USACE-ERDC RESEARCH ON AQUATIC INVASIVE PLANTS

Gulf & South Atlantic Regional Panel Meeting

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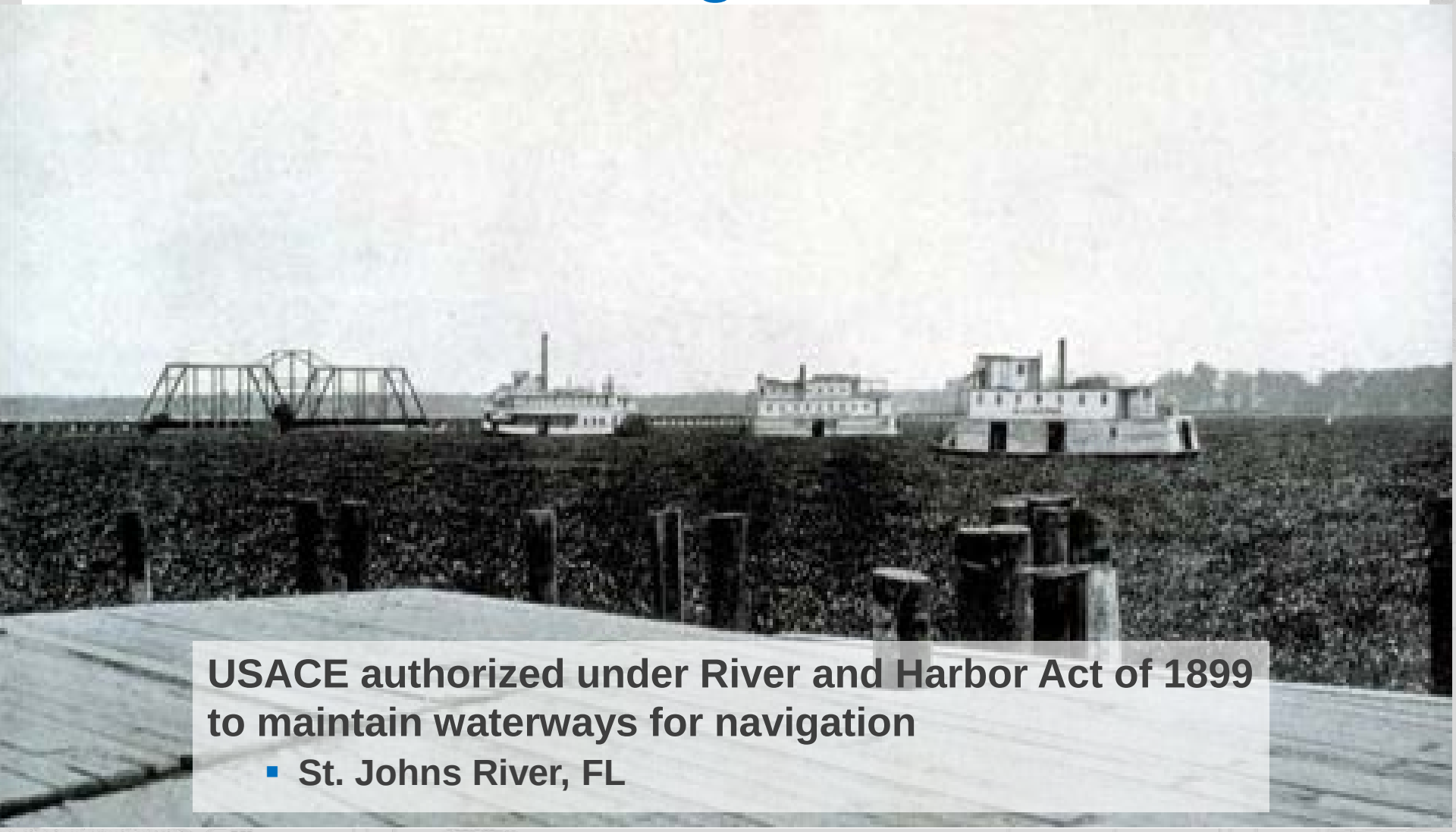
APCRP
AQUATIC PLANT CONTROL RESEARCH PROGRAM

Presentation Outline

- **USACE and aquatic plant management**
- **Invasive species impacts to Corps mission**
- **What are our problem species?**
- **Aquatic Plant Control Research Program**
- **Key ongoing research projects**

Role of USACE in Aquatic Plant Management



USACE authorized under River and Harbor Act of 1899 to maintain waterways for navigation

- **St. Johns River, FL**

The Corps Operates & Manages…

- 12,000 miles of inland river channels
- 13,000 miles navigation channels
- 207 navigation locks at 171 sites
- 300 commercial harbors, 600 small harbors
- 383 dams and reservoirs; 330 million acre ft of water
- 456 lakes in 43 states
- #1 federal provider of outdoor recreation; more visitors to Corps projects/year than the National Park Service

Impacts to CE Activities

- Navigation
- Flood Risk Management
- Ecosystem Restoration
- Hydropower
- Regulatory
- Recreation

Problem Aquatic Plant Species

NWD: flowering rush, Eurasian watermilfoil, purple loosestrife, harmful algae

MVD: water hyacinth, hydrilla, Eurasian watermilfoil and hybrids, giant salvinia, flowering rush, alligatorweed

LRD: hydrilla, phragmites, starry stonewort, water chestnut

POD: giant salvinia, elodea

NAD: water chestnut, phragmites, hydrilla, Eurasian watermilfoil, starry stonewort, algae

SPD: water primrose, salt cedar, arundo, Brazilian elodea, water hyacinth, hydrilla

SWD: hydrilla, water hyacinth, giant salvinia, harmful algae, arundo, alligatorweed

SAD: water hyacinth, water lettuce, hydrilla, crested floating heart, algae (HAB, lyngbya), torpedograss, paragrass

AQUATIC PLANT CONTROL RESEARCH PROGRAM

- **Authorization:**
  - River and Harbor Act (Section 104), 1958, as amended
  - Only federally authorized R&D program for aquatic plant management
- **Develops effective, economical, and environmentally compatible strategies for assessing and managing invasive aquatic plant problems**
- **Research Requirements: Generated by USACE field offices; "Statements of Need"**
- **Applied research; supports Operations**
- **Current Focus Areas:**
  - Biological Control
  - Chemical Control
  - Ecological Assessment
  - Management Strategies & Applications
  - Harmful Algae

Aquatic Plant Control Research Program

Funded FY18 Projects:

Biological Control

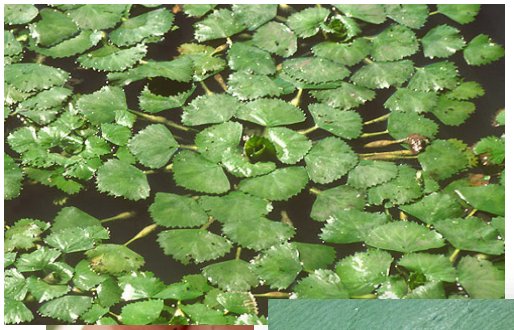
1. Biological Control of Hydrilla and Floating Hearts in the US
2. Development of Insect Biocontrols for *Phragmites* & Flowering Rush

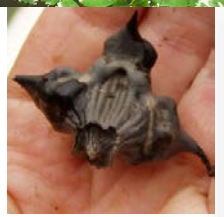
Chemical Control

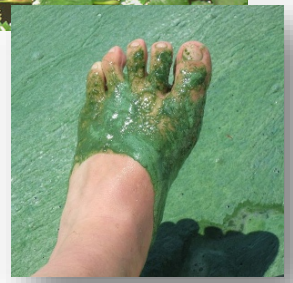
1. Evaluating Grass-specific Herbicides to Enhance Aquatic Restoration
2. Linking Plant Biology with Management Strategies to Improve Control of Monoecious Hydrilla
3. Comparing Generic Aquatic Herbicides with Proprietary Compounds
4. Chemical Control with ProcellaCOR
5. Management of Water Chestnut




Aquatic Plant Control Research Program







Ecological Assessment

1. Seasonal Ecology of Wetland Natural Enemy/Plant Interactions
2. Understanding Invasion Ecology and Genetics to Inform Management of Hybrid Milfoils
3. Water Chestnut Ecology and Genetics
4. Genotypic Variability, Invasive Traits of Flowering Rush & Implications for Biological Control

Management Applications & Strategies

1. Economic & Environmental Benefits of Invasive Aquatic Plant Management
2. ResistanceAlert – Early Warning System for Aquatic Herbicide Resistance
3. Geospatial Assessment of *Phragmites* die-off in South Louisiana

Harmful Algae

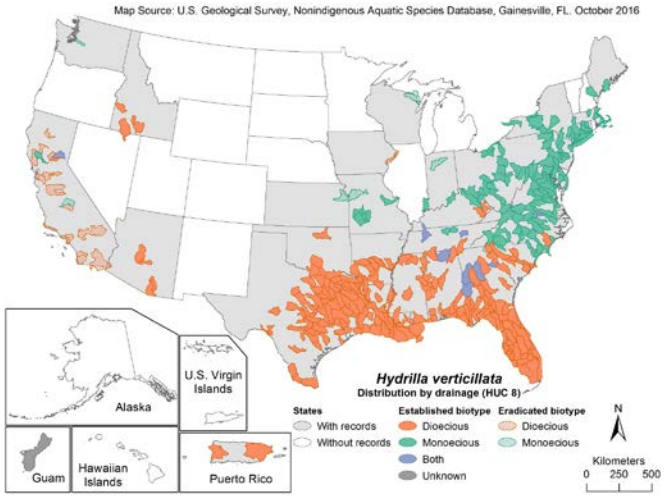
1. Reducing Eutrophication and the Prevalence of Harmful Algal Blooms
2. Strategies for Early Detection of Harmful Algal Blooms and Predicting Toxin Release
3. srRNAs for Control of Harmful Algal Blooms
4. Starry Stonewort Biology and Management

Biological Control – Ongoing R&D

- Overseas searches for new insect agents:
  - Monoecious hydrilla
  - Phragmites
  - Flowering rush
  - Crested and yellow floating heart (*Nymphoides* spp)

Monoecious hydrilla – expanding in the U.S.

- Leaf-mining *Hydrellia* flies are only agents for hydrilla in the US
- Not effective against monoecious biotype
- Fail to overwinter in cooler regions
- Collaborators: USDA-ARS Australian Biological Control Lab, Korea University, Chinese Academy of Sciences, Henan University
- Searching in China and Korea



Why Survey in China and Korea?

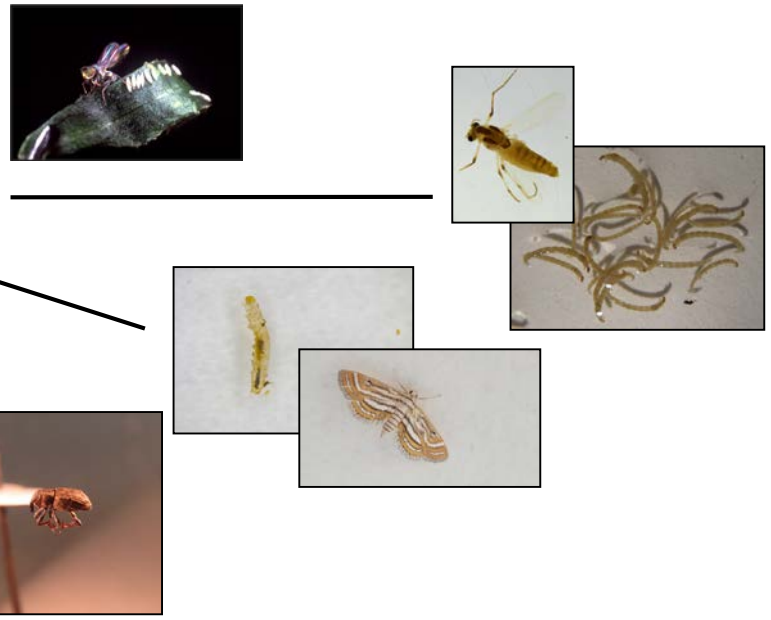
- Monoecious hydrilla biotype believed to have originated from Korea
- Recent genetic characterization of hydrilla samples collected from China and Korea; have located sites in both countries which contain hydrilla matching the **US biotypes (monoecious and dioecious)**
- Genetic characterization indicated **greatest genetic diversity of hydrilla** occurs in China; supports greater array of insect fauna and potential biological control agents
- New agents identified:

  Fly – (Ephydridae; *Hydrellia* spp.)

  Midge – (Chironomidae; *Cricotopus* spp.)

  Moth – (Cramdidae; *Paraponyx* spp.)

  Weevil – *Bagous rufipennis*



- Next steps: Quarantine
  Establish rearing
  Host specificity tests

Phragmites australis

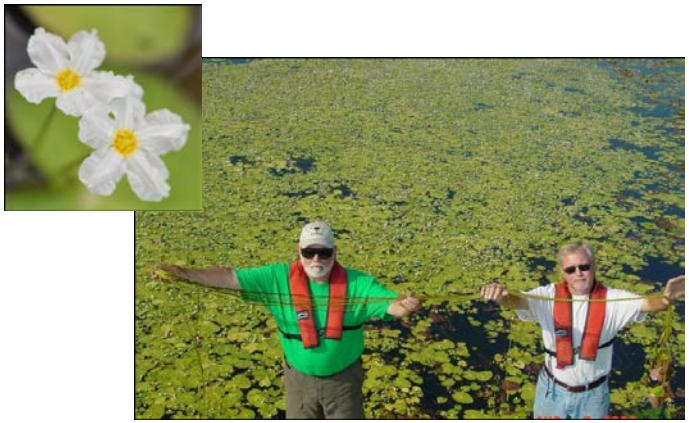
- European surveys; CABI-Switzerland
- Two moth species selected out of nine potential agents
  - *Archanara germinipuncta*
  - *Archanara neurica*
- Both moths specific to genus *Phragmites*
- Narrow host range
- No development on any of 45 plants in host specificity tests
- Very low risk of negative impact to native *Phragmites* haplotypes
- Next steps: Submit petition to TAG for field release

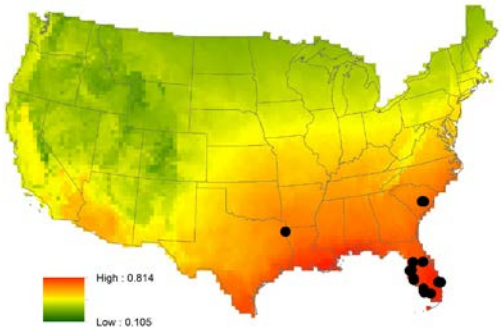
A. germinipuncta

A. neurica

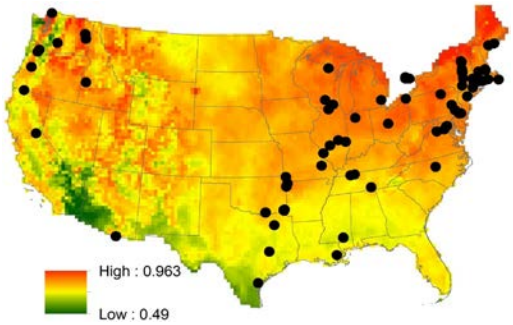
Nymphoides spp.

- Targets: Crested floating heart (*N. cristata*), yellow floating heart (*N. peltata*)
- Native to Eurasia
- Forms dense monocultures; vegetative and sexual reproduction
- Difficult to manage; grass carp will not eat
- Suitable targets for biocontrol based on Peschken-McClay assessment
- Work begins 2018: genetic characterization of US populations
  overseas plant tissue collections; genetic analysis
  initiate surveys for herbivores





Crested floating heart

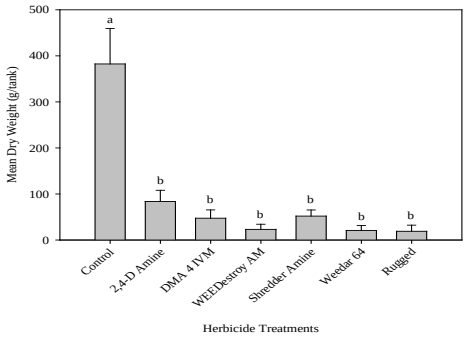


Yellow floating heart

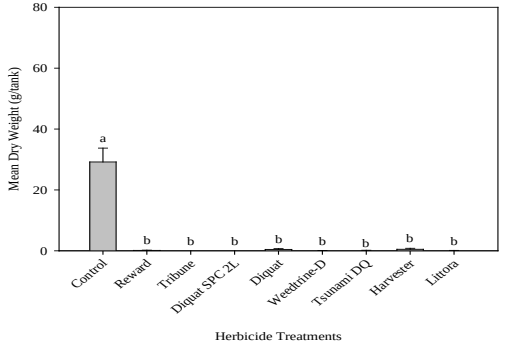
Chemical Control – Ongoing R&D

Comparing generic aquatic herbicides with proprietary counterparts

- District request – is efficacy the same?
- Compare efficacy of several generic and proprietary herbicides against floating, emergent and submersed plants
- 2017: small-scale, outdoor mesocosm trials
  water hyacinth, water lettuce, giant salvinia
  24 herbicides: 2,4-D, glyphosate, diquat and triclopyr
- Results: generic and proprietary products performed similarly
- 2018: herbicide testing on emergent species



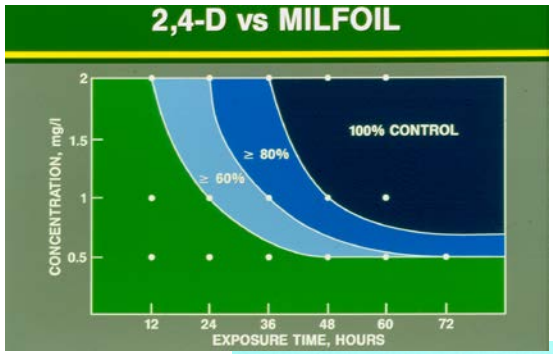
2,4-D products vs. water hyacinth

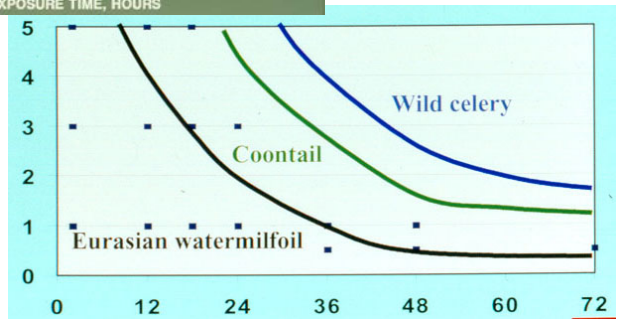


Diquat products vs. giant salvinia

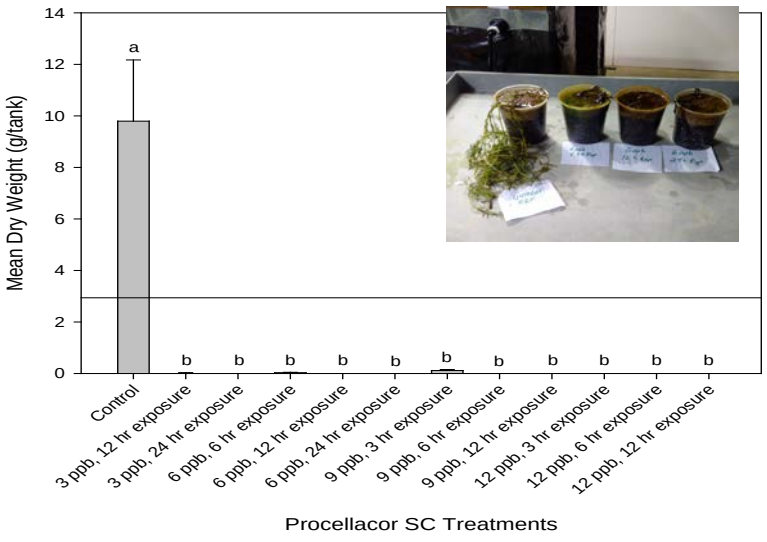
Chemical Control with ProcellaCOR

- ProcellaCOR – a new, arylpicolinate herbicide, SePRO
- Research Objectives:
  - Define concentration exposure time (CET) relationships against fluridone-resistant hydrilla and auxin-tolerant hybrid milfoils
  - Test against non-target native plants; develop CET
  - Refine selective use patterns





ProcellaCOR vs hybrid milfoil



Evaluating Grass-specific Herbicides to Enhance Aquatic Restoration

UF IFAS UNIVERSITY of FLORIDA

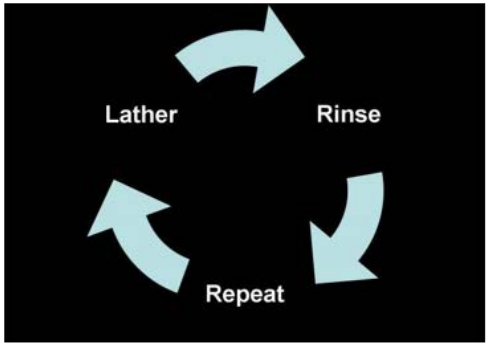
Problem:

- Minimal tools for aquatic invasive grass problems
- Large-scale problems
- No selective treatments
- Regrowth always happens
- Retreatment required

Research Objective:

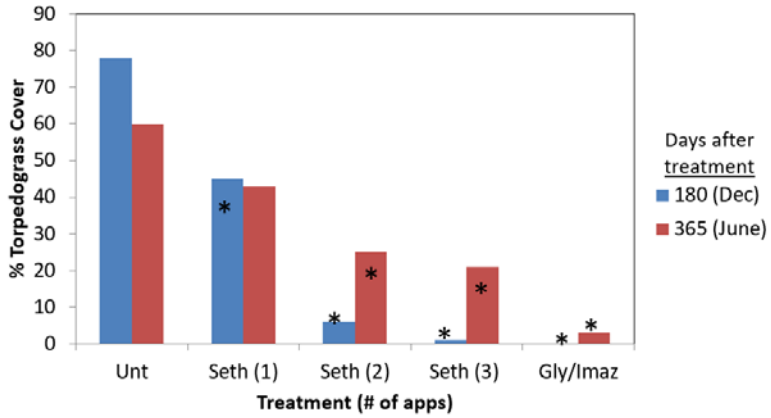
Identify and develop grass-specific herbicides ("dims" and "fops") for aquatic plant management

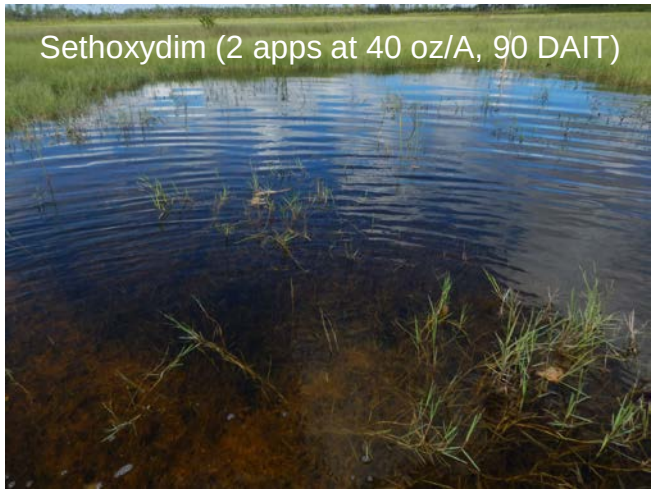
Sethoxydim
Fluazifop vs Multiple grass species



What we have learned…

- Graminicides are not silver bullets
- Season of treatment appears important for sethoxydim efficacy
  - Sequential treatments in the late spring worked well
- Spot treatment concentrations are most promising for single applications
- Fluazifop appears to have more activity on both torpedo and paragrass in field trials
- These graminicides are not enhanced by low rates of glyphosate or imazapyr





APCRP Website: https://apcrp.el.erdc.dren.mil/