COMMONWEALTH of VIRGINIA

Phragmites australis On Wallops Island
An update of control and monitoring done by Virginia Natural Heritage Program 2004-2009

Prepared by:
Virginia Department of Conservation and Recreation
Division of Natural Heritage

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DCR
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CONSERVING VIRGINIA'S NATURAL & RECREATIONAL RESOURCES

Phragmites australis on Wallops Island
An Update of Mapping, Control and Monitoring
Conducted by
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OVERVIEW

DCR has worked with the invasive non-native Phragmites on the Eastern Shore for many years including work to map, monitor, educate landowners about Phragmites control, directly control Phragmites and to support partnering agencies and private landowners with control of this noxious weed. Wallops Island Flight Facility (WFF) has been involved with DCR's effort since 2004, when DCR first mapped most of the facility's Phragmites. Since then, DCR has worked with WFF to conduct three aerial herbicide applications (2006, 2007 and 2008), and to establish and sample monitoring plots (2007, 2008 & 2009). DCR conducted a second census of Wallops Island along with the rest of the Eastern Shore seaside in 2008. As they pertain to Wallops Island, this document outlines DCR's activities and summarizes findings broken down into the three major categories of Phragmites Census, Phragmites Control and Phragmites Monitoring. Associated management recommendations are also included.

PHRAGMITES CENSUS

In both 2004 and 2008 DCR conducted aerial GPS censuses of Phragmites on the Seaside using a helicopter as a search and mapping platform (Myers et al 2009). The goal was to locate, document, and map all patches of Phragmites on the Seaside, including Wallops Island. A second aerial Phragmites survey was conducted for the Seaside in 2008 to compare with 2004 to determine rates of spread of untreated Phragmites across the landscape (Table 1), as a function of patch size (Table 2) as well as to determine effectiveness of Phragmites control efforts, including on Wallops Island (Table 3). Note that on Wallops Island, because of the sensitivity of flight areas, not all patches were mapped (see Figure 1). In this case, when comparisons are made to 2008 mapping, those areas not mapped in 2004 were not compared to assure that percentages of Phragmites remained true. This also means that the acres listed for Wallops underrepresented the total number of acres on Wallops Island in 2004.

Seaside Heritage Program funding from 2005 to 2008 supported 633 acres of Phragmites control treatments applied on lands held in the public interest. Additional control treatments were applied to the seaside of the Eastern Shore during this four year period by TNC, USFWS, and private landowners totaling 2160 acres treated. The 2004 and 2008 aerial surveys provide a means to monitor and assess the cumulative effects of these combined treatment efforts.

Most treated sites showed a decrease in Phragmites cover. For the eight treated sites where Phragmites abundance was reduced, the net decrease was 233 acres for an average reduction of 33%.

However, three treated sites (Mockhorn WMA, Parramore Island NAP, Wreck Island NAP) showed small increases in Phragmites abundance during the census interval. These results indicate that treatment methods need to be improved in order to achieve more effective and lasting control of Phragmites. Improvements in methods resulting from these monitoring results include an operational shift to higher spray volumes and an emphasis on follow-up treatment in the year after initial treatment.

Table 1. Changes in Phragmites abundance without aerial control treatments.

Site name	2004 Phrag cover (ac)	2008 Phrag cover (ac)	Change (ac)	Change (%)
Brownsville Farm (TNC)	1	6	+5	+600%
Wreck Island NAP (DCR)	8	12	+4	+50%
Seaside Farm (TNC)	136	206	+70	+51%
Machipongo River (private lands)	45	96	+51	+113%
Total	**190**	**320**	**+130**	**+68%**

A comparison of the number and sizes of patches mapped in 2004 and 2008 indicate that small and medium size patches increased substantially, while large patches decreased in both size and number. The increase in number and size of small and medium patches (see table 4) reflects the relatively small level of treatment focus on these, compared to the larger patches that receive the bulk of treatment effort. This is primarily due to the comparative logistical ease of treating large patches relative to small patches.

Table 2. Phragmites patch comparison between 2004 and 2008.

Patch size class	2004 cover (acres)	2008 cover (acres)	Change (acres)	Change (%)
Large ($\geq$ 5 acres)	1,358 (n=140)	1,078 (n=80)	-280	-21
Medium (0.25 - 5.0 ac)	484 (n=456)	589 (n=629)	+105	+22
Small (< 0.25 ac)	126 (n=560)	235 (n=1,091)	+109	+87
Total	**1,968**	**1,902**	**-66**	**-3.3**

Table 3. Phragmites cover change on managed lands with treatment.

Site Name	2004 Cover (ac)	2008 Cover (ac)	Change (ac)	Change (%)
Chincoteage NWR	53	28	-25	-47
Wallops Island NWR	382	302	-80	-21
E. Shore of VA NWR	46	19	-27	-59
Fishermans Is. NWR	66	55	-11	-17
Magothy Bay NAP	36	16	-20	-56
Smith Island (TNC)	33	23	-10	-30
Mockhorn private	90	25	-65	-72
Total	**706**	**468**	**-238**	**-34**

These results underscore the importance of on-going efforts to improve the effectiveness of aerially applied herbicides and to increase the amount of Phragmites treated on private lands. It is apparent from the results of the 2008 Phragmites census that these strategies can at least hold Phragmites in check, and perhaps reduce its abundance to some degree, until that point in time when more effective control methods become available.

Figure 1. Phragmites on Wallops Island , 2004 & 2008 mapping.

PHRAGMITES CONTROL

For three consecutive years (2006, 2007 and 2008) DCR oversaw aerial treatments of a total of 322 acres on Wallops Island. Treatment areas were prioritized to best protect non-infected habitat in and around Wallops Island, to reduce the amount of Phragmites acres on Wallops Island and to slow the rates of spread and inoculation of Phragmites into non-infected areas (including high priority conservation areas south of Wallops such as Assawoman Island, Metompkin Island and Mutton Hunk Fen Natural Area Preserve which all continue to have active Phragmites management by DCR, TNC and/or USFWS).

Table 4. Aerial acres treated at Wallops Island by DCR

Year	Acres
2006	92
2007	150
2008	80
Total	**322**

As demonstrated in the tables above, Wallops Island's Phragmites was reduced by 21% when compared between the years of 2004 and 2008 with two years of control effort (census work in 2008 did not account for Phragmites treated during the fall of 2008). As demonstrated across the seaside of the Eastern Shore, Phragmites patches not treated increased between 50% and 600% over the same time period. If no Phragmites treatments had occurred, it is probable that Wallops Island's entire Phragmites population would have increased at least 50% during this same time period and would have totaled close to 600 acres (instead of the 308 acres mapped in 2008). If Phragmites treatments had not occurred and increases were 113% as experienced on the Machipongo River during that time period, Wallops would have had over 800 acres of Phragmites by 2008.

Figure2. 2006 Phragmites spray areas

Figure 3. 2007 Phragmites spray areas

Figure 4. 2008 Phragmites spray areas

PHRAGMITES MONITORING

Monitoring effectiveness of herbicide treatments to control Phragmites and measuring re-establishment of native species after herbicide treatments have been sampled for the three consecutive years between 2007 and 2009. In 2007, study plots were established at Wallops Island, Eastern Shore of Virginia National Wildlife Refuge and Magothy Bay Natural Area Preserve. The plots were established to assess:

1. Efficacy of imazapyr-based herbicide applied at 7.5 gallons per acre and
2. Rates of recovery of native marsh vegetation following Phragmites control treatments.

Methods follow previous Phragmites studies as outlined in Mozdzer et.al. (2008), utilizing each species' height, cover-class and density, combined into a Relative Importance Value (RIV). Annual changes in RIV are then compared. Additionally, when plots were established, soil samples associated with each quadrat on Wallops Island were collected to better understand the existing seed bank and the potential germination and natural re-growth of desired native species post-treatment.

Findings from the germination study, imazapyr efficacy on Phragmites and native species' response to Phragmites control are listed below. The germination study was confined to Wallops Island study area however, the efficacy and native species response study included study areas at Magothy Bay Natural Area Preserve, Eastern Shore of Virginia National Wildlife Refuge, as well as Wallops Island.

Germination Study

Twelve species had some level of growth presence in the Wallops Island study plots prior to being treated aerially with imazapyr (although it should be noted that Phragmites' RIV at pre-treatment was 191.5. The average of the other 11 species was only 31, demonstrating the overwhelming dominance of Phragmites. The germination study showed that 16 species germinated in the University of Virginia greenhouse, with only 4 species common to both pre-treatment sampling and the germination study. One year after treatment, 9 species occurred in treated study plots. Two years after treatment, 25 species occurred. Of these 25 species, 6 were observed in the germination study. Two growing seasons after treatment, 19 other species that were not observed in the germination study had presence in the study plots.

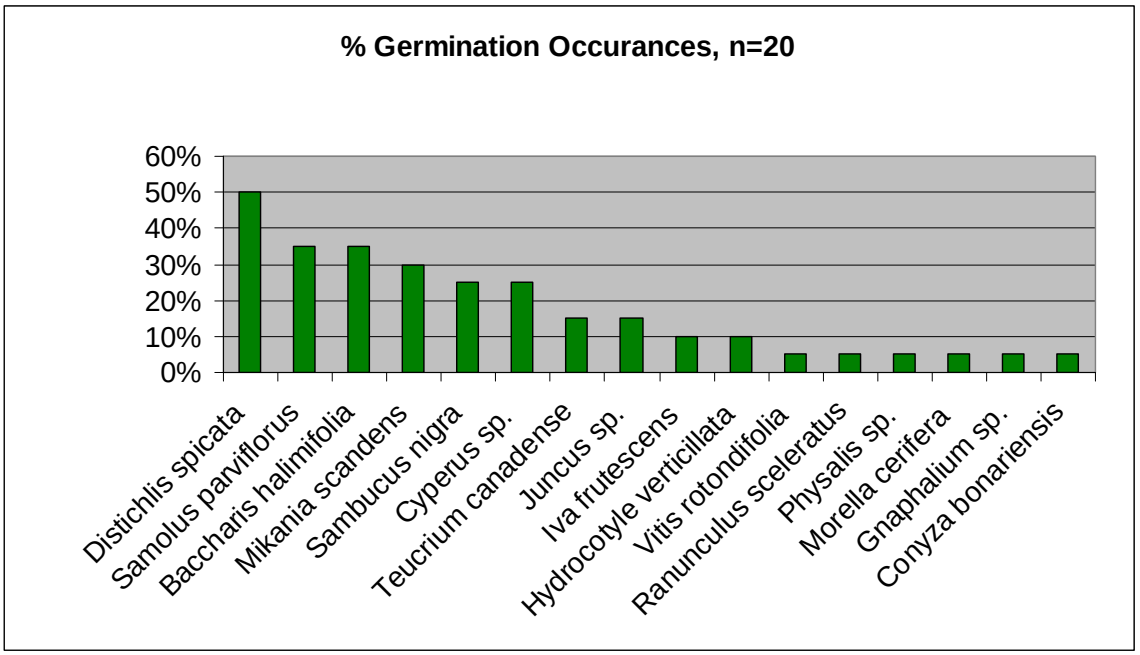

Figure 5. Frequency of seedlings germinated from Wallops Is study plots.

Table 5. Presence by year in Wallops Is. study plots and soil sample germination

Scientific name	Common name	Pre-treatment presence 2007	Greenhouse germination presence 2007	Post treatment presence 2008	Post treatment presence 2009
Atriplex patula	Atriplex patula				√
Baccharis halimifolia	Eastern baccharis		√		
Calystegia sepium	Hedge false bindweed			√	√
Conyza bonariensis	Asthmaweed		√		
Cyperus sp.	Flatsedge		√		
Distichlis spicata	Salt grass	√	√		√
Euphorbia sp.	Spurge	√			√
Gnaphalium sp.	Cudweed		√		
Hydrocotyle verticillata	Whorled marsh pennywort	√	√		√
Iva frutescens	Jesuit's bark	√	√	√	√
Juncus sp.	Rush		√		
Lactuca sp.	lettuce				√
Melothria pendula	Guadeloupe cucumber				√
Mikania scandens	Climbing hemp vine		√	√	√
Morella cerifera	Wax myrtle		√		
Parthenocissus quinquefolia	Virginia creeper	√			√
Phragmites australis	Common Reed	√		√	√
Physalis sp.	Ground cherry		√		√
Phytolacca americana	American pokeweed			√	√
Pluchea odorata	Sweetscent				√
Polygonum pensylvanicum	Pennsylvania smartweed				√
Ranunculus sceleratus	Cursed buttercup		√		
Sambucus nigra	American black elderberry		√		
Samolus parviflorus	Seaside brookweed		√		
Schoenoplectus robustus	sturdy bulrush				√
Setaria parviflora	Marsh bristlegrass			√	√
Smilax sp.	Greenbrier	√		√	√
Solidago sempervirens	Seaside goldenrod	√			√
Spartina patens	Saltmeadow cordgrass	√		√	√
Symphyotrichum tenuifolium	Perennial saltmarsh aster				√
Teucrium canadense	Canada germander	√	√	√	√
Toxidendron radicans	Poison Ivy	√			√
Unknown forb	Unknown forb				√
Unknown grass	Unknown grass				√
Vitis rotondifolia	Muscadine		√		

Phragmites Control Monitoring Plot Findings
One year after treatment, Phragmites RIV was reduced by 87% (191.5 to 24.7). By two growing seasons after treatment Phragmites RIV was reduced by 54% compared to pre-treatment (191.5 to 87.4), however this demonstrates an increase of 254% from one year after treatment to two years after treatment (see Figure 6).

Native Species Response Monitoring Plot Findings
Including Phragmites, 11 plant species occurred in the study area prior to treatment in 2007. One growing season after treatment, 9 species occurred, with only two species common to pre- and post-treatment (*Iva frutescens* and *Teucrium canadense*). After two growing seasons, all 11 species occurring pre-treatment also occurred post-treatment, plus another 14 species not found before treatment.

Native species can and do respond positively to reducing Phragmites cover. Of particular interest are the key ecological species, *Iva frutescens*, *Distichlis spicata* and *Spartina patens*, all were set back be the treatment, however, *Distichlis* had fully recovered to pre-treatment levels by the second growing season and *Iva* and *Spartina* were well represented after treatment.

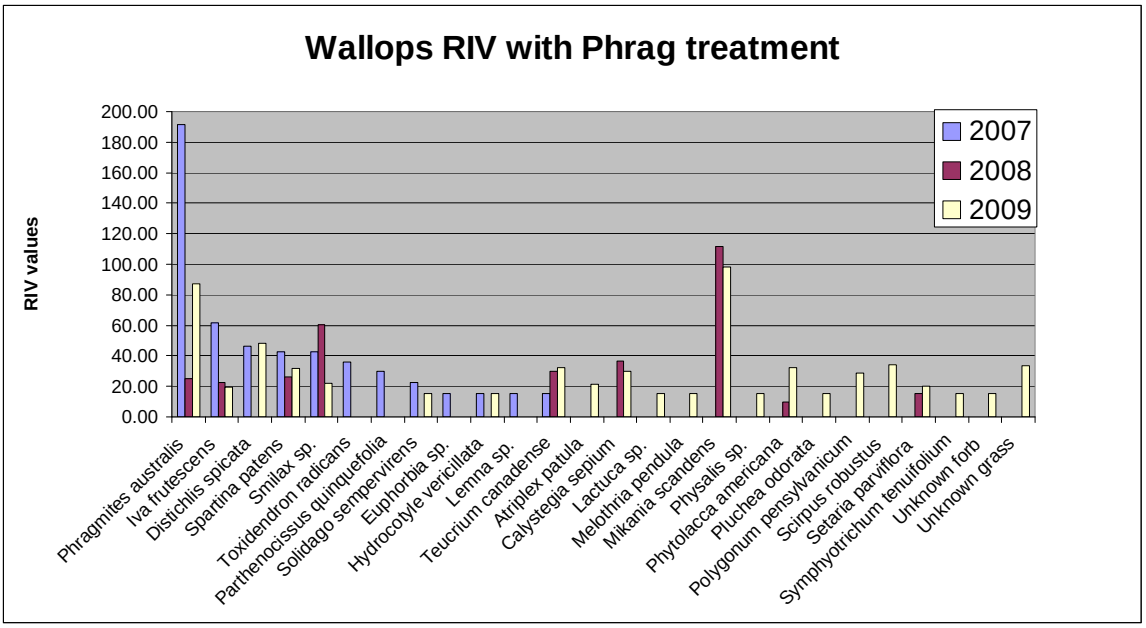

Figure 6. Wallops Relative Importance Values, 2007-2009

PHRAGMITES MANAGEMENT RECOMMENDATIONS

Over the years of managing Phragmites, two key lessons have been established. First, eradicating all the Phragmites at a site such as Wallops Island is neither feasible nor probable. Second, in spite of the challenges involved with controlling Phragmites, protecting native marsh areas and keeping Phragmites at controllable levels is completely feasible and very possible.

RECOMMENDATIONS

- Set goals that focus on protection of non-invaded marshes through prioritizing marshes to protect.
- Controlling small, new and/or remote patches, while expensive based on per acre costs (compared to treating large, older patches), are generally more effective use of funds as measured by both long-term protection of non-invaded marshes and long-term control of Phragmites expansion;
- Use herbicide treatments in September, especially in those areas where native vegetation in still present. When treating large swaths of monoculture Phragmites (i.e. non-target native vegetation is not present), August treatments can be effective. Due to Phragmites' later senescence compared to other marsh vegetation, the optimal time to most effectively kill Phragmites while minimizing non-target kill of native marsh species is the middle to late September. However, this timing is frequently compromised due to helicopter availability (agricultural and forestry operations are generally busy during this same time) and inclement weather. Hurricanes and tropical storms during late summer or early fall can often speed up the senescence of Phragmites, which will greatly reduce the effectiveness of herbicides.

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