Region 5 Aerial Invasive Species Control Project: Photopoint monitoring of *Phragmites australis* control efforts

August 2005 (LRM)

Background: *Phragmites australis* control through aerial spraying

Wetland ecologists and wetland habitat managers have pointed out that large-scale, aerial spray "control" treatments for *P. australis* are frequently chronically repeated, since herbicide applications often fail to fully control *P. australis* invasions (O'Shea, USFWS; Haglan, USFWS). There are several potential mechanisms for this failure. One may be that the tallest *P. australis* plants in a colony capture the spray (esp. if aerial application or boom sprayers are used), while shorter plants are sheltered (Lehman 1984). Also, because large *P. australis* infestations are composed of a complex and formidable array of clones, with rhizomes that may extend for many meters underground (Adams and Bate 1999), it is possible that herbicides mainly reach and kill the aerial stems and upper portions of rhizomes, but fail to translocate throughout large plants completely. As a result, some rhizome material may remain viable. This seems to be supported by observations by many wetland managers, who report multiple sprouts/epicormic branching from rhizomes in *P. australis* colonies, following spray activities (Packett, USFWS; McCauley, USFWS). Because buried rhizomes have high survivorship and can grow rapidly (Ailstock et al. 2001), remaining viable rhizomes may potentially re-colonize a stand quickly.

Other possible reasons for failure include weather conditions at the time of herbicide application and/or the phenological stage of the colony. Glyphosate products are recommended for use during warm, dry conditions, while *P. australis* is actively growing. Rains shortly after herbicide application may reduce the herbicide's absorption by the plants (Marks 1994); high winds may cause the spray to drift from target patches. Furthermore, authorities recommend applying glyphosate to *P. australis* immediately after the plant has "tassled" (flowers have matured), when the plants have begun to translocate nutrients to the rhizomes *in preparation* for fall senescence, generally in late summer/early fall. Studies in DE have shown that tasseling in *P. australis* colonies is never 100% (Lehman 1984). Therefore, plants within a colony may be at various phenological stages, and not all plants may be at the optimal stage for translocating glyphosate to the rhizomes. Also, tropical storms common in late summer/early fall may cause salt-damage to *P. australis* colonies in coastal areas, causing plants to enter senescence. Coastal storms at the time of spraying, or soon thereafter, may therefore decrease the effectiveness of spraying (Reyes and Perry 2004).

Finally, *P. australis* may be well-adapted to compete with native vegetation at a particular site, due to physical or chemical conditions favorable to *P. australis.* For example, nutrient inputs significantly increase the growth and expansion of *P.*

australis populations (Minchinton and Bertness 2003, Romero et al. 1999). *P. australis* has higher chloroplast concentrations and photosynthetic rates than native wetland vegetation (Mozdzer 2005). Increased nutrient inputs may increase *P. australis* nutrient uptake rates and photosynthetic rates (Mozdzer 2005) resulting in exponential increases in biomass production. These increases in biomass due to environmental eutrophication may be of a greater magnitude than the decreases in biomass due to spraying. This effect is more likely in *P. australis* stands located in natural marshes, such as those found downstream of nutrient sources, such as agricultural operations or sewage treatment plants.

Monitoring purpose

To develop a set of criteria (for refuges in Region 5) by which a *Phragmites australis* patch (polygon) may be coarsely evaluated, in terms of whether chemical control is likely to significantly reduce *P. australis* cover for a moderate period (5 years or more) or if the site is likely to be quickly re-invaded and to return to its pre-treatment state. Information will be used to assist refuges in determining herbicide treatments of sites that are not likely to result in moderately long-term *P. australis* control, and should instead be considered for alternative treatments, no treatment, or will be used to realistically plan future budget allocations for invasive control**.**

Monitoring Objectives

We want to qualitatively detect changes in *P. australis* cover over time (likely a 5-year time-frame), following an initial helicopter herbicide spray treatment completed during the late summer of 2005. We are not conducting a statistically rigorous monitoring effort, since we do not have identical, independent random samples from a population of interest. Instead, we have 11 refuges applying a glyphosate product, and one refuge applying an imazapyr product, in various marsh habitats, including: natural tidal marshes, anthropogenic and hydrologically-manipulated freshwater impoundments and associated ditches/dikes, and unmanipulated freshwater ponds. We are proposing a qualitative assessment, to determine if the treatments appear to arrest or reduce *P. australis* colony spreading, and if so, if the effect lasts only a short period (1-2 years), or lasts for a moderately longer period (up to 5 years), at the various refuges, and to investigate if any of the factors listed above may have affected treatment success.

General Methodology

We propose using *photographic monitoring*, using semi-permanent *photopoints*, distributed according to each refuge's ability, for the following reasons:

1. Photographic monitoring is relatively efficient, unobtrusive, permanent, and useful when resources and time are limited

2. It is a good first step in baseline studies, when it is not clear what parameters should be measured and how/when
3. Qualitative information may be converted to more quantitative information, at a later time, by overlaying photographs with a grid and counting the hits at each grid intersection

We have selected *photopoints* (repeated photographs of a landscape area) for this photographic monitoring, because:

1. The invasive plant, in general, is greater than .5m tall
2. *P. australis* is readily identifiable in a photograph
3. Small (m^2) plots may not be sufficient to demonstrate changes in *P. australis*

Permanent photopoints will aid in photograph replication (same frame, same position of pole to show scale, same vegetation community). Although a typical GPS unit allows observers to come within a few meters of a point, a GPS unit cannot be relied upon to position a camera and a meter board (or range pole) in the exact position of either device, from a previous year. It is therefore necessary to have *permanently* (or semi-permanently) marked positions for both the camera and the scale, to make photographs comparable from year to year (Hall 2001). This can be simplified by establishing a transect with permanent end-points.

In addition, we propose collecting brief information regarding herbicide application and weather conditions/plant phenology at the time of spraying. We recognize that *P. australis* stands being sprayed by helicopter are generally difficult to access. We have attempted to request information which will we hope will require minimal time and difficulty to obtain. This information will not be analyzed statistically. However, it may give us a sense of herbicide application procedures, site conditions, or *P. australis* colony conditions, which may be linked with either moderately long-term control, or failure.

Transect/Photopoint Setup

Materials needed: GPS unit, compass, 50m tape, surveyor stakes, hammer, permanent marker, data sheets (see below), pens and clipboard, high-resolution digital camera (at least **2.0** megapixels), tripod, meter board or range pole

Note: A meter board is a target board, 20 cm wide and at least 1 m tall, obviously marked at 10 cm intervals (see Figure 1). If a meter board is not available, a range pole may be substituted. A range pole is a surveying instrument consisting of a straight rod painted in bands of alternate red (or black) and white each one foot wide; used for sightings by surveyors.

Location data is necessary to allow accurate photo-replication over time. First, locate a single *P. australis* patch ("polygon" or "infestation"), between 1-10 acres in size, geo-referenced, and assigned a refuge ID# (e.g. PH001, PH002, etc.) . Second, establish the position of the camera when taking a landscape photograph which is representative of the site. We would like you to do the following:

- Establish the transect in an accessible area of heavy infestation (to track gross changes over time)
- Establish a short transect (about 10 m) **tangential to the edge of the *P. australis* colony, so that the interface of the invasive colony, and adjacent native plant community (being invaded) is obvious** (see Figure 2)
- Mark the transect with permanently marked endpoints (stakes, flags, etc.); record the bearing
- Establish the photopoint (where the camera and tripod will be placed) at one end of the transect
- Place the meter board/range pole at the other end of the transect (10 m from the camera position); permanently mark this position (note: the meter board should be 25 to 33 percent of the height of the final photograph) (see example photograph in Figure 3)

Figure 1. Example of meter board.

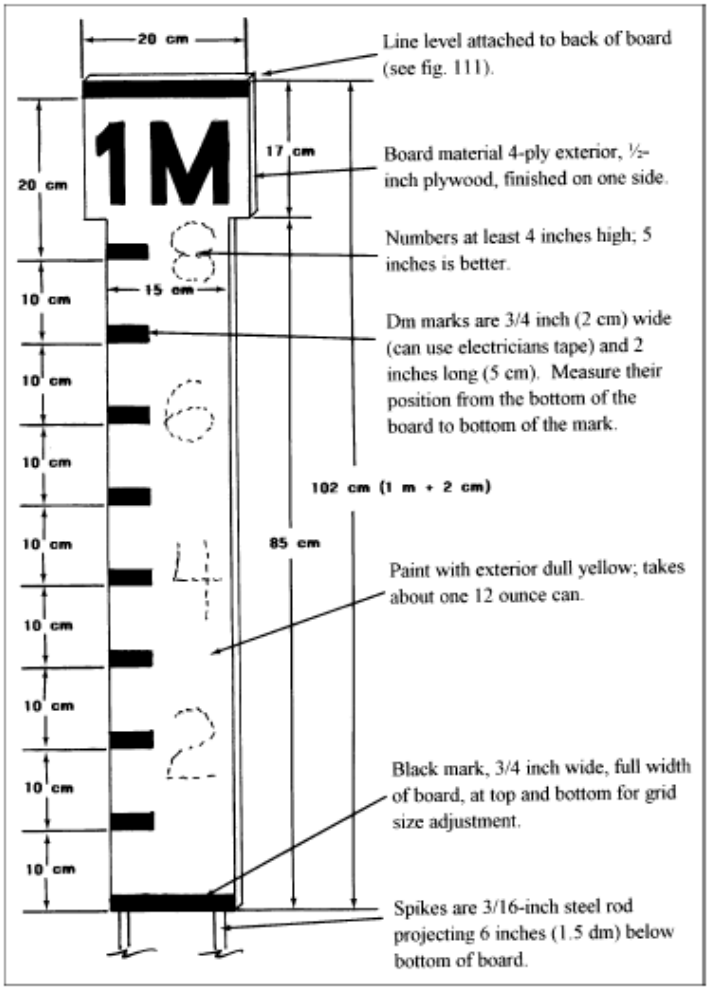
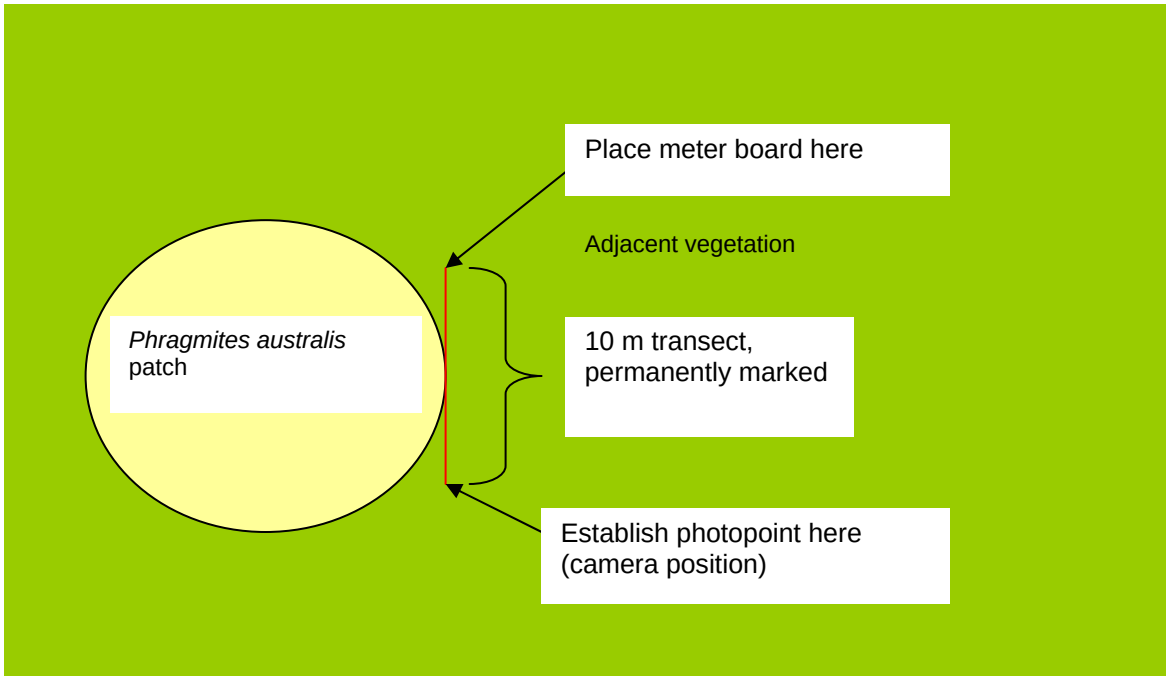


Figure 2. Setting up the photopoint transect – viewed from above.



Complete the "Photoplot Monitoring Record Form" (Appendix A). This involves listing the *P. australis* patch being monitored, describing how to access the infestation site, and describing/sketching where the transect, photopoint, and meter board are located within the infestation site. Other permanent fixtures (such as a road, tree, or post), which will facilitate re-finding the transect, may also be listed as "Reference Points."

Taking the photograph

Set the digital camera resolution to **2.0 megapixels**, and ensure the focal distance is infinite. Plant the tripod, centered directly over the Reference Point. Mount the digital camera on the tripod. Ensure the tripod is level. Note the height of the camera on the tripod above the ground. Take the picture, recording on the "Photoplot Data Form" (Appendix A): the infestation site (ItemID), the camera height, vertical angle, and focus distance (see Figure 3).

Figure 3. An example photo-point photograph. *P. australis* infestation is on the right, *Typha* sp. community being invaded is on the left.

This procedure should be repeated for as many *P. australis* patches for which the refuge can reasonably collect treatment information and photographs (approximately 5- 10, if the refuge has that many patches). If the refuge is spraying infestations in different habitats, it would be useful to establish monitoring points within each habitat type.

Collecting additional application/site factor data

During August or early September, 2005, complete the "Treatment Application/Site factor Form", generalizing for each entire infestation site represented by a photopoint. This form is located in Appendix B.

Repeating the photograph

In late summer, 2006, after *P. australis* has reached peak growth, use the "Photoplot Monitoring Record Form" from 2005 to re-establish the transects, photopoints, and take new pictures of the meter board. Use the "Photoplot Data Form" from 2005 to repeat the photograph, using the same camera height, vertical angle and focus distance.

Literature Cited

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Appendix A. Photoplot Form

PHOTOPLOT MONITORING RECORD FORM

Project:

Initial Take Information:

Photoplot Number(s): Photoplot or Transect Location:

Date: Retake Frequency:

Photoplot or Transect Description -- Describe access, location of permanent points, surrounding area, include sketch map.

Reference Point Descriptions: **Sketch Map below:**

Reference Point 1

Description:

Marking:

Bearing: , m. to camera point

Reference Point 2

Description:

Marking:

Bearing: , m. to camera point

Reference Point 3

Description:

Figure 3. Sample Photoplot Monitoring Record Form.

Appendix B

Treatment Application/Site factor Form

Site Physical Factors

1. Describe the location of the infestation:
Either a) natural tidal marsh
b) natural, non-tidal marsh
c) anthropogenic, hydrologically manipulated marsh (moist soil impoundment)
d) anthropogenic, non-hydrologically manipulated marsh (pond)

2. Annual hydrologic cycle of site:
1. daily tidal inundation (low marsh)
2. lunar tidal inundation (high marsh)
3. infrequent temporary flooding (severe storm events)
4. vernal pool wetland
5. permanent, stable water regime throughout the year
6. temporary wetland 1 (drawdown during growing season, soil remains saturated)
7. temporary wetland 2 (drawdown during growing season, soil remains dry)

3. If site is natural marsh, describe any point-sources or suspected non-point sources of nutrients:

4. If site is tidal, describe any unusual tidal flooding or coastal storm events during the August – October time frame (closely preceding or following the spray application):

5. If site is an impoundment, describe any hydrologic manipulations on the site, during 2-weeks post treatment:
1. drawdown
2. flooding

Description of Infestation

6. Identify primary adjoining vegetation communities in photopoint (e.g. *Typha* sp., *Spartina patens*, *Schoenoplectus* sp.) and describe how *P. australis* rhizomes are invading the adjoining community; select either:
a) “soft edge” (see Figure 4) or
b) “hard edge” (see Figure 5)

7. Phenological stage of most *P. australis* plants in the photopoint at time of spraying:

a) actively growing; pre-flower stage;
b) actively growing; just past flower stage and energy stores presumably being translocated to rhizomes
c) beginning to senesce (yellowing, browning)

Spray Treatment

8. Please list: herbicide, adjuvant, and application rate:

9. Previous treatments for this infestation (burning, herbicide application, mowing) (include type of herbicide, and time of year of treatment) for:
2004: _____
2003: _____
2002: _____

Weather conditions during treatment

Average wind speed (use Beaufort scale) during treatment:

Average precipitation during 48 hours post-treatment: