

Assateague Island National Seashore

Alien Plant Management Program (APMP) / Phragmites Control Project Report 2014



Image 1: NCR EPMT and Kristina Fahey on the beach adjacent to burn unit 8

Jonathan Chase, Biological Technician
Vegetation Management
Division of Resource Management

Assateague Island National Seashore
7206 National Seashore
Berlin, MD 21811
(410) 641-1443

December 2014

List of Tables

Table 1: <i>P. australis</i> Herbicide Use and Area treated by Burn Unit and responsible party....	Page 19
Table 2: Percentage of Change of %Cover in ASIS Burn Units for Monitoring Years 2013 and 2014.....	Page 22
Table 3: Average %Density, Average Size Class and Estimate of <i>P. australis</i> present on periphery of Burn Units 2013 and 2014.....	Page 23
Table 4: ASIS Alien Plant Management Program Site Coordinates.....	Pages 26, 27, 28, 29 and 30
Table 5: ASIS Alien Plant Management Program Treatments Information for FY2014.....	Pages 31, 32, 33 and 34
Table 6: ASIS Alien Plant Management Program Treatments Information (Herbicide use) for FY2014.....	Pages 35, 36, 37, 38, 39, 40

List of Figures

Figure 1: ASIS Phragmites Project: Prescription Burn (units 3, 4, 7, 8 and 9).....	Page 16
Figure 2: Ground Treatments of <i>Phragmites australis</i> from FY 2013 and 2014.....	Page 17
Figure 3: <i>Phragmites australis</i> Aerial and Ground Treatments from FY 2008, 2009, and 2014 on ASIS Burn Unit 4	Page 18
Figure 4: 200 meter x 200 meter Grid design (1 block of 4 subplots.....	Page 20
Figure 5: Example Grid Overlay Burn Unit 3.....	Page 21

List of Images

Image 1: NCR EPMT and Kristina Fahey on the beach adjacent to burn unit 8.....	Page 1
Image 2: One of 2 recruited trees at the Scotts Ocean Beach Hotel Site (AIAL_Site_02) (NPS ASIS Photo).....	Page 5
Image 3: <i>A. julibrizzan</i> tree from @ 12 meters (NPS Photo).....	Page 6
Image 4: Hack and squirt treatment of the <i>A. julibrizzan</i> trunks (NPS Photo).....	Page 6
Image 5: <i>A. julibrizzan</i> bagged seeds. (NPS Photo).....	Page 6
Image 6: <i>C. terniflora</i> in flower. (Credit: EDDMapS.org).....	Page 8
Image 7: <i>E. umbellata</i> in flower (Credit: Bill Johnson (NPS)).....	Page 8
Image 8: <i>E. curvula</i> along Bayberry Drive just south of the Northern boundary marker (Credit: NPS ASIS 2004).....	Page 9
Image 9: <i>P. alopecuroides</i> behind the Sinepuxent District Visitor Center in September 2014 (NPS ASIS Photo).....	Page 12
Image 10: J. Chase and K. VanDyne use the sand cart herbicide pump apparatus at Kilometer 17 shrubline (NPS Photo).....	Page 15

Introduction

During 2014 Assateague Island National Seashore's (ASIS) Alien Plant Management Program (APMP) worked to monitor and control infestations of: *Ailanthus altissima*, *Albezia julibrissan*, *Artemisia stelleriana*, *Artemesia vulgaris*, *Carex kobomugi*, *Cirsium arvense*, *Clematis terniflora*, *Elaeagnus umbellata*, *Eragrostis curvula*, *Hedera helix*, *Lezpedeza cuneata*, *Lonicera japonica*, *Ligustrum vulgare*, *Mentha spp.*, *Microstegia viminium*, *Miscanthus sinensis*, *Morus alba*, *Pennisetum alopecuroides*, *Phragmites australis*, *Pinus thunbergiana*, *Rosa multiflora*, *Rosa wichuriana*, and *Vitex rotundifolia*. During the APMP's implementation, ASIS received some much appreciated assistance from the National Capitol Region's Exotic Plant Management Team (NCR EPMT) who helped treat *Phragmites australis* infestations in Burn Unit 8 in the vicinity of the Bullpen at Km 22 in the Over Sand Vehicle zone of the Park's backcountry. The alien plant species infestations that were treated by the Alien Plant Management program (APMP) during 2014 occurred in the park, as well as around the park's Headquarters area. Previously documented and treated infestation sites were monitored during 2014 and those sites found to be inactive during each of the past three years were determined to be controlled.

Methods

ASIS Alien Plant Management Program Design 2009-2014

The APMP follows the alien species guidelines found at the NPS inventory and monitoring website (<http://science.nature.nps.gov/im/monitor/index.cfm>) and employs the North American Weed Management Association (NAWMA) standards. The APMP also refers to the Bureau of Land Management's (BLM) Technical Reference 1730-1: Measuring and Monitoring Plant Populations and the Nature Conservancy Weed Handbook for guidance on monitoring and treating targeted alien plant populations. The ASIS APMP database was updated to include 2014 APMP activities. Additionally, the Phragmites database was updated to store and manage data associated with the ASIS Phragmites Control Project. During FY14 the ASIS APMP continued to expand its management of *P. australis* with large scale ground treatments and continued to treat/ retreat the previously mapped/ treated infestations associated with this monitoring and management project. The grand size and complexity of this ambitious project became the responsibility of the permanent biological technician and 2 seasonal employees were hired to assist our program. Additionally, 2 Student Conservation Association (SCA) members were recruited and subsequently delegated to assist with this project along with other Resources Management activities, though the majority of their assistance was dedicated to this project. The permanent biological technician and the Chief of Resources Management shared the coordination of all *P. australis* monitoring and management activities during this reporting period.

Data Management

The ASIS APMP database and the ASIS Phragmites Control Project databases document and track the development and treatment success of each targeted alien plant infestation. Multiple infestations are often grouped into sites for record keeping and reporting purposes. Beginning in 2008, a site code was used to group the infestations so that they could be referred to more generally. This practice has been found to be burdensome, but does at some level help to identify the areas of infestation on the island. For the purposes of continuity, the same sites will be used for this report. The APMP database sites are listed in Table 4. Treatment information for the APMP actions taken in 2014 are presented in Table 5. The herbicide use log associated with treatment information in Table 5, are included for all APMP activities in Table 6.

To indicate multiple different treatments on a single day, each treatment was given a "Rx Code" that included the characters "Rx" and the date of the treatment and if more than 1 treatment was conducted on that day the filename was appended with discreet numbers added to the end of the filename. For example, the second treatment on 7/5/2013 would be labeled "Rx070513_2". This was especially useful in the naming of polygons that represented separate treatments that occurred on the same day.

Safety Precautions

A non-toxic marker dye has been used in herbicide mixtures at ASIS since 2004. The dye assures that proper coverage of the herbicide is administered on the foliage of targeted species. It also ensures the protection of the applicator by making visible, any possible contamination of his/her protective clothing. Proper protective equipment (PPE) was always employed during treatment activities. Employee safety is important to ASIS, especially when working with potentially hazardous materials. Therefore, the project lead assured that all equipment was in good working order and that all permits were current at the start of the season prior to large scale treatment activities. This methodology has been adopted as standard operating procedure by the ASIS APMP. The lead technician responsible for coordinating and implementing the APMP is a certified pesticide applicator (categories 2 and 5) in the State of Maryland who is therefore permitted to conduct and oversee the herbicide treatments described in this report.

Alien Plant Inventory and Monitoring

The criteria used to determine a plant species' status as an alien invasive are:

1. The species has been identified in a previous APMP report as an invasive alien Species of Management Concern (ASIS SOMC).
2. The species is included on the Maryland Department of Natural Resources Wildlife & Heritage Services' list of invasive non-native plants (<http://www.dnr.state.md.us/wildlife/inintro.asp>)
3. The species is considered to be potentially invasive by the NPS Natural Resource Program Center's Invasive Plant Program and its level of abundance at ASIS has been found to warrant management consideration.

Island searches for invasive alien plants were conducted in 2014 and Global Positioning System (GPS) units were used to record data. The Trimble® Juno 3B® handheld unit was the preferred unit in 2014. Whenever possible, the perimeter of larger alien plant infestations were mapped, however some infestations were too difficult to circumnavigate and were therefore documented using point data. The descriptive data recorded for each infestation includes: species, abundance (sparse, moderate, or heavy), length (longest axis, m), width (shortest axis, m), height (m), # individuals, phenology and comments. These data were visually estimated in order to increase monitoring efficiency each year. Additionally, these visual estimates are compared with the amount of area treated (which, with the exception of *L. japonica* in 2014 (as was also the exception in 2013) was equal to the known extent of the remaining population for each infestation) these actions enable accurate estimates for reporting purposes. Essentially all species that have been targeted by these efforts since 2004 are at manageable levels (≤ 0.1 Acres) with the exception of *A. vulgaris*, *C. arvense*, *C. kobomugi*, *C. terniflora*, *L. japonica*, *P. australis*, and *P. alopecuroides*.

Results

A summary of the ASIS APMP accomplishments during the fiscal year 2014 follows. This summary includes ASIS APMP monitoring and treatment activities as well as those conducted with the assistance of the NCR EPMT. During 2014, the NCR EPMT visited for a week during which time they helped treat *P. australis* infestations in the southern portion of Burn Unit 8.

Treatment data are presented by species including the time associated with these treatments in Table 5. The herbicide use log associated with the treatments in Table 5 are presented in Table 6. Treatment and monitoring information are presented in the narrative for each species. The sites used by the APMP are found in Table 4 for reference, as mentioned previously.

Ailanthus altissima:



Image 2: One of 2 recruited trees at the Scotts Ocean Beach Hotel Site (AIAL_Site_02) (NPS ASIS Photo)

During 2013 one of the five known *Ailanthus altissima* sites (AIAL_Site_02) was found to be active. Because the remaining 4 sites have not been active for more than 3 consecutive years they can be considered to have been controlled/ eradicated. Two trees at the single active site had emerged from a previously well-established seed bank and had grown to between 2 and 3 meters in height. These two trees at the Scott's Ocean beach Hotel site were treated using the hack and squirt method with a 50% solution of Garlon 3A® in water.

In total, only 2 trees of this species were located and treated in 2014.

Albezia julibrizzan:



Image 3:



Image 4:



Image 5:

Images 3: *A. julibrizzan* tree from @ 12 meters (NPS Photo)

Image 4: Hack and squirt treatment of the *A. julibrizzan* trunks (NPS Photo)

Image 5: *A. julibrizzan* bagged seeds. (NPS Photo)

Two trees discovered in 2012 (Alb_jul_Site_001) were relocated during this period and treated very carefully by removing all seed pods from the trees and then using herbicide on the trunks with a hack and squirt method with a 50% solution of Garlon 3A® in water. The seeds were cut from the branches of the trees, bagged up and disposed of off of the island.

In total, only 2 trees of this species were located and treated in 2014. There are no known occurrences of this species elsewhere on the island (Chase 2014).

Alnus glutinosa:

Because the site has not been active for more than 3 consecutive years the single tree once present at this site can still be considered to have been controlled/ eradicated.

Artemisia stelleriana:

ARST_Site_01 and ARST_Site_02 were visited in August of 2014 during Seabeach Amaranth searches and were found to still be inactive and required no further treatment. Because the sites have not been active for more than 3 consecutive years they can still be considered to have been controlled/ eradicated.

Artemesia vulgaris:

A sizable infestation has appeared in the vicinity of the ASIS Sinepuxent District Visitor Center since 2012 and has been found to be active on the island, as well. The many parking islands and planting beds surrounding the Maryland Visitor Center have provided ideal growing conditions for this. It is possible that the species came to the area when the planting beds surrounding the Visitor Center were mulched during

various plantings at this site. To continue control efforts at the Visitor Center and Island infestations, treatments were conducted in May of 2014 with a foliar spray application of 2% glyphosate herbicide solution of Rodeo® in water.

A small infestation is thought (Chase 2013) to have been vectored from the ASIS Sinepuxent District Visitor Center to the Sinepuxent Ranger Station where it has become established between the Ranger Station and the Hunt Shack. This small infestation was treated in August of 2013 with a foliar spray application of 2% glyphosate herbicide solution of Rodeo® in water. The site remained active in 2014 and will be targeted again in 2015. Additionally several clumps of this invader were discovered, and subsequently treated as the others had been, underneath the guardrail on the northern approach to the fee station on the eastern side of Bayberry Drive in 2014.

The total area treated for this species in 2014 was 717.5 meters squared, or 0.177 Acres.

Carex kobomugi:

In July and August of 2014, all of the known *C. kobomugi* sites in Maryland were monitored and if living plants were encountered, they were treated. Nine of the Maryland sites were found to be active with an additional (6) new infestations discovered. The active sites in 2014 were Cako_Sites_3, 4, 13, 18, 23, 33, 36, 39, 42 and 43. Some of the sites that were active in 2013 (CAKO_Sites_13, 14, 22, 33, 36, 37, 39 and 43) were again active in 2014 which indicates the difficulty that can be had in gaining control of this species. Repeated treatments are common elsewhere and ASIS is not an exception. The following article addresses this fact:

When Invasive Species have Benefits as well as Costs: Managing *Carex kobomugi* (Asiatic sand sedge) in New Jersey's Coastal Dunes, L. S. Wootton, S. D. Halsey, K. Bevaart, A. McGough, J. Ondreicka, P. Patel, *Biological Invasions*, November 2005, Volume 7, Issue 6, pp 1017-1027.

These sites were promptly treated after being located with a foliar spray application of 2% glyphosate herbicide solution of Rodeo® in water. One site near Km 17 received a treatment of 2% Imazapyr herbicide solution of Polaris® in water because treatments of *P. australis* in the same area overlapped.

The Seabeach Amaranth Restoration project provides the opportunity to locate new infestations of this species annually both before the census when we attempt to locate and protect as many plants as possible with cages as well as during the island wide census. Because we continue to find new infestations of this species as well as re-emergent, or newly emergent populations in previously treated sites, it is believed this species will be of continued concern for many years to come.

The total area treated for this species in 2014 was 1069.2 meters squared, or 0.264 Acres.

Cirsium arvense:

This nefarious invader had become established in areas of the Maryland Headquarters starting in 2011 when various disturbances related to landscape buffer construction and large quantities of abandoned vehicles altered mowing practices in the southern portion of this property. Judicious herbicide treatments have helped to reduce, but not eliminate, the prevalence of this species since 2011.

In May and again in October of 2014 a 2% glyphosate herbicide solution of Rodeo® in water was used to treat this species.

The total area treated for this species was 934.5 meters squared, or 0.231 Acres.

Clematis terniflora:



Image 6: *C. terniflora* in flower. (Credit: EDDMapS.org)

The reoccurrence of *C. terniflora* at CLTE_Site_01 is likely the result of an abundant seed bank established by the original infestation over many years. The entire CLTE_Site_01 was found to be active during a late season assessment of the area in August of 2013. Because the footprint of this infestation had been proposed to be the relocation of an adjacent parking lot it was not deemed to be a worthy recipient of treatments this year by the biological technician. Later, the relocation of the lot garnered significant dissatisfaction and did not gain approval. Therefore, work in this area began early in May of 2014 to continue the control of what has become a significant population of vines that pose a very significant threat to the island.

In May of 2014, a 2% glyphosate herbicide solution of Rodeo® in water was used to treat this species.

The total area treated for this species was 150 meters squared, or 0.037 Acres.

Elaeagnus umbellata:



Image 7: *E. umbellata* in flower (Credit: Bill Johnson (NPS))

Many *E. umbellata* saplings continue to emerge at the Headquarters area of ASIS. Both large mature trees at ELUM_Site_01 and saplings were treated with a basal bark or cut stump application of a 25% triclopyr herbicide solution of Garlon4 Ultra® in diesel fuel. A small number of saplings were treated with a 2% foliar application of glyphosate herbicide solution of Rodeo® in water. Because a great number of

these trees can be found bordering the Headquarters land, as well as being well established throughout South Point, it is believed that this species will remain on our watch list for many years to come. Very few trees of this species have become established on the island in the past, but there have been some found and treated in the past on the State Park land near their pump houses along Bayberry Drive as well as at the end of ASIS's Bayside Peninsula. This species remains well under control on the island.

A total of 25 trees and saplings were treated at ASIS during 2014.

Eragrostis curvula:



Image 8: *E. curvula* along Bayberry Drive just south of the Northern boundary marker (Credit: NPS ASIS 2004)

E. curvula infestations have been treated in the Developed Area (which it has remained confined to) at ASIS since 2005. The Developed Area was treated during August 2014 within ERCU_Site_01. The previous years of treatments had significantly diminished *E. curvula* occurrences in the Developed Area's Federal Lands (Chase 2014). Cutting was not performed in 2014 because *E. curvula* occurrences were comparatively small. Cutting of large tussocks followed by allowing re-growth to reach (15 cm) height that is then treated with a foliar application of a 2% glyphosate herbicide solution of Rodeo™ in water, remains the optimal treatment for this species when it is mature and well established (Chase 2014).

The *E. curvula* occurrences present during 2014 were likely recruits from a well-developed seed bank that remains established along ASIS's paved roads during previous years. During August of 2014, all observed *E. curvula* occurrences at ERCU_Site_01 were treated with a 2% foliar application of glyphosate herbicide solution of Rodeo® in water. The areas with the highest occurrence of *E. curvula*

were 1. Just south of the entrance sign along Bayberry Drive on the western side of the roadway, 2. The Life of the Marsh Parking Area, 3. Site 65 at the Oceanside Campground, and 4. Just west of the mounds of soil in the western portion of the ASIS Boneyard in the remnant of the old road scar that was the previous first camping loop of the Bayside Peninsula Campground.

The total area treated for this species in 2014 was 49 meters squared, or 0.012 Acres.

Hedera helix:

The single *H. helix* plant discovered and treated at HEHE_Site_01 during 2006 was monitored in July of 2013 and found to be active with a single vine extending 1 meter from its base. This small infestation was targeted for treatment in 2014, but was not present when the site was revisited in 2014. The site will be monitored and treated, if necessary, in 2015.

Lezpedeza cuneata:

This species is present in 2 Park locations, they are: 1. The Sinepuxent Vegetation Buffer: behind the ASIS Sinepuxent District Visitor Center and 2. Bayside Peninsula: along the south side of Bayside Drive in the Developed Area on the island. Treatments have been conducted on the mainland in the past, but not on the island. Two treatments in October were conducted at the Sinepuxent Vegetation Buffer where a foliar application of a 2% glyphosate herbicide solution of Rodeo™ in water was used. It should be noted that the island population was monitored early, in June during the growing season of 2014 and the species was not detectible at that time. Only later, in October, was the species detectible, indicating that it can easily escape detection if this species is not monitored later in the growing season. Because the level of detection has increased at both locations, treatments of this highly invasive species are recommended to continue in the fall of 2015.

The total area treated for this species in 2014 was 355 meters squared, or 0.088 Acres.

Ligustrum vulgare:

No further recruitment from the original infestation (500 m²), found in the vegetated buffer that borders the Sinepuxent Bay on our Headquarters property was observed during treatments of other invasive species in the same location during 2014. The area will continue to be monitored for recruitment in 2015 and if found, will be treated accordingly.

Lonicera japonica:

There were no treatments of this species conducted this year, as a PMIS project had been submitted to deal with the threat, which in the absence of treatments for the previous 3 years, had become difficult to manage with current resources. The PMIS project has been funded and treatments will begin, in the Park's backcountry, during the 2015 field season.

To address this problem in the Developed Zone of ASIS in the future, ASIS will seek assistance from the Exotic Plant Treatment Teams that can be made available to us. These teams (in particular, the National Capital Region) have helped us to treat this species in the past with measurable success.

Mentha spp.:

A species of non-native, hybridized mint was discovered to have become well-established in the vicinity of Loblolly house in Park Housing at the Maryland Headquarters property during the 2014 growing season. Because it had escaped the mowed areas behind the house and entered the vegetated islands that do not get mowed it was able to flourish. The original source is unknown, but is thought to have been planted by a previous resident of Park housing.

This discreet infestation covering 25 meters squared, or 0.006 Acres was treated with a 2% glyphosate herbicide solution of Rodeo™ in water during late April of 2014, before it could flower and set seed. The site should be revisited in 2015 to ensure that it has been successfully managed and to determine the effectiveness of the treatment.

The total area treated for this species in 2014 was 25 meters squared, or 0.006 Acres.

Microstegium vimineum:

A very sizable infestation, the extent of which remains unknown, but is thought to occupy more than an acre of cover, was discovered in the fall of 2014 by Seasonal Biological Technician Kristina Fahey. The infestation lies on land owned and managed by the Maryland Department of Natural Resources (MDDNR) which borders the southern and western boundaries of Park Headquarters.

There is now an imminent threat of having this notorious invasive species become established on our Park headquarters property. Therefore, the adjacent populations will be monitored closely at the interface of our boundaries in 2015 to prevent introduction onto our park lands. The MDDNR will be contacted in 2015 to share the discovery with them, in hopes that they will take some action to control this aggressive invader.

Miscanthus sinensis:

All of the 5 known sites of *M. sinensis* were treated in 2008. In 2010, just MISI_Site_01, on the North end of the island in the forest near the inlet, received treatment. None of the sites had been monitored in 2013 because they have shown that they need years to become substantially active following treatment(s). Further monitoring and treatment of this species was required in 2014 at the largest of the known *M. sinensis* sites, MISI_Site_01.

Treatments of *M. sinensis*, that had occurred in 2013 at the Headquarters area where large plants were found west of the Hudsonia house in Park Housing were observed to have been successful in 2014, but will require future investigations because of the previously stated issues that are characteristic to this species.

MISI_Site_01 received treatments during 2014, as enough time had passed to allow the species to become detectable and thus treatable. Only 5 plants were treated with a foliar application of a 2% glyphosate herbicide solution of Rodeo® in water at this during August of 2014. This site had previously harbored many hundreds of plants that were very well established with large tussocks present at their bases. The fact that so few plants had recruited in the past at the site indicates that while our treatments have been very successful over time, a seed bank still persists there.

Additionally, the vegetated buffer bordering the University of Maryland Eastern Shore Paul S. Sarbanes Coastal Center, was found to have a small quantity of plants that were treated using the same prescription used at Misi_Site_001, in October of 2014.

The total area of treated material at MISI_Site_01 was 9 meters squared, or 0.002 Acres.

Morus alba:

All known sites where *M. alba* has been present in the past were found to be inactive during 2014, though a single sapling, discovered in 2013 at the entrance of the OSV will require treatment in 2015, as it was not treated in 2014. This species is brought to the island by birds that have eaten the ripe fruits from the nearby mainland. The birds vector the seeds by evacuating seeds in random places. We will continue to see this species appear periodically in random locations in the open at the edge of vegetated areas along roadways and paths of the island.

Pennisetum alopecuroides:



Image 9: *P. alopecuroides* behind the Sinepuxent District Visitor Center in September 2014 (NPS ASIS Photo)

This species was originally discovered in September 2007 in the footprint of what would later become the ASIS Sinepuxent District Visitor Center. At that time the ASIS infestation measured approximately 100 m². The source of this invasive plant had been located on the golf course which borders the southern portion of the State of Maryland land that contains the Ratcliff House. This plant was intentionally planted at the golf course as an ornamental and it has successfully escaped its plantings and proven to be extremely invasive in both open and shaded habitats. The golf course was notified 5 years ago that this plant was an aggressive invasive plant and they have not taken any action to control the source of the problem since that time.

The purple-colored inflorescence of this species is very distinctive and in September of 2014, hundreds of plants were seen throughout the ASIS Headquarters land, as was the case in 2013. These plants were treated with a foliar application of a 2% glyphosate herbicide solution of Rodeo® in water late in the 2014 growing season when they were flowering, which makes them easier to locate. We will continue to spray the infestations found on Federal lands in 2015. This species may offer opportunities for volunteer involvement because it would be helpful to remove the seed heads of plants that escape treatment, thereby reducing further recruitment of the species.

A total area of 916.5 meters squared, or 0.23 Acres, of *P. alopecuroides* were treated at this location in October of 2014.

Phragmites australis:

Abstract

The native coastal communities of Assateague Island National Seashore (ASIS) are threatened by the expansion of *P. australis* (Phragmites or common reed) an invasive, alien plant species. Assateague Island contains the only intact natural barrier island ecosystem remaining in the state of Maryland. At the mid-Atlantic regional scale ASIS represents the largest contiguous expanse of native coastal communities that still collectively functions as an intact barrier island ecosystem. This valuable and unique resource is being degraded and functionally altered by the invasion of *P. australis* and through the development of dense infestations.

P. australis is an aggressive invader that spreads from established infestations by sending out rhizome and root runners thereby creating a thick mat of rhizome which may extend down several feet in depth. *P. australis* spreads to new sites via three routes; through seeds dispersed by wind and water, through dispersal of pieces of rhizome carried in water, and through pieces of rhizome contained in dirt and mud tracked by vehicles and equipment. *P. australis* forms dense monotypic stands, displaces and out compete native wetland and terrestrial vegetation, changes marsh hydrology, alters wildlife habitat, and increases wildfire potential.

P. australis has gradually (over a period of years or decades) established an expansive foothold on Assateague Island in a variety of coastal habitats. Individual infestations of varying sizes occur throughout the island. Over time *P. australis* infestations have expanded to the point that today vast areas of once diverse native forest, shrub and marsh communities have been replaced with dense monocultures of itself. Given the comparative rarity of undisturbed coastal communities present elsewhere throughout the region, the serious and continued threat posed by *P. australis* invasion, and the conservation mandate expressed by Congress in ASIS' founding legislation, the park continues to undertake this large scale project to document and treat *P. australis* infestations in order to restore native coastal communities and ecosystem health. After 6 years of treatments, ASIS has made measurable progress in the effort to gain control of this aggressive invader.

Ground Treatment of Infestations:

The effective control of *P. australis*, particularly larger well-established stands, has required multiple treatments using a combination of methods including aerial applications of herbicide, ground based cut stem treatments followed by applications of concentrated solutions of herbicide, and ground based foliar spraying with herbicide. The use of herbicide treatments is recommended as the primary control method and the first step towards effective control for *P. australis*. By applying herbicide to actively growing green foliage and flower plumes of the target plants after full leaf elongation and up to first killing frost, it is believed to produce the most effective way to control *P. australis*. However, because the window of hiring opportunity and workforce availability occurs earlier than this optimal treatment time period, managers have had to conduct their treatments during the growing season, rather than at the end of the growing season. Despite treating this species outside of optimal treatment interval ASIS has had success in gaining control of this species.

During FY2014 *P. australis* was sprayed exclusively from the ground with only foliar backpack and UTV pump sprayer applications. With the assistance of 2 seasonal crew members and 2 Student Conservation Association (SCA) interns, the Vegetation Management crew was able to spray, or retreat larger infested areas that had been sprayed aerially in the past. Backpack sprayers were used in infestations of every density (0-90%) and a 50 gallon ATV sprayer, transported on a Kawasaki Teryx® UTV, was used to fill the backpacks at a location on the beach near the treatment areas. Until this year, backpack sprayers were not used for the treatment of densities greater than 60%. However, the time that had passed since the initial aerial treatments in 2008 and 2009, had allowed some areas within the burn units that remained to be treated (units 4 and 8 respectively) to the extent that other units had been treated (units 2, 3, 5, 6, 7, 9, 10, 11 and 12 respectively) to grow and become more dense than they had been after the aerial treatments. Additionally it was impracticable and impossible to get a high volume pump sprayer into the treatment areas and so, there was no other option than to use backpack sprayers on these more dense areas of infestation. The use of backpack sprayers in the areas of density greater than

60% was found to be extremely difficult and time consuming and further justifies the need for further aerial applications of areas of this density as it is perhaps impractical to use backpack sprayers in this fashion. Nonetheless, the crew sprayed these dense areas to “tie in” with previous years’ treatments at whatever cost to come very near to fully treating the remainder of burn units 4 and 8 respectively (see Figures 2: and 3:).

All treatments were mapped and sprayed with a solution containing 2% concentration of Polaris®, or Rodeo® herbicide and 0.5% concentration of surfactant and marker dye. The solution was mixed in water and sprayed on *P. australis* infestations starting from the crown of the plant and working down covering approximately 70% of the plant. See Table 1: below for the summary of treatments associated with the *P. australis* at ASIS during FY2014.

When applied to the foliage of actively growing plants, Imazapyr the active ingredient in Polaris® and Habitat® herbicide, is rapidly absorbed and transported throughout the plant tissues. The herbicide kills the entire plant: leaves, stems, and rhizomes. Rodeo® glyphosate-based herbicide is also effective for the control of *P. australis* and is the preferred product when treating near sources of water, as it is not persistent in the soil following treatment. ASIS has primarily used Imazapyr based herbicides to control this species because it has been proven to be statistically superior (see reference below) in efficacy.

Efficacy of Imazapyr and Glyphosate in the Control of Non-Native *Phragmites australis*, Thomas J. Mozdzer^{1,*}, Curtis J. Hutto, Paul A. Clarke and Dorothy P. Field, Restoration Ecology, Volume 16 Issue 2, May 2008.

The crews’ efforts during 2014 were employed in the retreatment of *P. australis* within the ASIS burn units 4 (aerially treated in 2008) and 8 (aerially sprayed in 2009) (see Figures 1, 2 and 3 below and Table 1). Additionally, an infestation directly west of Kilometer post 17 was treated to test an apparatus (a sand cart that an ATV sprayer was fixed to and used to be pulled manually across the sand between the western OSV boundary and the shrubline where driving was not an option). This allowed applicators to treat a higher density stand without the use of backpacks, which is preferable.



Image 10: J. Chase and K. VanDyne use the sand cart herbicide pump apparatus at Kilometer 17 shrubline (NPS Photo)

Initial goals were set for the treatment crew that included:

- 1) Treatments would all be foliar applications to reduce time spent cutting *P. australis* stems that would have to be sprayed individually.
- 2) To build off of what other prior crews had accomplished in burn units 4 and 8, essentially “tying in” with previous treatment boundaries.
- 3) To work closer to the entrance of the OSV to reduce travel time, allowing more time to be spent treating infestations in the field, rather than spending time reaching more remote infestations.
- 4) To see what a larger crew could accomplish working together in homogeneous stands of *P. australis*, as opposed to splitting the crew up and having them work in separate treatments areas. The accomplishments of this year’s treatment crew (including the NCR EPMT) are presented below in Table 1.

Figure 1:

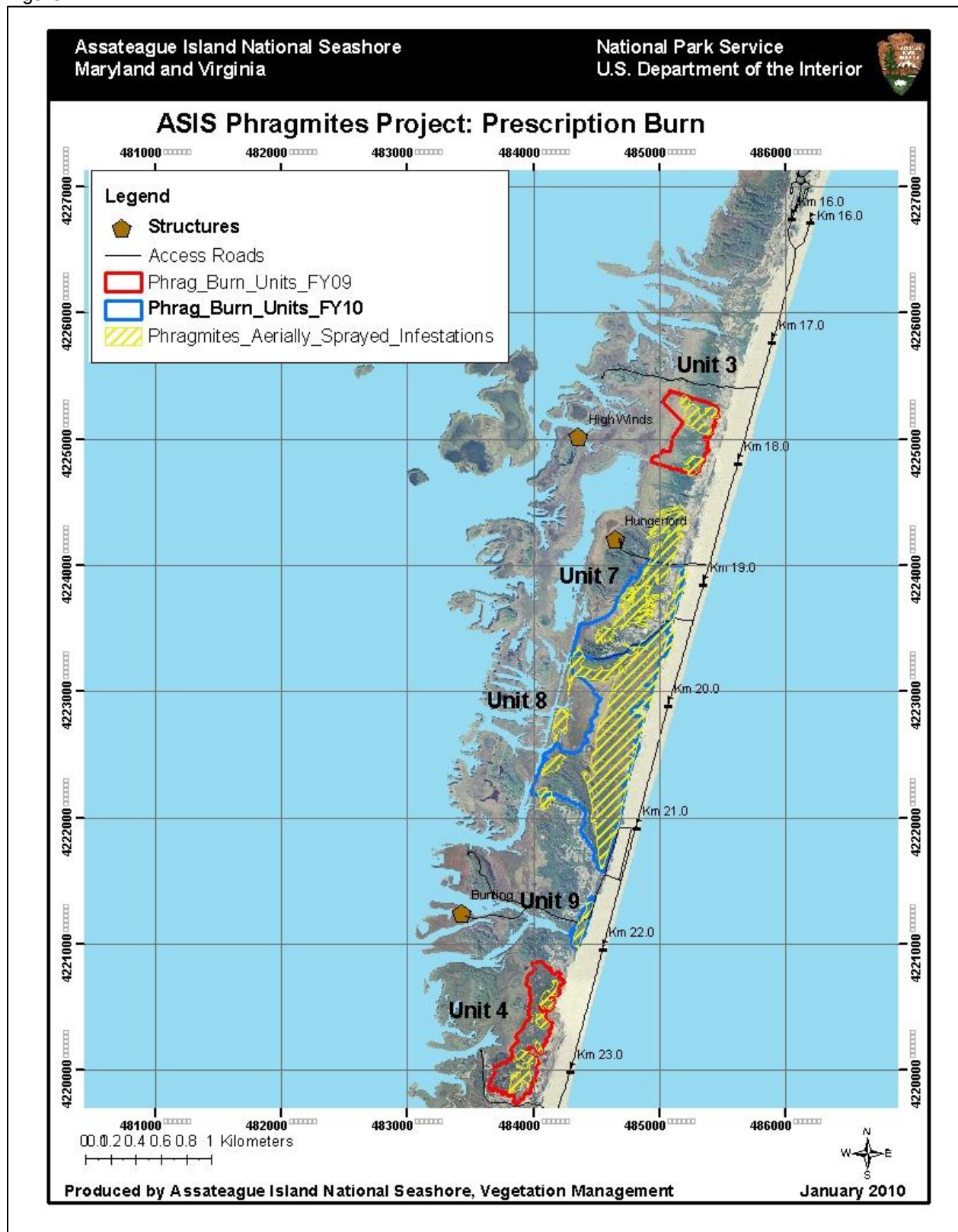


Figure 2:

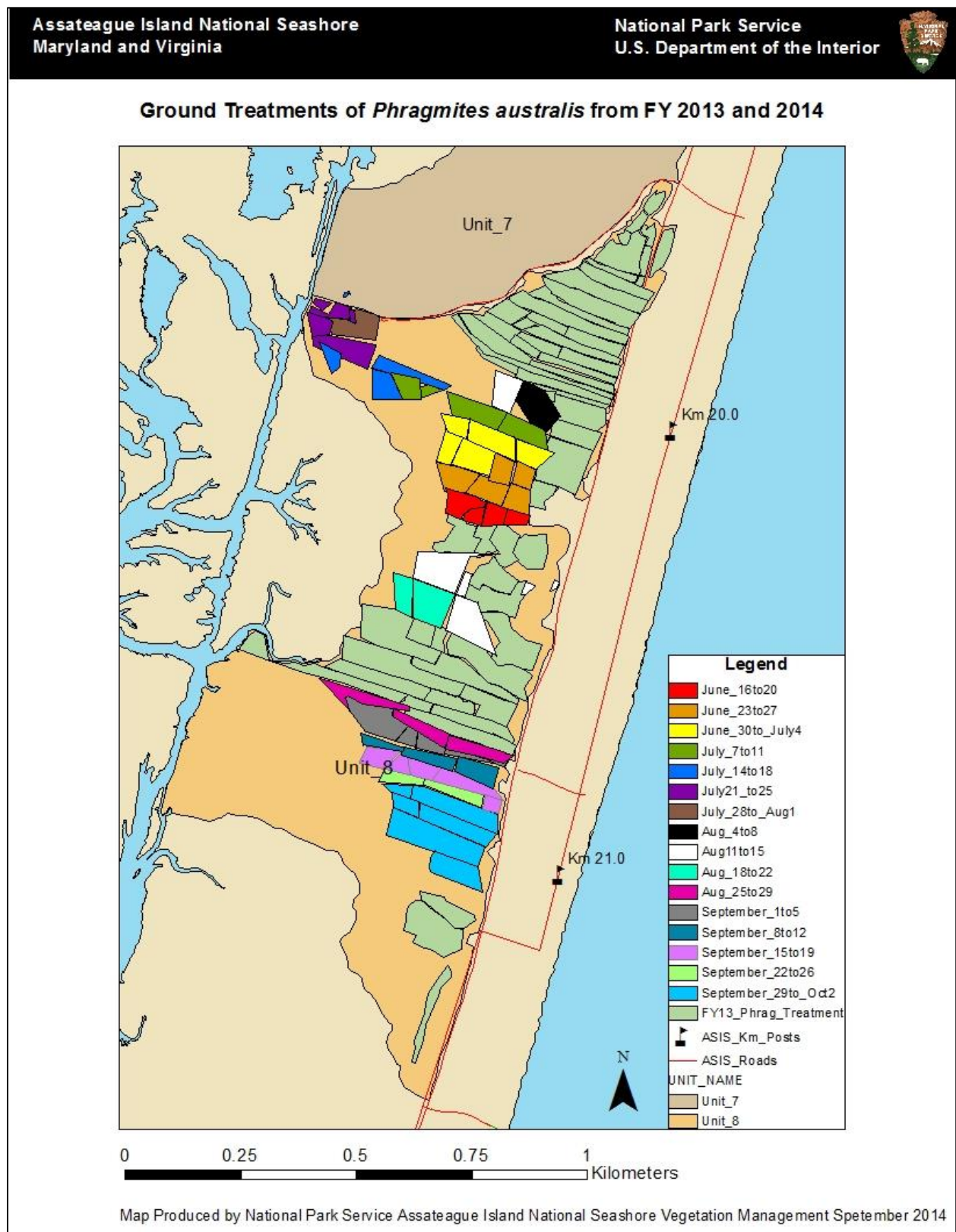
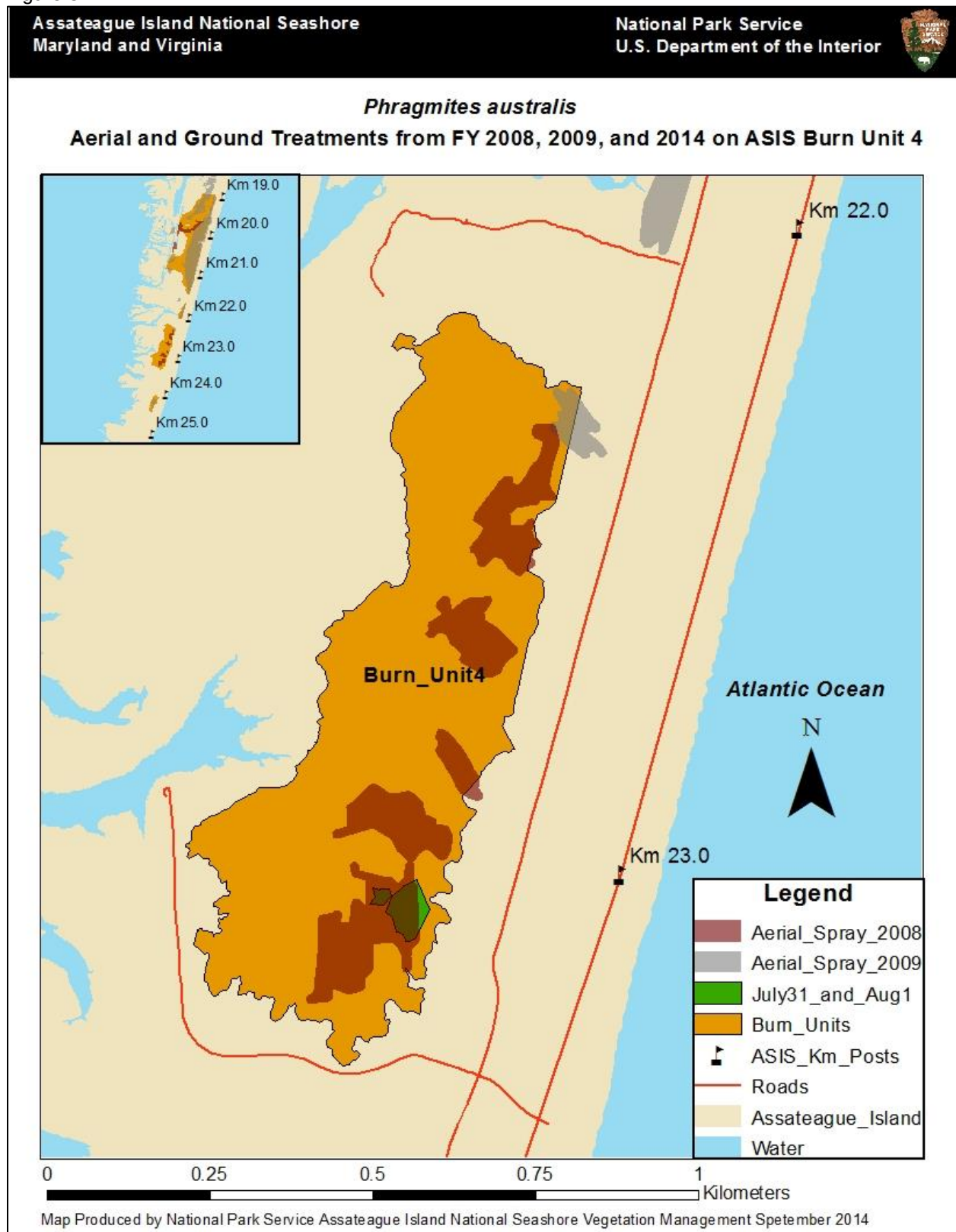


Figure 3:



2014 Treatment Accomplishments for *P. australis*:

Table 1:

Site	#Treatments	Days	Acres Treated	Qty. Herbicide Used (L)	Responsible Party	Herbicide Used
Unit 8	57	48	40.30	65.48	ASIS/ NCR EPMT	Polaris® EPA Reg. Num. (228-534)
Unit 8	5	4	8.25	11.94	ASIS	Rodeo® (62719-324)
Unit 4	2	2	1.11	4.80	ASIS	Polaris® EPA Reg. Num. (228-534)
Km17	2	2	2.03	2.32	ASIS	Polaris® EPA Reg. Num. (228-534)

Monitoring of *P. australis* in ASIS Burn Units:

In 2013, it was determined by the ASIS Resources Management Chief that monitoring of the burn units would be conducted to better understand the effect of our treatments, and to better understand the extent of remaining infestations within the boundaries of the burn unit areas. An island-wide aerial survey of *P. australis* had been proposed for 2014 to quantify the extent of the infestations outside of the burn units, but was not funded and therefore, not conducted. To accomplish the task of monitoring the burn units, the biological technician developed a rapid assessment in 2013 to monitor the existing cover and density of *P. australis* within the boundaries of the previously burned areas and to have an indicator of whether *P. australis* had either gone untreated on the periphery of the burn units, or had escaped the burn unit boundaries and had become better established outside of these boundaries. The same methodology was employed during 2014 for the monitoring of burn unit 7.

Burn Unit 1 and 8 were excluded from the monitoring because they had either not been retreated after aerial applications (as was the case for Unit 1 on Great Egging Island), or they were under treatment in FY14 (Unit 8) and it would be too early to interpret the effect of these recent treatments.

Methods:

Experimental Design

A grid was developed with the assistance of the ASIS GIS Specialist that was used to overlay all terrestrial lands of the island, utilizing the UTM grid (Datum: Zone 18 North Conus) as a template that would not change over time. The size of each grid was chosen to be 200 m x 200 meters in size. The 200 m x 200 m grids were numbered from south to north and retain the UTM grid number in the shapefile for cross referencing. In the field, each grid was subdivided into (4) 100 m x 100 m sub plots (blocks) that would be sampled individually and averaged later as a total for each grid. When monitoring, these (4) blocks within each grid were numbered in a clockwise fashion starting with 1 which was located in the upper northwest quadrant. Each 100 m x 100 m block was visited individually. These discrete 100 m x 100 m blocks were coded by starting with the grid Id and adding the block number to the end of the grid Id to name the blocks individually. For example Grid 947 in (Figure 5:) would yield the following codes: 947_01, 947_02, 947_03 and 947_04 respectively.

To monitor the *P. australis* within the sub plots of each grid, ocular estimates were utilized to rapidly assess the extent of the infestations. Monitoring personnel began preparation by becoming familiar with making ocular estimates of area. Personnel familiarized themselves with various sizes of square plots, in particular, the 10 m x 10 m plot which is equal to 100 m², or 1% of the size of a sub plot within the overlying grids. By counting these smaller 10 m x 10 m plots and adding them up during monitoring assessments, very accurate estimates of infested area were recorded. Attention was given only to recording infested areas; the area that was not infested is the sum of the total area minus the infested area. The attributes that were recorded were % Cover *P. australis*, % Density *P. australis*, Size Class (1-

0m to 1m, 2- 1m to 2m, 3- 2m to 3m height, Present or Absent (1/0) *P. australis* outside of the burn unit boundary that is within the grid block, and Comments relating to the sub plot.

Monitoring Procedure:

In the office, preparations for the day of monitoring were conducted by creating a list of the quads that overlay that encompass the area to be surveyed by observing the target areas with grid overlay, in this case, a burn unit, using the GIS software ArcGIS 10. Datasheets were prepared to include 4 blocks for each grid (see Figures 4 and 5:). Grid block Id's (1 through 4) were attached to each grid name as described in the experimental design by coding the sub plots to give a discreet reference to the data attributes.

The best routes to enter the burn units were then determined and recorders navigated within them using a handheld PDA/GPS (that has the grid layer and grid center points as well as burn unit layer) and a compass to navigate to the center of each grid block. The compass was checked prior to fieldwork to ensure that declination had been adjusted to read True North for this locality. The GPS tracklog was activated on the GPS device.

While observing the "bread crumb trail" of the GPS Tracklog indicated in the screen of the PDA/GPS as small points showing the path that the observer had travelled, recorders thoroughly investigated the sub plots and recorded the data for the attributes that were observed.

When an infestation of *P. australis* was encountered, the size, or extent, of the infestation was recorded by the observer after determining their location on the map and proximity to the boundaries of the grid block to be certain that information was recorded for the correct grid id and block. Recorders combined the use of the GPS, compass and ocular assessment to best estimate the extent of the infestation(s) within each block .

Once ocular assessments of the infestation's size were determined and individual infestations' percentages were summed the values were recorded individually in the appropriate column of the datasheet along with the other data ie. % Density (average) *P. australis*, Size Class (1- 0m to 1m, 2- 1m to 2m, 3- 2m to 3m Height (average) of *P. australis*, and Presence or Absence (1/0) of *P. australis* outside of the burn unit boundary, and comments for each sub plot individually within the grid block were recorded.

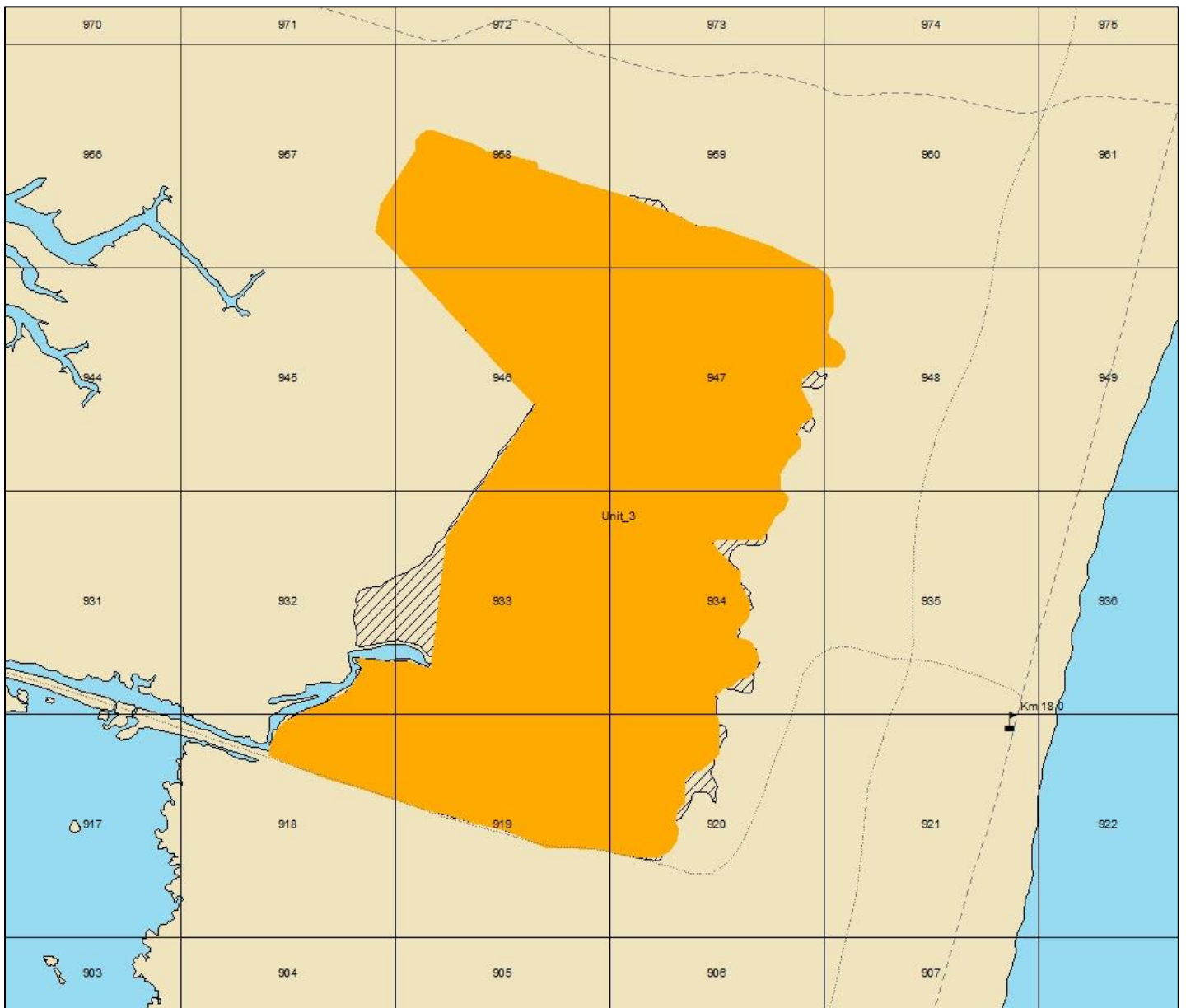
Figure 4:

|-----200m-----|

Grid 947

1	2
4	3

Figure 5:



Results

Table 2:

Burn Unit	Unit Area (ac)	Phragmites Area (ac) in Burn Unit FY2008/2009	Phragmites Area (ac) in Burn Unit FY2013	Phragmites Area (ac) in Burn Unit FY2014	% Cover Phragmites in Burn Unit FY08/09	% Cover Phragmites in Burn Unit FY2013	% Cover Phragmites in Burn Unit FY2014	% Change of Phragmites Cover from FY08/09 to FY2013	% Change of Phragmites Cover from FY08/09 to FY2014
1	15.63	16.00	N/A	N/A	102.39	N/A	N/A	N/A	N/A
2	17.82	13.34	1.63		74.82	9.14		-87.78	
3	43.56	17.40	2.26		39.95	5.19		-87.01	
4	74.93	15.35	14.56		20.48	19.43		-5.13	
5	54.10	22.96	4.61		42.44	8.52		-79.92	
6	6.48	2.98	0.31		45.90	4.78		-89.58	
7	84.15	36.26	N/A	5.76	43.09	N/A	6.84	N/A	-84.13
8	197.05	147.31	N/A	N/A	74.76	N/A	N/A	N/A	N/A
9	5.76	5.52	0.20		95.88	3.47		-96.38	
10	11.49	5.10	0.87		44.38	7.57		-82.94	
11	3.36	2.10	0.09		62.48	2.68		-95.71	
12	43.25	17.70	0.16		40.92	0.37		-99.10	

Table 3:

Year Monitored/Burn Unit	SUM % Cover Phragmites	Phragmites Cover Translate to m ²	Phragmites Cover Convert to acres	AVG % Phragmites Density	AVG Phragmites Size Class	SUM Phragmites Outside Burn Unit +/-
1	N/A	N/A	N/A	N/A	N/A	N/A
(FY13) 2	66.00	6600	1.63	7.34	0.93	3.00
(FY13) 3	91.50	9150	2.26	11.04	0.89	8.00
(FY13) 4	589.00	58900	14.56	29.62	1.12	6.00
(FY13) 5	186.50	18650	4.61	17.89	0.85	4.00
(FY13) 6	12.50	1250	0.31	4.24	0.37	3.00
(FY14) 7	233	23300	5.76	12.98	2.19	2
8	N/A	N/A	N/A	N/A	N/A	N/A
(FY13) 9	8.00	800	0.20	10.09	0.88	0.00
(FY13) 10	35.00	3500	0.87	5.20	1.20	5.00
(FY13) 11	3.50	350	0.09	9.25	0.75	2.00
(FY13) 12	6.50	650	0.16	2.55	0.50	0.00

P. australis Discussion

To understand the changes that have occurred in the ASIS burn units since the combined treatments began, observe the summary of the original cover of *P. australis* presented in Table 2. This table presents the “before and after” that explains where we were at the start of the project and where we are at the present in regards to the combined cover of *P. australis* in our ASIS burn units. With the exception of burn units 1 and 8, there have been significant reductions of *P. australis*, as is indicated in the column titled “% Change of Phragmites Cover from FY08/09 to FY2014” above in Table 2. These reductions in cover are the result of the combined treatments (aerial herbicide application, prescribed fire, and follow up treatments of ground sprayed application of herbicide via foliar application and/ or cut stem treatments). All of the burn units, with the exception of burn unit 4 had a reduction in cover greater than, or equal to 80% as a result of the combined treatments. The disparity of remaining cover post treatment in burn unit 4 is likely because the follow up treatments after the initial aerial spraying and subsequent burning of the unit were not thorough and included an experimental cut stem treatment that did not completely include all of the infested area that was present there during the treatment performed in 2011 (Chase 2013). This remains to be true after the monitoring of unit 7 in 2014.

The results from the FY13 and FY14 monitoring are presented in Table 3 as averages of the combined data for each respective burn unit. Because the cover of *P. australis* was measured in 100m x 100m sub plots within each block it was easily translated to meters squared by adding up the total percentages of cover (1% is equal to (1) 10m x 10m patch of cover) and multiplying the sum by 100 to come up with meters squared cover. For example, burn unit 2 had a combined sum of 66% (or (66) 10m x 10m portions of cover) which was equal to 6600 meters squared or 1.63 ac of *P. australis* cover. Essentially, percentages were used to factor, or “add up” the observed cover within each of the burn units that were investigated.

There was no additional monitoring in FY14 of the units that had been monitored in 2013. The results from the FY14 monitoring for unit 7 were compiled into tables 2 and 3 for comparison, but it should be noted that there have likely been changes in the previously monitored units, the extent of which would have been too labor intensive to assess again in FY14, therefore the values are not entirely comparable because they were collected in different time frames, however the likelihood of there being significant changes in the cover of the previously monitored units is thought to be minimal after a year's time (Chase 2014).

Further treatments at ASIS are recommended to follow the same progression as has been conducted in the past (ie. aerial spray treatments followed by controlled burning and then follow up ground treatments for infestations with high density and poor accessibility. Smaller satellite infestations with densities less than or equal to 60% may still be treated with backpack sprayers, but the effort put into spraying infestations of high density and poor accessibility with backpack sprayers is not recommended (Chase 2014).

Pinus thunbergiana:

Because seedlings continue to emerge at PITH_Site_01, it was revisited in August of 2014 and 2 saplings were located. A return visit in 2015 will be scheduled to cut, at the ground level, the newly emergent saplings. Annual monitoring of the site will continue to occur as a result of ongoing activity there.

Rosa multiflora:

Twenty shrubs, less than 2 meters tall each, were encountered at ROMU_Site_02 (Park Headquarters) and 3 plants were discovered at ROMU_Site_01 (Bayside Peninsula) in 2014. They were treated in April, May, August and October with either a foliar spray of 2% glyphosate herbicide solution of Rodeo® in water, or a cut stump treatment of 50% solution of Garlon 3A® in water.

A total area of 107 meters squared, or 0.028 Acres, of *R. multiflora* were treated at Headquarters in 2014. A total area of 35 meters squared, or 0.009 Acres, of *R. multiflora* were treated at Headquarters in 2014. *Rosa wichuriana*:

The ASIS headquarters area was landscaped with *R. wichuriana* in 1979, a species considered to be an invasive plant by the National Park Service. Since its introduction to ASIS, *R. wichuriana* has expanded and has become widespread throughout the surrounding Headquarters area. The extent of its proliferation continued in 2014 where it remained well established throughout the Headquarters and bordering State of Maryland lands.

During 2014 two treatment methods were utilized to control the infestations at ROWI_Site_01 (Park Headquarters).

These treatments were:

1. A cut stump application of a 50% triclopyr herbicide solution of Garlon3A® in water used in April at the Sinepuxent Vegetation Buffer because the (5) treated plants were comingling with other native plants. This herbicide was used because it is only effective on broad leafed plants and would not kill the many grasses at their specific locations behind the Sinepuxent Visitor Center.
2. A foliar application of a 2% glyphosate herbicide solution of Rodeo® in water was used in May and again in October to treat the remaining infestations in the Headquarters vegetated buffers where there was not an issue with using a non-selective herbicide because there were no non-target plants beneath the shrubs that were treated.

The methods used were the best universal treatment for the other alien, invasive species being targeted at the same time of these treatments. Both methods used are known to be successful at controlling *R. wichuriana* infestations, although the emergence of new *R. wichuriana* recruits will require continued monitoring and treatment at ROWI_Site_01 during 2015. Many large infestations of *R. wichuriana* exist on the neighboring State of Maryland land that borders the ASIS Headquarters area and we will continue to receive propagules that are vectored from adjacent lands.

A total area of 188.5 meters squared, or 0.001 Acres, of *R. multiflora* were treated at Headquarters in 2014.

Vitex rotundifolia:

One single plant of this species has been discovered and treated here at ASIS. The plant was treated in September of 2009 with a 25% solution of Imazapyr herbicide in water that was applied to small incisions soon after circular pieces of cambium were removed from the adaxial surface of the stems, along their length, at several intervals no closer than 10 cm. The treatment is still considered to be a success because the site has not been active for more than 3 consecutive years, therefore it can be considered to have been eradicated/ controlled.

Table 4:

ID	Site	Northing	Easting	Species	Site Description
1	AIAL_Site_01	4241835	491440.7	Ailanthus altissima	A discreet location the epicenter of which is indicated by the coordinates
2	AIAL_Site_02	4241800	491414.5	Ailanthus altissima	A discreet location the epicenter of which is indicated by the coordinates
3	AIAL_Site_03	4215810	481379.4	Ailanthus altissima	A discreet location the epicenter of which is indicated by the coordinates
4	AIAL_Site_04	4215049	481260.1	Ailanthus altissima	This site is a 100 meter radius surrounding the footprint of the Paradise Hotel site which is situated north of and across the water from the Green Run inholding and just south of the road leading to the Valentine's inholding
5	AIAL_Site_05	4209607	478053.1	Ailanthus altissima	A discreet location the epicenter of which is indicated by the coordinates
6	ALGL_Site_01	4241153	491106	Alnus glutinosa	A discreet location the epicenter of which is indicated by the coordinates
7	ARST_Site_01	4236363	489500	Artemisia stelleriana	This site is a 100 meter radius surrounding the epicenter point near Km 5.75 on the North End of ASIS
8	ARST_Site_02	4226024	485848	Artemisia stelleriana	A discreet location the epicenter of which is indicated by the coordinates
9	CAKO_Site_01	4241654	491796.8	Carex kobomugi	A discreet location the epicenter of which is indicated by the coordinates
10	CAKO_Site_02	4238487	490186.9	Carex kobomugi	A discreet location the epicenter of which is indicated by the coordinates
11	CAKO_Site_03	4237589	489897	Carex kobomugi	A discreet location the epicenter of which is indicated by the coordinates
12	CAKO_Site_04	4237503	489793.6	Carex kobomugi	A discreet location the epicenter of which is indicated by the coordinates
13	CAKO_Site_05	4237425	489824.1	Carex kobomugi	A discreet location the epicenter of which is indicated by the coordinates
14	CAKO_Site_06	4237420	489843.7	Carex kobomugi	A discreet location the epicenter of which is indicated by the coordinates
15	CAKO_Site_07	4237419	489825.8	Carex kobomugi	A discreet location the epicenter of which is indicated by the coordinates
16	CAKO_Site_08	4237404	489838.6	Carex kobomugi	A discreet location the epicenter of which is indicated by the

					coordinates
17	CAKO_Site_09	4237402	489824	Carex kobomugi	A discreet location the epicenter of which is indicated by the coordinates
18	CAKO_Site_10	4237394	489843.4	Carex kobomugi	A discreet location the epicenter of which is indicated by the coordinates
19	CAKO_Site_11	4237039	489716.9	Carex kobomugi	A discreet location the epicenter of which is indicated by the coordinates
20	CAKO_Site_12	4236194	489394.7	Carex kobomugi	A discreet location the epicenter of which is indicated by the coordinates
21	CAKO_Site_13	4236173	489412.3	Carex kobomugi	A discreet location the epicenter of which is indicated by the coordinates
22	CAKO_Site_14	4236123	489409.4	Carex kobomugi	A discreet location the epicenter of which is indicated by the coordinates
23	CAKO_Site_15	4225647	485760.2	Carex kobomugi	A discreet location the epicenter of which is indicated by the coordinates
24	CAKO_Site_16	4225037	485594.4	Carex kobomugi	A discreet location the epicenter of which is indicated by the coordinates
25	CAKO_Site_17	4222491	484802.9	Carex kobomugi	A discreet location the epicenter of which is indicated by the coordinates
26	CAKO_Site_18	4222447	484789.4	Carex kobomugi	A discreet location the epicenter of which is indicated by the coordinates
27	CAKO_Site_19	4224430	485407.9	Carex kobomugi	A discreet location the epicenter of which is indicated by the coordinates
28	CAKO_Site_20	4222427	484820.5	Carex kobomugi	A discreet location the epicenter of which is indicated by the coordinates
29	CAKO_Site_21	4216381	482792.6	Carex kobomugi	A discreet location the epicenter of which is indicated by the coordinates
30	CAKO_Site_22	4216370	482801.6	Carex kobomugi	A discreet location the epicenter of which is indicated by the coordinates
31	CAKO_Site_23	4216367	482811.7	Carex kobomugi	A discreet location the epicenter of which is indicated by the coordinates
32	CAKO_Site_24	4216361	482827.9	Carex kobomugi	A discreet location the epicenter of which is indicated by the coordinates
33	CAKO_Site_25	4216356	482852.7	Carex kobomugi	A discreet location the epicenter of which is indicated by the coordinates

34	CAKO_Site_26	4215252	482321.1	Carex kobomugi	A discreet location the epicenter of which is indicated by the coordinates
35	CAKO_Site_27	4214321	481780.7	Carex kobomugi	A discreet location the epicenter of which is indicated by the coordinates
36	CAKO_Site_28	4210394	479583.6	Carex kobomugi	A discreet location the epicenter of which is indicated by the coordinates
37	CAKO_Site_29	4209968	479281.4	Carex kobomugi	A discreet location the epicenter of which is indicated by the coordinates
38	CAKO_Site_30	4190275	466183.2	Carex kobomugi	A discreet location the epicenter of which is indicated by the coordinates
39	CAKO_Site_31	4190178	466247.7	Carex kobomugi	A discreet location the epicenter of which is indicated by the coordinates
40	CAKO_Site_32	4190025	466371.8	Carex kobomugi	A discreet location the epicenter of which is indicated by the coordinates
41	CAKO_Site_33	4237292	489768.1	Carex kobomugi	A discreet location the epicenter of which is indicated by the coordinates
42	CAKO_Site_34	4237424	489822.9	Carex kobomugi	A discreet location the epicenter of which is indicated by the coordinates
43	CAKO_Site_35	4234703	488914	Carex kobomugi	A discreet location the epicenter of which is indicated by the coordinates
44	CAKO_Site_36	4222525	484789	Carex kobomugi	A discreet location the epicenter of which is indicated by the coordinates
45	CAKO_Site_37	4232004	487963	Carex kobomugi	A discreet location the epicenter of which is indicated by the coordinates
46	CAKO_Site_38	4189535	466500.8	Carex kobomugi	A discreet location the epicenter of which is indicated by the coordinates
47	CAKO_Site_39	4234972	488774	Carex kobomugi	A discreet location the epicenter of which is indicated by the coordinates
48	CAKO_Site_40	4236012	489150	Carex kobomugi	A discreet location the epicenter of which is indicated by the coordinates
49	CAKO_Site_41	4208812	478513	Carex kobomugi	A discreet location the epicenter of which is indicated by the coordinates
50	CAKO_Site_42	4216380	482799.9	Carex kobomugi	A discreet location the epicenter of which is indicated by the coordinates
51	CLTE_Site_01	4229108	485365.6	Clematis terniflora	A discreet location the epicenter of which is indicated by the coordinates

52	ELUM_Site_01	4233449	486272	Elaeagnus umbellata	The combined State and Federal lands surrounding the Headquarters building on the mainland
53	ELUM_Site_02	4229033	485466.3	Elaeagnus umbellata	The entire developed area from the northern park boundary to the OSV entrance
54	ERCU_Site_01	4229434	486764.2	Eragrostis curvula	The entire developed area from the northern park boundary to the OSV entrance
55	HEHE_Site_01	4209043	478638	Hedera helix	A discreet location the epicenter of which is indicated by the coordinates
56	LOJA_Site_01	4215263	481374.7	Lonicera japonica	Is a series of infestations located along the access road to Valentines cabin.
57	LOJA_Site_02	4228590	486484	Lonicera japonica	Originally located within the Bayside Campground peninsula, was expanded during 2007 to include ASIS' entire developed area.
58	LOJA_Site_03	4231224	487325	Lonicera japonica	Located along Bayberry Drive within Assateague State Park.
59	LOJA_Site_04	4232259	487949	Lonicera japonica	Located along the Shell Road and the trail leading to the handicapped accessible duck blind.
60	LOJA_Site_05	4241732	491652	Lonicera japonica	This site is a single infestation discovered near the Ocean City inlet on top of the high dunes there.
61	LOJA_Site_06	4225065	485380	Lonicera japonica	Is located within shrub and forested areas between km 17 and 20.
62	LOJA_Site_07	4233405	486447	Lonicera japonica	Is located on the mainland within the ASIS headquarters area Federal land only.
63	LYSA_Site_01	4227399	486228	Lythrum salicaria	A discreet location the epicenter of which is indicated by the coordinates
64	MISI_Site_01	4241657	491485.7	Miscanthus sinensis	A discreet location the epicenter of which is indicated by the coordinates
65	MISI_Site_02	4240156	490579	Miscanthus sinensis	A discreet location the epicenter of which is indicated by the coordinates
66	MISI_Site_03	4239777	490387	Miscanthus sinensis	A discreet location the epicenter of which is indicated by the coordinates
67	MISI_Site_04	4225014	484363	Miscanthus sinensis	A discreet location the epicenter of which is indicated by the coordinates

68	MISI_Site_05	4240009	490500	Miscanthus sinensis	A discreet location the epicenter of which is indicated by the coordinates
69	MOAL_Site_01	4233425	486455	Morus alba	The combined State and Federal lands surrounding the Headquarters building on the mainland
70	MOAL_Site_02	4227399	486228	Morus alba	A discreet location the epicenter of which is indicated by the coordinates
71	PEAL_Site_01	4233296	486521	Penisetum alopecuroides	A discreet location the epicenter of which is indicated by the coordinates
72	PITH_Site_01	4209046	478675	Pinus thunbergiana	This site is a 100 meter radius surrounding the Clements inholding located in MD near the MD/ VA State Line
73	ROMU_Site_01	4228841	485870	Rosa multiflora	The entire peninsula where the Bayside Campground resides on the island and including the Boneyard maintenance staging area
74	ROMU_Site_02	4233583	486209	Rosa multiflora	Is located on the mainland within the ASIS headquarters area Federal land only.
75	ROMU_Site_03	4209058	478625	Rosa multiflora	A discreet location the epicenter of which is indicated by the coordinates just to the west of the Clements inholding located in MD near the MD/ VA State Line
76	ROWI_Site_01	4233405	486447	Rosa wichuriana	The combined State and Federal lands surrounding the Headquarters building on the mainland

Table: 5

Rx Code	Location	Species	Applicator	Start Time	End Time	Rx Method	Retreatment	Comments
Rx090214_1	Scotts Ocean Beach Hotel Site	Ailanthus altissima	JC	9:00	11:30	Hack & Squirt	Yes	Scotts Ocean beach hotel
Rx090414_1	Alb_jul_0001	Albezia julibrizzan	JC	12:00	14:00	Hack & Squirt	Yes	2 trees each 3 meters tall
Rx090514_1	Alb_jul_0001	Albezia julibrizzan	JC	12:00	13:00	remove seeds	No	cut all seeds from plant material double bagged and taken to trash off of the island
Rx042814_2	Sinepuxent Visitor Center	Artemisia vulgaris	JC	9:00	12:00	Foliar Spray	Yes	on the periphery of the mowed areas surrounding the Sinepuxent Visitor Center
Rx050214_1	Between VC and HQ Buildings	Artemisia vulgaris	JC	8:30	9:30	Foliar Spray	Yes	
Rx050514_1	Developed Area	Artemisia vulgaris	JC	9:00	11:00	Foliar Spray	Yes	WP1,2,3,4,5,6,14
Rx050714_1	Bayside Campground	Artemisia vulgaris	JC	10:00	14:00	Foliar Spray	No	WP17,19
Rx050814_1	HQ	Artemisia vulgaris	JC	8:00	8:45	Foliar Spray	No	UMES Veg Buffer
Rx050814_3	New MD VC Main Lot	Artemisia vulgaris	JC	14:45	15:00	Foliar Spray	No	New MD VC main lot
Rx100914_2	UMES Buffer	Artemisia vulgaris	JC, KF	8:30	15:00	Foliar Spray	Yes	
Rx101414_2	VC, UMES Buffer	Artemisia vulgaris	JC, KF	8:30	15:00	Foliar Spray	Yes	55m ²
Rx101614_2	UMES Buffer	Artemisia vulgaris	KF	9:30	10:20	Foliar Spray	Yes	20m ²
Rx072914_1	Km 17 Car kob	Carex kobomugi	JC	10:00	10:15	Foliar Spray	Yes	at Km 17 see polygon 6m x 6m x 0.1m area
Rx081814_1	Cako_0003 and Cako_0004	Carex kobomugi	JC, JM, KF, KV	8:00		Foliar Spray	Yes	4m x 0.3m x 0.2m, New FY14 N4226420 E486048, 2 clumps 4 meters apart 003 and 004 done together in 1 treatment
Rx081814_10	Cako_0043	Carex kobomugi	JC,JM,KF,KV			Foliar Spray	Yes	436 ramets
Rx081814_11	Cako_0033	Carex kobomugi	JC,JM,KF,KV			Foliar Spray	Yes	22 ramets

Rx081814_2	Cako_0036	Carex kobomugi	JC, JM, KF, KV			Foliar Spray	Yes	6m x 2m x 0.2m, ≤ 50 ramets
Rx081814_3	Cako_0017	Carex kobomugi	JC, JM, KF, KV			Foliar Spray	Yes	Absent
Rx081814_4	Cako_0039	Carex kobomugi	JM, JC, KF, KV			Foliar Spray	Yes	2 plants 5m x 0.2m x 0.2m
Rx081814_5	Cako_0_newfy14	Carex kobomugi	JM, JC, KF, KV			Foliar Spray	No	2m x 1m x 0.2m, N4233319 E488413
Rx081814_6	Cako_0013	Carex kobomugi	JM, JC, KF, KV			Foliar Spray	Yes	2 plants 5m x 0.2m x 0.2m
Rx081814_7	Cako_0014	Carex kobomugi	JM, JC, KF, KV					Absent
Rx081814_8	Cako_0_newfy14	Carex kobomugi	JM, JC, KF, KV			Foliar Spray	No	2m x 1m x 0.2m many plants but low density
Rx081814_9	Cako_0040	Carex kobomugi	JM, JC, KF, KV		14:30			Absent
Rx081914_1	Cako_0018	Carex kobomugi	LM, KF	9:35	9:50	Foliar Spray	Yes	found 30 meters south of waypoint
Rx081914_10	Cako_0022	Carex kobomugi	JM, KV					Absent
Rx081914_11	Cako_0_newfy14	Carex kobomugi	JM, KV, KF, LM	8:00		Foliar Spray	No	30m x 15m x 0.2m, many patches located fringes of sand/shrub med to low density N4216359 E482716
Rx081914_12	Cako_0015	Carex kobomugi	JM,KV,KF,LM					Absent
Rx081914_2	Cako_0019	Carex kobomugi	LM, KF					Absent
Rx081914_3	Cako_2_newfy14	Carex kobomugi	LM, KF			Foliar Spray	No	HIGH DENSITY,Cako 2 new fy14, 5m x 3m x 0.1m
Rx081914_4	Cako_0042	Carex kobomugi	LM, KF			Foliar Spray	Yes	low density 25m x 10m x 0.1m
Rx081914_5	Cako_0020	Carex kobomugi	LM, KF					Absent
Rx081914_6	Cako_0021	Carex kobomugi	JM, KV					Absent, though very near to new waypoint in file RX081914
Rx081914_7	Cako_0017	Carex kobomugi	JM, KV					Absent
Rx081914_8	Cako_0016	Carex kobomugi	JM, KV					Absent
Rx081914_9	Cako_0_newfy14	Carex kobomugi	JM, KV		14:30	Foliar Spray	No	one patch high density, 8m x 6m x 0.3m
Rx052514_1	Cako_0025	Carex kobomugi	JM	8:00				Absent
Rx052514_2	Cako_0026	Carex kobomugi	JM					Absent

Rx052514_3	Cako_0035	Carex kobomugi	JM					Absent
Rx052514_4	Cako_0023	Carex kobomugi	JM			Foliar Spray	Yes	many patches with low density
Rx052514_5	Cako_0024	Carex kobomugi	JM		14:30			Absent
Rx050214_2	Between VC and HQ Buildings	Cirsium arvense	JC	8:30	9:30	Foliar Spray	Yes	
Rx050214_4	Sinepuxent Veg Buffer	Cirsium arvense	JC	10:05	11:42	Foliar Spray	Yes	
Rx050214_6	Sinepuxent Veg Buffer	Cirsium arvense	JC	12:30	14:30	Foliar Spray	Yes	
Rx100814_2	UMES Buffer	Cirsium arvense	KF	12:40	3:00	Foliar Spray	Yes	105m ²
Rx100914_1	UMES Buffer	Cirsium arvense	JC, KF	8:30	15:00	Foliar Spray	Yes	Cir. arv.=60%, Ros. mul.=1%, Ros. wic.=1%, Art. vul.=20%, Pen. alo.=3%, Native grass=15%
Rx101414_4	VC, UMES Buffer	Cirsium arvense	JC, KF	8:30	15:00	Foliar Spray	Yes	114m ²
Rx101614_1	UMES Buffer	Cirsium arvense	KF	9:30	10:20	Foliar Spray	Yes	20m ² . Finished the area started on 10/8/14 and 10/9/14
Rx101614_4	VC	Cirsium arvense	KF	10:30	11:00	Foliar Spray	Yes	2.5m ²
Rx051214_1	Bayside Canoe Rental	Clematis terniflora	JC	10:00	14:30	Foliar Spray	Yes	
Rx042414_1	HQ	Eleagnus umbellata	JC	9:00	15:00	Basal Bark	No	WP1,2,3,4,5,7,8,9 (8 trees)
Rx042414_3	HQ	Eleagnus umbellata	JC	9:00	15:00	Cut Stump	No	WP11,12,13,14,15,16,17,18,19,20,21,22,25,26,29,30,31,32,33 (19 trees)
Rx050714_4	Bayside Campground	Eleagnus umbellata	JC	10:00	14:00	Cut Stump	No	WP24,25,27
Rx101414_3	VC, UMES Buffer	Eleagnus umbellata	JC, KF	8:30	15:00	Foliar Spray	Yes	3 trees
Rx082814_1	Ercu_Site_001	Eragrostis curvula	JM,JC,KF	8:00	10:15	Foliar Spray	Yes	Areas that had plants were: Life of the Marsh parking, North boundary to Ranger station, site 65 Oceanside campground
Rx091014_1	Shed B HQ	Grass	JC, KF, JM, LM, KV	14:35	14:15	Foliar Spray	No	Shed B 6L of 3% mix rodeo to spring weeds in gravel
Rx101414_1	VC, UMES Buffer	Lezpedeza cuneata	JC, KF	8:30	15:00	Foliar Spray	Yes	350m ²
Rx101614_3	VC	Lezpedeza cuneata	KF	10:30	11:00	Foliar Spray	Yes	5m ²

Rx102414_2	DNR Land (By wetland C)	Lonicera japonica	JC, KF	8:00	10:00	Foliar Spray	No	
Rx042814_1	MD Housing in islands by Loblolly House	Mentha spp.	JC	14:00	14:30	Foliar Spray	Yes	mint found behind loblolly house
Rx082814_3	Misi_0001	Miscanthus sinensis	JM,JC,KF	12:00	12:45	Foliar Spray	Yes	plants were 0.5m to 2m tall, near eradication at this site
Rx101414_5	VC, UMES Buffer	Miscanthus sinensis	JC, KF	8:30	15:00	Foliar Spray	Yes	4m². Very southwest of HQ field behind sheds
Rx100714_1	HQ, VC	Pennisetum alopecuroides	JC, KF	7:30	14:15	Foliar Spray	Yes	31 L old EPMT mix, 18.5 L new mix. 813 m²
Rx100814_1	UMES Buffer	Pennisetum alopecuroides	KF	10:00	11:30	Foliar Spray	Yes	61m²
Rx100914_3	UMES Buffer	Pennisetum alopecuroides	JC, KF	8:30	15:00	Foliar Spray	Yes	
Rx101414_6	VC, UMES Buffer	Pennisetum alopecuroides	JC, KF	8:30	15:00	Foliar Spray	Yes	39m²
Rx101614_5	VC	Pennisetum alopecuroides	KF	10:30	11:00	Foliar Spray	Yes	2.5m²
Rx042414_2	HQ	Rosa multiflora	JC	9:00	15:00	Basal Bark	No	WP6,10, (2 bushes)
Rx050514_2	Boneyard	Rosa multiflora	JC	11:00	12:00	Foliar Spray	No	WP7,8,9,10,11,12,13,15,16
Rx050714_2	Bayside Campground	Rosa multiflora	JC	10:00	14:00	Cut Stump	Yes	WP18,23
Rx050714_3	Bayside Campground	Rosa multiflora	JC	10:00	14:00	Cut Stump	Yes	WP20,21,22,26
Rx050814_2	Bayside Peninsula	Rosa multiflora	JC	9:00	14:00	Foliar Spray	No	Bayside Peninsula WP28,29,30
Rx082814_2	Oceanside 42-50	Rosa multiflora	JM,JC,KF	10:15	10:30	Foliar Spray	No	new Ros mul Fy14
Rx100914_5	UMES Buffer	Rosa multiflora	JC, KF	8:30	15:00	Foliar Spray	Yes	
Rx101414_7	VC, UMES Buffer	Rosa multiflora	JC, KF	8:30	15:00	Foliar Spray	Yes	4m². By fire hydrant at HQ
Rx042414_4	HQ	Rosa wichuraiana	JC	9:00	15:00	Cut Stump	No	5 bushes
Rx050214_3	Pole Barn Veg Buffer	Rosa wichuraiana	JC	9:30	10:05	Foliar Spray	Yes	
Rx050214_5	Sinepuxent Veg Buffer	Rosa wichuraiana	JC	12:30	14:30	Foliar Spray	Yes	
Rx100914_4	UMES Buffer	Rosa wichuraiana	JC, KF	8:30	15:00	Foliar Spray	Yes	

Table: 6

Rx Code	Location	Species	Rx Method	Product	EPA Reg Number	Active Ingredient	Amt Product (mL)	% Conc	Area Treated (m sq)	Total Amt Spray (L)	Equipment Used*
Rx090214_1	Scotts Ocean Beach Hotel Site	Ailanthus altissima	Hack & Squirt	Garlon 3A	62719-37	Triclopyr	20	50	2.00	0.04	2
Rx090414_1	Alb_jul_0001	Albezia julibrizzan	Hack & Squirt	Garlon 3A	62719-37	Triclopyr	100	50	16.00	0.2	2
Rx090514_1	Alb_jul_0001	Albezia julibrizzan	remove seeds	N/A	N/A	N/A	N/A	N/A	N/A	N/A	3
Rx042814_2	Sinepuxent Visitor Center	Artemisia vulgaris	Foliar Spray	Rodeo	62719-324	Glyphosate	740	2	370.00	37	1
Rx050214_1	Between VC and HQ Buildings	Artemisia vulgaris	Foliar Spray	Rodeo	62719-324	Glyphosate	140	2	75.00	7	1
Rx050514_1	Developed Area	Artemisia vulgaris	Foliar Spray	Rodeo	62719-324	Glyphosate	52	2	45.00	2.6	1
Rx050714_1	Bayside Campground	Artemisia vulgaris	Foliar Spray	Rodeo	62719-324	Glyphosate	30	2	33.00	1.5	1
Rx050814_1	HQ	Artemisia vulgaris	Foliar Spray	Rodeo	62719-324	Glyphosate	20	2	10.00	1	1
Rx050814_3	New MD VC Main Lot	Artemisia vulgaris	Foliar Spray	Rodeo	62719-324	Glyphosate	20	2	12.00	1	1
Rx100914_2	UMES Buffer	Artemisia vulgaris	Foliar Spray	Rodeo	62719-324	Glyphosate	195	2	97.50	9.75	1

Rx101414_2	VC, UMES Buffer	Artemisia vulgaris	Foliar Spray	Rodeo	62719-324	Glyphosate	110	2	55.00	5.5	1
Rx101614_2	UMES Buffer	Artemisia vulgaris	Foliar Spray	Rodeo	62719-324	Glyphosate	40	2	20.00	2	1
Rx072914_1	Km 17 Car kob	Carex kobomugi	Foliar Spray	Polaris	228-534	Imazapyr	10	2	36.00	0.5	1
Rx081814_1	Cako_0003 and Cako_0004	Carex kobomugi	Foliar Spray	Rodeo	62719-324	Glyphosate	1.2	3	1.20	0.04	1
Rx081814_10	Cako_0043	Carex kobomugi	Foliar Spray	Rodeo	62719-324	Glyphosate	66	3	130.00	2.2	1
Rx081814_11	Cako_0033	Carex kobomugi	Foliar Spray	Rodeo	62719-324	Glyphosate	5.85	3	20.00	0.195	1
Rx081814_2	Cako_0036	Carex kobomugi	Foliar Spray	Rodeo	62719-324	Glyphosate	1.2	3	12.00	0.04	1
Rx081814_4	Cako_0039	Carex kobomugi	Foliar Spray	Rodeo	62719-324	Glyphosate	0.3	3	1.00	0.01	1
Rx081814_5	Cako_0_newfy14	Carex kobomugi	Foliar Spray	Rodeo	62719-324	Glyphosate	9	3	2.00	0.3	1
Rx081814_6	Cako_0013	Carex kobomugi	Foliar Spray	Rodeo	62719-324	Glyphosate	0.3	3	1.00	0.01	1
Rx081814_8	Cako_0_newfy14	Carex kobomugi	Foliar Spray	Rodeo	62719-324	Glyphosate	1.2	3	2.00	0.04	1
Rx081914_1	Cako_0018	Carex kobomugi	Foliar Spray	Rodeo	62719-324	Glyphosate	15	3	100.00	0.5	1

Rx081914_11	Cako_0_newfy14	Carex kobomugi	Foliar Spray	Rodeo	62719-324	Glyphosate	30	3	450.00	1	1
Rx081914_3	Cako_2_newfy14	Carex kobomugi	Foliar Spray	Rodeo	62719-324	Glyphosate	30	3	15.00	1	1
Rx081914_4	Cako_0042	Carex kobomugi	Foliar Spray	Rodeo	62719-324	Glyphosate	60	3	250.00	2	1
Rx081914_9	Cako_0_newfy14	Carex kobomugi	Foliar Spray	Rodeo	62719-324	Glyphosate	15	3	48.00	0.5	1
Rx052514_4	Cako_0023	Carex kobomugi	Foliar Spray	Rodeo	62719-324	Glyphosate	2.13	3	1.00	0.08	1
Rx050214_2	Between VC and HQ Buildings	Cirsium arvense	Foliar Spray	Rodeo	62719-324	Glyphosate	140	2	75.00	7	1
Rx050214_4	Sinepuxent Veg Buffer	Cirsium arvense	Foliar Spray	Rodeo	62719-324	Glyphosate	60	2	100.00	3	1
Rx050214_6	Sinepuxent Veg Buffer	Cirsium arvense	Foliar Spray	Rodeo	62719-324	Glyphosate	100	2	100.00	3	1
Rx100814_2	UMES Buffer	Cirsium arvense	Foliar Spray	Rodeo	62719-324	Glyphosate	220		105.00	11	1
Rx100914_1	UMES Buffer	Cirsium arvense	Foliar Spray	Rodeo	62719-324	Glyphosate	836	2	418.00	41.8	1
Rx101414_4	VC, UMES Buffer	Cirsium arvense	Foliar Spray	Rodeo	62719-324	Glyphosate	228	2	114.00	11.4	1
Rx101614_1	UMES Buffer	Cirsium arvense	Foliar Spray	Rodeo	62719-324	Glyphosate	40	2	20.00	2	1

Rx101614_4	VC	Cirsium arvense	Foliar Spray	Rodeo	62719- 324	Glyphosate	5	2	2.50	0.25	1
Rx051214_1	Bayside Canoe Rental	Clematis terniflora	Foliar Spray	Rodeo	62719- 324	Glyphosate	300	2	150.00	15	1
Rx042414_1	HQ	Eleagnus umbellata	Basal Bark	Garlon 4 Ultra	62719- 527	Triclopyr	200	25	39.00	0.8	2
Rx042414_3	HQ	Eleagnus umbellata	Cut Stump	Garlon 3A	62719- 37	Triclopyr	54	25	53.00	2.7	2
Rx050714_4	Bayside Campground	Eleagnus umbellata	Cut Stump	Garlon 3A	62719- 37	Triclopyr	9	50	2.40	0.013	2
Rx101414_3	VC, UMES Buffer	Eleagnus umbellata	Foliar Spray	Rodeo	62719- 324	Glyphosate	4	2	2.00	0.2	1
Rx082814_1	Ercu_Site_001	Eragrostis curvula	Foliar Spray	Rodeo	62719- 324	Glyphosate	210	3	49.00	7	1
Rx091014_1	Shed B HQ	Grass	Foliar Spray	Rodeo	62719- 324	Glyphosate	120	3	60.00	6	1
Rx101414_1	VC, UMES Buffer	Lezpedeza cuneata	Foliar Spray	Rodeo	62719- 324	Glyphosate	628	2	350.00	31.4	1
Rx101614_3	VC	Lezpedeza cuneata	Foliar Spray	Rodeo	62719- 324	Glyphosate	10	2	5.00	0.5	1
Rx102414_2	DNR Land (By wetland C)	Lonicera japonica	Foliar Spray	Rodeo	62719- 324	Imazapyr	90.84	2	50.00	4.542	1
Rx042814_1	MD Housing in islands by Loblolly House	Mentha spp.	Foliar Spray	Rodeo	62719- 324	Glyphosate	20	2	25.00	1	1

Rx082814_3	Misi_0001	Miscanthus sinensis	Foliar Spray	Rodeo	62719-324	Glyphosate	30	3	5.00	1	1
Rx101414_5	VC, UMES Buffer	Miscanthus sinensis	Foliar Spray	Rodeo	62719-324	Glyphosate	2	2	4.00	0.1	1
Rx100714_1	HQ, VC	Pennisetum alopecuroides	Foliar Spray	Rodeo	62719-324	Glyphosate	990	2	813.00	49.5	1
Rx100814_1	UMES Buffer	Pennisetum alopecuroides	Foliar Spray	Rodeo	62719-324	Glyphosate	110	2	61.00	5.5	1
Rx100914_3	UMES Buffer	Pennisetum alopecuroides	Foliar Spray	Rodeo	62719-324	Glyphosate	2	2	1.00	0.1	1
Rx101414_6	VC, UMES Buffer	Pennisetum alopecuroides	Foliar Spray	Rodeo	62719-324	Glyphosate	78	2	39.00	3.9	1
Rx101614_5	VC	Pennisetum alopecuroides	Foliar Spray	Rodeo	62719-324	Glyphosate	5	2	2.50	0.25	1
Rx042414_2	HQ	Rosa multiflora	Basal Bark	Garlon 4 Ultra	62719-527	Triclopyr	50	25	5.00	0.2	2
Rx050514_2	Boneyard	Rosa multiflora	Foliar Spray	Rodeo	62719-324	Glyphosate	108	2	68.00	5.4	1
Rx050714_2	Bayside Campground	Rosa multiflora	Cut Stump	Garlon 3A	62719-37	Triclopyr	50	50	13.00	0.1	2
Rx050714_3	Bayside Campground	Rosa multiflora	Cut Stump	Rodeo	62719-324	Glyphosate	14	2	15.00	0.7	1
Rx050814_2	Bayside Peninsula	Rosa multiflora	Foliar Spray	Rodeo	62719-324	Glyphosate	64	2	35.00	3.2	1

Rx082814_2	Oceanside 42-50	Rosa multiflora	Foliar Spray	Rodeo	62719-324	Glyphosate	6	3	1.00	0.2	1
Rx100914_5	UMES Buffer	Rosa multiflora	Foliar Spray	Rodeo	62719-324	Glyphosate	2	2	1.00	0.1	1
Rx101414_7	VC, UMES Buffer	Rosa multiflora	Foliar Spray	Rodeo	62719-324	Glyphosate	1	2	4.00	0.05	1
Rx042414_4	HQ	Rosa wichuraiana	Cut Stump	Garlon 3A	62719-37	Triclopyr	58	50	5.00	0.232	2
Rx050214_3	Pole Barn Veg Buffer	Rosa wichuraiana	Foliar Spray	Rodeo	62719-324	Glyphosate	60	2	80.00	3	1
Rx050214_5	Sinepuxent Veg Buffer	Rosa wichuraiana	Foliar Spray	Rodeo	62719-324	Glyphosate	100	2	100.00	3	1
Rx100914_4	UMES Buffer	Rosa wichuraiana	Foliar Spray	Rodeo	62719-324	Glyphosate	7	2	3.50	0.35	1

*1-Backpack Sprayer
2-Hand Sprayer