
- Invasive Species at the Park v
- Invasive Species Management Goals and Implementation vi
- Roles and Responsibilities for Implementation vi

Introduction 1

State Park Overview 2
- Establishment of the Park 2
- Previous Planning Efforts 2
- The Robert G. Wehle Charitable Trust 3
- Recreational Resources/Activities 3
- Geology, Topography and Soils 3
- Natural Resources 4

Invasive Species at the Park 6
- A History of Invasive Plants in Robert G. Wehle State Park 8
- Invasive Species Management Model 8
- Invasive Species Management Plan - Goals and Implementation 10

Roles and Responsibilities for Implementation 23

References 24

Appendix 1: Inventory Form 25

Appendix 2: PRISM Ranking Form 29

Appendix 3: Pale Swallow-Wort Fact Sheet 33

Appendix 4: Removal Schedule Form 36

Appendix 5: Experimental Controls 40

List of Figures

Figure 1 - Wehle State ParkLocation Map 3
Figure 2 - Ecological Communities Map 4
Figure 3 - Approximate Pale Swallow-wort Densities at Robert G. Wehle State Park 6
Figure 4 - Approach to Invasive Species Management 9
Figure 5 - Restoration Flow Chart 16

List of Tables

Table - 1. Known Invasive Species Found within or adjacent to Robert G. Wehle State Park 7
Table - 2. Watch List of Invasive Plant Species for Robert G. Wehle State Park 7
Table - 3. - Explanation of Removal Schedule Fields 12
Table - 4. Groups Utilized in Stewardship and Invasive Species Control 22

Executive Summary

Introduction

This Draft Invasive Species Management Plan for Robert G. Wehle State Park (Wehle State Park) has been prepared, in conjunction with the park's Master Plan, by the New York State Office of Parks, Recreation and Historic Preservation (OPRHP) to provide guidance and a planning framework for invasive species control efforts at the park. It is included as Appendix B to the master plan and is included within the master plan's environmental review under SEQR, including its availability for public review and comment. The Commissioner of OPRHP will simultaneously adopt this plan at the same time the master plan is adopted.

This plan provides background information about the park and its invasive species issues, and outlines a process through which invasive species management can be implemented. This involves a series of goals and objectives that are adaptable to changing conditions. The plan also provides an overview of ongoing invasive species control efforts at the park and near-term control project plans. The overall vision of this plan is to promote and restore native biodiversity to the greatest extent possible.

Due to the severe infestation of the invasive plant, pale swallow-wort (*Cynanchum rossicum* syn. *Vincetoxicum rossicum)* at the park, this plan places an emphasis on its removal and control. The plan also includes information on the identification and control of other invasive species known to exist within the park. The severity of the pale swallow-wort infestation in the park has led OPRHP to the decision that an invasive species management plan is especially needed for this park so that control efforts can be planned and implemented in the most effective manner possible from both an ecological and economical perspective.

Background

Wehle State Park occupies 1,067 acres and is located in the Town of Henderson in Jefferson County (Figure 1). The park has three miles of Lake Ontario shoreline. Its southern boundary is adjacent to the Henderson Shores Unique Area managed by DEC. The park was established in 2003 and recreational activities and facilities offered in the park include hiking, mountain biking, picnicking, tennis courts, volleyball, and hunting. A house and associated outbuildings are also available for rent. Park visitation has been rising and was nearly 40,000 in 2009.

The New York Natural Heritage Program conducted a survey of the park and identified eleven ecological community types. Of these eleven, calcareous pavement barrens and calcareous shoreline outcrop are identified as significant natural communities (Lundgren and Smith, 2008). These calcium-rich bedrock outcrops are one of the most prominent features of the park.

The flora of the park is characteristic of limestone areas of northern and western New York, where shallow limestone bedrock affects everything from soil depth and drainage to soil chemistry and susceptibility to erosion. Most of the park contains second growth forest comprised of a diverse assemblage of young and mature trees, shrub and herbaceous plant species. The Natural Heritage survey also identified several specimens of the rare plant, cork elm (*Ulmus thomasii)* within the park. The park's wildlife is typical of the region and the rural setting.

Invasive Species at the Park

Wehle State Park contains an extensive infestation of the invasive plant pale swallow-wort. This is an aggressive invasive species from the milkweed family. It can form dense patches that crowd out

native plant species and impact wildlife habitat. In addition to being a long-lived perennial, pale swallow-wort is a prolific seed producer and produces allelochemicals that inhibit the development of neighboring plants. Studies within the park are ongoing, with partners such as the United States Department of Agriculture (USDA) and Cornell University, to learn about and control pale swallow-wort. This plant is not only a serious problem for biodiversity at the park but also presents challenges for maintenance and enjoyment of the park's trails. The primary control method used at the park is mowing, yet seeds continue to disperse from plants surrounding the mowed areas.

Invasive Species Management Goals and Implementation

This plan sets forth the goals, objectives and actions for the management of invasive species. The goals/planning steps presented in the plan include:

1. Inventory and Map – Collect and map data on invasive species within the park.
2. Rank and Prioritize – Rank invasive species according to the feasibility of control and significance of impact on the environment.
3. Control/Remove – Select control methods and develop removal plans.
4. Restoration – Restore treatment sites to a native ecological state following the removal of invasive species.
5. Maintain Native Ecological Systems – Monitor sites to prevent re-invasion and to identify and maintain areas free of invasive species.
6. Promote Stewardship – Train, educate, and provide outreach to staff and the public in order to provide support for successful invasive species control efforts.

Roles and Responsibilities for Implementation

The implementation of this plan involves working through each of the objectives and actions provided within each goal. The plan calls for adaptive management to account for new information. OPRHP will work with other important partners such as the NY Department of Environmental Conservation (DEC), the St. Lawrence Eastern Lake Ontario (SLELO) Partnership for Regional Invasive Species Management (PRISM), the USDA and Cornell University to achieve the goals of this plan.

Introduction

Wehle State Park is located in the Town of Henderson in Jefferson County. The park is located on the eastern side of Lake Ontario on Stony Point, approximately eight miles south of Sackets Harbor (Figure 1).

The mission of OPRHP calls for responsible stewardship of natural resources while providing appropriate recreational and interpretive opportunities to the public. Relevant natural resource goals of the master plan are to "Protect, manage and maintain areas important as habitat for rare, threatened, endangered or protected plant and animal species and community types" and to "Maintain, restore and/or enhance the natural environment to improve the quality of natural resources and support biodiversity of plant and animal species."

The park is located in a part of New York dominated by agricultural land use, and homes and cottages are the predominant development along the shores of Lake Ontario. The 1,067 acres of Wehle State Park, no longer in agricultural production and almost entirely undeveloped with nearly three miles of natural shoreline, is an important natural resource area. Surrounded by "working landscapes" and shorelines in private ownership, the park provides easy access to natural areas for the recreating public. Thus, there is clearly a need to provide careful stewardship to manage invasive species and protect important natural communities. This Invasive Species Management Plan is consistent with OPRHP's mission of providing responsible stewardship of natural resources.

Invasive species are defined as species (e.g. plants or animals) non-native to the ecosystem that cause or are likely to cause economic or environmental harm or harm to human health. Invasive species can develop extremely large populations, usually due to a lack of competition or predation, thereby causing adverse effects such as a loss of wildlife habitat and impacts to landscapes and ecosystems. The basic steps involved in managing invasive species are inventory, control, and monitoring. The vision of this plan is to promote and restore native biodiversity to the greatest extent possible. This plan describes the goals, objectives and actions needed to achieve this vision.

State Park Overview

Wehle State Park is located in Jefferson County, New York in OPRHP's Thousand Islands Region on the eastern shore of Lake Ontario. The park is just 30 miles southwest of Watertown, NY. The southern boundary of the park connects to the Henderson Shores Unique Area, administered by the NYDEC.

Establishment of the Park

The use of the property has evolved since permanent European settlement of the county in the early 19th century. Between 1895 and 1947, the U.S. military used the property for training purposes in preparation for warfare. The area was known as the Stony Point Rifle Range and housed soldiers for several days at a time as they trained for land, oversea and air combat. In 1963, the Army sold the land to Louis Wehle and Thomas Nagle of Rochester. Mr. Wehle and his son Robert Wehle maintained the property as a cattle farm, game preserve and rural retreat until 1990 when Robert sold the property to the NY DEC. The Wehle Family occupied the property until a year after Mr. Wehle's death in 2002. At the end of the following year, DEC transferred ownership of the tract, not including the Henderson Shores State Unique Area, to OPRHP for management as both a recreational facility and a facility that focuses on conservation. Following this transfer, Wehle State Park was created in 2003 to provide a place for patrons to enjoy scenic views of Lake Ontario, the recreational trail system and park facilities.

Previous Planning Efforts

OPRHP completed an Interim Management Guide for Wehle State Park in April 2004 in which existing patron use, facilities, and features of the park were documented. The NYS Historic Preservation Office conducted a Phase 1A cultural report for the park, which identified culturally significant aspects in the park. Following this review, the office conducted a more detailed Phase 1B cultural survey in 2008 for the main entrance roadway project. Based on these surveys OPRHP developed a five-year capital improvement plan to guide the initial development of the park. Regional staff have implemented the majority of this plan. Cultural and natural resource analysis has been ongoing for inclusion within the master plan.

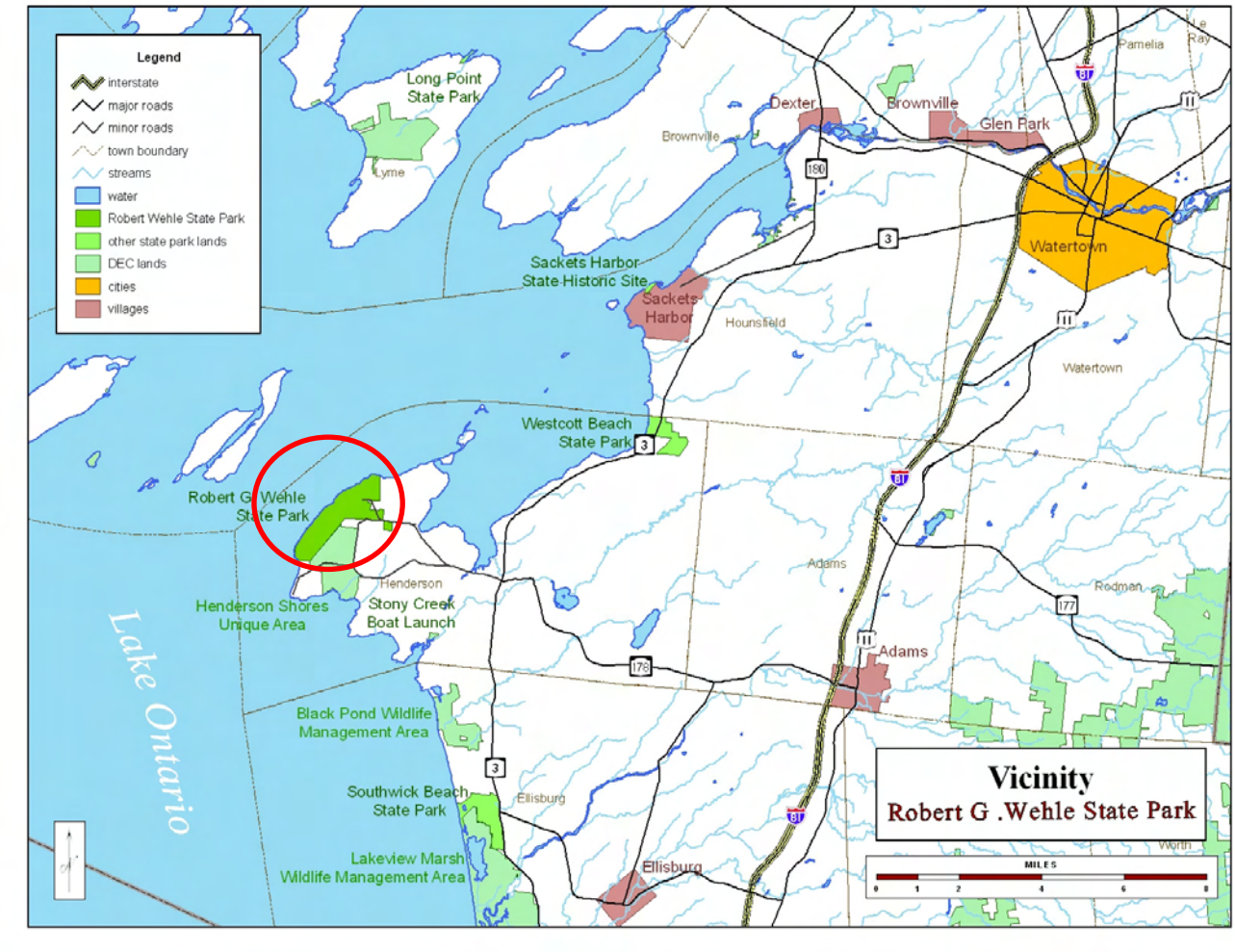


Figure 1 - Wehle State Park Location Map

The Robert G. Wehle Charitable Trust

The park receives funding support, on an annual basis, through distributions from the Robert G. Wehle Charitable Trust. Income and principal from the Trust is distributed in support of the properties under the terms of the Trust instrument. Distributions totaling in excess of $1.1 million have supported Wehle State Park since its establishment in 2003.

Recreational Resources/Activities

Park visitation has been rising and was nearly 40,000 in 2009. The park offers picnic areas, tennis and volleyball courts, interpretive exhibits and over 14 miles of trails for hiking, biking, cross-country skiing and snowshoeing. Portions of the park are also open to hunting. The park has a cottage and outbuildings that are available for rent by the week. There is also rental of a park cabin and group camping proposed under the master plan. The park is also accessible from the Great Lakes Seaway Trail.

Geology, Topography and Soils

The park is underlain by Ordovician Rocks, which include the Lorraine Trenton Black River Group. The Black River and Trenton groups are shallow water carbonates composed mostly of limestone and some dolostone.

The property gradually slopes downward from northeast to southwest. Based on the International Great Lakes Datum (IGLD) the property's highest point sits along the northern edge of the property at an approximate elevation of 332 ft. IGLD. This results in 60 ft. to 85 ft. high escarpments, a defining feature of the park, along the western shoreline. These cliffs represent the highest such escarpments of Eastern Lake Ontario. The land surface slopes downward from this point to near lake level (high water) of 246 ft. IGLD at the far southwestern end.

The entire Stony Point geographical area is noted for very shallow soils, with depths to bedrock from 0-20". The soils at Wehle State Park are no exception, with bedrock outcroppings common in the fields and forests of the park.

Natural Resources

Ecological Communities

The New York Natural Heritage Program survey identified eleven ecological community types at Wehle State Park (Figure 2), including calcareous cliff community, calcareous pavement barren, calcareous talus slope woodland, limestone woodland, successional old-field woodland, successional red cedar woodland, calcareous shoreline outcrop, cobble shore, shallow emergent marsh, silver maple-ash swamp and sinkhole wetland (*Ibid*). Although not included as a natural community type, large areas of the park are mowed lawn. Ecologically, the mowed areas of the park help to reduce the spread of pale swallow-wort seeds.

Figure 2 - Ecological Communities Map

Of the eleven natural community types identified in the park, calcareous pavement barrens and calcareous shoreline outcrop are significant natural communities. Calcareous pavement barrens are landforms that originated from sedimentary deposits in a vast, shallow inland sea that covered much of New York approximately 450 million years ago. Also known as alvar, these areas support grassland vegetation in a permanent early successional state. These areas often harbor rare species of plants and animals.

Calcareous shoreline outcrops occur along almost the entire Lake Ontario shoreline within the park. These outcrops of calcium-rich bedrock, such as limestone, are one of the most prominent features of the park. There are several hundred occurrences statewide of varying quality. This community type is limited to the calcareous regions of the state. The communities at Wehle State Park are good quality examples.

Flora

The flora of the park is characteristic of limestone areas of northern and western New York, where shallow limestone bedrock affects everything from soil depth and drainage to soil chemistry and susceptibility to erosion. Most of the park consists of second growth forest interspersed with alvar and successional old field habitats. The forests are comprised of a diverse assemblage of young and mature trees and shrub and herbaceous plant species.

Rare Plants

The NHP survey identified several specimens of *Ulmus thomasii* within the park (*Ibid*). Known as "cork elm" for the distinctive corky ridges on its twigs and branches, this species is listed as threatened by New York State, but is not identified federally on the “Endangered and Threatened Wildlife and Plants” list published by the U.S. Fish and Wildlife Service. This species has a limited range in New York State consisting mostly of the areas along Lake Ontario and the Finger Lakes. Primary threats to cork elm are logging of larger trees and Dutch elm disease.

Fauna

The park’s wildlife is typical of the region and the rural setting. The park supports a wide diversity of mammals, birds, fish, amphibian, reptile and insect species that are common to the northeastern United States.

Endangered, Threatened and Rare Animal Species

According to the New York State Breeding Bird Atlas, Stony Point provides potential habitat for 90 total bird species, three of which the State of New York has designated as species of special concern: Cooper's hawk (*Accipiter cooperii*), Sharp-shinned Hawk (*Accipiter striatus*) and Whip-poor-will (*Caprimulgus vociferus*).

Invasive Species at the Park

One of the most significant threats to the natural areas of Wehle State Park is invasive species (*Ibid*). While multiple species of invasive plants have been identified as being present at the park, the invasion of one specific plant was the impetus for the creation of this plan – pale swallow-wort *(Cynanchum rossicum)*. Although no formal surveys have been conducted to determine the true extent of the pale swallow-wort infestation at the park, anecdotal evidence from park staff, visitors, and local researchers suggest that almost all available habitat in the park has been invaded to some degree. Figure 3 shows the estimated abundance of the pale swallow-wort infestation based on non-scientific field observations. The first goal of this management plan is to create a more accurate map of the pale swallow-wort infestation.

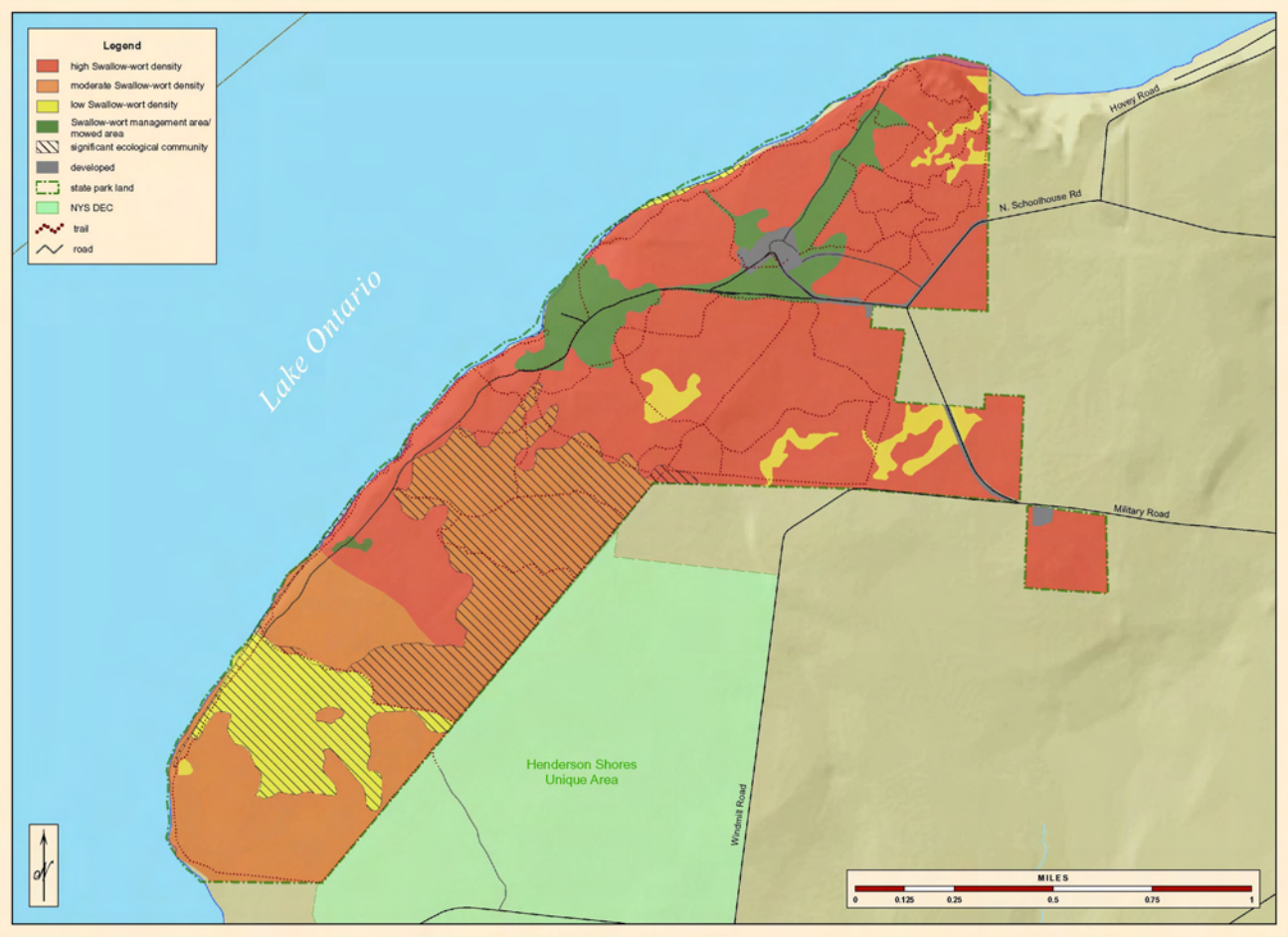


Figure 3 - Approximate Pale Swallow-wort Densities at Robert G. Wehle State Park

Native to southwestern Europe, pale swallow-wort was likely introduced for ornamental purposes in the late 1800's (Plant Conservation Alliance's Alien Plant Working Group, 2006). Pale swallow-wort can form dense patches that crowd out native plant species, which can lead to impacts to wildlife. In addition to being long-lived, pale swallow-wort is also a prolific seed producer. Pale swallow-wort produces large quantities of windborne seeds, which are widely dispersed. As pale swallow-wort densities increase, the above and below-ground ecology of these areas are altered, due partly to the plant's ability to produce allelochemicals, chemicals that inhibit the development of neighboring plants (Lawlor, 2006). The heavy rootstocks provide an energy and water storage mechanism that facilitates rapid early season growth and allows for survival in habitats that have

wide seasonal cycles of water availability (DiTommaso et al., 2005). This combination of adaptations allows pale swallow-wort to almost completely take over habitats in both sunny old fields and shaded woodlands. According to Edinger (2002), pale swallow-wort's aggressive spread is specifically threatening the globally rare alvar communities, such as those within Wehle State Park.

Recent studies have shown how these changes affect bird and insect assemblages in infested areas. In one laboratory study, monarch butterfly adults were offered black swallow-wort (*C. louiseae*) and common milkweed (*Asclepias syriaca*) in choice tests. Adults that fed on black swallow-wort laid some eggs, but none of the first larval instars survived (Haribal and Renwick 1998). A preliminary study of a habitat managed for grassland birds in Jefferson County NY, showed a significant negative correlation between pale swallow-wort cover and the number of breeding grassland birds (Central and Western NY Chapter - The Nature Conservancy, unpublished data).

This plan recommends that identifying the best options for management of pale swallow-wort control at Wehle State Park, especially within the significant communities, should be a high management priority. Decreasing pale swallow-wort populations will have a positive effect on the natural communities and native species that depend on suitable uninvaded habitats. OPRHP staff, with the assistance of many partners, has identified several other invasive plants within the boundaries of the park and surrounding the park, with pale swallow-wort representing the major threat. Table 1 lists the invasive species found within or adjacent to the boundaries of the park. Table 2 lists the invasive species that pose a threat to the park, based on their presence on nearby lands.

Table - 1. Known Invasive Species Found within or adjacent to Robert G. Wehle State Park

Common Name	**Scientific Name**
Bush Honeysuckles	*Lonicora morrowii & L. tartarica*
Common Reed	*Phragmites australis*
Garlic Mustard	*Alliaria petiolata*
Glossy Buckthorn	*Rhamnus cathartica*
Pale Swallow-wort	*Cynanchum rossicum*
Periwinkle	*Vinca minor*
Purple Loosestrife	*Lythrum salicaria*

Table - 2. Watch List of Invasive Plant Species for Robert G. Wehle State Park

Common Name	**Scientific Name**
Burning Bush	*Euonymus alatus*
Canada thistle	*Cirsium arvense*
Dame's Rocket	*Hesperis matronalis*
Giant Hogweed	*Heracleum mantagazzinum*
Goutweed	*Aegopodium podagraria*
Japanese Barberry	*Berberis thunbergii*
Japanese Knotweed	*Polygonum cuspidatum*

A History of Invasive Plants in Robert G. Wehle State Park

Control Efforts to Date

Anecdotal accounts document that several of Mr. Wehle's actions may have impacted the spread of pale swallow-wort. Mr. Wehle used the property to graze beef cattle. The presence of these animals in large numbers could have suppressed the invasion of pale swallow-wort through grazing and trampling of plants. Mr. Wehle also utilized fire management to maintain some fields as grazing lands and pasture. This too may have had an impact. However, documentation that he later used herbicides in an attempt to control pale swallow-wort suggests that, like scientific studies conducted on pale swallow-wort, Mr. Wehle found that grazing and burning were not effective control techniques.

Once the land became a state park, grazing, burning, and chemical treatments were no longer conducted. Instead, park staff mow the areas surrounding the entrance, maintenance shop, parking lots, rental compound, and trails frequently to maintain recreational facilities and contain seedpod production. This effort has been effective at controlling seedpod production in the maintained areas. However, it has not resulted in the eradication of pale swallowwort in those areas and seeds continue to disperse from plants surrounding the mowed areas. Pale swallow-wort is not only a serious problem for biodiversity at the park but also presents challenges for maintenance as well as enjoyment of the park's trails (Lundgren and Smith 2008).

Research by the U.S. Department of Agriculture into the control of pale swallow-wort is currently being conducted in the park. There is currently educational information about pale swallow-wort at park kiosks.

Invasive Species Management Model

The decision to develop an invasive species management plan for Wehle State Park came about due to an identified need for a more formalized and streamlined approach to the invasive species control process.

OPRHP Environmental Management Bureau (EMB) formulated this invasive species management plan based on work that has been occurring at Minnewaska State Park Preserve under Bob O'Brien, Invasive Species Control Field Director. This plan provides more than a basic look at invasive species management and control, and can serve as a resource for other parks. To supplement the information provided in this plan, other references that can be utilized to gain further understanding and knowledge have been included.

This Plan explains the process by which invasive species control efforts should be implemented. This process is broken into the following six overall goals:

1. Inventory and Map Invasive Species
2. Rank and Prioritize Invasive Species
3. Control Invasive Species
4. Restore Native Ecological State
5. Maintain Native Ecological State
6. Promote Stewardship

Each goal is further broken down by objectives and then actions or steps, which when completed, achieve the goals and guide invasive species management, so important native biodiversity is protected.

This invasive species management plan is to be implemented in an adaptive management approach. Adaptive management is a systematic approach for improving management by learning from past mistakes. Since this plan is adaptive, each year a manager/ coordinator should look at what has worked and what has not, and make changes accordingly. It is expected that changes will occur year to year as best management practices are refined.

This plan is also adaptive in its approach, because all the goals of invasive species management are tied together, as demonstrated in the adaptive management approach schematic diagram below:

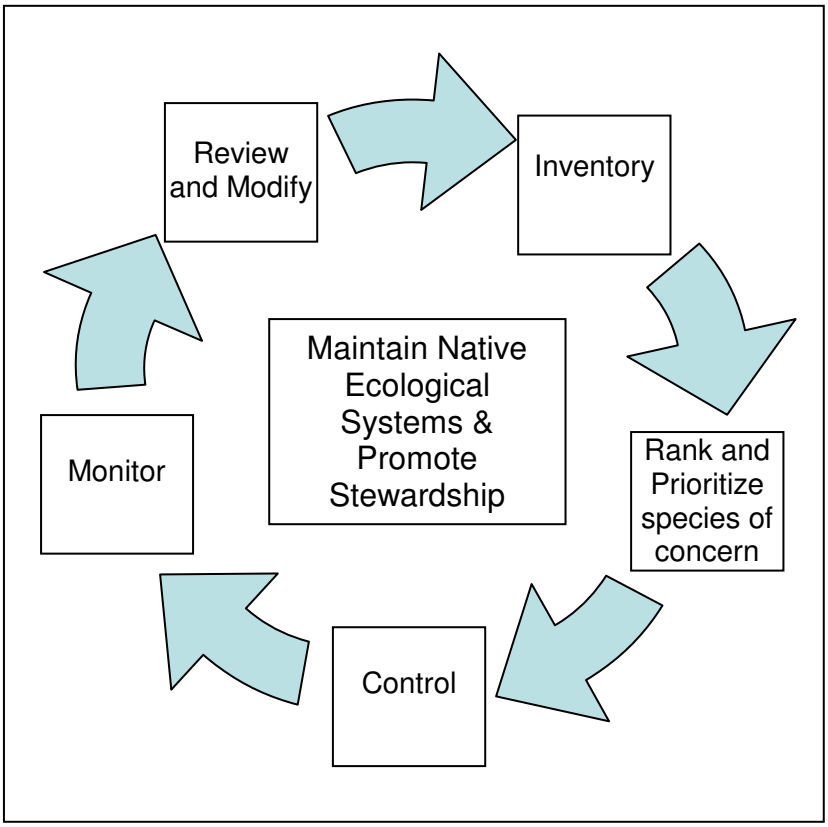


Figure 4 - Approach to Invasive Species Management

This circular diagram indicates that the goals occur in cycles which can begin at any point depending on resource availability. Noted that after the first invasive control season passes, the process of controlling invasive species becomes dynamic. All the goals have certain parts occurring at the same time and thus have to be managed at the same time. There exists a continual cycle of planning, implementing, reviewing and improving the invasive management process and actions. Deciding which goals to work on at any particular time depends on many factors including but not limited to availability of personnel, time, conservation goals, and the season.

This plan is consistent with the findings and recommendations of the NY Invasive Species Task Force along with other plans developed by organizations involved in invasive species management. Using this type of approach to formulate the plan is beneficial as it maximizes efficiency of efforts

and prevents duplication of work, while being able to relate the plan specifically to Wehle State Park.

Invasive Species Management Plan - Goals and Implementation

This section of the plan describes each goal and the objectives and actions that are involved in meeting that goal. As invasive species control is already an ongoing process at the park, each goal section also contains a summary of the current work being done and plans for future control work ("Current and Planned Controls"). Control includes the entire set of activities associated with managing invasive species: training, prevention, survey and data collection, early detection, removal or treatment, monitoring/follow-up, education and outreach.

Goal 1: Inventory and Map Invasive Species

Objective 1 - Collect and Store Data on Invasive Species and Locations

Knowing what and where invasive species are in the park is essential to begin to address potential threats**.** A standardized method of collecting and storing data on invasive species has been developed. The collection of complete inventory data is an ongoing process, therefore control can begin before the entire park is inventoried and mapped. In general, this objective consists of the following four steps:

Action 1a. Become Knowledgeable on Invasive Plant Species

Formal training on identification of species, both invasive and threatened, will be given to staff and volunteers.

Action 1b. Utilize Field Data Collection Form

Refer to Appendix 1 for OPRHP's "Field Data Collection Form".

Action 1c. Plan Data Collection

The data collection will begin in areas where there are known invasive species, working from more undisturbed areas toward disturbed areas, including trails.

Action 1d. Perform Data Collection

New initial assessment data will be collected continuously (weather permitting) until the entire park has been assessed and mapped. When performing data collection, care will be taken not to disturb sensitive areas. The field data collection will be curtailed during seed dispersal, insect movement cycle or time of pathogen propagule or spore dispersal.

Action 1e. Enter Data into Database and File Original Collection Form

The data collected will be entered into the OPRHP Statewide Invasive Species database. Access to this information can be obtained through the OPRHP Environmental Management Bureau. Original collection forms will be retained in an office file so they can be used for reference in the future. Referencing the comments and sketches on these paper forms has proven useful elsewhere for relocating plots.

Objective 2. Create Maps Linked to Inventory Data

Action 2a. The GIS Unit within the OPRHP Planning Bureau Converts Data Tables

The data entered in the OPRHP Statewide Invasive Species database will periodically be entered into the Agency's GIS database. The data will be shared with other agencies and organizations per approved request or agreement.

Action 2b. GIS Unit Prepares Maps

Periodically or by special request, maps will be created using GIS software to show the inventory data graphically. These maps will present a to-scale representation of invasive species locations and display the information regarding the specific plots, including species and size of infestation, which is viewable and printable via the Invasives drive. Users will need to install ArcReader application on computers used to view maps.

Current and Planned Controls

The NY Natural Heritage Program Report for Wehle State Park confirmed park-wide heavy infestation with pale swallow-wort. Formalized data collection was not needed to determine this fact. Figure 2 represents a preliminary effort to show levels of abundance. Several ¼-acre plots have been delineated and mapped for exploring experimental controls. Future data collection will include accurate mapping of pale swallow-wort infestation throughout the park. Collection of data and locations of all invasive species will occur over time.

Goal 2: Rank and Prioritize Invasive Species for Control

Objective 1. Create List of Invasive Species for Control Based on Rankings

This step will use the inventory data to create a ranking based on feasibility of control, significance of impact and resources available. The value in ranking park-specific invasions is to prioritize control efforts according to the most effective manner to produce the best possible outcome.

Action 1a. Review Invasiveness Ranking for Each Invasive Species Present

The New York Invasive Species Council (ISC) has developed a standardized list of known invasive species in New York and their statewide invasiveness rankings. This list is contained within the New York Invasive Species Council Final Report, A Regulatory System for Non-Native Species (ISC, 2010). The Nature Conservancy in New York and the Brooklyn Botanic Garden developed the ranking system, designed to assess the invasive nature of non-native plant species, in 2008. The ISC, in consultation with the Invasive Species Advisory Committee, adopted the plant ranking system for use statewide in 2009. State Parks will consider any species listed as prohibited or regulated through this process as an invasive species if present at or threatening the park.

Action 1b. Perform Local PRISM Ranking for Each Invasive Species

Following review of the statewide ranking listing, each species will then be ranked based on its local invasiveness. This will be done using regional information available, and if possible, through evaluation by the applicable Partnership for Regional Invasive Species Management (PRISM), in the case of Wehle, the St. Lawrence-Eastern Lake Ontario (SLELO) PRISM. A current PRISM Invasive Plant Ranking Form is contained in Appendix 2.

Objective 2: Prioritize controls based on rankings and resources available

Action 2a. Determine Resources and Job Hours for Control

In addition to rankings of invasiveness and feasibility on a state/region wide scale, controls will also consider local/park aspects such as funding, available staff, and timing. Small-scale removal, early

detection and post removal controls, as well as landscape scale controls, will be planned in accordance with regional and park priorities.

Current and Planned Controls

The state ranking system will be applied to the invasive species present in the park, and it is expected that pale swallow-wort will be identified as the most invasive plant present at the park. Most other invasive plants occur within pale swallow-wort infestations. Due to the pervasive nature of pale swallow-wort, its control is a priority at all scales. Invasive species found within pale swallow-wort control plots will be removed concurrent with removal of pale swallow-wort.

Goal 3: Control/ Remove Invasive Species

Objective 1. Select Management Options/Control Methods

Invasives will be controlled based on the ranking and available resources. Several different methods or combination of methods may be employed including manual, mechanical, cultural and, at times, chemical.

Action 1a. Based Priority and Constraints, Select Species to be Controlled

All invasive species will be considered for control. Species presenting the highest threat and/or greatest feasibility of control will be addressed first.

Action 1b. Determine Method of Control/Removal to be Used

OPRHP has been developing fact sheets on some of the primary invasive species that occur in New York State Parks. These contain information about both the biology as well as current control methods of each species. Staff will use these fact sheets during exploration into different options available for control. Staff will also consult additional fact sheets developed by various agencies and organizations as available. National Park Service fact sheets for numerous invasive plants found in New York State are available at http://www.nps.gov/plants/alien/fact.htm. Staff will also utilize OPRHP's "Control Recommendations Matrix" (Reid, 2010, unpublished) to review and guide control method decisions. The pale swallow-wort fact sheet is included in Appendix 3.

Objective 2. Develop Removal Schedule and Removal Plan(s) for Season

A removal schedule will be prepared annually for each invasive control project using a Removal Schedule Form (Appendix 4). The fields on this form are explained in Table 3,

Removal plans may be generated automatically based on data collected on a site-by-site basis. Staff will be trained as appropriate by OPRHP invasive species staff on the use of this database. Information may also be submitted to EMB for development of site removal plans.

Table - 3. - Explanation of Removal Schedule Fields

Date(s) of Removal	Based on when removal is most efficiently performed for each plant.
Site Location	Descriptive location of the invasive species to be removed
Type of Disturbance	From the data collection form
Target Species	The species common name you are addressing.
Method of Removal	This is determined in Objective 1 of this goal.

Ranking	Based on results from Goal 2.
Description of Threat/ Conservation target	What the invasive is threatening or what you are working to conserve or improve by removing invasive species.
# of days planned for removal	Based on size of infestation, personnel and equipment, and difficulty of removal technique.
# of Persons	How many people are going to be working? This is important for preparation of removal project, gathering tools etc.
# of hours	The expected number of hours needed to perform work
Job Hours	# of expected hours; X # of people.
Participants	Note who is going to be involved in removal.
Disposal Method	Different species have different disposal methods and these will be determined before the project begins.
Ownership of Property	Region
Restoration	Describe the restoration plans.
Monitoring Date	Identify your next monitoring date to see results.

Objective 3. Obtain approvals for planned removals

Action 3a. Submit Removal Schedule for approval to agency staff

Removal plans will be submitted for agency review and will include the following information:

1. Number of plots and methods of control for each species
2. A restoration plan
3. A map for each removal plan with topography and soil disturbance

Additional environmental and historic review may be required.

OPRHP has adopted a pesticide policy, limiting use of pesticides at NY State Parks. In the case of invasive controls, pesticides can be used where invasive species pose a significant threat to natural or recreational resources, and where manual, mechanical and biological controls are ineffective. Any proposed use for treatment of invasive species in New York State Parks must be approved by EMB (518.391.3953 or 518.474.0409). Chemical treatments must be performed by a NYSDEC Certified Pesticide Applicator.

Objective 4. Removals and/or Controls

Action 4a. Perform Removals as Prescribed in Removal Plans

Prior to any control or removal, an inventory of tools and other items must be taken before issuance and after the removal is performed. Staff needs to check that all items are returned. Performing removals and controls with a focus on safety is imperative. It is always a good idea to include some

education, interpretation, and recreation for the participants after a hard day's work. Always thank volunteers and groups in writing by e-mail or a letter.

Objective 5. Report on the Results of Removal /Control.

Removal Report information will be collected using the OPRHP Site Monitoring Form (SMF) in the field and then entered into the database. Images (post removal) will be taken and sent with the reports.

Current and Planned Controls

Pale swallow-wort has been controlled primarily through mowing in high use areas since the park was acquired. A 2008-09 assessment led to plans to undertake an experimental control technique. Some preparations, including the delineation of four ¼-acre plots, have occurred and OPRHP intends to move ahead with this control project in 2010. This project is discussed in more detail at the end of Goal 6 and in Appendix 4. The results of these experiments will lead to a best management strategy for the park on a landscape scale. Removal and control of pale swallow-wort leading to restored native ecology is the primary goal.

Goal 4: Restore Site to Native Ecological State

The goal of removing invasive species is restoration of native natural communities. This preserves the natural landscape and resources of the park and prevents further changing/degrading ecological communities that may contain rare and sensitive species.

Objective 1. Plan Site-specific Restoration, Including Native Replacement Species to be Used

Disturbed soils present an opportunity for re-invasion. Taking an informed approach to restoration is important because in many cases post-removal invasions are more problematic than the original invasion. There are three general restoration strategies, all of which play a role in the overall invasive species management plan:

1) Allow for natural re-growth of native vegetation
2) Fully restore removal plots using native plants immediately after removal
3) Restore removal plot(s) in stages (involves multiple removals/restorations)

Site-specific restoration plans for re-establishing native vegetation will be developed. Local nurseries and others will be sought out to supply native grass seeds and other plants. The park may also be a good source for collecting and storing native seed. The development of a park-specific native grass seed mix may be a future action.

Action 1a. Prepare Restoration Plan

If a control site is bounded by an abundance of native vegetation and the threat of re-establishment by invasive species is low, sites may be allowed to restore naturally through native plant recruitment. In this strategy, the site is prepared and allowed to re-vegetate while being monitored to ensure that no invasive species return.

In many cases, actions such as planting and controlling erosion are needed to restore the site effectively. Examples of such sites are those that are susceptible to erosion or re-invasion by invasive species or sites that do not have a good source of nearby native vegetation that can provide new growth.

In other cases, a series of control activities are required to achieve success. In these situations, reaching final restoration will not be viable or prudent after the first time control is performed. Performing a full restoration, only to disturb that restoration a short time later, would be a waste of effort. In these cases, restoring an area to its native condition is often reached in stages. This type of restoration plan has multiple removal and restoration cycles. If there are multiple phases in removal or control, interim restoration will be considered the best management practice. Interim restoration will involve spreading native annual grass seeds. Spreading of seed and laying down a retaining mesh is a relatively easy interim restoration and is effective erosion control.

All options will be explored and researched, and a plan will be in place, prior to conducting removals or controls. The plan will describe how removal/control and then subsequently restoration of a site to its native condition will occur. Figure 5 outlines the restoration process and clarifies the different techniques or combination of restoration techniques that can be utilized.

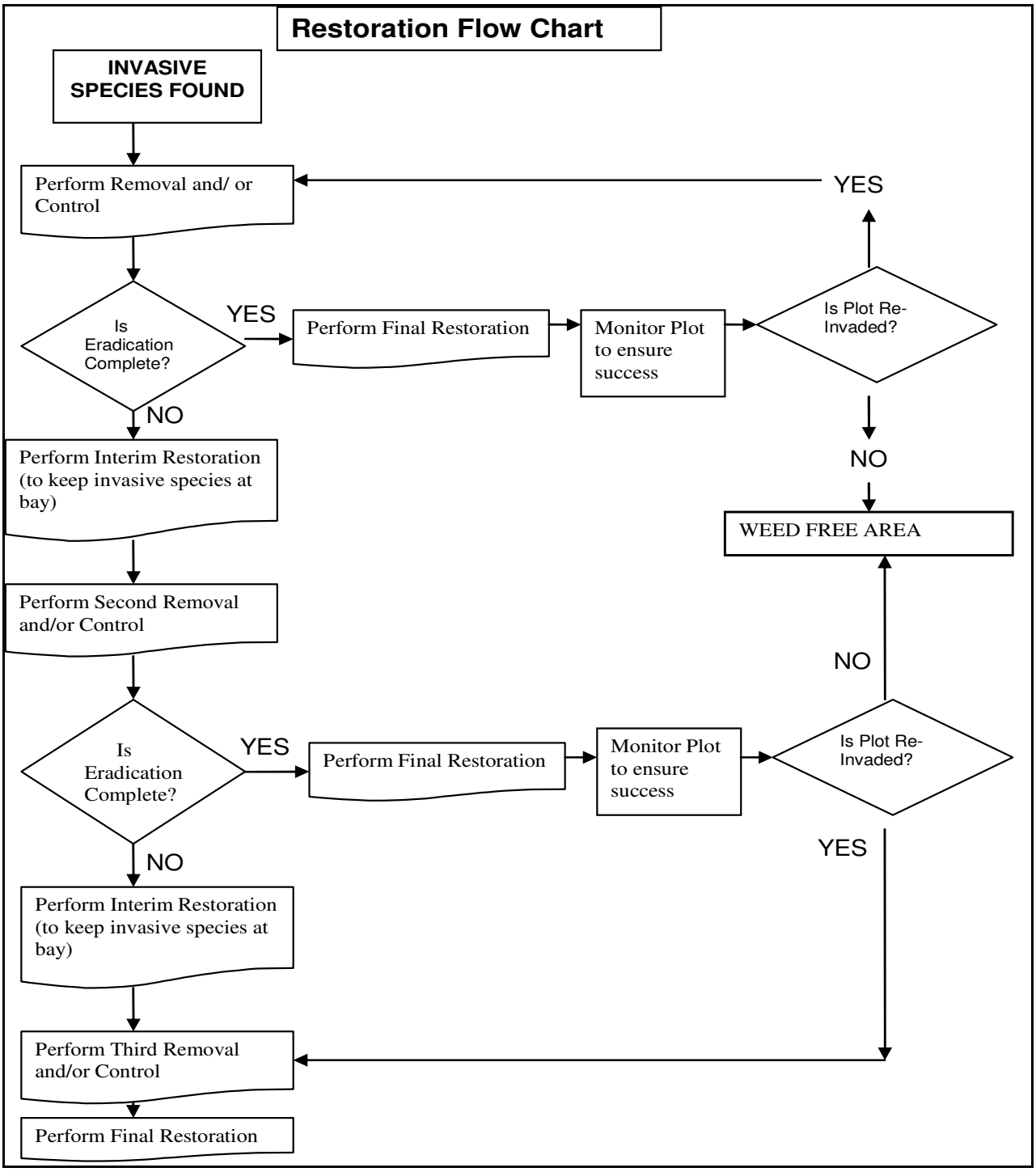


Figure 5 - Restoration Flow Chart

Action 1b. Select Native Species to be Used in Restoration

Restoration of site(s) to a native condition will utilize species native to the specific ecosystem so that non-native plants which could be problematic are not inadvertently introduced. When making decisions, transplants from within the park itself should be strongly considered.

Objective 2. Restore Removal/Control Plots to Native State

Successful restorative planting will fend off future invasions and reaching this final step is an integral part of this invasive species management plan. Follow-up monitoring and removal of invasive regeneration within removal/control plots are important for allowing the restoration efforts to take hold and will be discussed in the next goal, Monitoring.

Action 2a. Obtaining Native Plants

One option is the cultivation of natives. Though this is a viable option, the costs and time involved may be prohibitive because plants need to be nurtured into maturity before transplanting. Transplanting natives (another option for obtaining native plants) from other locations, possibly within the park, is a low cost approach to native restoration. This option can be effective provided a sufficient quantity of native plants exist and transplanting does not cause further ecological shifts.

Native plants can also be purchased from reputable nurseries. Care must be taken, however, to ensure that the plants are truly native. Native plants that originated from as close to the site as possible should be utilized. Plants native to a site but grown from stock that originated from an area far away may contain genetic material that may alter local genetic pools and slight physical adaptations that may not make them ideal candidates for restoration at a given site.

Action 2b. Perform Restorative Planting

A briefing on safety and the restoration, including how the plants will be distributed along with planting requirements such as depth and watering, will occur on site.

A site visit will be performed to assess the success of the replanting a month or so following the work. A second planting may be necessary if planting more than one species or if seasonality plays a role in plant availability or growth requirements.

Planning for the eventual replanting of grasses, shrubs or tree saplings once eradication is complete will be a part of the overall site specific removal plan.

Current and Planned Controls

To date, no restoration efforts have taken place at the park because no formal removal projects have occurred. The proposed experimental control project will include the goal of reestablishment of the native grassland community. Restoration will include sterilization of soils using high heat, followed by reseeding with a native grass mix. Fast-growing annual grasses will be seeded to protect the site from non-native re-infestation while the native grassland community develops.

Goal 5: Maintain Native Ecological Systems

Maintaining native ecological systems will be achieved by preventing re-introductions of invasive species in areas where removal/control has taken place, and stopping new invasions of invasive species as they occur through an Early Detection and Rapid Response program.

Objective 1. Monitor Control Locations Post-Removal

After removal/control is performed, further monitoring is needed in order to reassess actions performed and to determine what control methods and restoration practices may need to be adapted.

A Site Monitoring Form (SMF) will be completed for each monitoring action and then, if needed, on the spot treatment of regenerating invasions can be performed.

Action 1a. Monitoring Schedule

A planned schedule of plot monitoring will be developed when planning the removals for a season. All sites where removal/control projects have taken place will be reassessed at least annually. Monitoring dates for each new removal plot will be scheduled in conjunction with the Removal Schedule for that season.

A Monitoring Schedule will include the previous year(s) removal plots and their monitoring dates, as well as updating the schedule with the monitoring dates for this year's removal/control plots. A quick site check several weeks post-removal will be done to gauge the frequency at which monitoring will be planned in subsequent years and to assess the plot for reinvasion of the same or possibly additional invasive species. This site visit will also be used to assess erosion at the site and native plant re-growth.

Action 1b. Collect Data on Removal/Control Plots

The SMF contains fields of information pertaining to each removal/control plot including: plot ID, species controlled, date of first control, date of last control, and space to note if a subsequent onsite removal was necessary. New, dated photographic images will be taken when returning to the removal/control plot for monitoring. The data collected during monitoring will be entered in the OPRHP Statewide Invasive Species database.

Action 1c. Perform on the Spot Treatment of Regenerating Invasive Plants

OPRHP's best management practice for monitoring recommends that a team of two perform monitoring activities. The team will have all the tools necessary for plot maintenance and control of any regrowth of invasives along with the Post Removal Report for the plot(s). If removal of invasive species (due to regeneration) is necessary, it will be performed on the spot and images will be taken pre and post removal for the next monitoring cycle. Any treatment performed during the site monitoring visit will be noted on the SMF.

Objective 2: Setup and Monitor Invasive Free Prevention Zones

Collecting data, mapping and delineating zones where invasions have not occurred will ensure conservation targets are protected. It also aids rapid response to new invasions.

Action 2a. Development and Implementation of Invasive Free Zone Mapping Strategy

There are a few different strategies for setting up invasive free zones. The first option uses a map of the park, and sets up invasive free zones based on knowledge of the park. This includes consideration of sensitive conservation targets, and areas likely to be free of invasives based on location and characteristic vegetation and landscape.

An invasive-free protection zone mapping strategy will be based on "what we already know." All known ecologically sensitive or significant communities will be surveyed and delineated on the map, followed by areas likely to be invasive-free based on knowledge of park vegetation, and/or ortho-images or satellite images which show the landscape, vegetation, slope, aspect, and ecological communities. Natural Heritage reports as well as the NYS GIS Clearinghouse website and the DEC website of breeding bird areas will be used in determining where sensitive areas are located.

No samples of flora or fauna will be collected. If invasive species are found while delineating what was thought to be an invasive free zone, rapid action is immediately required to remove the species. Control/ removal will occur as soon as possible.

Invasive-free protection zone mapping is part of the overall mapping and data collection strategy for the whole park. This is necessary information that allows for proactive efforts in order to preclude invasions, not just respond to known infestations. Additionally, mapping invasive-free zones allows buffer zones to be established around conservation targets.

Action 2b. Set up Prevention Zones

As invasive-free areas are established, the next step is to set these areas up as prevention zones. An Invasive Species Prevention Zone (ISPZ) is a natural area that is dominated by desired native species and natural communities, which is monitored and protected from non-native invasive species introductions. A buffer area, large enough to be certain of early detection and rapid response to new invasion, will surround the invasive free conservation targets.

As ISPZs and conservation targets are designated, annual or semi-annual monitoring will take place and become part of the monitoring schedule in subsequent years following the initial survey.

Action 2c. Early Detection and Rapid Response (EDRR)

To promote a successful rapid response program, it is important to identify species that pose a high risk to the region in general and to be prepared to act quickly if an invasive free or prevention zone is invaded. Early detection species and areas take precedence over any other removal projects.

Rapid response includes immediate data collection and planning of eradication and control. All of the steps outlined in this management plan will begin immediately including making additions to the Removal Schedule for the current field season whenever possible. Early detection and rapid response is the best management practice for overall invasive species prevention and eradication.

Current and Planned Controls

As experimental and landscape scale control progresses, protection areas and prevention zones will be designated, monitored and maintained as weed free to the greatest extent possible. Special attention will be paid to early detection and rapid response.

Goal 6: Promote Stewardship

Objective 1: Institute Training Programs

Volunteers, well suited to time and labor intensive objectives that tax park workforces, will be used during all steps of management. To make the most of volunteer effort, training programs must be developed so that the volunteers, partners, and staff that become involved in invasive species management have at least a basic background on invasive species and safety protocols. Training programs that have been created for other parks will be used whenever possible.

Action 1a. Develop Training Programs

All volunteers will be trained on identification, control, and safety. The completion of each goal of the plan requires both a basic training and more advanced training program. The park will offer and deliver various types of training. The basic training program is for volunteers who are there for one day to perform one aspect of invasive management, such as removal and control or restoration planting. This type of training program will include:

- Welcome and Introduction (if a group)

- Overview of the problem (invasive species) and goal for the day
- Safety lecture
- Plan of the day (i.e., conduct and order of activities)
- Question and Answer Session

Advanced training programs focus on particular interests of the volunteers. An advanced training program is detailed in nature and will be focused on one or more goals of the plan.

A PowerPoint program on matching volunteers, "Playing the Match Game" (available upon request), is a valuable resource in learning how to match people and activities so that both the park and volunteers feel they have benefited from being involved in stewardship.

Action 1b. Perform Outreach

Getting the word out about the need for volunteers and partners can be done through the use of local newspaper calendars of events, environmental publications and newsletters, farmers markets, college campus informational boards and municipal kiosks.

Action 1c. Train Volunteers/Partners/Staff

Volunteer training will occur as often as possible and on a variety of days and times throughout the field season.

Partners will likely schedule training as an outcome of meetings on the group goals. The outcome of partnership training will be scheduled removals and controls.

In addition to training outside groups and the public, it is necessary to have staff training. This will occur in spring or early summer and will be specific to the roles staff can play in overall invasive species management. Field-based staff will receive training on species identification and data collection. This is an excellent way to gather data and initiate early detection and rapid response. It should be noted that the field staff at a park can be the most valuable resource a coordinator has for constant monitoring of the park.

Objective 2: Educate

Education programs, as separate from training programs, with an emphasis on the threats invasive species pose to native biodiversity, economics, aesthetics, and human health, have been developed for students at K-12 and college levels, and the public in order to promote stewardship values and ethics. These programs can be re-designed to apply more directly to a park or region with an emphasis on field involvement.

Action 2a. Research and Design Education Programs

Educational program development has, for the most part, been done by others. There are several K-12 programs available for free over the internet. An example of a primary school curriculum, from California State University Monterey Bay and Bureau of Land Management, is located on the web at: http://watershed.csumb.edu/ron/roncor/cor/index.htm. Programs such as this can be used in part, whole, or tailored to meet specific educator needs. The basic training program is well suited as an educational tool for general public programs delivered at nature centers and other venues and events such as Earth Day or Invasive Species Awareness Weeks.

Action 2b. Coordinate School-Based Programs

Ideally, coordinating with school based-programs will be a part of this overall education program. Classroom and field activities will include actual removals wherever possible. Traveling offsite to

deliver education programs in late winter prior to the field season is a possible activity if resources are available.

Action 2c. Develop Public Information Campaign

Information about invasive species should be included in park kiosk panels, brochures, flyers, and newsletters to raise the overall level of awareness and promote participation and stewardship. The distribution of information on early detection is especially important. The sooner a new infestation of an invasive species is reported the less time and effort is needed to control and eradicate. When a citizen locates a new infestation it will be suggested that images rather than voucher specimens be taken of the suspect invasive, as often times species are misidentified and the possibility that a rare species is mistakenly collected needs to be avoided.

Objective 3: Develop Working Partnerships

Acting locally in partnerships is especially valuable and ad hoc groups involved in environmental issues will be sought out or created. Environmental commissions, friends groups, university environmental science and natural resource departments, and watershed organizations are other such groups to collaborate with in invasive species management.

Action 3a. Assist With Community and Private Landowner Actions

Disseminating information to surrounding private landowners and encouraging them to restore native species on their land is essential to the success of any invasive control program over the long term. Private lands are the largest segment of the state with invasive species to manage. Educating the private land owner in public forums and cooperative demonstration projects is a step toward statewide early detection, rapid response, and eradication of existing invasive species.

Objective 4: Research and Experimentation

Often volunteers, partners, and academic institutions will have interest and skill in the natural sciences. These valuable persons and organizations can aid in development and augmentation of best management practices and help carry out experimentation. Qualitative and quantitative data analysis can lead to better understanding and new methods of control and eradication. The measurement of failure and success of management practices over time aids in achieving the best cost-benefit ratio in invasive species management.

Action 4a. Conduct Research on Best Management Practices

OPRHP is open to testing new and innovative control strategies that adhere to the resource management guidelines established for the statewide park system. Whether conducted by park staff or by outside researchers, this type of research will help determine the efficacy and feasibility of new control strategies.

Current and Planned Controls

OPRHP has been involved in a number of invasive species stewardship efforts since acquiring Wehle State Park. These include expanded mowing of high use areas and fields and trails, the publication of kiosk information and brochures on pale swallow-wort, and participation in the SLELO PRISM. In addition, OPRHP has cooperated with USDA and Cornell University for a long-term experiment to examine the ecology of pale swallow-wort and its invasion of the park. . This research is in support of the development of a future bio-control for pale swallow-wort.

Recently OPRHP hired an environmental education consultant to prepare the document “Swallow-wort Interpretive Plan for Robert G. Wehle State Park” (Veverka, 2010). This plan was funded

through the Robert G. Wehle Trust and will be implemented as part of the Master Plan to further raise public awareness about pale swallow-wort at the park. Some of the recommended actions that will be undertaken in the near term include the installation of seed check/boot brush stations, and additional signage. The goal is to provide additional information about the plant and the control measures that are being taken at the park, and to engage the public to assist in preventing its spread beyond park boundaries.

A list of potential groups that OPRHP has worked with in the past, and plans to work with in the future, is below. This list gives an idea of the variety of groups and people who can be utilized to advance invasive species management and the promotion of stewardship within a park. Of particular note is the SLELO PRISM. The agency is involved with this group and strives to become a more involved partner.

Table - 4. Groups Utilized in Stewardship and Invasive Species Control

General Public	Friends groups
Girl/Boy Scout troops	Student Conservation Association
High Schools	Jefferson County Alternative Sentencing
BOCES Jefferson County	SLELO
Town or County environmental commissions	NY Department of Corrections
NY Department of Transportation	Community groups (senior citizens, 4-H, others, campus groups, environmental groups)
Town of Henderson Highway Department	

Finally, work will be advanced on the experimental test plots for pale swallow-wort removal this summer. A full description of this project is contained in Appendix 5. This project will undertake mechanized pale swallow-wort plant material removal in both field and forest communities. In four separate test plots, pale swallow-wort plant material will be excavated and removed from the soil using Bobcat brand tractors with special tilling and sifting attachments. Once sifted, the site will be restored using native plantings.

Roles and Responsibilities for Implementation

This plan provides a framework for the management of invasive species at Wehle State Park. Implementation will involve coordination between OPRHP staff at the park, the regional office and the EMB in the Albany office. Representatives from each of these levels should meet annually to discuss implementation of the management plan and specific actions that will be taken during the year. Some actions will be on-going activities while some will be specific projects or events. Results of the previous year's experiences and progress should also be evaluated at this meeting. Staff who will attend this meeting will include the Park Manager, General Park Manager or other regional representatives, the Saratoga/Thousand Islands Regional Natural Resource Steward (Biologist) and the Invasives Species Control Field Director.

The actual staff responsible for the implementation of each of the goals and objectives outlined in the plan will vary. For example, staff will implement some tasks that are day-to-day oriented, such as early detection and rapid response, on the park level. Other activities, such as the training and use of volunteers, will involve coordination between park staff and the Natural Resource Steward as well as others. Primarily the Invasive Species Control Director and the Natural Resource Steward will coordinate larger projects such as the implementation of the experimental plots. Close communication between these parties will be the key to insuring that invasive controls are effectively implemented. In general, responsibility for implementation of the different parts of the plan will be reviewed and discussed as part of the annual planning meeting.

Continued participation in the SLELO PRISM is an important role for the agency. The Park Manager and the Natural Resource Steward will continue to attend these meetings and find ways that the agency can fully participate in its activities.

Coordination with USDA and Cornell University regarding the ongoing research will also continue and will be done primarily through the Park Manager in close consultation with the Regional Office and the Natural Resource Steward. The same applies to coordination with DEC regarding management of the adjacent Unique Area, particularly in terms of opportunities for funding and staffing for pale swallow-wort control. For example, the opportunity to fund an "invasive species steward" position similar to the Dune Steward program on the Eastern Lake Ontario shoreline should be explored. This position could be shared among the Lake Ontario State Parks and possibly DEC properties, and the person could advance public education about impacts and prevention of pale swallow-wort, as well as coordinate site-specific control and monitoring efforts.

Changes and adaptations may occur to specific steps involved in this plan because of new information, improvements in technologies and methodologies, and because of the evolving nature of invasive species management. The need to remain flexible is especially necessary when performing natural resource related management projects because of changing or unexpected environmental conditions. Thus, this needs to be kept in mind as invasive species management is implemented.

Invasive species management is not done in a void. It is performed in the context of the park, its neighbors and the surrounding land. There are many groups actively working on invasive species issues who could become involved with the implementation of this plan. It is sometimes a best use of resources to take advantage of these groups as they offer expertise, people hours and may be on the forefront of new ways to best manage invasive species.

References

DiTommaso, A., Lawlor, F. M. and Darbyshire, S. J. 2005. *The Biology of Invasive Alien Plants in Canada. 2. Cynanchum rossicum (Kleopow) Borhidi [= Vincetoxicum rossicum (Kleopow) Barbar.] and Cynanchum louiseae (L.) Kartesz & Gandhi [=Vincetoxicum nigrum (L.) Moench*]. Canada Journal of Plant Science 85: 243–263.

Edinger, G. J., D. J. Evans, S. Gebauer, T. G. Howard, D. M. Hunt, and A. M. Olivero 2002. *Ecological Communities of New York State, Second Ed.*. New York Natural Heritage Program. Albany, NY.

Haribal, M. and Renwick, J. A. A. 1998. *Identification and distribution of oviposition stimulants for Monarch butterflies in hosts and nonhosts*. Journal of Chemical Ecology 24: 891–904. Available at www.ofnc.ca/fletcher.

Lawlor, F. 2006. *Pale Swallow-wort Fact Sheet.* Central and Western New York Chapter, The Nature Conservancy, Pulaski, NY. Available at http://www.nps.gov/plants/alien/fact/pdf/cyro1.pdf

Lundgren, J and Smith, K. 2008. *Rare Species and Ecological Communities of Robert G. Wehle State Park*. New York Natural Heritage Program, Albany, NY.

National Park Service Invasive Plant Fact Sheets.
Available at http://www.nps.gov/plants/alien/fact.htm

New York Invasive Species Council. *FINAL REPORT: A Regulatory System for Non-Native Species*. June 10, 2010. Available at http://www.dec.ny.gov/animals/63402.html

New York State Office of Parks, Recreation and Historic Preservation (OPRHP) 2010. *Draft Master Plan/Draft Environmental Impact Statement for Robert G. Wehle State Park*. Empire State Plaza, Agency Building 1, Albany, NY

North American Weed Management Association 2002. North American Invasive Plant Mapping Standards.
Available at http://www.nawma.org/).

Plant Conservation Alliance's Alien Plant Working Group. 2006. *Least Wanted: Pale Swallow-wort*. Available at http://www.nps.gov/plants/alien/fact/cyro1.htm.

Reid, A.. 2010, unpublished. *Invasive Plant Control Recommendations Matrix.* New York State Office of Parks, Recreation and Historic Preservation (OPRHP). Empire State Plaza, Agency Building 1, Albany, NY

Veverka, J. 2010. *Robert G. Wehle State Park Pale Swallow-wort Educational Interpretive Plan.* John Veverka & Associates, Okemos, MI

Appendix 1: Inventory Form

NY State Invasive Plant Survey Report Form

*At a minimum, please fill out all fields in **bold** type. Fill out all observer information the first time you complete one of these forms.*

Site Location Information	
Town:	
County:	**State:** New York
Directions to Site:	
Property Organization:	
Property Contact Person:	
Contact Information (Phone, Email, and/or Address):	

Observer Information
Observation Date:
Name(s):
Organization:
Telephone:
Email:
Address:
GPS Unit Model:

GPS Coordinates: UTM **E:**_____ UTM **N:**_____ Receiving WAAS Signal? ☐ Yes ☐ No

Set your GPS Coordinate system to UTM, Map Datum to NAD83, Zone 18N. Coordinates are ideally taken from the center of the infestation. Please note if otherwise.

If GPS coordinates are not available, please include a map (USGS topographic preferred) with the site location marked.

Property Ownership:	
☐ Private	☐ County
☐ Village	☐ State
☐ Town	☐ Federal
☐ NGO (Non Gov't. Org.)	
☐ Other _____	

Current Land Use:	
☐ Roadside	☐ Backcountry
☐ Powerline	☐ Trailside
☐ RR Tracks	☐ Logging Road
☐ Farm Field	☐ Yard/Garden
☐ Recreation Area (i.e. ball parks)	
☐ Other _____	

Historical Disturbance:	
☐ None	☐ Construction (General)
☐ Cultivation	☐ Construction (Road/Trail)
☐ Dumped Debris	☐ Flood
☐ Fire	☐ Former Homestead
☐ Fire Break	☐ Tree Harvesting
☐ Other _____	

Habitat:
☐ Aquatic
☐ Nonforested Wetland
☐ Forested Wetland
☐ Field
☐ Forest/Upland
☐ Rock Outcrop
☐ Other _____

Site ID: Use> date_speciescode_dailyid# (example> 20080303BETH03)

Invasive Plant Species (Common and/or Scientific name)	**Size of infestation** (Infested Area)	**Abundance** (# of plants)	**Distribution**	**Invasive % Cover**	Documented? *	Phenology *(note all present)*	Tree Canopy % Cover
1. List invasive plants found at this site. *2. Please characterize each infestation using the letter codes provided for the following questions.*	***Include units:*** · square feet (ft^2) · square meters (m^2) · acres (ac) · hectares (ha) tenths kilometer tenths mile	A. 1 B. < 20 C. 20-99 D. 100-999 E. > 1000	A. Single plant B. Evenly sparse C. Single Patch D. Multiple patches	A.< 1% B. 1- 25% C. 26 – 50% D. 51 – 75% E. 76 – 100%	A. No B. Digital Photograph C. Specimen Collected	A. Vegetative B. In Bud C. In Flower D. Immature Fruit E. Mature Fruit F. Senescent/Dormant	A. 0 – 25% B. 26 – 50% C. 51 – 75% D. 76 – 100%
1.							
2.							
3.							
4.							
5.							
6.							

Comments:

Thank you for collecting this information! Mail to: Robert O'Brien PO Box 893 New Paltz, NY 12561

Email: robert.o'brien@oprhp.state.ny.us

Appendix 2: PRISM Ranking Form

PRISM

(New York Partnerships for Regional Invasive Species Management)

NON-NATIVE PLANT INVASIVENESS RANKING FORM

PRISM:

Scientific name: _____ USDA Plants Code: _____

Common names: _____

Native Distribution _____

Date Assessed: _____

PRISM Assessors: _____

PRISM Reviewers: _____

Date Approved: _____ Form version date: 13 April 2009

New York Relative Maximum score: _____ Date NY assessment approved: _____

New York State Invasive Rank: _____

SUMMARY OF PRISM RANKING RESULTS:

Distribution: ☐

Estimated number of infested sites: ☐

PRISM Invasiveness Rank[§]: ☐

A. DISTRIBUTION AND ABUNDANCE (KNOWN/POTENTIAL):

1. What is the species distribution and abundance in the PRISM?

A.	Not present	Not Present
B.	Occurs in three or fewer natural areas (locations that are at least ¼ mile apart) with no infested area* >1 acre or containing >100 individuals	Restricted
C.	Present in 4–10 natural areas, or with one occupied location >1 acre or containing >100 individuals	Common
D.	Present in >10 minimally managed areas	Widespread
U.	Unknown	Unknown

Answer: ☐

Describe distribution:

Sources of information:

[§]Not Assessable: not persistent in the PRISM, or not found outside of cultivation.

*Definition of "infested area" is the "…actual or percentage of land occupied by [canopy cover of] weed plants" NAWMA (North American Weed Management Association) 2002. North American Invasive Plant Mapping Standards (see **http://www.nawma.org/**).

2. What is the likelihood the species will occur (if not yet present) or expand its distribution and abundance (if already present) in the PRISM?

Answer:

Documentation (e.g.: history of establishment in PRISM, suitability of habitats and climate, distribution models, literature, expert opinions):

Sources of information:

B. INVASIVENESS RANK IN THE PRISM:

Is the species distribution Widespread or Common?

Yes: Go to column A in table below.

No: What is the likelihood of species occurrence or expansion? Answer:

Very Likely:	Use column A below
Moderately likely:	Use column B below
Unlikely:	Use column C below
Zero likelihood	Invasive potential Insignificant
Unknown	Invasive potential Unknown
Not assessed	Invasive potential not assessed

Assign a PRISM invasiveness rank to the species based on its New York Relative Maximum Score, using the designated column in the table below.

New York Relative Maximum Score	New York Invasiveness Rank	A	B	C
> 80.00	Very High	VH	H	M
70.00–80.00	High	H	M	L
50.00–69.99	Moderate	M	L	Ins
40.00–49.99	Low	L	Ins	Ins
<40.00	Insignificant	Ins	Ins	Ins

Column used: __ (Insert PRISM Invasiveness Rank on page 1)

References for species assessment:

Citation: This ranking form for regions within NYS may be cited as: Jordan, M.J., G. Moore and T.W. Weldy. 2008. Invasiveness ranking system for non-native plants of New York. Unpublished. The Nature Conservancy, Cold Spring Harbor, NY; Brooklyn Botanic Garden, Brooklyn, NY; The Nature Conservancy, Albany, NY. Note that the order of authorship is alphabetical; all three authors contributed substantially to the development of this protocol.

Acknowledgments: Valuable contributions by members of the Long Island Invasive Species Management Area's Scientific Review Committee were incorporated in revisions of this form.

Appendix 3: Pale Swallow-Wort Fact Sheet

FACT SHEET

Pale Swallow-wort

Cynanchum rossicum

Milkweed Family - Asclepiadaceae

USDA PLANT CODE: CYLO8

Pale swallow-wort stem with seed pods (top) and in bloom (bottom).

Description – Herbaceous perennial vine, climbing 1-2 m. Stems climb on other plants or twine together forming ropes. Similar in appearance and habit to black swallow-wort (*Cynanchum nigrum*), but with pale pink colored flowers.

Leaves - Oval shaped, pointed at tip, opposite positions on stem, 5-10 cm long. Leaves larger at mid-stem, smaller and narrower at tip. Dark green, shiny, smooth and hairless. Turn golden yellow in late summer.

Fruit & Seeds - Narrow, pointed pods, 4-7 cm long, often in pairs. Pods first appear in early June, turning from green to light brown as they ripen for approximately 6 weeks.[1] Seed dispersal is late July to September, occurring first in sunny, open locations, and later in shade.[1] Pods open lengthwise releasing wind-borne, milkweed type seeds attached to tufts of long, soft, white hairs. Up to 2000 seeds per m^2 in open sun and few to no flowers or seeds in dense shade.[7] Pods remain on dried vines.

Flowers - Open mid-May to July, peaking in early June, continuing into early August in shade.[4] Small at 5-7 mm wide. Clusters of 5-20 flowers arise from a single stem at the junction of leaf and stem. Five long and narrow triangular petals form a 5 pointed star shape. Color is pale pink to reddish brown. Petals hairless, often twisted. Five small, thick lobes in center. Flowers smell of rotting fruit. Insect and self-pollinated.

Roots - Pale, thick, and fibrous. Rootstalk is woody. Root crown buds form dense mats and produce many shoots below ground.

Habitat & Ecological Impacts – Native to Ukraine and southwestern Russia. First recorded in North America in Toronto Junction, Ontario in 1889.[5] First recorded in New York in 1897 in Monroe and Naussau Counties.[7]

Current Distribution - Known to occur in 12 states across the northeastern and mid-western United States, from New Hampshire southwest to Missouri. Reported in Ontario and Quebec. NY State populations from central NY north to St. Lawrence County, and also in Suffolk County and Kings County. Some distribution overlap with black swallow-wort which has darker, purple-black flowers; specific identification should be made.

Habitat - Grows in fields, woodlands, shrub habitat, river banks, transportation corridors, disturbed areas, fence rows, in shallow soils over limestone bedrock, on talus slopes, and is usually found in calcareous soils. Adapted to a wide range of light and moisture. Greater population densities occur in open, sunny areas.

Ecosystem Impacts - Populations out-compete native plants, have higher reproductive rates in dense stands, and reduce plant and animal biodiversity. Swallow-wort changes soil ecology which displaces other plants, reducing insect diversity.[2] Monarch butterflies lay eggs on swallow-wort, but larvae do not survive, and native monarch host plants are crowded out.[5] Grassland bird breeding decreases in infested areas and is completely absent in dense stands.[1] Black swallow-wort has similar potential to degrade habitat. Toxic to livestock and wildlife.[5] Sensitive ecosystems and habitats that support rare plants, birds, and invertebrates are being invaded.[2] Movement of infested hay crop can spread swallow-wort to new areas.[6]

Management Overview – An integrated management approach with follow-up monitoring is most effective in control of both pale and black swallow-wort. Early detection and removal of small patches is advised to prevent establishment and spread. Larger infestations require a multi-year control plan and revegetation. Can take up to 5 years to deplete seed bank.[7] Where eradication methods are not possible, containment of infestation can be achieved. Avoid areas during seed dispersal, clean all equipment, clothing, and shoes when leaving infested areas.[5] If feasible, restrict public access during seed dispersal. Dispose of plants by bagging and placing in landfill as waste, or by burning.[7]

Manual - Manual control can be effective on a small scale and must be thorough. To eradicate, dig out and destroy complete root crowns before pods ripen.[7] If digging is not possible, manual suppression of seed crop is advised.[1] Cut just below lowest pod in early to mid-July, before seed pods mature. Do not cut before flowering, as plants will regrow in time to produce mature fruits.[7] Cutting of vines to keep from climbing and hand removal of seed pods will minimize spread.[1] Hand pulling aboveground cover will cause resprouting and is not recommended.

Pale swallow-wort shoots.

Mechanical - Where impact mitigation and restoration are possible, complete grubbing of all plant parts (including root crowns) using heavy equipment is effective. Mowing will not eradicate the plant, but will prevent seed crop in larger areas if well-timed.[1] Mow early to mid-July after flowering when pods are small and immature. Monitor and mow a second time later in season before more pods mature.[6,7]

Chemical - The Office of Parks, Recreation and Historic Preservation has adopted a pesticide free policy, with one of few exceptions being treatment of invasive species. Pesticides will be used only as a last resort, where invasive species pose a significant threat to natural or recreational resources, and where manual, mechanical and biological controls are ineffective. Any proposed use for treatment of invasive species in NY State Parks must be approved by the Environmental Management Bureau (518.391.3953 or 518.474.0409). Chemical treatments must be performed by a NYSDEC Certified Pesticide Applicator. Foliar herbicide application should be conducted prior to fruiting, to ensure mature pods do not release viable seeds. If plants have pods, cut below lowest pod, bag, and treat regrowth in August or early September. For cut stem method, cut and immediately apply herbicide to cut surface.[7]

Cultural - Pale and black swallow-wort contain toxic substances and may be poisonous to some livestock. Deer do not browse, preferring native vegetation.[5]

Biological Control - Biological control for swallow-wort is being developed but is not available at this time.

Restoration – Plowing large stands and planting an annual crop for several years will deplete the seed bank and help to control large infestations.[7] Revegetation is needed in controlling large areas of swallow-wort.[4]

Site Condition	Control Method 1 = preferred 2 = alternate 3 = least effective					
	Manual	Hand Pull	Cut/Mow	Mechanical	Chemical	Cultural
Less than 20 plants	1	3	3	1	2	Poisonous
Open field greater than 20 plants	3	3	2	1	2	Poisonous
Woods/slopes/rocky areas > 20	3	3	3	2	1	Poisonous

Control methods recommended according to site condition are not one-size-fits-all. There may be exceptions to the preferred approaches listed in the table. For more information or guidance, please contact NYS OPRHP Environmental Management Bureau (518.391.3953 or 518.474.0409).

Sources

1. DiTommasso, A. et al. 2005. The Biology of Invasive Alien Plants in Canada. 2. *Cynanchum rossicum* and *Cynanchum louisae*. Canadian Journal of Plant Science. 85:243-263.
2. Di Tommasso, A. & S. Greipsson. 2006. Invasive Non-Native Plants Alter the Occurrence of Arbuscular Mycorrhizal Fungi and Benefit from This Association. Ecological Restoration. 24(4):236-241.
3. Ernst, C.M. & Cappuccino, N. 2005. The Effect of an Invasive Alien Vine, *Vincetoxicum rossicum* (Asclepiadaceae), on Arthropod Populations on Ontario Old Fields. Biological Invasions. 7(3) 417-425.
4. Lawlor, F. 2002. Element Stewardship Abstract for *Vincetoxicum nigrum* (L.) Moench & *Vincetoxicum rossicum* (Kleopov) Barbarich, Swallow-wort. The Nature Conservacy, Wildland Invasive Species Program.
5. Lawlor, F. 2003. The Swallow-worts, European or Pale Swallow-wort and Black Swallow-wort. The New York Forest Owner. 41:4, 14-15.
6. Lawlor, F. 2003. Swallow-wort Mangement Suggestions for Jefferson County, N.Y. TNC, Tug Hill / Eastern Lake Ontario, Project Office, Pulaski, N.Y.
7. Lawlor, F. 2006, Plant Conservation Alliance's Alien Plant Working Group – Pale Swallow-wort (*Cynanchum rossicum*). http://www.nps.gov/plants/alien/fact/cyroi.htm.
8. Sheely, S. 1992. The Distribution and Life History Characteristics of *V. rossicum* (*Vincetoxicum rossicum*). MS Thesis, State University of New York College of Environmental Science & Forestry.
9. USDA, NRCS. 2010. The PLANTS Database Data Center, Baton Rouge, LA 70874-4490 USA. <http://plants.usda.gov>.
10. Weldy, T. & D. Werier. 2010. *Cynanchum rossicum*. New York Flora Atlas. New York Flora Association, Albany, N.Y.

Pale swallow-wort vines climbing trees and other vegetation.

Appendix 4: Removal Schedule Form

Planned Date of Removal	Site Location	Disturbance	Target Species	Common Name	Method of Removal

Ranking	Description	# of Days	#of Persons	#of hours	Job Hours
		0	**Field Days**		

Participants	Disposal Method	Ownership	Restoration	Monitor Next

Appendix 5: Experimental Control Project

State Parks Natural Resource Project Proposal

Descriptive Title of Project*: Conduct and evaluation of mechanical eradication techniques for pale swallow-wort (Cynanchum rossicum) on four test plots.*
Region: *Thousand Islands*
Park/Site: *Robert G. Wehle State Park*
Date: *June 17, 2009 (modified 11-4-2009)*
Lead Contact Information:

Name: *Casey Holzworth*
Title: Natural *Resource Stewardship Biologist*
Address and Phone Number: *Saratoga Spa State Park*
19 Roosevelt Dr.
Saratoga Springs, NY 12866
(518)-584-2000
E-mail address: *casey.holzworth@oprhp.state.ny.us*

Project Abstract: Wehle State Park is highly infested with pale swallow-wort *(Cynanchum rossicum)*. OPRHP is concerned about the impacts this dominance may be having on the ecology of the park as well as this population's role in the spread of pale swallow-wort in the region and along the Lake Ontario shoreline. This proposal is to test several approaches to suppression and eradication in order to determine the best approach to management of this species in the habitat and communities represented within the park. This project is focused on manual and cultural tilling as a means of eradication over time. The proposal would include contract tilling and hand removal of exposed root crowns over several acres over several years to determine the effectiveness of this control method. Costs are estimated to be $12,000.00 per year for a period of 3 years.

1. Project Background

Pale swallow-wort *(Cynanchum rossicum)* is a long-lived perennial, twining herbaceous vine in the milkweed family. According to the Plant Conservation Alliance (www.nps.gov), "Pale swallow-wort was likely introduced for ornamental purposes and was first collected in Monroe and Nassau counties in New York State in 1897."

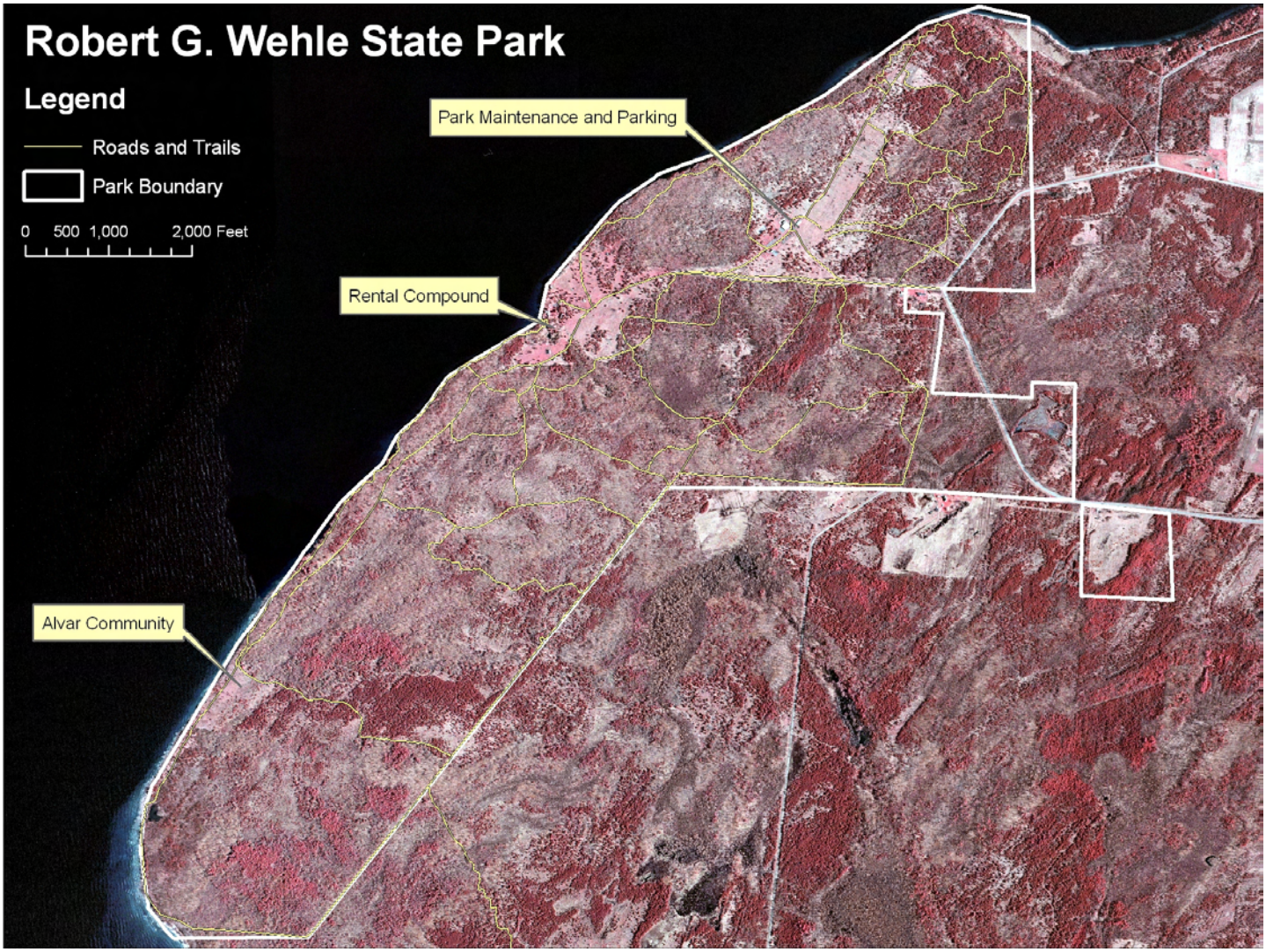
Native to southwestern Europe, pale swallow-wort can form dense patches that crowd out native plant species, which can lead to impacts to wildlife. In addition to being long-lived, pale swallow-wort is also a prolific seed producer and produces allelochemicals, which inhibit the development of neighboring plants. This combination of adaptations likely plays a strong role in pale swallow-wort's ability to nearly completely take over habitats in both sunny old-fields and shaded woodlands. As pale swallow-wort densities increase, the physical and chemical ecology of these areas is altered. Studies are beginning to show how these changes affect bird and insect assemblages in infested areas. Pale swallow-wort's aggressive spread also threatens rare plant species such as the federally listed Hart's tongue fern (*Asplenium scolopendrium*) and globally rare alvar habitats.

Control of pale swallow-wort has proven difficult. Arguably, the most heavily used and effective method of control to date has been herbicidal treatments utilizing glyphosate. This systemic herbicide is absorbed by the plants, which transport the chemical to the root system, killing the plant. This has been proven effective, however, concerns over the possibility of chemical drift onto desirable species as well as the potential long-term impacts that herbicides may have on the environment should give

pause to the use of this strategy. Additionally, recent Parks policy dictates that other non-chemical methods be utilized wherever applicable. As a result, the efficacy and feasibility of mechanical techniques must be examined.

2. Environmental Setting/Existing Conditions

Wehle State Park(Wehle S.P.) is a roughly 1,100 acre park situated along the shores of Stony Point, a peninsula jutting out into eastern Lake Ontario. The site has a history of use as grazing land and military training. Since that time, most of the land has developed into successional woodlands, with the exception of the area around the park entrance and a former summer home in the north-central and northwest portions of the park and an area containing a globally rare alvar community in the southwestern portion of the park (see Figure 1).



Wehle S.P., like much of the local area, is situated on shallow soils atop limestone bedrock. Anecdotally, these soil conditions appear to be very favorable to the growth of pale swallow-wort. Although no formal survey of the extent of pale swallow-wort has been conducted, information from park workers and others suggest that most of the park is infested to some degree. Currently, the only areas known not to contain large quantities of pale swallow-wort are the wetland and alvar areas of the park.

3. Project Goals

The goal of this project is to test the efficacy and feasibility of manual/mechanical control and eradication of pale swallow-wort in the open field and forested areas of the park. The results of these test plots will be used to compare the effectiveness of these manual/mechanical methods to that of current chemical and future experimental biological controls. The results of these comparisons will inform future management activities for the control of pale swallow-wort in the park. This project will also test the efficacy of repeated mowings over many years.

4. Project Description

Field work from Canada (www.ofnc.ca/fletcher.php) has demonstrated successful partial eradication of pale swallow-wort with the use of a modified tilling technique. In the documented cases, areas infested with pale swallow-wort were tilled. Afterward, volunteers sifted through the loosened soil, removing pale swallow-wort roots and root nodes. Collected material was then properly disposed and the tilled area planted with a native seed mix. Some pale swallow-wort plants did grow in the controlled area; however, the density of pale swallow-wort plants was greatly diminished. It is believed that these individuals represent new plants that sprouted from seeds that remained in the soil. Without the addition of new seeds, spot treatments of the remaining plants should lead to long-term eradication of pale swallow-wort at this site.

The concept of utilizing heavy equipment to replicate this procedure on a large scale was the subject of a meeting of swallow-wort experts held at OPRHP's Albany headquarters as well as on-line on May 12th, 2009. At this meeting, experts from US Department of Agriculture, Cornell University, and The Nature Conservancy agreed with OPRHP natural resources staff that this approach has promise, but needs to be experimentally tested. Testing would be used to determine the efficacy and feasibility of utilizing this tilling methodology on a large scale to control pale swallow-wort across Wehle S.P.

In order to test this methodology we propose the establishment of four, 1/4 acre test plots at the site. Since unlike the Canadian field plots, pale swallow-wort at Wehle S.P. grows in open fields as well as closed canopy woodlands, these plots will be equally divided between forest and field conditions. Additionally, mowing has been shown to be unsuccessful as a control for pale swallow-wort. However, studies researching the effectiveness of mowing have been relatively short term in nature. Areas of Wehle S.P. that have been repeatedly mowed for a number of years provide an excellent opportunity to test whether longer-term mowing is a successful control strategy. In order to test this, two test plots will be established in areas of lawn that have been mowed for over 10 years. Mowing in these plots will be discontinued, allowing plants to grow. The plant species composition in these plots will be measured in order to determine the effect of long-term mowing on pale swallow-wort density (See Figure 2).

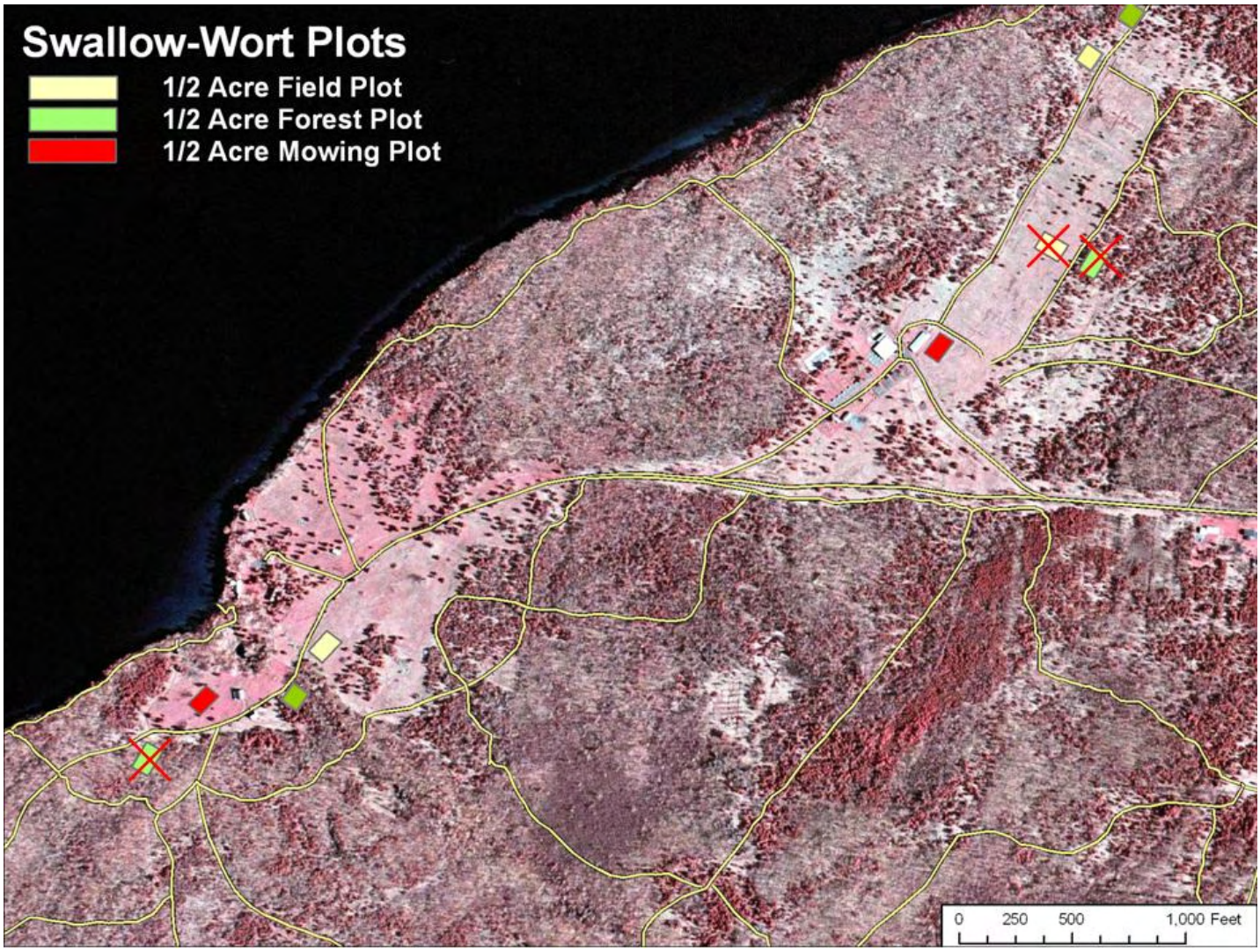


Figure 2. Pale Swallow-wort Control Test Plot Locations.

A landscaping company will be hired to conduct the removal following the basic protocol outlined in successful Canadian mechanical control projects (www.ofnc.ca/fletcher.php). In accordance with these projects, infested field and forest sites at Wehle S.P. will be tilled and pale swallow-wort plant material sifted from the soil. This will be accomplished through the use of three Bobcat® (or similar) attachments. The tiller attachment is a larger version of a conventional roto-tiller made to attach to the Bobcat® tractor (See Figure 3). This tool will be used to expedite the process of turning over the soil and digging up pale swallow-wort plant material from the old field test plots. The second attachment is a soil conditioner. With better maneuverability and a more adjustable depth control, the soil conditioner should provide the added versatility to expose pale swallow-wort plant material in the forested study plots (See Figure 4) while doing as little damage as possible to nearby trees and their root systems. The third attachment, a power rake (Figure 5), will be used to rake up the soil and shake out the loose dirt.

Once broken up, workers will sift through the soil and remove all pale swallow-wort plant material. This plant material will be placed in plastic bags which will be placed in a corner of the parking lot. Water will be added to the bags then allowed to decompose for one month before being taken to a nearby landfill for disposal by park staff.

Figure 3. Tiller

Figure 4. Soil Conditioner

Figure 5. Power Rake

Pale swallow-wort roots are very thick and tend to tightly hold a large volume of soil. With most other plant removals of this sort, soil can be thoroughly shaken out of the root system. However, in the case of pale swallow-wort there is a concern that this activity could result in lost plant material, leading to regrowth. Therefore, only light sifting of the root masses is recommended. The inability to reclaim this material will likely result in the loss of a substantial quantity of soil from the sites. It is proposed that sifted soil devoid of pale swallow-wort plant material from a nearby site be purchased to replace lost soil in the test plots. Once all pale swallow-wort plant material is removed and the site is re-graded, a mixture of annual rye erosion control grass seed and native grass seed mix will be planted on the site and mulched with straw. Park staff will place all sifted plant material into a silage bag for on-site composting.

The Regional Natural Resource Steward will survey the plots monthly during the growing season throughout the remainder of the year and once every two months throughout the growing season for the remaining two years. A preliminary analysis of the plots will be conducted based on the results of the May 2010 vegetation survey to determine the next step in management. If May 2010 surveys show an 85% or greater decline in pale swallow-wort density, mechanical removal of remaining plants will be conducted followed by the planting of a native, perennial seed mix. If May 2010 surveys show a decline in pale swallow-wort densities less than 85% the site will be re-tilled and sifted again using the same protocol as in the original treatment. If additional tilling is required, surveys conducted in May 2011 will determine the need for additional treatment.

5. Budget: Season 1

Item	Per Unit Price	Quantity	Total
Bobcat® Tiller Rental	$500/Week	1	$500.00
Bobcat® Conditioner Rental	$500/Week	1	$500.00
Bobcat® Power Rake Rental	$500/Week	1	$500.00
Sifted Soil	$7/yd^3	200	$1,400.00
Annual Rye and Native Grass Seed	$50/25lb	8	$400.00
Total			**$3,300.00**

6. Potential Environmental Impacts and Mitigation

Negative environmental impacts are possible from two aspects of this project; 1) the unintended damage of native plants and 2) erosion of soil at the treatment plots. The first impact is being minimized with the soil conditioner attachment as opposed to the tiller attachment. As stated above, the soil conditioner attachment has better maneuverability and a more adjustable depth control, which will enable the operator to adjust the mechanical action in response to changing soil and root density conditions. Although some damage to tree roots is inevitable, this piece of equipment will minimize that damage in an effort to do a little damage as possible to trees.

The potential erosion and loss of soil at the study sites is an issue as the soil is broken up and becomes exposed to the elements. As the sites are almost flat, soil erosion by rain is only a minor problem when compared to the potential erosion by wind. This is being addressed through the planting of erosion control seed mix and mulching with straw. These will act to hold the soil in place until more robust vegetation can be re-established.

If successful, this project will have several positive environmental benefits. This evaluation will hopefully lead to a management strategy for pale swallow-wort eradication throughout Wehle S.P. If areas now dominated by pale swallow-wort can be restored with native field and forest plant species, negative impacts to bird and insect populations observed due to pale swallow-wort infestations could be reversed. In turn, pale swallow-wort control within the park could make the job of controlling pale swallow-wort beyond the park a more successful proposition.

7. References

Lundgren and Smith 2008. *Rare Species and Ecological Communities of Robert G. Wehle State Park.* New York Natural Heritage Program, Albany, NY

Plant Conservation Alliance's Alien Plant Working Group: Least Wanted: Pale Swallow-wort. http://www.nps.gov/plants/alien/fact/cyro1.htm accessed 6/17/09.

Fletcher Wildlife Garden. http://www.ofnc.ca/fletcher/research/swallow-wort/index_e.php accessed 6/17/09