STATE of the STRAIT

ECOLOGICAL BENEFITS OF HABITAT MODIFICATION

DETROIT RIVER AND WESTERN LAKE ERIE

2010

Cover photos: DTE's River Rouge Power Plant in Michigan by Chris Lehr/Nativescape LLC; Lower left: Legacy Park in Windsor, Ontario by Essex Region Conservation Authority; Lower middle: Elizabeth Park in Trenton, Michigan by Emily Wilke/Detroit River International Wildlife Refuge; Lower right: Fort Malden in Amherstburg, Ontario by Essex Region Conservation Authority.

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5.7 Strategies to Improve Wetland Habitats by Managing Invasive Common Reed (*Phragmites australis*): A Case Study at Sterling State Park

Introduction

William C. Sterling State Park is located on the western shore of Lake Erie, adjacent to the city of Monroe, Michigan. The park is located 27 km north of Toledo, Ohio, and 40 km south of Detroit. Most of the 502-hectare (1,240-acre) park lies within the delta of the River Raisin. The River Raisin Delta was once a complex of Great Lakes marsh and lakeplain prairie with a few areas of lowland hardwoods (wet-mesic flatwoods).

European settlement of the area began in the early 1700s. Alteration of the delta soon followed. The marsh and river were dredged to facilitate boat travel and commerce. Marshes were dredged, diked and water levels manipulated for agriculture and waterfowl hunting. Large areas of marsh were dredged by the Works Progress Administration (WPA) to create upland recreational land for the state park. In the 1980s, two large confined disposal facilities were constructed within the park by the U.S. Army Corps of Engineers. After 300 years of alteration to meet human needs and desires, little if any of the River Raisin Delta remains undisturbed.

While significantly degraded, there are small areas of Sterling State Park that have retained many native species, including several rare plants and animals. Rare plants include: American lotus, *Nelumbo lutea* (state threatened); trailing bean, *Strophostyles helvula* (state special concern); swamp rose-mallow, *Hibiscus moscheutos* (state special concern); and arrowhead, *Sagittaria montevidensis* (state threatened). Rare animals include: the Eastern fox snake, *Pantherophis gloydi* (state threatened); marsh wren, *Cistothorus palustris* (state special concern); king rail, *Rallus elegans* (state endangered); common moorhen, *Gallinula chloropus* (state special concern); and osprey, *Pandion haliaeetus* (state threatened). The bald eagle, *Haliaeetus leucocephalus* (state threatened) nests just south of the park and frequently fishes within the park.

A legislatively mandated mission of Michigan State Parks is to preserve the unique natural resources of Michigan. In 2003, the Michigan Department of Natural Resources, Parks and Recreation Division, Stewardship Unit began an ecological restoration of the native ecosystems of Sterling State Park.

The goal is to restore or re-create Great Lakes marsh and lakeplain prairie, while improving the park for recreation and preserving a part of southeast Michigan's natural heritage. A major component of our ecological restoration efforts is control of common reed (*Phragmites australis*).

Phragmites is a tall perennial grass that is native to wetlands in the temperate and tropical regions of the world, including Michigan. A nonnative invasive variety of *Phragmites* is becoming widespread in Michigan. This invasive *Phragmites* is displacing native *Phragmites* as well as many other native wetland plants species. It forms dense and extensive monocultures that can simplify native ecosystems and alter hydrology and sediment deposition. Plants can exceed 4 meters in height. Amazingly, almost as much biomass of a *Phragmites* stand is found belowground as aboveground. This makes established stands of *Phragmites* difficult to eradicate.

Phragmites control at Sterling State Park began in 2003 and annual follow-up treatments are ongoing. All treatments were conducted under Department of Environmental Quality permits.

Methods

Our protocol was to treat *Phragmites* with glyphosate herbicide in late summer (between the last week of August until killing frost). Typically we see 80% to 90% reductions in *Phragmites* cover from a single glyphosate application. Ideally, areas sprayed with herbicide are treated with a prescribed burn in winter or spring. The purpose of the burning is twofold: 1) to remove the massive amounts of biomass to facilitate access for follow-up treatment, and 2) to stimulate seed germination and resprouting, which increases the effectiveness of follow-up treatment. To sustain *Phragmites* control, annual follow-up treatments are performed.

Phragmites control at Sterling State Park involved several treatment methods. Large monoculture stands of *Phragmites* were treated by means of a helicopter. *Aqua Star*®, an aquatic formulation of glyphosate with *Cygnet Plus*® added as a penetrant and surfactant, was applied at 7.01 L per hectare (6 pints per acre). Application occurred during the first week of September. Fifty-three hectares (130 acres) were treated by aerial application. Treatments were primarily performed by private contractors.

Smaller monoculture stands intermixed with desirable native vegetation were treated with “ground base” spray rigs including boats, all-terrain vehicles, marsh vehicles and backpack sprayers. A 2% active ingredient mix of glyphosate (*Aqua Neat*®, *AquaPro*® or *Glypro*®) with *Cygnet Plus*® was used for ground-based application. Hand swiping was used to apply herbicide to widely scattered *Phragmites* stems. A 5% active ingredient mix of glyphosate (*Aqua Neat*®, *AquaPro*® or *Glypro*®) with *Cygnet Plus*® was used for hand swiping. Applications occurred each year during September. Two hundred and eighty acres were treated by ground-based foliar spray and hand swiping. Annual follow-up treatments have all been ground-based spray or hand swiping.

A monitoring protocol is in place to gauge the success of our *Phragmites* control project at Sterling State Park. The purpose of our monitoring is to inform adaptive management. Our monitoring is not designed or intended to test a scientific hypothesis. Monitoring at Sterling State Park has only been qualitative. Seventeen photo-monitoring locations have been established at Sterling State Park to document the change in *Phragmites* cover. At each photo-point, photographs are taken with a camera at a standard height and facing specific compass bearings. Baseline photographs were taken in 2003 and in each subsequent year. Photographs are taken at approximately the same calendar date. Additional photographs were taken to document the response to treatments. A sequence of photo-monitoring photographs is presented in Figure 1.

8 August 2003 — *5 September 2003*

17 November 2003 — *24 March 2004*

6 May 2004 — *19 August 2004*

Figure 1. Photo-monitoring sequence of Phragmites *control.*

18 August 2005

24 August 2006

11 September 2007

30 August 2008

Figure 1 (continued). Phragmites *control photo-monitoring sequence.*

Results and Discussion

Phragmites cover declined dramatically after the first herbicide and prescribed fire treatments. After one year of follow-up treatment, in most areas *Phragmites* cover was reduced to less than 15%. After two years of follow-up treatment, *Phragmites* had been eliminated in many areas and occurred in stunted, scattered stands where it persisted. Photo-monitoring documented that in many areas a fairly diverse collection of native wetland species returned. However, in some areas, reed canarygrass (*Phalaris arundinacea*) and narrow-leaved cattail (*Typha angustifolia*) emerged as the new dominant species. Monitoring after the third year of follow-up treatment documents many areas becoming highly dominated by narrow-leaved cattail. It may be worthwhile to include control of aggressive species in the first few years of follow-up treatment to provide less aggressive, more desirable native plants sufficient time to establish.

We found that it is more difficult to achieve eradication or percent cover reduction greater than 80% for some stands of *Phragmites*. The lower efficacy of herbicide treatment appears to be correlated with how long the stand has been established, which is indicative of how much root biomass the stand has amassed. We also found the efficacy of herbicides to be less when applied to *Phragmites* growing in standing water.

At our Bay City Recreation Area, 20 point-intercept transects have been established to monitor *Phragmites* control. Results of this quantitative monitoring are noteworthy. *Phragmites* cover was reduced from a baseline condition of 74% *Phragmites* cover (2005) to 11% (2006) after a single herbicide treatment followed by a spring prescribed fire. After the first year of follow-up treatment, *Phragmites* cover increased to 22% (2007). After the second year of follow-up treatment, *Phragmites* cover was reduced to 15% (2008). The spike in *Phragmites* cover may be attributed to differences in contractor performance, water levels, stimulation of regrowth from the root system after the prescribed fire, or the amount of dead vegetation cover, but the exact cause is not understood. After three treatments, very few dense patches of *Phragmites* remained and the remaining plants are stunted and scattered. However, the amount of *Phragmites* cover remained near but above our target of less than 15%. In 2008, the decision was made to adapt our management strategy. A combination of imazapyr (*Habitat*® 1%) and glyphosate (*Aqua Neat*® 2%) was used to see if greater control could be achieved.

Cost for herbicide treatments varied significantly. Variation is influenced by application methods, density of *Phragmites*, mobilization costs, accessibility of the treatment area, size of the treatment area(s) and the contractor used. Aerial herbicide application at Sterling State Park had a cost of $135/acre (130 acres treated; 1 acre=0.40 ha) in 2003. In 2005, aerial herbicide application at the Bay City Recreation Area had a cost of $235/acre (24 acres treated). Mobilization costs for aerial treatment are generally the same regardless of the total acreage treated. Ground-based herbicide treatment varied from $38/acre (348 acres treated) to $136/acre (222 acres treated) at Sterling State Park. At Bay City Recreation Area, cost per acre for ground-based herbicide treatment varied from $308/acre (24 acres treated) to $425/acre (40 acres treated). The cost of ground-based herbicide is very dependent on the conditions of the individual treatment area.

Our original expectation was that cost for *Phragmites* treatment would be most expensive for the first treatment and then diminish correspondent with the cover of *Phragmites*. This has proven not to be the case. We have found that aerial application is less expensive per acre than ground-based application, but a minimum number of acres are needed to overcome the fixed mobilization costs associated with aerial application. Stand density and accessibility greatly influence the per acre cost of ground-based herbicide treatment. Ground-based cost per acre declines with *Phragmites* density to a point and then remains fairly constant as the hours required for treating a given area plateau. Contractor time applying herbicide is replaced by contractor time searching for *Phragmites*.

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Conclusions

- Expect 80%–90% reduction in *Phragmites* cover from a single foliar application of glyphosate (2% active ingredient) applied in late summer.

- Older *Phragmites* stands are more difficult to control.

- Cost per acre does not diminish correspondent with diminishing *Phragmites* cover.
- Cost per acre varies widely depending on treatment method, density of *Phragmites* and difficulty of accessing *Phragmites* stands.
- Prescribed fire is a useful tool to facilitate physical access for re-treatment.
- Fire stimulates *Phragmites* resprouting and seed germination. This is good or bad depending on the overall control strategy.
- The quality/diversity of the seed bank is critical to success of restoring native marsh.
- The "next" most aggressive species often will replace the *Phragmites* as the dominant species (narrow-leaved cattail, reed canarygrass, etc.). Controlling aggressive undesirable species may be needed to allow less aggressive native species time to colonize.
- Despite low germination rates frequently mentioned in the literature, *Phragmites* easily colonizes new sites by means of seed dispersal.

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