

PHRAGMITES AUSTRALIS IN THE HUMBOLDT BAY REGION: BIOLOGY OF AN INVASIVE SPECIES AND OPPORTUNITIES FOR TREATMENT

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INTRODUCTION

- Phragmites australis (common reed) is a pernicious invasive exotic that is widespread in distribution throughout the United States, and occurs in a handful of unique habitat types in the Humboldt Bay region.
- It typically inhabits freshwater, brackish and alkaline areas.
- Occurrences of *Phragmites* in the Humboldt Bay region have been increasing substantially in area over the past several years.
- A variety of habitat types in the region support Phragmites.
- Due to various management limitations, each site poses a different opportunity for method of treatment and analysis of treatment success.
- Treatment and eradication of Phragmites at these locations can be a first step towards site enhancement and habitat restoration.

BIOLOGY

- Common reed is a perennial rhizomatous grass with alternate leaves
- It can grow up to 6 meters tall
- The origin of the name *Phragmites* is from the Greek word "phragma," meaning fence, for its **fence-like growth along streams**
- Phragmites* reproduces primarily by rhizomes, but is also known to reproduce by seed.
- Rhizomes can extend up to 2m below ground, with roots penetrating even deeper
- Individual rhizomes can live 3-6 years**
- Buds develop at the base of vertical rhizomes every year in late summer
- These buds mature and grow horizontally for approximately 1m (or up to 10m in newly colonized, nutrient-rich areas)
- Growth terminates in an upward apex then goes dormant until spring, when the apex grows upward into a vertical rhizome
- The process then begins anew. **Growth is most vigorous at the periphery of stands due to a prevalence of horizontal stems**
- Rhizomes and adventitious roots form dense mats that outcompete and prevent other species from growing and establishing in the area.
- It is this characteristic that enables *Phragmites* to form monotypic stands.**
- Common reed is widespread in the U.S., and may have the widest distribution of any flowering plant (Tucker 1990).
- Common reed is very tolerant of a range of conditions, including acidic and saline environments; stagnant water; upland
- Although native forms of the species do occur, morphological analyses of Humboldt County plants has confirmed that local occurrences are exotic.



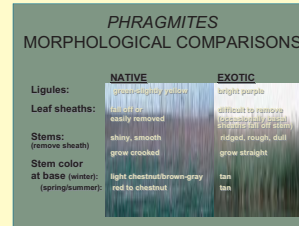
- The inflorescence on common reed is a panicle up to 1.25' long.
- Each spikelet consists of 3-7 flowers.
- Plants generally flower and set seed between July and September
- Seeds are variably viable
- Seeds can be dispersed by wind, birds, and people, among others
- Following seed set, nutrients are translocated down into rhizomes; above-ground portions of plant die back for the season

Comparison of Features of Superficially Similar Species. (From Jepson 1993)

	LEAF LENGTH	LEAF WIDTH	BLADE MORPHOLOGY	HEIGHT	INFLORESCENCE LENGTH	SPIKELET FEATURES	OTHER NOTES
<i>Phragmites australis</i>	20-45cm	1-5cm	flat or folded, generally deciduous	2-6m tall	15-50cm	- Glabrous glumes - Glumes shorter than lemmas	- Leaves generally break at collar and have scabrous margins
<i>Phalaris arundinacea</i>	20-50cm	1-2cm wide	flat	20cm-2m tall	7-40cm	- Hairy glumes - Glumes longer than lemmas	- Inflorescence branches spreading in flower, appressed in fruit
<i>Arundo donax</i>	less than 1m	2-6cm	flat or folded	less than 6m	30-60cm	- Lemmas covered with soft whitish hairs - Glumes longer than lemmas	- Laterally compressed spikelets - Inflorescence branches ascending

NATIVE VS. EXOTIC?

- There is historic evidence that common reed is indigenous to North America:
 - Fossil records show evidence of *Phragmites* in southwestern U.S. for at least 40,000 years (Hansen 1978);
 - Paleoecological records show *Phragmites* evidence along Atlantic and Pacific coasts for several thousand years (Nearing et al. 1977; Orson 1990; Cozart et al. 2000);
 - Remains of *Phragmites* dating back to 600-900 A.D. have been found in Anasazi ruins in CO (Jans & Gross 1986; Brenner et al. 1988)
- HOWEVER:
 - The habit of *Phragmites* has become more aggressive in the past 100-200 years;
 - Botanical records from the 1800s describe *Phragmites* as being rare or uncommon
 - Phragmites* now readily displaces vegetation and communities, forming monotypic stands
 - Such aggressive growth characteristics are typical of invasive species



- Genetic research by K. Saltonstall (2002) addressed the theory that non-native genotypes may have been introduced to North America in the last 200 years
- Saltonstall's research indicates that 27 haplotypes (lineages) of *Phragmites* occur worldwide
- 11 haplotypes have widespread distribution on multiple continents; one of these, haplotype "M" is most common in N. America, Europe, and Asia, and is most closely related to other haplotypes found in Europe, Asia, & Africa
- Additional data provided by Saltonstall indicate that haplotype M is not closely related to other haplotypes in North America
- Yet haplotype M is the most common currently, and now has the most widespread distribution in North America
- Haplotype M has displaced native haplotypes, as evidenced by historic herbarium samples
- Concurrent with Saltonstall's work, Dr. Bernd Blossey at Cornell University has been studying morphological differences between native and exotic *Phragmites*
- Diagnostic service available: <http://www.invasiveplants.net/diag>

CONTROL METHODS

- Have included:
 - Mowing;
 - Hand removal;
 - Burning;
 - Excavation;
 - Covering with plastic;
 - Manipulation with water and salinity;
 - Manual cutting followed with herbicide application, and
 - Aerial herbicide application.
 While biological control is being researched, it is not a viable option at this time
- PROS & CONS (What has worked, what hasn't)
 - Literature reviews and consultations with resource professionals experienced with Phragmites removal have concluded the following:
 - excavating common reed can often stimulate new growth as the plant attempts to respond to stress.
 - use of burning without other treatment methods can actually stimulate aggressive regrowth of common reed, in much the same way that excavating the plant causes.
 - Mowing will not remove Phragmites from a site, and may stimulate the population if not done at the correct time of year.
 - Hand removal requires years of effort, can be cost-prohibitive, and could further stimulate additional growth
 - Manipulation with water level would require Phragmites be submerged for 4-month intervals on a regular basis, for at least 2 years. This would prevent natives from establishing, and is impractical at Palco and Railroad Marsh.
 - While use of plastic may be a viable option in central CA, where temperatures are often above 80°, temperatures would likely not reach or sustain sufficient heat to kill Phragmites at Palco Marsh;
 - Transients would vandalize the plastic and/or use it for shelter immediately
 - Herbicide treatments have been most successful, but require follow-up spot treatments for several years due to life span of rhizomes
 - Phragmites may require perpetual management regardless of treatment method

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 - City of Eureka
 - Humboldt Bay Harbor, Recreation, & Conservation District
- Bibliography and List of Persons Contacted is available upon request



TREATMENT OPPORTUNITIES FOR LOCAL OCCURRENCES (Ownership in parentheses)

- Balloon Track (Private)**
 - The owner of this parcel had not yet been contacted prior to this publication, however anecdotal information (personal communication L. Shikany, J. Robinson) indicates that an extensive population occurs on this parcel.
 - It appears that some of these occurrences were mowed and burned in 2004 for fire prevention measures.
 - However, no formal management measures are known to exist for Phragmites at the Balloon Track at this time.
- Bracut (Caltrans)**
 - Phragmites located in CalTrans Right of Way occurs in a Palustrine emergent wetland (freshwater drainage ditch) along Highway 101 next to Resale Lumber.
 - Because Caltrans is restricted from applying herbicide in this region, they are considering the treatment option of using black plastic to smother the common reed
 - The challenges in using plastic at this site include removal of fence for thorough treatment of Phragmites; obtaining adequate temperatures to achieve efficacy; and removing excessive biomass prior to treatment without further spreading the species.
 - Transient impacts to plastic material are not a concern at this site due to the location.
- Palco Marsh (City of Eureka)**
 - Habitat types that support Phragmites in and near the Palco Marsh complex include estuarine emergent with freshwater and muted tidal influences (marsh complex), isolated palustrine emergent wetland with relict saline soils (Railroad Marsh), and palustrine emergent (freshwater ditches).



- The City recently completed the first proposed phase of treatment, which included burning Phragmites to reduce biomass while taking advantage of the stimulation of growth.
- The intent was to encourage the plant to tap its carbohydrate resources sooner, and once the plant set seed, immediately treat with an aquatic-approved herbicide (glyphosate with "Competitor" surfactant) to maximize the translocation activity of the plant at this stage.
- Initial burning of vegetation was also intended to decrease excessive herbicide use by applying only to living material
- This will be a long-term treatment process that will require many years of follow-up treatment and response assessment.

Woodley Island (Harbor District)

- Phragmites at Woodley Island occurs in estuarine emergent intertidal wetland habitat.
- The consistent tidal inundation and high salinity soils may explain why this population is non-flowering.
- However, this is speculation and has not been confirmed.
- The Harbor District has recently mowed some of the population in anticipation of treating with a yet-to-be-determined method. Methods being considered include plastic and herbicide, and will depend on feasibility.

