

National Park Service
Fire Island National Seashore

INVASIVE PLANT INVENTORY AND
CONTROL PROGRAM

2007 REPORT

Prepared by:
Fernando Villalba, in collaboration with
Melissa Borowiak and Shawn Gilpatrick

Fire Island National Seashore
120 Laurel Street
Patchogue, NY 11772

TABLE OF CONTENTS

INTRODUCTION	Page 2
METHODS	Page 3
Inventory and Control Areas	Page 3
Invasive Species of Concern	Page 4
Geographical Data Collection and Mapping	Page 5
RESULTS AND DISCUSSION	Page 7
Otis Pike Wilderness Area	Page 7
William Floyd Estate	Page 8
LIMITATIONS OF INVENTORY	Page 9
CONTROL AND MANAGEMENT	Page 9
CONCLUSIONS	Page 11
FUTURE RECOMMENDATIONS	Page 13
BIBLIOGRAPHY	Page 15
TABLES AND FIGURES.....	Page 16
MAPS	Page 23
 APPENDIX A: Management of Biologically Invasive Cultural Plantings	
 APPENDIX B: Identified Natural Sites of Priority at the William Floyd Estate	

INTRODUCTION

Fire Island National Seashore (FIIS) was established as a unit of the National Park Service (NPS) on September 11, 1964, as authorized by United States Congress (Public Law 88-587). The 32 mile-long barrier island is located off the south shore of Long Island, N.Y. (Figure 1). FIIS occupies 21 miles of the island and includes of 17 private communities and incorporated villages, predominately on the western end. Park land includes the federal Otis W. Pike High Dune Wilderness Area (OPWA), which is a seven-mile stretch located on the eastern half of the Seashore and is the only federally designated wilderness area in New York State. FIIS also manages the 613-acre William Floyd Estate (WFE), a valuable cultural site, which is located in Mastic Beach, NY on Long Island.

Over the past decades, general concern for preserving natural resources has greatly increased. One of the main issues recently being addressed is native habitat degradation caused by invasive species infestations, including exotic plants. Invasives pose myriad threats to otherwise intact endemic ecosystems. Moreover, controlling pervasive exotic species has proved to be problematic due to their ability to thrive and spread aggressively. Also, not having any local predators that can naturally control these species' populations, invasive plants simply out-compete natives. Consequently, they rapidly and seriously disrupt quality of wildlife habitat, reducing biodiversity, and at times displacing threatened or endangered species in some areas.

Invasive plants are introduced to areas in a wide variety of ways. Humans, both knowingly (e.g. ornamentals) and un-knowingly (e.g. transportation), are the main contributing factor. Some exotic plants are not as pervasive as others, so they may not spread as quickly or dominate large areas. However, they still affect natural resources of the area and compromise the native landscape aesthetics. Per our management policies, the National Park Service has an obligation to protect the delicate native biota from anthropogenic effects. All invasive species fall under this criteria.

In response, Fire Island National Seashore (FIIS) inventoried and mapped invasive plant species at the OPWA and the WFE during the spring and summer of 2007. Securing funds, this work was only the beginning of the Parks three-year effort. Work accomplished by Kathy L. Schwager in 2002 served as a foundation and baseline for the program.

As it pertains to invasive plants, FIIS has some unique challenges. First, within the island dwell 17 communities and a county park. This situation brings challenges in managing the importation of exotic, potentially invasive species. Eventually the Park will need to address this issue and develop a management and enforcement strategy. Also, the William Floyd Estate has an exceptional circumstance due to its historical significance. Some ecologically invasive plant species characterize the cultural landscape. Thus, these species are maintained as such, per the Park's enabling legislation. These conditions create quite a predicament, posing a unique circumstance. However, developing a collaborative effort between the Park's Natural Resources Management and Cultural Resources staffs is imperative to the success of the program. Likewise, the Park will have to encourage community involvement and cooperation in managing invasive species.

METHODS

Inventory and Control Areas

As a result of limited time and resources that were available for the program it was not feasible to inventory all of Fire Island National Seashore. Specifically, the survey concentrated on mapping and inventorying the 6.5 mile stretch of the OPWA and the WFE.

OPWA is the only designated Wilderness Area in the state of New York and one of only a few in the Northeastern U.S. This area is chiefly characterized by an extensive saltmarsh and reedgrass marsh network, which has been historically ditched for mosquito abatement that were maintained from the 1930's to about 1964. These mosquito ditches still have a strong presence in the marshes and are clearly visible in recently documented aerial photographs. This site is also vegetated by northern dune shrubland, northern beach grass dune, pitch pine dune woodland, maritime deciduous scrub forest, highbush blueberry shrub forest, beach heath dune, northern salt shrub vegetation; and on the bay side (north) there are features of reedgrass marsh, brackish meadow and low and high saltmarsh (Klopfer et al. 2002). The Wilderness Area is bordered on the east by Smith Point County Park and on the west by Watch Hill, a FIIS site with amenities to accommodate large numbers of Park staff and visitors. OPWA is bisected (nearly in half) by a very small

seasonal village, Bellport Beach, consisting of only a few amenities including a dock and restroom.

The historic William Floyd Estate, though not located on the barrier island, is also managed by FIIS. The Estate consists of 613 acres and is located in Mastic Beach, NY on Long Island. It is dominated by coastal oak-heath forest and also characterized by cultivated pastures, pitch pine-oak forest, maritime deciduous scrub forest, acidic red maple basin swamp forest (red maple-tupelo dominant), northern sandplain and northern salt shrub vegetation; and to the south, reedgrass marsh and low and high saltmarsh are dominant features (Klopfer et al. 2002). There are also two or more inland, permanent freshwater pools. The Estate is surrounded by two fairly densely-populated communities – Mastic Beach and Shirley. Due to the over-growth of vegetation at the William Floyd Estate, only fields and main trails were inventoried, with the exception of a few forested areas that had lower under-story vegetation. On average, however, the perimeter of wooded areas was inventoried to about 5 meters in, before the brush became too thick to walk through.

Invasive Species of Concern

A comprehensive list of inventoried species can be found in Table 1. Of the species surveyed, Japanese Black Pine (*Pinus thunbergiana*) was the most abundant invasive plant found in OPWA. Also found in abundance in this area was autumn olive (*Eleagnus umbellata*) and common mullein (*Verbascum thapsus*), which we found to be associated to historically disturbed areas. At the WFE the main species recorded were multiflora rose (*Rosa multiflora*), Oriental bittersweet (*Celastrus orbiculatus*), Japanese barberry (*Berberis thunbergii*), and Chinese lespedeza (*Lespedeza cuneata*). Also, Chinese/Japanese wisteria (*Wisteria spp.*), lesser celandine (*Ranunculus ficaria*), Japanese knotweed (*Polygonum cuspidatum*) and tree of heaven (*Ailanthus altissima*) were found in small, isolated patches at the WFE and will hopefully be addressed in the near future through early response.

Common reed (*Phragmites australis*) was not recorded because its occurrence was so abundant it would have required more time and resources than were available. Moreover, the most effective recommended control methods, which include habitat modification, would be difficult to implement in a Wilderness Area given its designation. At the WFE,

black locust (*Robinia pseudoacacia*) was found in such large quantities that it was recorded as large polygons and given infestation ratings per area.

Geographical Data Collection and Mapping

The methodology used to complete the inventory of OPWA and WFE was consistent with methods applied by the National Park Service's Northeast Regional Exotic Plant Management Team (EPMT). To familiarize staff in invasive plant species identification, GPS units and GIS programs, the EPMT presented a hands-on training program. The training included field work with GPS units, learning the essential GIS software, data storage and management.

The GPS survey was completed using a Trimble Geo Explorer XM GPS (courtesy of TNC) and a Trimble Geo Explorer XT GPS unit. Mapping was done by three biologists, each rotating units. Coordinates were collected and projected in Universal Transverse Mercator (UTM) coordinate system, Zone 18 North, NAD 1983 datum and the altitude reference was set to mean sea level (MSL). Real-time differential correction was used throughout the entire inventory, using base station in Darien, CT. All recorded measurements were in meters.

A data dictionary template containing attribute information was obtained from the Northeast Regional EPMT. The weed species in the copied data dictionary was then modified to reflect species of concern for this particular survey. For each species identified in the field a 6 letter NPS code had been established by the Data Dictionary Editor, generally using the first 3 letters of the genus and the first 3 letters of the species name. Several local species did not have yet have a designated code so one was created using the same basic naming principles.

When a weed infestation was found, the first step in the mapping procedure was to determine what kind of data feature would be appropriate. A weed infestation can be designated as a weed point, buffered line, or polygon. Weed points were used for individual plants or for small groups of plants in relatively small vicinity of each other. For accuracy purposes, at least 20 positions were taken for each weed point recorded.

Buffered lines were used when a species was present repeatedly in a predominantly linear path, typically on or alongside a trail or road. Both of these file structures require a buffer estimate. For weed points, the buffer zone represents the radius of the area; for lines, it represents the width of the line from the center (i.e. half the entire width of the actual line being produced). Polygons were created around infestations that were too extensive to plot with individual points or lines and/or if the plot was an irregular shape.

In addition to entering the weed species into the data dictionary, supplementary data, such as the buffer zone and other infestation data were collected in designated sections of the dictionary form. The buffer zone is considered a fairly accurate size estimate of the infested area in meters.

Cover class is an estimate of ground area that an infestation covers. For weed points that mapped individual plants, cover class was considered one hundred percent coverage. However, polygons and some lines were cataloged using the Daubenmire System. This system has a designated rating accounting for the infestation level in a Trace (0%-1%), Class 1 (1.1%-5%), Class 2 (5.1%-25%), Class 3 (25.1%-50%), Class 4 (50.1%-75%), Class 5 (75.1%-95%), or Class 6 (95.1%- 100%). The field staff also estimated and collected data on weed distribution/consistency. This qualitative measurement ranges from the infestation being clumped, scattered, an isolated individual, an isolated pattern, forming continuous coverage, or gradual coverage. Lastly, information on a more general, secondary density class is collected. The density can consist of being a trace, light, moderate, or heavy.

After an area was surveyed, the data was transferred from the GPS units to a desktop computer running Microsoft Windows XP® and Pathfinder Office® 4.00 software. The initial accuracy was somewhere between 1m and 15m. After using differential correction, the final accuracy was between <1m and 5m. All differential correction was completed using base files from a CORS, Darien, CT base.

Differentially corrected files were then exported as ArcGIS shape files and the final maps were created in ESRI® ArcMap™ 9.2. Aerial ortho-photographs of Fire Island and the William Floyd Estate were obtained from the Park's GIS database. Since each shape file had data on multiple species, taxa were then appropriately teased out and later merged

into shape files with respective species. Maps were compiled to depict quality of infestation. The mapped results can be found in attached maps at the end of this document.

RESULTS AND DISCUSSION

Two areas, on separate parcels of land, both contained within the National Park boundaries were surveyed. Our effort for this year were concentrated on Otis Pike Wilderness Area (OPWA), a 6.5 mile stretch of land located on the east end of Fire Island National Seashore and the William Floyd Estate (WFE), a 613 acre historical parcel of land located in Mastic Beach, New York.

Otis Pike Wilderness Area

The OPWA had only seven exotic species documented during this survey (Table 1, Maps 1-3). Some less pervasive species were common mullein (*Verbascum thapsus*), autumn olive (*Elaeagnus umbellata*), multiflora rose (*Rosa multiflora*), and spotted knapweed (*Centaurea maculosa*). Mainly, these species were observed in areas that have a history of development and heavy human activity. The most disturbed habitats were small, high traffic areas including the border of Watch Hill to wilderness, around the OPWA Visitor Center and a thin strip of privately owned land, Bellport Beach, which has only a few amenities.

Of the species mapped during this survey, Japanese black pine (*Pinus thunbergiana*) is found to be the most extensive. It is found across the entire the length of the island. In most instances the pines were found in large groups, but there were also several isolated individuals. These plants tended to be associated to areas which had a history of development and human disturbance. Though not generally considered as invasive as other species, it is of concern to the Park, largely because of its dominant presence in the OPWA. Per the Park's GPRA goal on Wilderness Character, removing exotic vegetation is of priority in attempting to return this area to its native state.

William Floyd Estate

The WFE had much higher invasive plant abundance, containing sixteen documented species that are considered ecologically and biologically invasive (Table 1, Maps 4-10). However, a few of these species characterize the cultural landscape of this site, presenting another management dimension (see Appendix A). Most fields were prominently covered with black locust (*Robinia pseudoacacia*), Japanese honeysuckle (*Lonicera japonicus*), autumn olive (*Eleagnus umbellata*), and multiflora rose (*Rosa multiflora*). Some forested areas were heavily infested by garlic mustard (*Alliaria petiolata*), Oriental bittersweet (*Celastrus orbiculatus*) and black locust. Lesser celandine (*Ranunculus ficaria*) and Japanese knotweed (*Polygonum cuspidatum*) have been found in the Estate as well. Though they are in small infestations, they are highly invasive and should be removed promptly. Common mullein is found to be relatively widespread at the WFE, but it doesn't seem to be exhibiting invasiveness and will not be a priority species to be removed.

The results show that most of the invasive plants occurring at the William Floyd Estate are along trails and roadsides (Maps 4-10). Though, it must be noted that a much greater amount of time was spent surveying areas right adjacent to trails and roads because of access and safety. In some areas the brush thinned out making it possible to inventory off of the main trail. However, many of the forested areas have an overgrowth of catbrier which limits our ability to access remote locations. Where catbrier was not present the field crew did survey more isolated areas, but all attempts to do so resulted in no invasive plants found beyond 15-20 meters from trails and roads. Because of this, we utilized our limited time to inventory no more than about a 5-10 meter buffer on both sides of trails and roads.

The trails at the WFE are well maintained, making it simple to survey. Many of the grass fields are low growing making it easy to spot most invasive species. There was an overgrowth of concerning species along the perimeter of the estate due to outside communities. In some areas, invasive plants are growing over the fence line, others are encroaching. With this considered, areas that bordered outside local communities are where most of the invasive species were found.

There are some invasive plants found just outside of the WFE. Lesser celandine, wisteria, Japanese knotweed, mugwort, and garlic mustard were all documented in the yards and roadsides right adjacent to western and northwestern boundaries (Maps 4 and 9). Though all of these species are already currently found in the Estate, they pose an on-going threat and could eventually re-infest the Estate if they are not addressed.

LIMITATIONS OF INVENTORY

Black locust, garlic mustard and Japanese honeysuckle were too wide spread to thoroughly inventory. Although, these species were mapped, there is certainly a very limited amount of information and consistency. For next year, there are tentative plans to more thoroughly survey these species, but it may have to be a negative inventory (i.e where is it not?). However, given the lack of resources, it would be difficult to inventory and manage these species. In order to address these species, more detailed management criteria would have to be continually developed and prioritized.

In several fields at the WFE the perimeter had been mowed making it considerably easier to locate species. Also, for convenience, transects had been mowed in some of the fields by WFE staff in order to access the interior of the plot. Unfortunately, other fields could not be mowed because of the mowing schedule. Box turtles nest throughout the summer months, which then hatch around October. The WFE staff also intends to allow the natives wildflowers (e.g. goldenrods, asters, etc.), the biggest variety of the flowers, to set their seeds, in late summer into the fall. This promotes excellent biodiversity. Therefore, in these fields, there was an overgrowth of vegetation with waist-high grass and other brush, making it difficult to notice young or shorter plants, while also presenting a safety hazard due to concerns of the abundant tick population during the time of the survey.

Common reed (*Phragmites australis*) is the predominant invasive species found throughout OPWA, possibly the entire island. Though large areas of common reed completely cover the islands bayside, this species was not mapped during this inventory because of its expansiveness and the Park's lack of current resources to inventory and control its population. Also, there is insufficient knowledge about the population of this

species' native genotype (*Phragmites australis* ssp. *americana*) on FIIS land to determine a desired management approach.

CONTROL AND MANAGEMENT

A comprehensive list of recommended control methods and other useful information are summarized in Table 2 for most recorded species. Utilizing resources from various organizations and online databases, control methods for species observed were researched. The Nature Conservancy's Global Invasive Species Team website/database is where most of our information regarding management and biological information was acquired.

Natural sites of priority have been identified at the WFE and invasive plant control will be implemented at these locations (Map 10, Appendix B). Through productive collaboration with the Cultural Resources staff, special consideration has also been taken for plant species that are part of the cultural landscape at the Estate (see Appendix A). A tentative management approach has been agreed upon and will continually be developed as this program persists.

Most species can be best controlled if treatment is implemented during a certain time of the year. In general, the optimal time for control is the growing season, before the invasive plant sets seed; ranging from early spring through early fall. However, some species may be controlled throughout the whole year. For chemical applications, fall is usually most beneficial, but treatment can also be accomplished in the spring for certain species and in the summer, if impacts to non-target species is expected to be minimal.

There are several suggested approaches to control such as mechanical, manual, controlled burns, chemical and biological treatments. Success rates vary depending on the type or combination of control and surrounding conditions. In most instances, it is effective to apply multiple methods. Due to the historical value and uniqueness of the WFE a number of control methods are not applicable to this site, in order to avoid impacting the cultural landscape. The most practical methods that can be implemented will be manual, mechanical and/or some chemical.

In the OPWA, most species should be controlled in spring/early summer with the exception of common reed (*Phragmites australis*) which is best controlled in the fall. Also, there were no control methods found specifically for Japanese black pine (*Pinus thunbergiana*). Cutting down these trees, as a possible control method, should be researched further for effectiveness, along with basal bark and hack and squirt treatments.

At the WFE, recommended control for most species recorded should start in early spring and then retreated in the fall, if needed. Generally, season-long mechanical/manual controls are most appropriate for species found at this site; possibility of chemical application will be determined by timing of control.

The ideal control for all species is early detection and rapid response. At the WFE, the team observed a small tree of heaven infestation. Steps for control were taken in May 2007. Under the guidance of the Northeast EPMT, a basal bark treatment of Garlon 4™ was applied using hand-held sprayers. As of August 2007, treatment seems promising but there will be repeated monitoring to confirm eradication.

Encouraged by success, it is recommended that the single infestations of Japanese knotweed and lesser celandine (*Ranunculus ficaria*) at the WFE also be immediately removed. These are both highly invasive plants and are difficult to control when there is a moderate infestation and practically impossible when they pervade. Fortunately, these are still considerably small infestations and can still be eliminated completely with a rapid effort.

Replanting of native species is something that should seriously be considered to complement invasive removal. Several factors, however, need to be considered prior the replanting. First, investigation of the surrounding soil is required. The moisture, pH, consistency and quality of the soil are important to the survival of reintroduced plants. However, once implanted the native species have opportunity to thrive because they survive well in their native habitat. Species to be planted should be investigated and plant dealers should be researched to make sure that plants are legitimate. Also, in some cases it is recommended that native species be ordered 2 years in advance. Because the area will be disturbed, making it highly vulnerable to invasive plants, the re-established area needs to be monitored closely to prevent re-infestation. Although this will be a very involved

project, requiring large amounts of work and resources, the reward of having native species restored will be worth the efforts. As the program develops and if the Park secures more funding, this treatment should strongly be considered.

Re-seeding native grasses and wildflowers should also be strongly considered. This is a relatively cost-efficient and effortless method of re-vegetating areas that would become barren after large areas of invasive plants are removed. Doing so would provide habitat for native wildlife and at least partially resist the potential for re-infestation of exotic plants.

CONCLUSIONS

Relative to other areas of Long Island, few invasive plant species were recorded on National Park Service land. A total of 18 known exotics were recognized. The most abundant species collectively were autumn olive (*Elaeagnus umbellata*), Japanese black pine (*Pinus thunbergiana*), black locust (*Robinia pseudoacacia*), Japanese honeysuckle (*Lonicera japonicus*), common reed (*Phragmites spp.*), garlic mustard (*Alliaria petiolata*), and multiflora rose (*Rosa multiflora*). Out of the two areas surveyed, the William Floyd Estate would require the most attention due to higher infestation and management complexity.

Fire Island is characterized by sandy, nutrient-poor soils and an almost constant salt spray on the ocean side that may be a factor limiting the number of exotic species that are able to colonize. This is very fortunate, but as the number of visitors and residents increases each year, there is an increase in the pedestrian, bicycle, and vehicular traffic along the island. These activities all provide an avenue for exotic plant species to be introduced and spread.

Unfortunately, the disturbance caused by the traffic may also contribute to the spread of exotics, while degrading native vegetation. Autumn olive and Japanese black pine are prime examples of exotics that spread in this way. Given their current abundance, management measures need to be taken promptly if their spread is to be curtailed. This is also the case with species like Oriental bittersweet and Japanese honeysuckle, which are

primarily found in high traffic areas. Their ability to spread rapidly and choke existing native vegetation warrants concern, especially in these targeted areas.

Research emphasizes that it is much easier to treat infestations in the early stages. Therefore, continuous monitoring for current invasive exotics and new infestations are extremely crucial for early response. Data collected from monitoring efforts will allow management decisions to be based off of current, accurate information so that control methods can be in the best interest of preservation. Together with constructive communication between all stake holders and other staff members, perhaps this problem can be kept under control and the native biological integrity of the Park protected from further compromise.

FUTURE RECOMMENDATIONS

This program is currently financed through the Project Management Information System (PMIS) is a service-wide intranet application within the NPS to manage information about requests for project funding. It enables parks and NPS offices to submit project proposals to be reviewed, approved and prioritized at park units, regional directorates, and the Washington Office. Through this system, the Park has secured funding for this program for only three years total at \$20,000 per year. Invasive plant management requires large amounts of resources, especially when addressing highly pervasive exotic plant populations, such as garlic mustard and Japanese honeysuckle, both of which are wide spread throughout the William Floyd Estate. Though the current funding is useful, it is only sufficient for managing just a fraction of the invasive species found on FIIS lands. Therefore, the opportunity for more future funding should be identified and pursued in order to sustain the program. Failure to do so will result in an unsuccessful program and the efforts accomplished during these three years would have been largely done in vain.

Some considerations for next year SCA intern hiring include: time of hire, length of internship, timing of training and field work. Particularly, because control of most species is recommended for the spring/early summer, SCA intern should start as early as late March/April. Also, the field conditions are important. Starting the work before the

mosquito season would amount to greater production. Although, working in the hot and humid conditions is inevitable, starting earlier in the year will reduce this experience. Lastly, before starting the actual field work, SCA interns should continue to be provided with practice and experience actually identifying most of the target species with hands on training.

The control of invasive species is something that should be monitored throughout the growing season. Manual and mechanical treatments often need to be done repeatedly to show effective results. Therefore, a 3 month internship is not adequate time to acquire all of the training and actually participate in the control. A longer internship may be beneficial if both inventory and control are expected. However, if a shorter time is allotted it may be favorable to only assign either mapping or control because of limited time that can be apportioned for training.

Because it was the start of the program, this year was a learning experience. Therefore, the biologist managing the program also had to be trained during some of the program. Interns this year did the bulk of the mapping in later months after training. However, with the training program now developed, an easier routine may become established. It is less complicated to be trained on GPS/GIS in the field rather than just being told or shown. Also, the same applies for plant identification; it is much easier to learn out in the field with someone experienced to explain how to identify individuals. Due to the fact that training and control both have to be accomplished as early as possible, it may be constructive to carry these out simultaneously.

BIBLIOGRAPHY

Federal Register. Public Law 89-244, 1965; Public Law 88-587, 1964. Fire Island National Seashore Establishment. Legislative History of Fire Island National Seashore. September 11, 1965.

Klopfer, Scott D., Adele Olivero, Lesley Sneddon, and Julie Lundgren. Final Report of the NPS Vegetation Mapping Project at Fire Island National Seashore. Virginia Tech, College of Natural Resources, GIS & Remote Sensing Division, Conservation Management Institute. April, 2002.

Schwager, Kathy L. (unpublished). Invasive Species Inventory and Mapping Project. National Park Service. Fire Island National Seashore. December 2002.

The Nature Conservancy. Global Invasive Species Team webpage, Element Stewardship Abstracts. Information obtained in October, 2007.

U.S. Congress. Fire Island National Seashore Establishment. Public Law 88-587. 88th Congress. September 11, 1964.

U.S. Congress. Fire Island National Seashore Establishment. Public Law 89-244. 89th Congress. October 9, 1965 [Approved October 21, 1976].

U.S. Department of the Interior. National Park Service. Description of the Selected Alternative Site Development and Facilities of the William Floyd Estate, Fire Island National Seashore. January, 1979.

U.S. Department of the Interior. National Park Service. Olmstead Center for Landscape Preservation. Cultural Landscape Inventory of the William Floyd Estate. 2008.

Table 1. Species Inventory List and Areas Found

Species	Scientific Name	Area(s) Found
*Autumn Olive	<i>Elaeagnus umbellata</i>	BOTH
*Black Locust	<i>Robinia pseudoacacia</i>	WFE
*Chinese Lespedeza	<i>Lespedeza cuneata</i>	WFE
*Chinese/Japanese Wisteria	<i>Wisteria spp.</i>	WFE
Common Mullein	<i>Verbascum thapsus</i>	BOTH
Common Reed	<i>Phragmites spp.</i>	BOTH
Garlic Mustard	<i>Alliaria petiolata</i>	WFE
Japanese Barberry	<i>Berberis thunbergii</i>	WFE
Japanese Black Pine	<i>Pinus thunbergiana</i>	OPWA
Japanese Honeysuckle	<i>Lonicera japonicus</i>	WFE
Japanese Knotweed	<i>Polygonum cuspidatum</i>	WFE
Lesser Celandine	<i>Ranunculus ficaria</i>	WFE
Mugwort	<i>Artemisia vulgaris</i>	WFE
*Multiflora Rose	<i>Rosa multiflora</i>	WFE
Norway Maple	<i>Acer platanoides</i>	WFE
Oriental Bittersweet	<i>Celastrus orbiculatus</i>	WFE
Spotted Knapweed	<i>Centaurea maculosa</i>	OPWA
Tree of Heaven	<i>Ailanthus altissima</i>	WFE

*Confirmed or likely historic planting, characterizing the maintained cultural landscape of the WFE.

Table 2: Recommended Control Methods (The Nature Conservancy, Global Invasive Species Team webpage, October 2007)

Species (Common Name)	Possible Control Methods	Timing	Considerations
<i>Acer platanoides</i> (Norway Maple)	Basal bark or cut stump	Pretty much anytime	
<i>Ailanthus altissima</i> (Tree-of-Heaven)	-Hand pulling after rain, when soil is loose. Must remove rooting system. -Cutting above ground portion allows access to base. -Digging only suitable for small infestations. -Cutting best when plants begin to flower. Several cuts needed for effect (re-sprouts if not treated with herbicides). -Broadcast herbicide application applied when in full leaf. -Cut stump application -Basal/stem spraying (effective when mixed with oil)	Spring-Fall (Mechanical) Late Spring/Early Summer (broadcast herbicide) Late Spring (Cut Stump) Fall (Basal/Stem spray)	
<i>Alliaria petiolata</i> (Garlic Mustard)	-The best management is to pull it out of the ground in early spring. -Cutting when plants are in full bloom. Pulling throughout growing season. -Glyphosate in late fall or early spring. Triclopyr applied in spring. Bentazon applied during growing season.	Early Spring-Late Fall (see individual methods)	*2,4-D is not recommended for control of <i>Alliaria petiolata</i>. This is a highly invasive species, which releases a chemical that could kill other plants for competition.
<i>Artemisia vulgaris</i> (Mugwort)	-Mowing 2-3 times per year. -Herbicide treatment for 2 years.	Early Spring-Fall	
<i>Berberis thunbergii</i> (Japanese Barberry)	-Uproot entire bush. -Difficult plants can be treated with glyphosate.	Early Spring (Mechanical)	
<i>Celastrus orbiculata</i> (Oriental Bittersweet)	-Cut to the ground and allow resurging. One month later apply foliar application of triclopyr mixed at 1% to 2% in water.	Early Spring (Mechanical part)	*Herbicides should only be applied when temperature is above 55 degrees Fahrenheit and when rain is not expected for a period of 24 hours. *Foliar applications of glyphosate and amitrole are both ineffective
<i>Centaurea maculosa</i> (Spotted Knapweed)	-Hand-pulling or digging, with a spade in less dense areas (0 to 10 plants per m²). -In denser areas (>10 plants per m²) repeated spot-burning	Summer (by August)	*Gloves should be worn when hand-pulling due to the plant's allelopathic compounds that are thought to be

	with trained individuals is more effective and efficient. -Mowing after flowering has ended but before seeding begins		toxic in large quantities.
<i>Cortaderia jubata</i> (Pampas Grass)	-Roundup sprayed during <u>early morning</u> .	Early Spring-Fall	
<i>Elaeagnus umbellata</i> (Autumn Olive), <i>Elaeagnus angustifolia</i> (Russian Olive)	-Hand pulling with moist soil. Continual mowing is effective. -Herbicide most effective during the growing season. Foliar and basal bark applications and cut stump method all report success -Cut stump method shows Glyphosate the most effective. -Basal bark application of triclopyr.	Late Summer (Cut stump) March (Basal bark)	
<i>Lespedeza cuneata</i> (Chinese Lespedeza)	-Mowing followed by herbicide application is most effective.	Herbicides should be applied in Early-Mid Summer, during flower budding stage.	
<i>Ligustrum</i> spp. (Privet)	-Mowing or cutting at least once during the <u>growing season</u> . Plants can be hand pulled as soon as they are big enough to grasp. -Foliar spray method. Cut stump and basal bark method effective when ground isn't frozen.	Spring-Summer (Mechanical) Early Spring or Late Fall (Chemical)	
<i>Lonicera japonica</i> (Japanese Honeysuckle)	-The most effective treatment is a foliar application of glyphosate and Dichloroprop mixed with 2,4-D. Treated plants should be re-examined at the end of the second growing season, as plants can recover from herbicide application	October (After native vegetation is dormant and when temperatures are near and preferably above freezing. Applications within 2 days of the first killing frost are more effective than applications later in the winter.)	
<i>Phragmites australis</i> (Common Reed)	-Cut just before the <u>end of July</u> . Will eliminate if carried on for several years.	Mid-July	
<i>Pinus thunbergiana</i> (Japanese Black Pine)	No Control has been identified, will try basal bark treatment.		
<i>Polygonum cuspidatum</i> (Japanese Knotweed)	-Spray herbicide approved for use near water that contains glyphosate or glyphosate with imazapyr on the leaves and stems. To avoid spraying very tall plants, cut	Summer or early fall (Chemical) [w/ mechanical precursor in May or June]	* It is extremely difficult, if not impossible, to eradicate large established stands of <i>Polygonum cuspidatum</i> .

	the stems once in May or June and allow the plant to re-grow to about waist height. (Dispose of cut stems where they will not re-sprout. Most patches require more than one year of treatment.) -Manually pull or dig surface roots of plants in loose soil. Check often for new sprouts and repeat. Or, cut the stems close to the ground every two weeks throughout the growing season.	Spring-Fall (Mechanical) [Continuous]	
<i>Ranunculus ficaria</i> (Lesser celandine, fig buttercup)	No effective control methods have been identified.		
<i>Robinia pseudoacacia</i> (Black Locust)	-Glyphosate as a band or direct spray.	September	
<i>Rosa multiflora</i> (Multiflora Rose)	-Application of Glyphosate or triclopyr -Repeated mowing results in controlling the spread, but not eradication.	Late June (Chemical)	
<i>Verbascum thapsus</i> (Common Mullein)	-Hand pulling before they seed. -Cutting when it just begins to flower. -Basal/Stem applications of chemicals in high concentrations.	Late Spring-early Summer (Mechanical) Fall (Chemical)	
<i>Wisteria</i> spp. (Wisteria)	-Cut every two weeks throughout growing season. Use a weed wrench to remove. -Cut stump as long as ground isn't frozen. Foliar application more effective at warmer temperatures.	Late Spring-Fall	

Table 3. Recommended Timeline for Control using various methods. Adapted from Table 2.

species	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
<i>Acer platanoides</i> (Norway Maple)												
<i>Ailanthus altissima</i> (Tree-of-Heaven)												
<i>Alliaria petiolata</i> (Garlic Mustard)												
<i>Artemisia vulgaris</i> (Mugwort)												
<i>Berberis thunbergii</i> (Japanese Barberry)												
<i>Celastrus orbiculata</i> (Oriental Bittersweet)												
<i>Centaurea maculosa</i> (Spotted Knapweed)												
<i>Cortaderia jubata</i> (Pampas Grass)												
<i>Elaeagnus</i> spp. (Autumn & Russian Olive)												
<i>Lespedeza cuneata</i> (Chinese Lespedeza)												
<i>Ligustrum</i> spp. (Privet)												
<i>Lonicera japonica</i> (Japanese Honeysuckle)												
<i>Phragmites australis</i> (Common Reed)												
<i>Pinus thunbergiana</i> (Japanese Black Pine)												
<i>Polygonum cuspidatum</i> (Japanese Knotweed)												
<i>Ranunculus ficaria</i> (Lesser celandine, fig buttercup)												
<i>Robinia pseudoacacia</i> (Black Locust)												
<i>Rosa multiflora</i> (Multiflora Rose)												
<i>Verbascum thapsus</i> (Common Mullein)												
<i>Wisteria</i> spp. (Wisteria)												

= pull

= cut

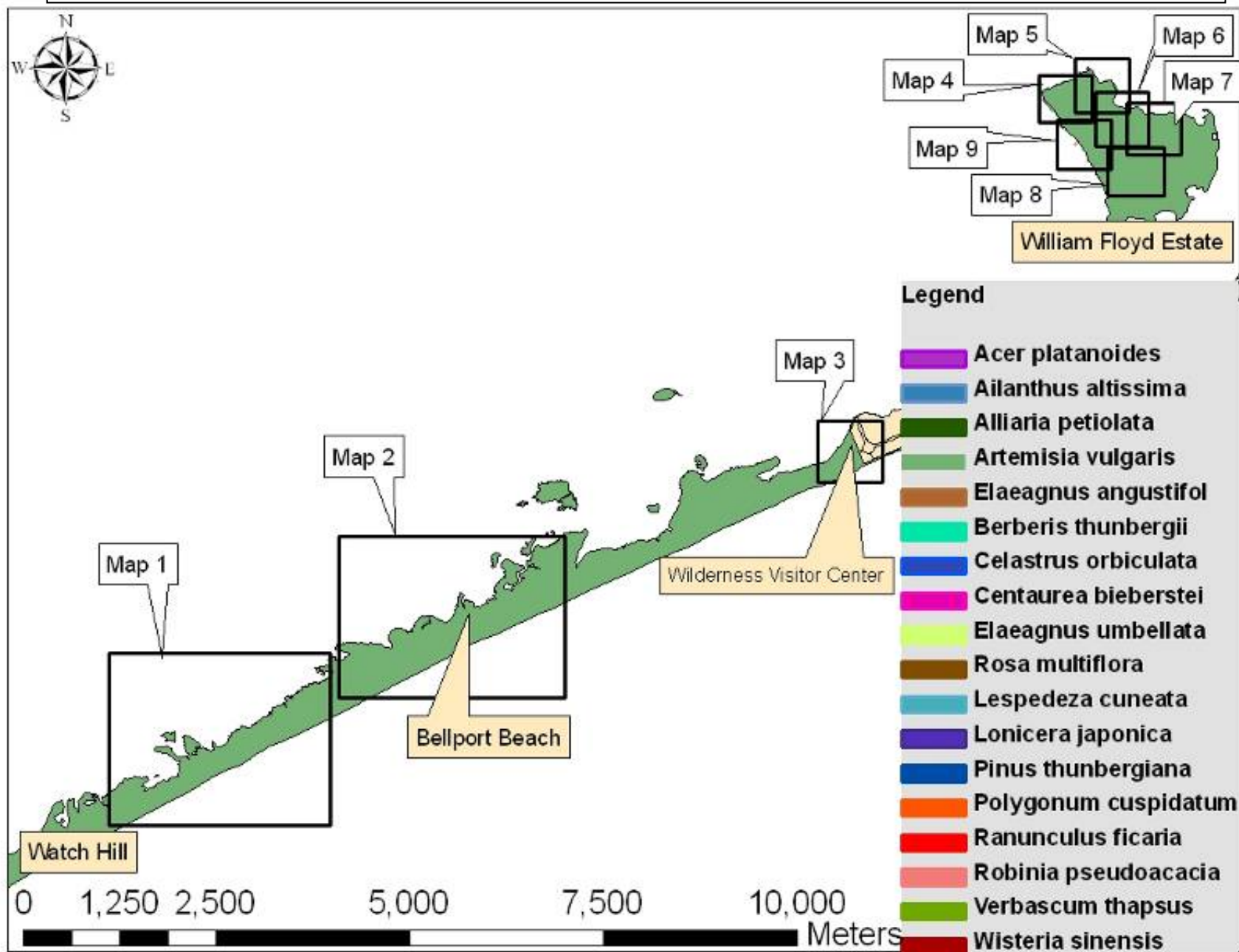
= herbicide

= dig

Figure 1. The eastern section of FIIS, showing the Wilderness Area, the WFE and surrounding areas.



Figure 2. Diagram depicting the locations enlarged by each of the following maps. Map 10 is not shown here.



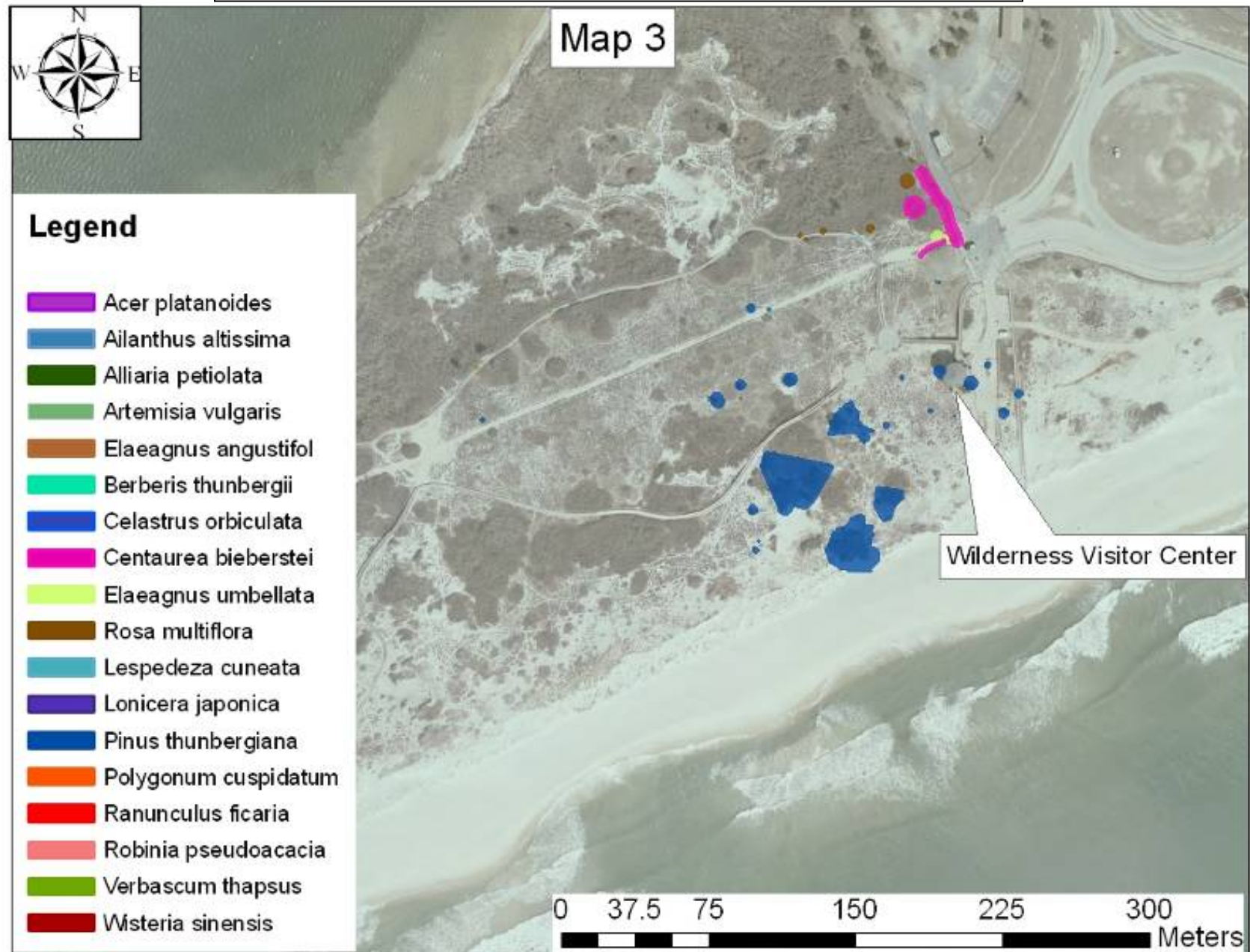
Map 1. Displaying results in the area just east of Watch Hill.



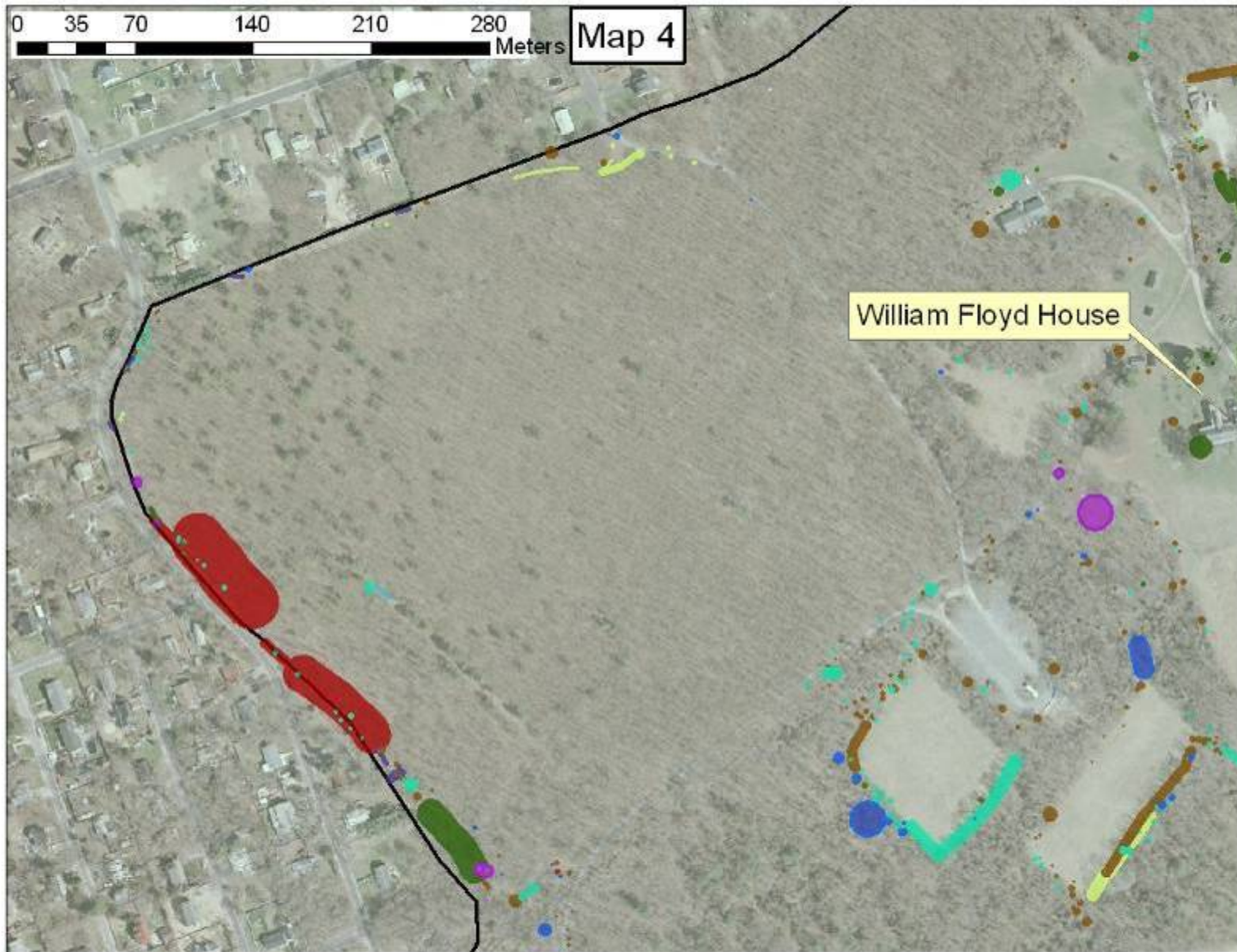
Map 2. Displaying area surrounding Bellport Beach.



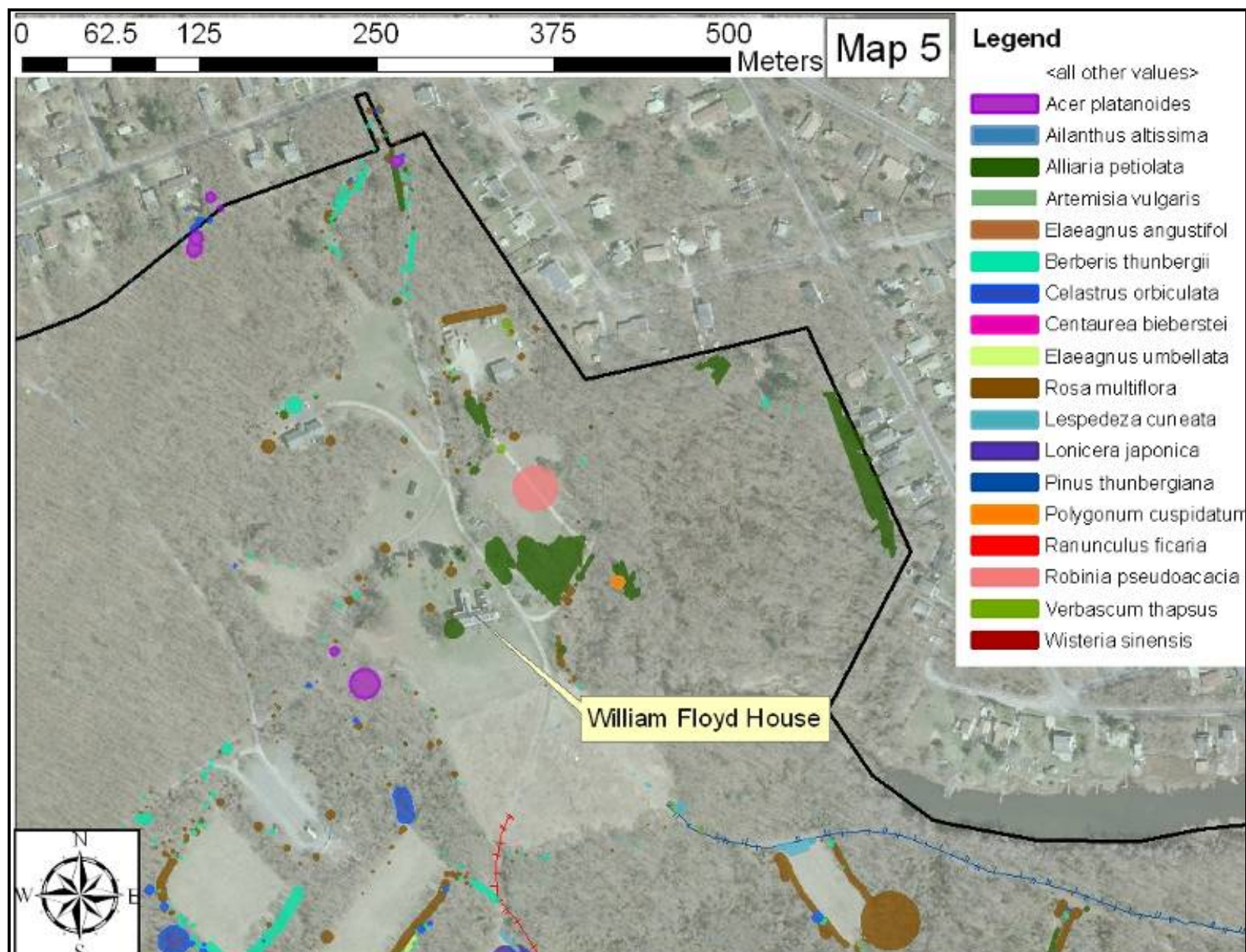
Map 3. Displaying area surrounding the Wilderness Visitor Center.



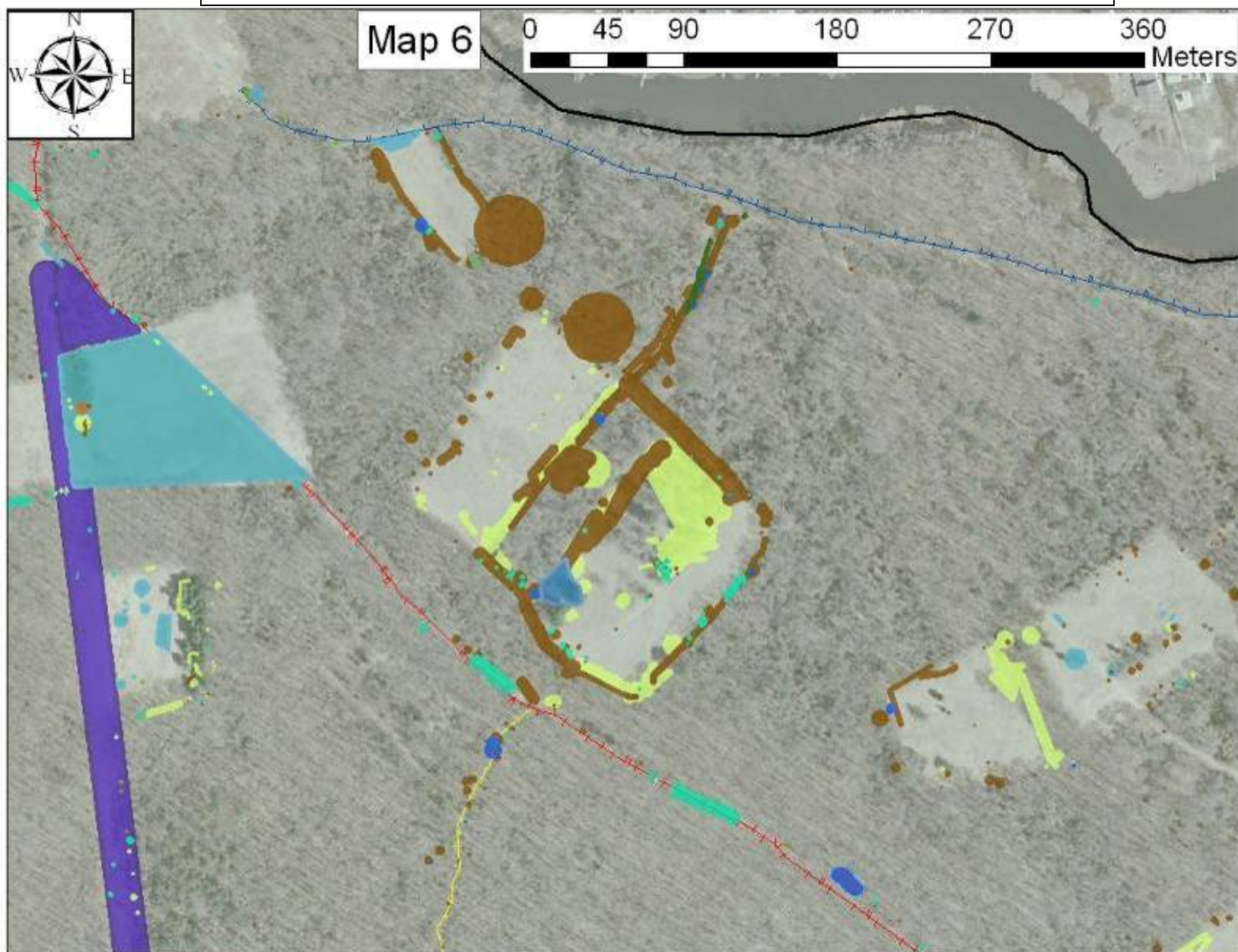
Map 4. Displaying results in the northwestern section of the William Floyd Estate.



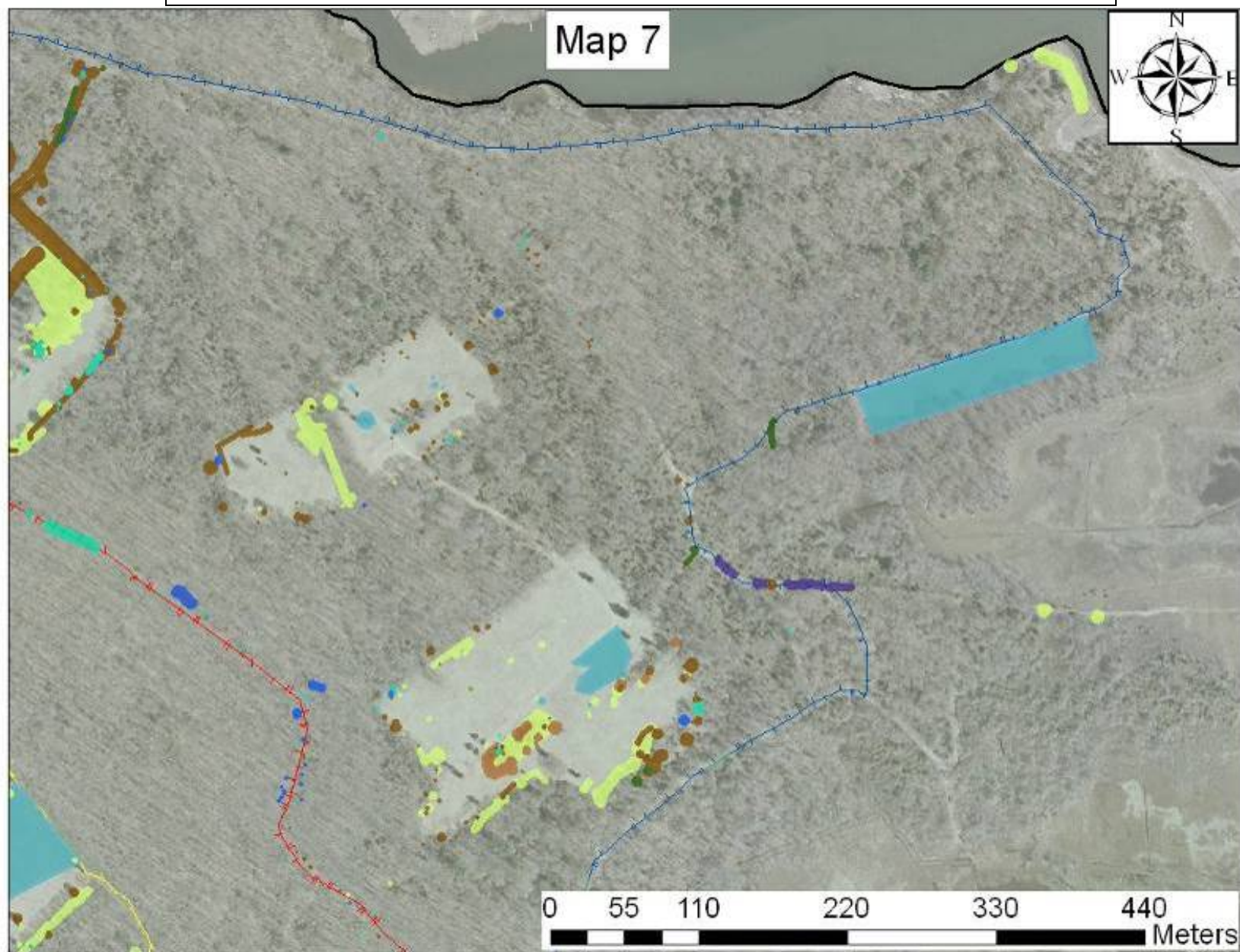
Map 5. Displaying results in the northeastern section of the William Floyd Estate.



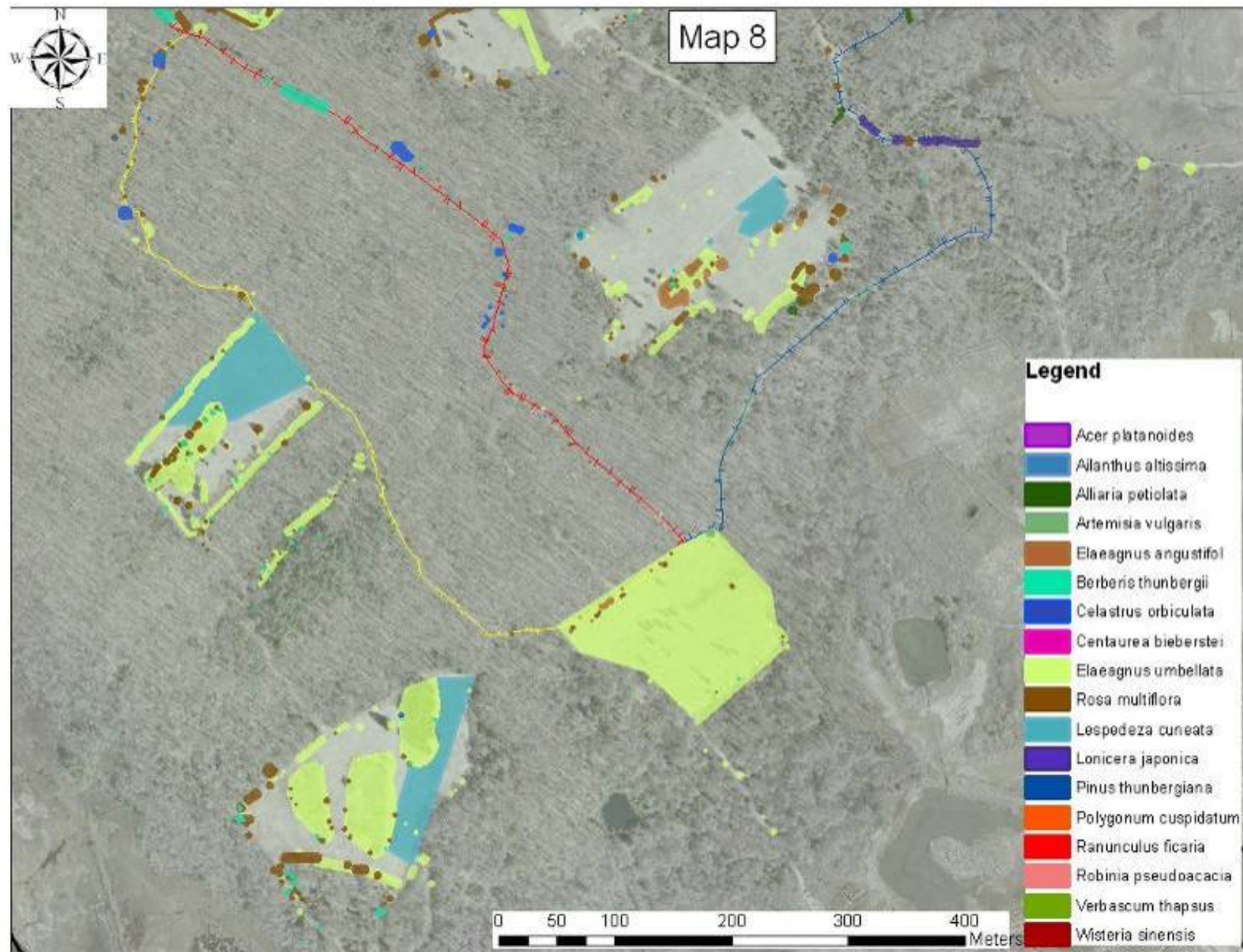
Map 6. Displaying results in the central-eastern section of the William Floyd Estate.



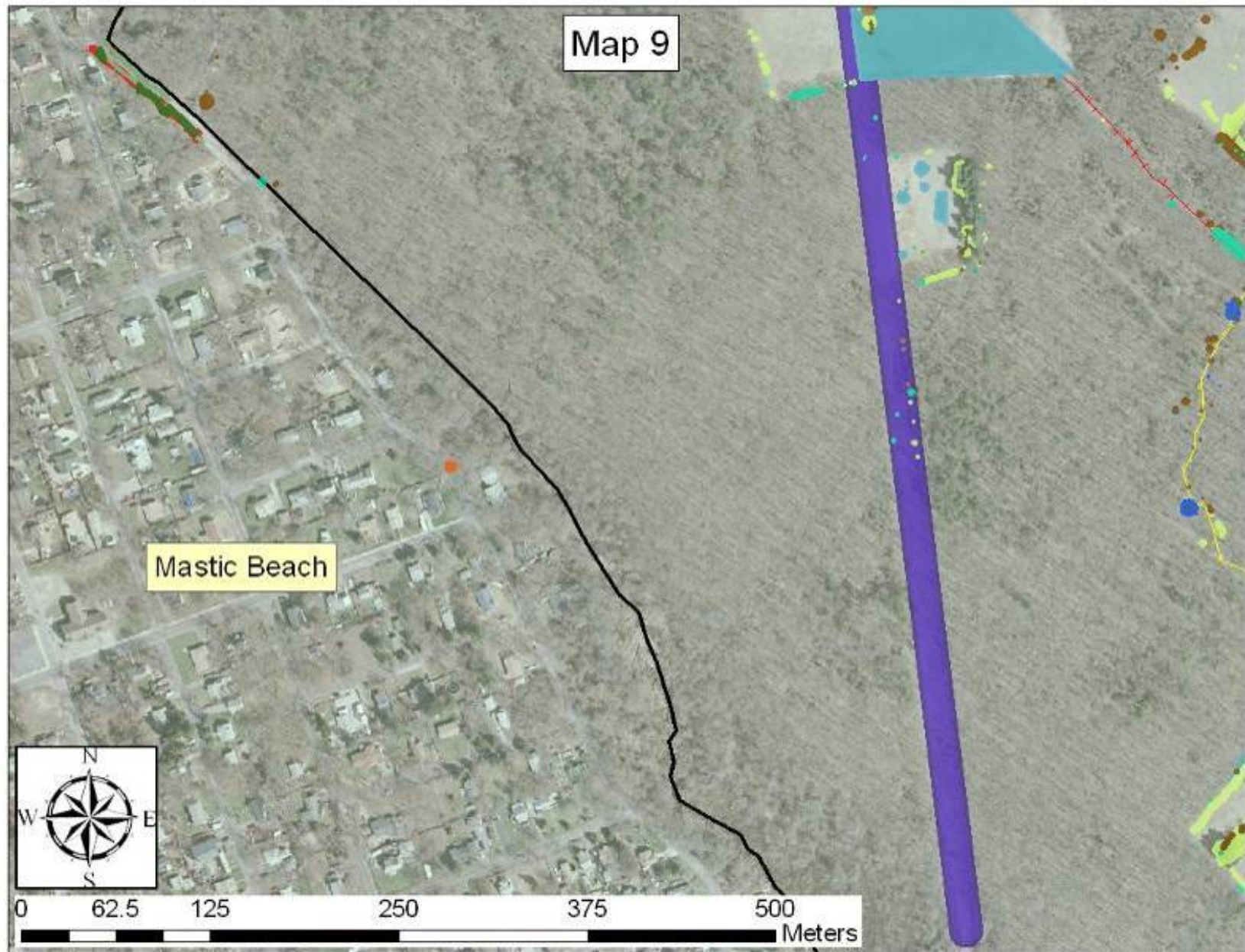
Map 7. Displaying results in the southeastern section of the William Floyd Estate.



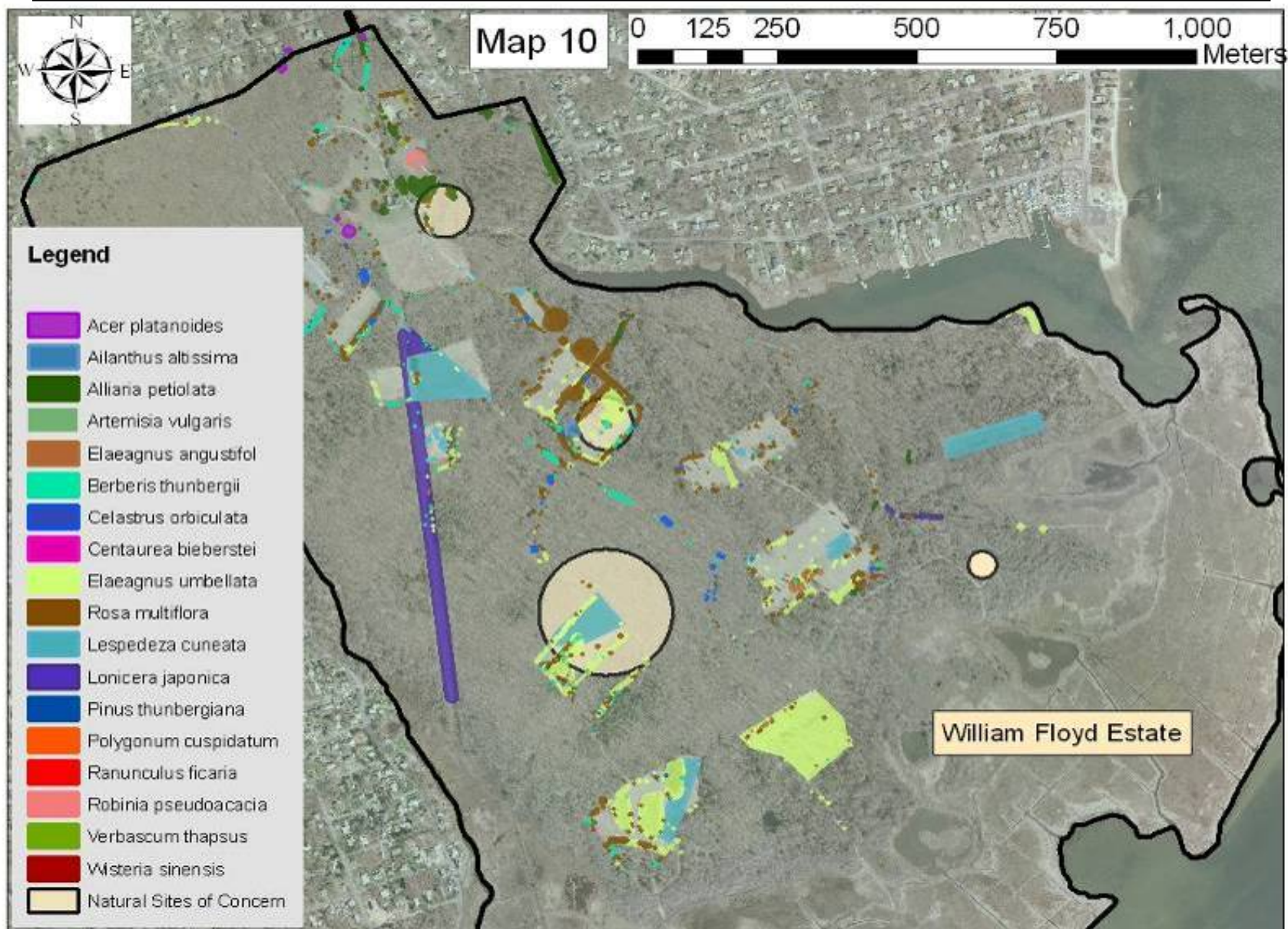
Map 8. Displaying results in the southwestern section of the William Floyd Estate.



Map 9. Displaying results in the central-western section of the William Floyd Estate.



Map 10. Displaying identified natural sites of priority (in beige circles) at the William Floyd Estate (Appendix B).



APPENDIX A:

Management of Biologically Invasive Cultural Plantings

United States Department of Interior
National Park Service
Fire Island National Seashore

IN REPLY REFER TO:

February 14, 2008
N50 (FIIS-NH-IPM)
H3017 (FIIS-CR-IPM)

To: Files, Fire Island National Seashore (FIIS)

From: Fernando Villalba, Park Biologist, FIIS

Subject: Invasive plant management at the William Floyd Estate, in accordance with the cultural landscape management site objectives

On February 14, 2008 I met with MaryLaura Lamont (Museum Technician) and Steve Czarniecki (Cultural Resources Management) to discuss management of invasive plants at the William Floyd Estate (WFE) in the context of the site's cultural landscape. Other invasive plant species not discussed in detail in this Memo have been addressed in the 2007 Invasive Plant Inventory and Control Report, including species found outside of the WFE.

As guided by the Development Concept Plan and the Interpretive Prospectus, the integrity of the WFE's cultural landscape is to be stabilized to protect the historical and cultural resources (buildings, landscape, etc.). According to the Cultural Landscape Inventory, which was concurred on August 31, 2006, the Period of Significance for this site is 1718-1977, while the Period of Treatment and Interpretation is 1975. The Floyd family terminated their use rights of the House and surrounding 613-acre land referred to as the William Floyd Estate in 1976, coinciding with the United States Bicentennial. Under the NPS List of Classified Structures, the House and landscape are rated as a category 1A, which mandates that these properties must be preserved. Additionally, FIIS is charged with "conserving and preserving for the use of future generations certain relatively unspoiled and undeveloped beaches, dunes, and other natural features within Suffolk County, New York" (FIIS Enabling Legislation, 1964). Invasive plants at the WFE are currently negatively impacting both cultural and natural resources, largely by modifying the landscape and habitats, and displacing native plant species. Careful consideration is needed when developing an Invasive Plant Management approach in order to meet both Park-wide and site-specific objectives.

Based on available resources, documents and conversations with the Cultural Resources staff at the WFE, most invasive plant species that are being considered for control in FIIS have no known cultural significance to the Park. Removal of these particular species will therefore be implemented accordingly for the protection of natural resources and stabilization of the cultural landscape. This will include all species mentioned in the 2007 Invasive Plant Inventory and

Control Program Report, with the exception of those mentioned below in the Memo. Removal of these species shall not affect the cultural integrity of the WFE. On the contrary, such efforts are intended to protect the valuable resources of this landscape. During the removal process of the invasive plants, care will be taken as to prevent impacts on non-target species, which may have cultural and/or natural significance.

Per conversations with MaryLaura and Steve, autumn olive (*Elaeagnus umbellata*), black locust (*Robinia pseudoacacia*), Japanese barberry (*Berberis thunbergii*) and Multiflora rose (*Rosa multiflora*) all are known to be cultural plantings, introduced by the early generations of the Floyd family for various reasons. This understanding largely comes from historic documents that were donated to the Park. No removal of these species will be implemented in areas surrounding the House and outbuildings, since they were purposely planted in these areas by the early Floyds. However, due to the ineffective landscape management by NPS and/or the more recent generations of the Floyds and the invasive nature of some of these non-native plant species, the original dimensions of the deliberate cultural plantings have expanded to the present-day characteristics.

Autumn olive was planted by the early Floyds in some of the maintained fields for hunting purposes (mainly pheasants and quails). It was planted as a food source for the birds, but some grew large enough to also provide cover for the hunters, as the birds that were being hunted foraged in the adjacent fields, which were largely characterized by native grasses. With this understanding, we have concluded that large extant autumn olive plants that were planted inside, and along the edges, of these fields will not be removed. These plants were probably planted in the 30's – possibly the 40's and are an asset to the cultural landscape.

However, autumn olive plants that have expanded and are growing beyond the intentional planting sites may be removed. It is easily distinguished what areas may be controlled, since these fields are still being mowed by the WFE staff annually. MaryLaura and I visited one of these fields and she suggested that the mowed areas were likely vegetated with native grasses and wildflowers, which produce seeds that are great food sources for pheasants and quails. Reseeding these fields with native grasses and wild flowers should be considered as a cost efficient means to reintroducing native grasses and to return a characteristic of the cultural landscape. MaryLaura concurred with this idea. Each field where autumn olive is growing will be assessed for management on a case-by-case basis in collaboration with the cultural resources staff.

Black locust was introduced to the Estate by the Floyds as well. It served as wood for fencing posts, other construction purposes and fire wood because it is extremely hard grained giving a long durability and resistance to decomposing into the soil. Black locust was mainly grown around the House and in the adjacent wood lots, but it was also possibly allowed to spread throughout the forested areas and harvested when the trees grew large enough. However, it is now growing in many of the mowed fields and lawns. Mowing has been slowing its spread, but every spring saplings are visible able grow rapidly, sometimes about 6 feet in a single season. Therefore, removal of black locust will not be implemented in the around the House and adjacent forested areas, but removal may occur in the fields and lawns where it was not intended to grow. Continual discussion and consultation would have to take place with the Cultural Resources staff

Japanese barberry and Multiflora rose were likely only planted as an ornamental and did not serve any recreational or harvesting purpose. Because of this, it was suggested by MaryLaura that these species were only planted for aesthetic purposes around the House, the outbuildings, and the

family cemetery. These two species have spread well beyond these areas. We concluded that it shall not be removed from the intended planting areas mentioned above, but may be controlled where it is has expanded beyond these areas.

Chinese and/or Japanese wisteria (*Wisteria* spp.) is also thought to possibly be a cultural planting. This is only based on the locations *Wisteria* spp. is found. For example, *Wisteria* spp. occurs in an area that historically has had a slave cabin. These plantings are now old, suggesting that they have been established in this area for a long time, likely during the early Floyd generations. To develop a more thought-out management decision for this species, the history of *Wisteria* spp. would have to be further investigated to better understand when and how these plants species were introduced. Otherwise, control of Chinese and/or Japanese wisteria shall occur on a case-by-case basis, removing only certain plants that have been introduced recently and/or they are young (e.g. if they are climbing over the boundary, saplings, etc.).

At least one more site visit shall take place before invasive plant control begins in the spring. More detailed objectives for specific fields and locations should be written in collaboration with the Cultural Resources staff, with the intentions to protect naturally and culturally significant land features.

Works cited:

Federal Register. Public Law 89-244, 1965; Public Law 88-587, 1964. Fire Island National Seashore Establishment. Legislative History of Fire Island National Seashore. September 11, 1965.

U.S. Department of the Interior. National Park Service. Description of the Selected Alternative Site Development and Facilities of the William Floyd Estate, Fire Island National Seashore. January, 1979.

U.S. Department of the Interior. National Park Service. Olmstead Center for Landscape Preservation. Cultural Landscape Inventory of the William Floyd Estate. 2008.

Cc: M. Bilecki, Chief, Natural Resources Management, FIIS
Steve Czarniecki, Cultural Resources Manager, FIIS
MaryLaura Lamont, Museum Technician, FIIS

APPENDIX B:

Identified Natural Sites of Priority for Control of Invasive Species at the William Floyd Estate, Fire Island National Seashore

Introduction

Four sites were chosen within the boundaries of the William Floyd Estate, these sites were selected as high priority areas because the invasive plant species found there could potential pose a threat to the park's natural resources and/or natural ecosystems (map attached below). Fields found at the Estate are great habitats for hunting hawks, particularly these fields can be (and are) critical wintering hunting habitats for hawks (e.g. Northern Harriers, *Circus cyaneus* -State threatened species), falcons (e.g. Peregrine falcons, *Falco peregrinus*) and owls.

Site Details

The sites were taken as buffered points completed using a Trimble Geo Explorer XT GPS unit (the size of the area was estimated). The GPS unit was set with the Universal Transverse Mercator (UTM) coordinate system, Zone 18 North, NAD 1983 datum and the altitude reference was set to mean sea level (MSL). Real-time deferential correction was used throughout the entire inventory, using the base station in Darien, CT. All recorded measurements were in meters.

Site #1

This site is located at the headwaters near "home creek" (Map 1). This area is where the Floyd's used to get their fresh water. It could be considered a high priority area because it is located within a fresh water spring and many native fresh water plant species grow in this area (i.e. wildflowers like violets). Invasive plant species such as Japanese knotweed (*Polygonum cuspidatum*), Japanese Barberry (*Berberis thunbergii*), multiflora rose (*Rosa multiflora*), mugwort (*Artemisia vulgaris*) and garlic mustard (*Alliaria petiolata*) are taking over much of this space and could threaten many of the native freshwater species.

This particular habitat has been characterized as a red maple-tupelo swamp forest; known for having plant species such as highbush blueberry (*Vaccinium corymbosum*), swamp azalea (*Rhododendron viscosum*), and coastal sweetpepperbush (*Clethra alnifolia*). (Klopfer et al. 2002) swamp azalea is listed in New York State as exploitably vulnerable.

Site #2

This site is located near one of the fields with in the William Floyd Estate and could become a new tour trail area (Map 1). It could be an area of high priority because visitors and guest will see this part of the William Floyd Estate. From a natural resource stand point, this area has a lot of native species such as black oak (*Quercus velutina*), black cherry (*Prunus serotina*), and Pitch Pine (*Pinus rigida*). Some of the invasive plant species found here are oriental bittersweet (*Celastrus orbiculatus*), Japanese barberry (*Berberis thunbergii*), and multiflora rose (*Rosa multiflora*). These invasive plants look like they are suffocating many of these native trees. For example, much

of the oriental bittersweet (*Celastrus orbiculatus*) has climbed to the top of the native oak and pine trees.

This particular habitat has been characterized as a Coastal Oak-Health Forest; known for having plant species such as scarlet oak (*Quercus coccinea*), black oak (*Quercus velutina*), sassafras (*Sassafras albidum*), and blue ridge blueberry (*Vaccinium pallidum*). (Klopfer et al. 2002)

Site #3

In this area (Map 1), autumn olive (*Eleagnus umbellata*) has taken up a big portion of a field. This field is huge and, if it can't be treated in its entirety, any form of abatement would be beneficial. This area serves as a potential habitat for many bird species such as grasshopper sparrow (*Ammodramus savannarum*), field sparrow (*Spizella pusilla*), northern bobwhite (*Colinus virginianus*), eastern bluebird (*Sialia sialis*) and the State endangered short-eared owl. Without proper nesting habitat and lack of quality food, these birds could have a hard time surviving in this area. Some native plant species include (but are not limited to) milkweeds (*Asclepias* sp.), blackberry (*Rubus* sp.) and grasses (*Andropogon* sp.) milkweed and blackberry.

Site #4

The area could be high priority because it has many native plant species (Map 1). However, invasive plants such as Japanese honeysuckle (*Lonicera japonicus*) and multiflora rose (*Rosa multiflora*) are starting to emerge. If these invasive plants can be controlled before they get too bad, it could help maintain this site's natural setting. This area can be a potential habitat for the narrow leaved sunflower (*Helianthus angustifolius*), which is a New York State listed threatened plant species.

This particular habitat has been characterized as a Maritime Deciduous Scrub Forest; known for having plant species such as black cherry (*Prunus serotina*), sassafras (*Sassafras albidum*), Canadian serviceberry (*Amelanchier canadensis*), and roundleaf greenbrier (*Smilax rotundifolia*) (Klopfer et al. 2002).

Work Cited:

Klopfer, Scott D., Adele Olivero, Lesley Sneddon, and Julie Lundgren. Final Report of the NPS Vegetation Mapping Project at Fire Island National Seashore. Virginia Tech, College of Natural Resources, GIS & Remote Sensing Division, Conservation Management Institute. April, 2002.

Map of the William Floyd Estate with the 4 priority treatment sites (in light blue).

