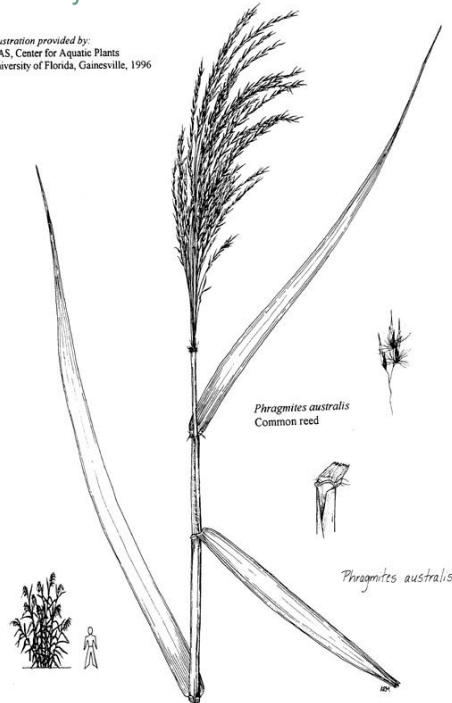




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Illustration provided by:
IFAS, Center for Aquatic Plants
University of Florida, Gainesville, 1996



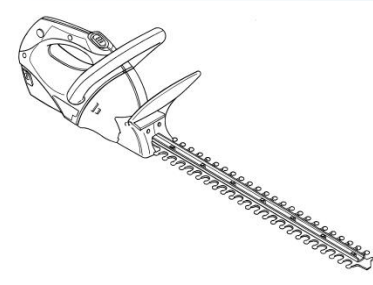
Phragmites

Control Strategies & Management



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Control Strategies

- Mechanical
- Chemical
- Biological



Mechanical

- Mowing/cutting/disking/spading
- Burning
- Water level manipulation
- Smothering



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Mowing

- Careful to avoid further soil disturbance
- Timing is critical (late summer)
- Cut to > 4 inches
- Remove cut shoots
- Rhizomes still remain
- Moist soils-access



Disking

- Breaks up and spreads rhizomes
- Disrupts wetland soils



Spading

- Ontario, Humber College
- Selective removal
- Cutting stalks below surface
- Goal is to not disturb the soil, prevent photosynthesis of plant
- Currently no recorded data – research started 2016



Burning

- Large dense stands
- Remove excess biomass....but
- Promotes native growth
- Easier to spot regrowth
- Cost-effective/ecologically sound
- Does not affect rhizomes



Water Level Manipulation

- Reduces oxygen available to rhizomes
- At least 3 inches of water
- Usually used in impoundments
- Tidal gates
- Conduct in late summer



Smothering

- Best for smaller sites
- During growing season
- Cover cut plants
- High temps/lack of sunlight kill rhizomes



<http://www.greatlakesphragmites.net/management/techniques/>



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Chemical

- Herbicide - Aquatic
 - Glyphosate
 - Imazapyr
 - Imazamox
- Methods of application
 - Spray
 - Hand swiping
 - Stem injection



Biological



- Grazing
 - Long term, low-intensity grazing can reduce density
 - Increase plant species diversity
 - 171 species of non-native herbivores that could potentially be used to control phrag
 - 21 of these species are introduced

Biological

- Most promising species that eat roots:
 - Reed leopard (*Phragmataecia castaneae*)
 - Reed stalk borer (*Chilo phragmitella*)
 - Aquatic reed borer (*Schoenobius gigantella*)
- Shoot feeding herbivores
 - Shoot feeding moths
 - Chloropid flies
- Shoot density reduction
 - Large wainscot (*R. lutosa*)



Biological

- Limited research
- Cornell University and CABI (Center for Agriculture and Biosciences International)
- USGS research on gene silencing & disruption of symbiotic relationship between phrag & microbial endophytes
- Recent blight in Louisiana
 - Roseau cane mealy bug



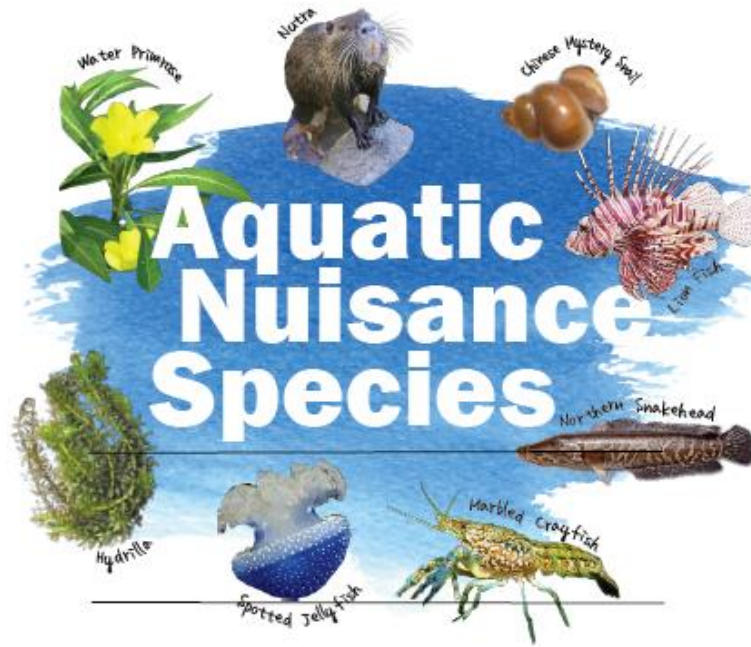
North Carolina Management



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NORTH CAROLINA



MANAGEMENT PLAN

NC Aquatic Nuisance Species Management Plan Committee

Prioritization of ANS Species currently found in North Carolina.
Species in bold have commercial or recreational value

Higher Priority Lower Priority
 Medium Priority

Scientific Name	Common Name	Taxa Group	Habitat	Rank
<i>Hydrilla verticillata</i>	Hydrilla	Plant	Freshwater	1
<i>Pterois miles</i>	Lionfish; Devil Firefish	Fish	Marine	2
<i>Pterois volitans</i>	Red Lionfish	Fish	Marine	3
<i>Nymphoides peltata</i>	Yellow Floating Heart	Plant	Freshwater	4
<i>Phragmites australis australis</i>	European Common Reed	Plant	Freshwater-Brackish	4
<i>Orconectes rusticus</i>	Rusty Crayfish	Crayfish	Freshwater	6
<i>Procambarus clarkii</i>	Red Swamp Crawfish	Crayfish	Freshwater	6
<i>Alternanthera philoxeroides</i>	Alligatorweed	Plant	Freshwater	6
<i>Orconectes virilis</i>	White Crayfish	Crayfish	Freshwater	9
<i>Lepomis microlophus</i>	Blue Catfish	Fish	Freshwater	10
<i>Lyngbya wollei</i>	Giant Lyngbya	Cyanobacterium	Freshwater	11
<i>Cyangopeludina chilensis molliseta</i>	Chinese Myxerynall	Gastropod	Freshwater	12
<i>Cyangopeludina japonica</i>	Japanese Myxerynall	Gastropod	Freshwater	12
<i>Anguillicoloides crassa (= Anguillicola crassa)</i>	Tel Swimb bladder Nematode	Nematode	NA	12
<i>Myriophyllum spicatum</i>	Eurasian Watermilfoil	Plant	Freshwater	12
<i>Myocastor coypus</i>	Nutria	Mammal	Freshwater	16
<i>Corbicula fluminea</i>	Asian Clam	Bivalve	Freshwater	17
<i>Micropterus punctulatus</i>	Spotted Bass	Fish	Freshwater	17
<i>Phyllorhiza punctata</i>	Australian Spotted Jellyfish	Coelenterate	Marine	19
<i>Lythrum salicaria</i>	Purple Loosestrife	Plant	Freshwater	19
<i>Lythrum spp.</i>	Purple Loosestrife (any not native to NC)	Plant	Freshwater	19
<i>Mandarinia kelsoi</i>	Marsh Dewflower; Asian Spiderwort	Plant	Freshwater	19
<i>Ludwigia hexapetala (= L. uruguayensis)</i>	Uruguay Waterprimrose	Plant	Freshwater	23
<i>Myriophyllum aquaticum</i>	Pantherlily	Plant	Freshwater	23
<i>Polysiphonia brevarticulata</i>	a red algae	Algae	Marine	25
<i>Egeria densa</i>	Brazilian Elodea	Plant	Freshwater	25
<i>Najas minor</i>	Brittle Nalad	Plant	Freshwater	25
<i>Triadica sebifera</i>	Chinese Tallow Tree	Plant	Freshwater	25
<i>Tilapia zillii</i>	Redbelly Tilapia	Fish	Freshwater	29
<i>Ludwigia peploides peploides</i>	Creeping Water Primrose	Plant	Freshwater	29
<i>Codium fragile tomentosoides</i>	Green Sea Fingers	Algae	Marine	31
<i>Carcinus maenas</i>	European Green Crab	Crab	Marine	31
<i>Onychomys leucogaster</i>	White Footed Mouse	Mammal	Freshwater	31



<i>Pterois miles</i>	Lionfish	Fish	Marine	2
<i>Pterois volitans</i>	Red Lionfish	Fish	Marine	2
<i>Nymphoides peltata</i>	Yellow Floating Heart	Plant	Freshwater	4
<i>Phragmites australis australis</i>	European Common Reed	Plant	Freshwater-Brackish	4
<i>Orconectes rusticus</i>	Rusty Crayfish	Crayfish	Freshwater	6
<i>Procambarus clarkii</i>	Red Swamp Crawfish	Crayfish	Freshwater	6
<i>Alternanthera philoxeroides</i>	Alligatorweed	Plant	Freshwater	6

North Carolina Gaps

*The overall goal of the North Carolina Aquatic Nuisance Species Plan is “**to prevent and control the introduction, spread and negative impacts of aquatic nuisance species in North Carolina.**” Currently gaps in ANS management within the state include: the lack of a comprehensive policy statement on ANS, the lack of a centralized decision making framework, inadequate statewide monitoring and reporting procedures, no centralized reporting system, a lack of biological and economic data, insufficient mapping, no rapid response plans, limited resources for enforcement, no comprehensive public education strategy, and limited coordination of partnerships with nonstate agencies and entities.*



State Agencies

- NC Division of Water Resources
- NC State Parks
- NC Division of Coastal Management
- NC Sea Grant
- NC Department of Transportation
- NC Wildlife Resources Commission
- Albemarle-Pamlico National Estuary Partnership



NC Aquatic Weed Control Program

- Cost share program
- Fact sheets
- Additional informational links

NC Environmental Quality Search... NC.GOV AGENCIES JOBS SERVICES

Permits & Rules ▾ Outreach & Education ▾ Research Conservation ▾ News ▾ About ▾ Contact

Home » About » Divisions » Water Resources » Water Planning » Water Supply Planning » Aquatic Weed Control Program

Aquatic Weed Control Program

Water Supply Planning

Interbasin Transfer Certification

Water Conservation

Aquatic Weed Control

The [Aquatic Weed Control Act of 1991](#) directs and regulates the Aquatic Weed Control Program. The purpose of the program is to assist North Carolina citizens and local governments burdened with aquatic weed infestations. The philosophy is that by responding early to localized outbreaks the Division of Water Resources can mitigate the long-term economic and environmental impacts.

NC State Parks

- No comprehensive treatment plan
- Efforts kept track separately at each park
 - EDD MapS
- Prescriptions on an as needed basis
- 2009 report out on management in 8 coastal parks
- Research 2015 “Distribution and Management of Invasive Plant Populations in State Park Properties in the Coastal Plain
- Challenges
 - Funding, staffing and time

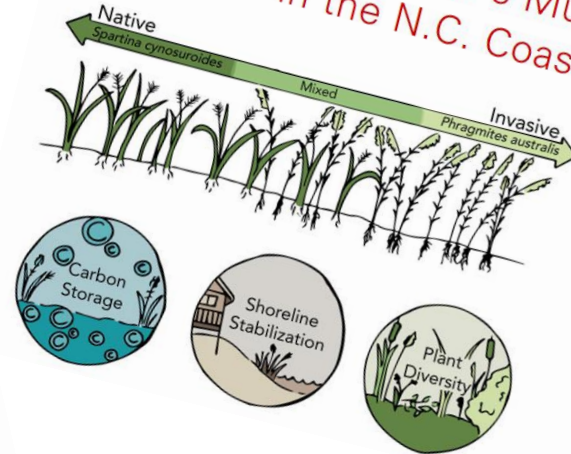
NC Coastal Reserve Program

NC Sea Grant

Invasive and Native Marsh Grasses May Provide Similar Benefits to Protected Wetlands



Uncovering an Invader's Multiple Roles:
Phragmites in the N.C. Coastal Reserves



Phragmites: Always a foe, or sometimes a friend?

SEPTEMBER 1, 2015 | E-CHING LEE

By SETH THEUERKAUF



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US Fish and Wildlife Service

Alligator River National Wildlife Refuge Comprehensive Conservation Plan



**U.S. Department of the Interior
Fish and Wildlife Service
Southeast Region**

August 2008



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US FWS

- Currently working on draft protocol to rapidly assess the management actions on Phragmites and to be able to report in a quantitative manor.
- Each refuge manages based on their own budget
- Looking at plants assistance for shoreline stabilization
- More funding and staffing needed



National Park Service



- Cape Hatteras (4 years) and Cape Lookout
- Exotic Plant Management Team
- Each park has own strategy
- Aerial spraying at Bodie Island
- Bi-yearly treatments (map treated)
- Either treat or map- not enough funding



Assateague Island National Seashore

- Managing for 10 years
- Aerial survey of existing
- Ground truthing
- Aerial spray (higher density)/burn
- New problem: NPDES concerns with chemicals near water





NRCS

Pest Management – Invasive Plant Control
Common Reed – *Phragmites australis*

Conservation Practice Job Sheet **NH-595**



Natural
Resources
Conservation
Service

Wetland
Science
Institute



Wetland Restoration, Enhancement, and Management



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The Nature Conservancy



- Element Stewardship Abstract
- Staffing, funding and time
- Knowing your sensitive areas and keeping it out

Audubon

- Management for shorebird nesting habitat
- Attempts at cut and cover projects but limited staffing
- Funding
- Coordinated efforts on research with Chowan University and NC Coastal Reserve



Management Elsewhere



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USFWS - Utah



PHRAGMITES CONTROL PLAN

By

Bridget E. Olson
Wildlife Biologist

U.S. Fish and Wildlife Service
Bear River Migratory Bird Refuge
2155 West Forest Street
Brigham City, Utah 84302
Phone: (435) 723-5887

August 29, 2007



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Great Lakes Region



LINKING PEOPLE, INFORMATION & ACTION

[Phrag Basics](#) ▾ [Management](#) ▾ [Resources](#) ▾ [Regulations](#) [PAMF](#) ▾ [Blog](#) [About](#) ▾ 

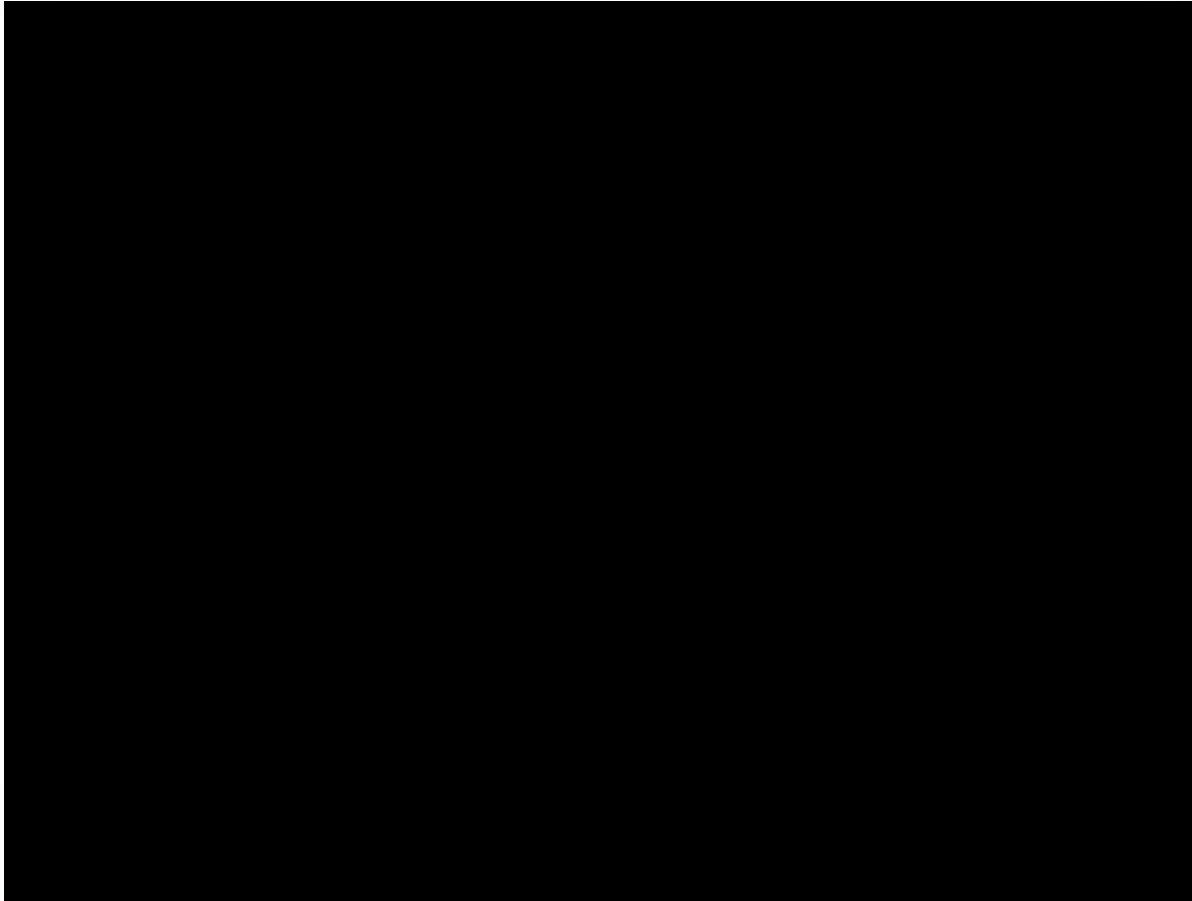


<http://www.greatlakesphragmites.net/>



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Phragmites Adaptive Management Framework (PAMF)



<https://www.usgs.gov/media/videos/phragmites-adaptive-management-framework-pamf>



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Events

The following PAMF Training Sessions are available for year one PAMF Participants. At each session, participants can network with the PAMF team and with other PAMF participants, pick-up a free PAMF Field Kit, and learn the PAMF protocols. Each session will run from 10 am – 2 pm and include a classroom and field component. If you would like to attend one of these training sessions, or if you do not see one in your area and you would like to participate in PAMF, please contact [Karen Alexander](#).

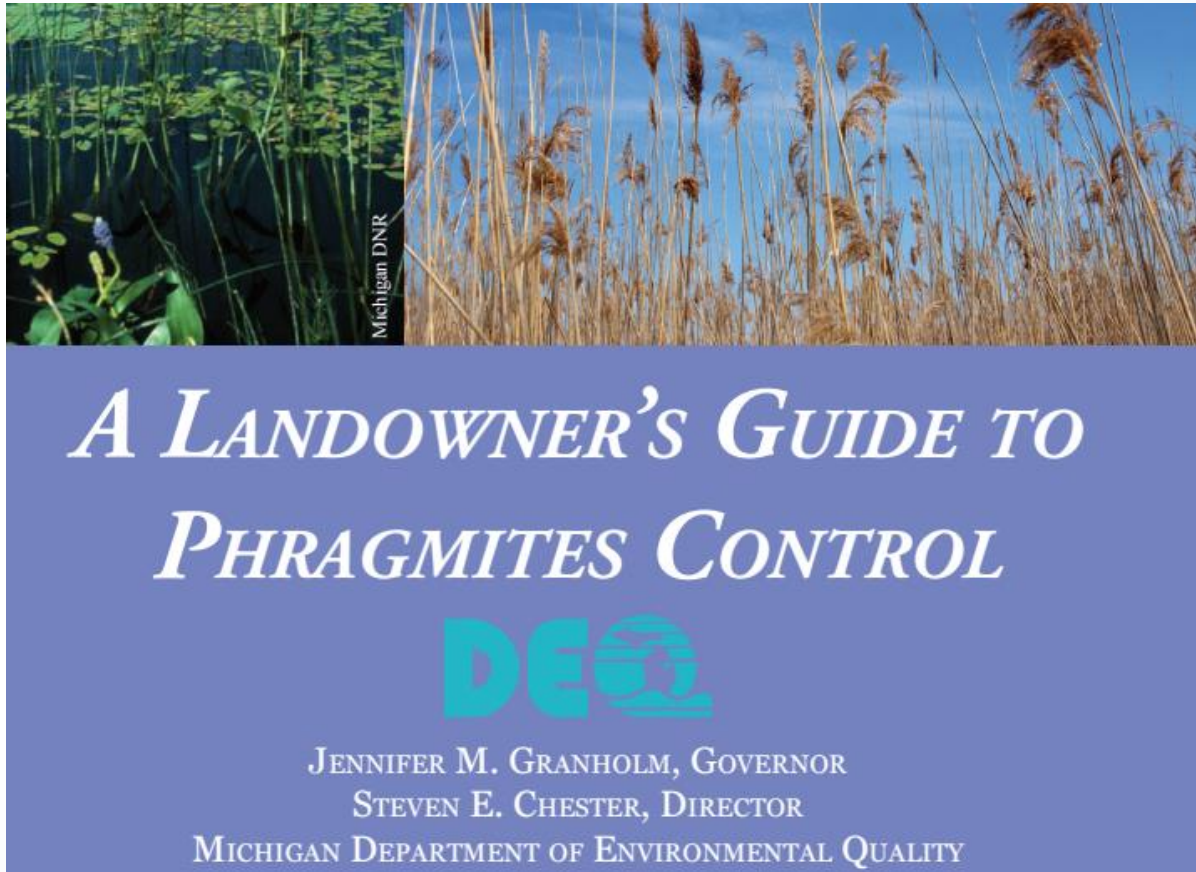
- Oakland University, Rochester, Michigan, June 28, 2017
- Georgian Bay Forever, Port Severn, Ontario, July 10, 2017
- Ozaukee-Washington Land Trust, West Bend, Wisconsin, July 12, 2017
- University of Green Bay, Green Bay, Wisconsin, July 11, 2017
- Upper Thames River Conservation Authority, London, Ontario, July 12, 2017
- Chickaming Open Lands, Sawyer, Michigan, July 13, 2017
- Huron Pines, Gaylord, Michigan, July 14, 2017
- Quanicassee State Wildlife Area, Essexville, Michigan, July 17, 2017
- Point Moulliee State Game Area, Rockwood, Michigan, July 18, 2017
- Ottawa National Wildlife Refuge, Oak Harbor, Ohio, July 19, 2017
- Cleveland Museum of Natural History, Mentor, Ohio, July 20, 2017



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Michigan



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Phragmites Treatment/Management Prioritization Tool

January 2014



Criteria

Ecological Criteria

Value Score

1. *Region:* In what region of Michigan is your site located?

Upper Peninsula	(5 pts.)	
Northern Lower Peninsula (north of vegetation tension zone)	(3 pts.)	
Southern Lower Peninsula	(1 pts.)	

2. *Local abundance:* Is invasive *Phragmites australis* locally abundant in similar habitat in the general area*?

*General area is approximately 2 miles from the site

Very Abundant (>50% of similar habitat is infested)	(-5 pts.)	
Moderate to low abundance (10-50% infested)	(0 pts.)	
Virtually absent locally (<10% infested)	(5 pts.)	

3. *Infestation size:* How large is the *Phragmites* infestation (approximate patch size)?

Less than 1000 square feet	(9 pts.)	
1000 square feet - 1 acre	(7 pts.)	
1 acre - 20 acres	(5 pts.)	
Greater than 20 acres	(3 pts.)	

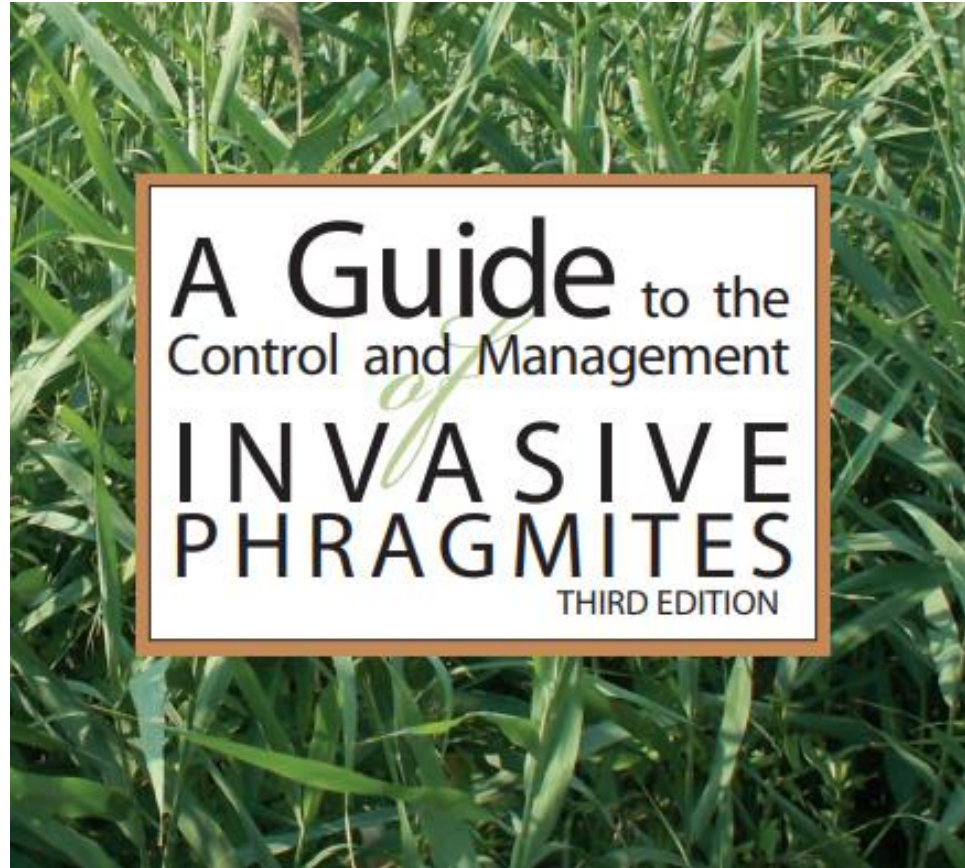
4. *Linear feature:* Is the infestation in a linear feature, such as a roadside ditch, drain, utility corridor, etc.?

Yes, the infestation is in a linear feature	(5 pts.)	
No, the infestation is not in a linear feature	(0 pts.)	

http://www.michigan.gov/documents/deq/wrd-ais-phragtool-print_445378_7.pdf



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Method	Phragmites Stand Characteristics	Site Conditions	Treatment Technique	Precautions
Injecting Stems	Scattered or isolated	Effective in areas where impacts to desirable, native plant species must be avoided.	Cut plants to waist height. Add one drop of herbicide to hollow stems with a squirt bottle or syringe.	Seed heads should be removed from the site after cutting to prevent seed spread.
Hand Swiping	Scattered or isolated	Effective in areas where impacts to desirable, native plant species must be avoided. Also recommended for follow-up treatments where native vegetation is recovering.	Cover (wipe) each individual stem using a cotton wicking glove worn over a chemical resistant glove.	Use care not to oversaturate or drip herbicides on native vegetation.
Backpack Sprayer	Scattered to moderately dense stands	Use on low-wind days to prevent drift outside the treatment area. Use carefully to avoid native plants.	Spray close to leaves using low pressure.	Utilize flat fan nozzles to minimize non-target exposure.
Wick or Dauber	Moderately dense to dense stands greater than 1 acre	Targets Phragmites without impacting shorter plant species. Useful when complete eradication of all plants is not desired. Also recommended for follow-up treatments where native vegetation is recovering.	Saturate absorbent material with low pressure sprayers attached to an ATV or tractor. The area must be covered twice.	Herbicide may not be effective on stems broken or damaged by the equipment.
Boom Sprayer	Dense stands greater than 1 acre	Use on low-wind days to prevent drift outside the treatment area. Use carefully to avoid native plants.	Attach low pressure boom sprayers to an ATV or tractor.	Herbicide may not be effective on stems broken or damaged by the equipment.
Aerial Application	Dense stands greater than 5 acres	Use on low-wind days to prevent drift outside the treatment area. Use carefully to avoid native plants.	Spray area from helicopter booms using proper droplet size, boom length and nozzle type.	Large scale application may affect adjacent plant communities. Using a skilled pilot is imperative.

http://www.michigan.gov/invasives/0,5664,7-324-68001_73817-178183--,00.html



		Imazapyr	Glyphosate	Combination
Treatment Timing		Apply to actively growing green foliage after full leaf elongation and up to first killing frost (i.e., August up to first killing frost). If stand has substantial amount of old stem tissue, allow to regrow to approximately 5 feet tall before treatment	Apply after plants are in full bloom in late summer up to the first killing frost (i.e., late August up to first killing frost)	Apply after plants are in full bloom in late summer up to the first killing frost (i.e., late August up to first killing frost)
Herbicide Rate	High Volume	4 to 6 pints per acre	6 pints per acre	3 pints glyphosate and 3 pints imazapyr per acre
	Low Volume	1 - 1.5% solution	1 - 1.5% solution	No recommended rate is available
Cost		High	Low	Medium
Effectiveness		High Acts slowly and can remain active in the soil during the following year or more	Medium Good results with follow-up treatment or where water level management is available	High Recommended for most dense Phragmites stands
Precautions		Non-selective and may persist actively in the soil for multiple years. Can move along roots and kill non-target species including nearby woody species. Not recommended for treatment in high quality areas with diverse native vegetation.	Non-selective and can kill non-target species when sprayed on foliage. May not be thoroughly transferred to roots in the first year and typically requires subsequent treatment.	Non-selective and may persist actively in the soil for multiple years. Can move along roots and kill non-target species including nearby woody species. Not recommended for treatment in high quality with diverse native vegetation.

http://www.michigan.gov/invasives/0,5664,7-324-68001_73817-178183--,00.html



		APPROACH 1	APPROACH 2	APPROACH 3	
Year 1	Jan				
	Feb				
	Mar				
	April				
	May				
	June				
	July	herbicide treatment with imazapyr			
	Aug		OR		
	Sep	herbicide treatment with glyphosate or imazapyr/glyphosate combo			
	Oct			mechanical treatment	
	Nov				
	Dec				
Jan		prescribed burn			
Feb					
Year 2	Mar				
	April				
	May				
	June				
	July	prescribed burn	spot treat with imazapyr (if necessary)		
	Aug		OR		
	Sep	spot treat with glyphosate or imazapyr/glyphosate combo (if necessary)			
	Oct				
	Nov				
	Dec				
	Year 3	Jan			
		Feb			
Mar					
April					
May					
June					
July		spot treat with imazapyr (if necessary)			
Aug			OR		
Sep		spot treat with glyphosate or imazapyr/glyphosate combo (if necessary)			
Oct					
Nov					
Dec					

http://www.michigan.gov/invasives/0,5664,7-324-68001_73817-178183--,00.html



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Northeast Region

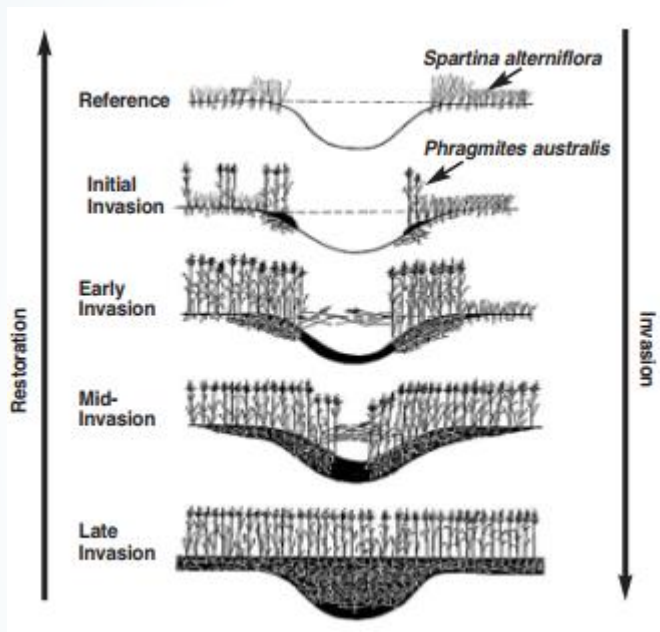


Manmade impoundment in Bass River Township, NJ



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Delaware



<http://www1.udel.edu/PR/UDaily/2008/oct/PhragmitesBulletin.pdf>

Delaware Private Lands Assistance Program

Delaware Phragmites Control Cost-Share Program



Do you have
Are they big
Program p

What is the Delaware Phragmites Control Cost-share Program?

[Delaware DNREC](#)



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Southeast



- South Carolina DNR
 - Aquatic Nuisance Species Program

Phragmites in South Carolina ([Cont. 2007-2009](#))

2009 Control was significantly reduced based on the current budget problems that are faced by Local, State, and Federal entities and the fact that control has been effective in significantly reducing the populations to a more manageable number in several areas including the Santee Coastal Reserve WMA and the Santee Delta WMA areas

2009 Phragmites Control Operations			
Location	PDF Maps	Acres	Costs
Santee Coastal		260	\$51,025
Yawkey		50	\$9,813
Baruch		22	\$4,823
Charleston Harbor NWS	NO MAP	65	\$12,756
Caw Caw Natural Area	NO MAP	2	\$289
Georgetown Parks		19	\$4,015
TOTAL		418	\$82,721
Private landowners	NO MAP	No Final Info	No Final Info

Cost Share Programs

- NC Aquatic Weed Control Program
- Delaware
- South Carolina
- NRCS Environmental Quality Incentives Program (EQIP)

PRISMs

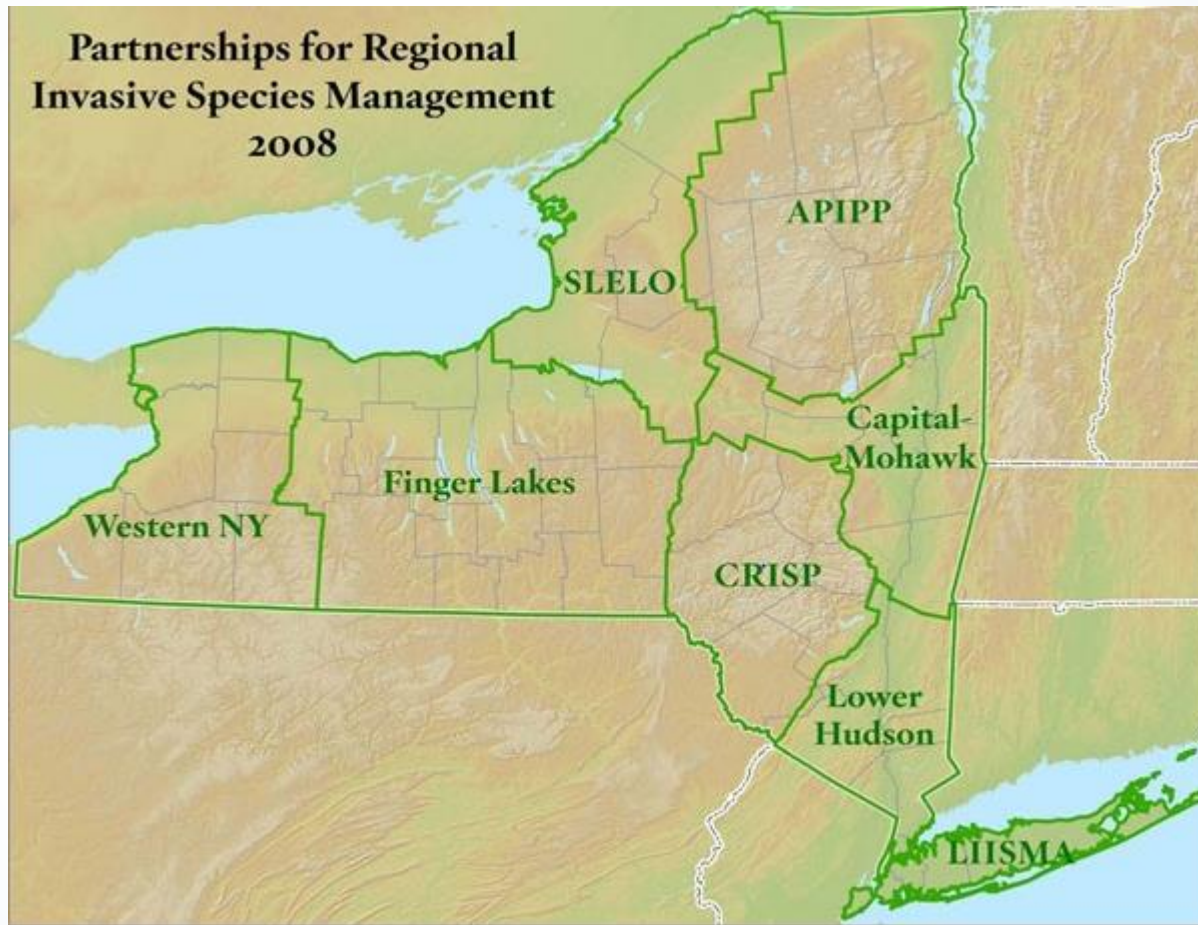
Partnership for Regional Invasive Species Management

- Recommendation from the NY Invasive Task Force
- Regional management
- Intended to:
 - Coordinate partner efforts
 - Recruit and train volunteers
 - Identify and deliver education and outreach
 - Establish early detection monitoring networks
 - Implement direct eradication efforts



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New York PRISMs



Proactive Management



WASHINGTON STATE
RECREATION AND CONSERVATION OFFICE
Washington Invasive
Species Council

Stop



Photographs courtesy of Wendy Brown and Joseph M. BiTomaso, invasive.org

Cordgrass; Spartina

Spartina alterniflora

The Invasion



What is it?

Spartina species are aquatic grasses that grow on the mud flats and marshes of Puget Sound and our coastal estuaries. The plants tend to grow in circular clumps called 'clones' and are bright green in color. Smooth cordgrass came to Washington State in the late 1800s, either in shipments of oysters from the East Coast or as packing material in ships' cargo. It is a hardy, aggressive colonizer that spreads rapidly and can outcompete native plants.



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www.nccoast.org

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252.393.8185