

# Aquatic Plant Management Team Research Overview

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# Outline:

## 1. USACE/Aquatic Plant Management History

## 2. Aquatic Plant Management Team

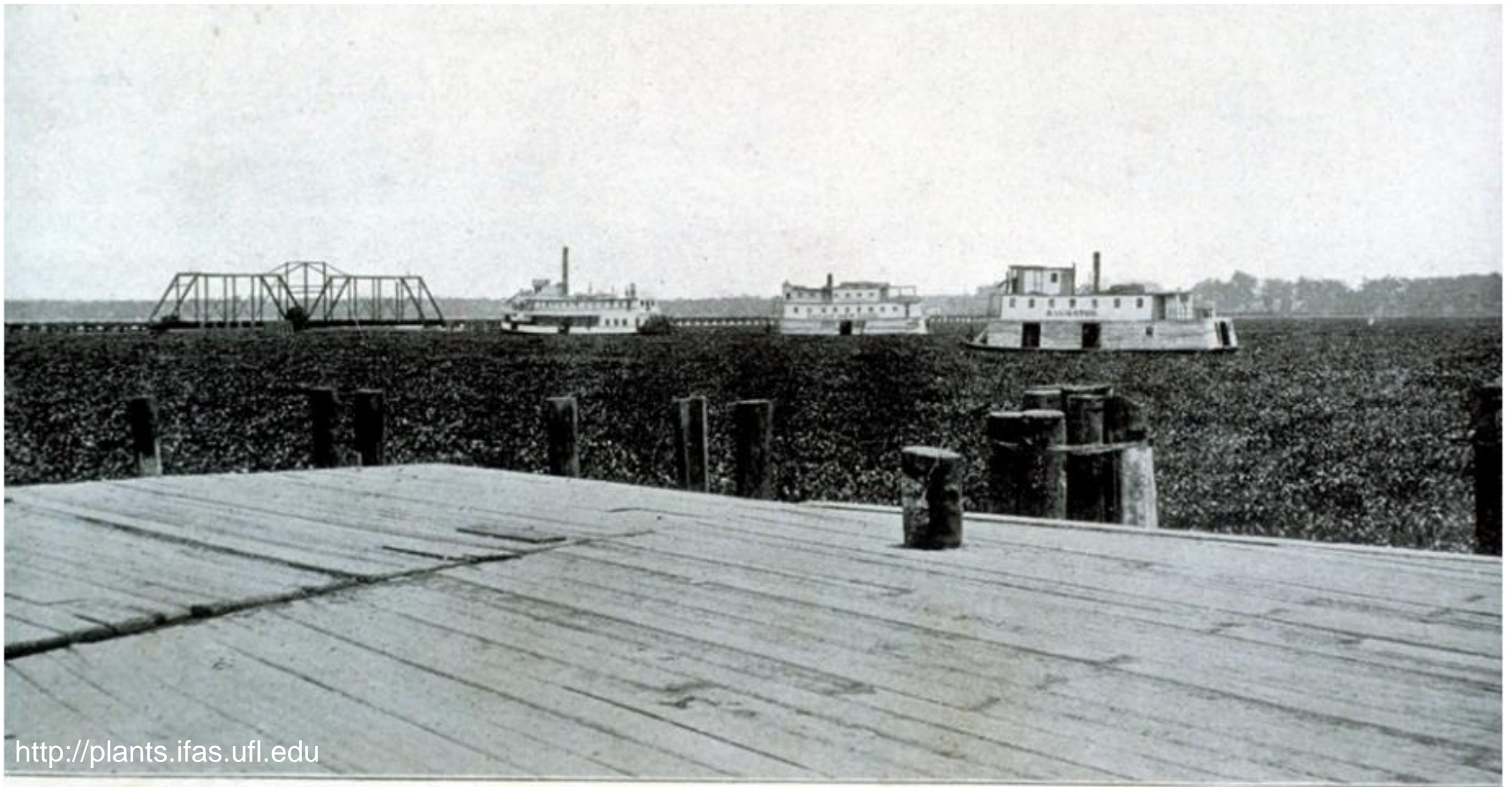
- Personnel
- Chemical Control R&D Capabilities
- Funding Sponsors

## 3. Project Examples

- Civil Direct Allotted (APCRP)
  - Flowing Water Research
    - ❑ Flowering Rush Control in the Run-of-the-River Reservoirs
  - Refining Herbicide Application Technology
    - ❑ Target Plant Herbicide Interception
  - New Product Development
    - ❑ Field Evaluations for Managing Monoecious Hydrilla with Florpyrauxifen-benzyl
  - Linking Plant Biology, Phenology, and Management
    - ❑ Genotypic Variability: Implications for Establishment, Spread, and Management of Flowering Rush
- Civil Reimbursable Projects







<http://plants.ifas.ufl.edu>

BRIDGE AT PALATKA, SHOWING THREE SMALL STEAMERS ATTEMPTING TO MAKE THEIR WAY THROUGH A MASS OF HYACINTHS.



# WHERE WE ARE - USACE WORLDWIDE



- USACE DIVISIONS**
- Northwestern NWD
  - South Pacific SPD
  - Southwestern SWD
  - Mississippi Valley MVD
  - Great Lakes & Ohio River LRD
  - South Atlantic SAD
  - North Atlantic NAD
  - Pacific Ocean POD
  - Trans Atlantic TAD

- Other USACE Organizations**
- 249th Engineer Battalion (Fort Belvoir, VA)
  - Army Geospatial Center (Alexandria, VA)
  - Engineer Research & Development Center (Vicksburg, MS)
  - Engineering and Support Center (Huntsville, AL)
  - Finance Center (Millington, TN)
  - Humphreys Engineer Center Support Activity (Alexandria, VA)
  - Institute for Water Resources (Alexandria, VA)
  - Logistics Activity (Millington, TN)
  - Marine Design Center (Philadelphia, PA)



MAP - Scale: 1:5,300,000  
North American Datum 1983  
USA Contiguous Lambert Conformal Conic Projection

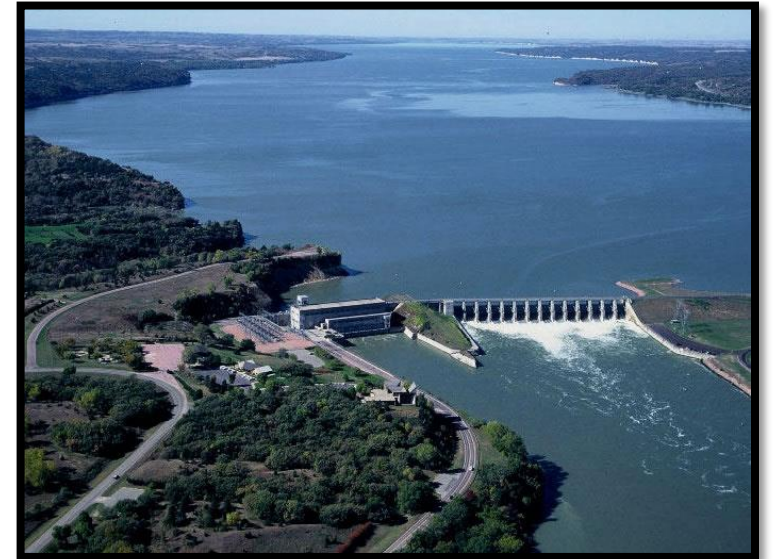
HARP - Scale: 1:12,498,606  
North American Datum 1983  
Alaska Albers Projection

HAWAII MAP - Scale: 1:6,000,000  
North American Datum 1983  
Albers Equal Area Conic Projection



# USACE Protects and Manages

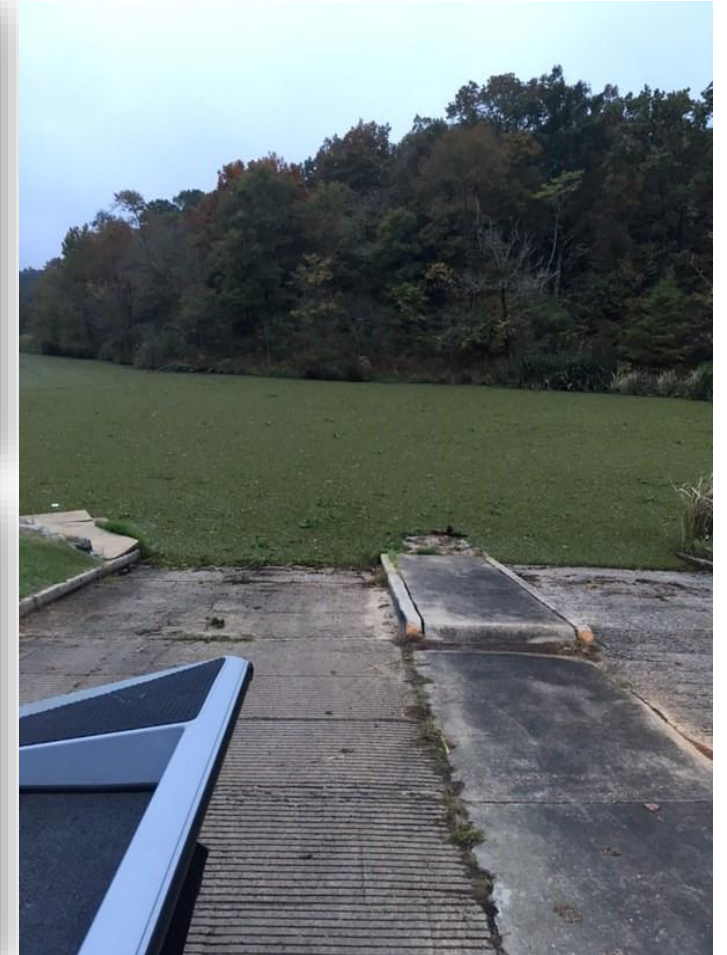
- 12,000,000 acres of natural areas
- 12,000 miles of inland and intracoastal waterways
- 218 lock chambers at 176 sites
- 1,067 coastal, Great Lakes, and inland channels and harbors
- 740 dams and associated structures
- 75 hydroelectric power plants
- 136 multi-purpose reservoirs
- 456 lakes in 43 states
- #1 Federal provider of outdoor recreation





# Impacts of Invasive Aquatic Plants to USACE Activities

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





# Aquatic Plant Management Team

## Team Mission:

Provide R&D services for development, evaluation, registration and field guidance for environmentally compatible use of techniques to selectively manage invasive vegetation in public waters and wetlands.

## R&D Focus Areas:

Chemical Control; Biological Control; Phenology; and Biological Invasions

## ERDC-Vicksburg Campus:

Dr. Bradley Sartain  
Dr. Kurt Getsinger  
Dr. Ian Knight

## Remote Sites:

Dr. Christopher Mudge  
ERDC, LSU, Baton Rouge, LA  
Dr. Benjamin Sperry  
ERDC, UF-CAIP, Gainesville, FL  
Dr. Nathan Harms  
ERDC, LAERF, Lewisville, TX





# APMT – Chemical Control Capabilities

- **Conduct** in-house R&D to improve use of USEPA-registered products for managing invasive aquatic vegetation
  - Develop environmentally compatible chemical strategies for managing historical weed problems & new invaders – hydrilla, water hyacinth, Eurasian watermilfoil, giant salvinia, flowering rush, hybrid watermilfoil
- **Serve** as the Federal Subject Matter Expert for chemical control issues
  - USEPA, state regulatory, and Federal/state resource management agencies
- **Collaborate** with registrants to develop/evaluate products for use across U.S.
  - Develop stewardship programs to prevent/mitigate future herbicide resistance

## From the Laboratory to the Label

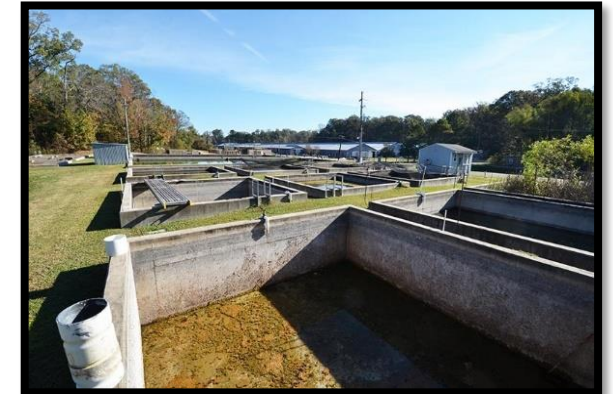
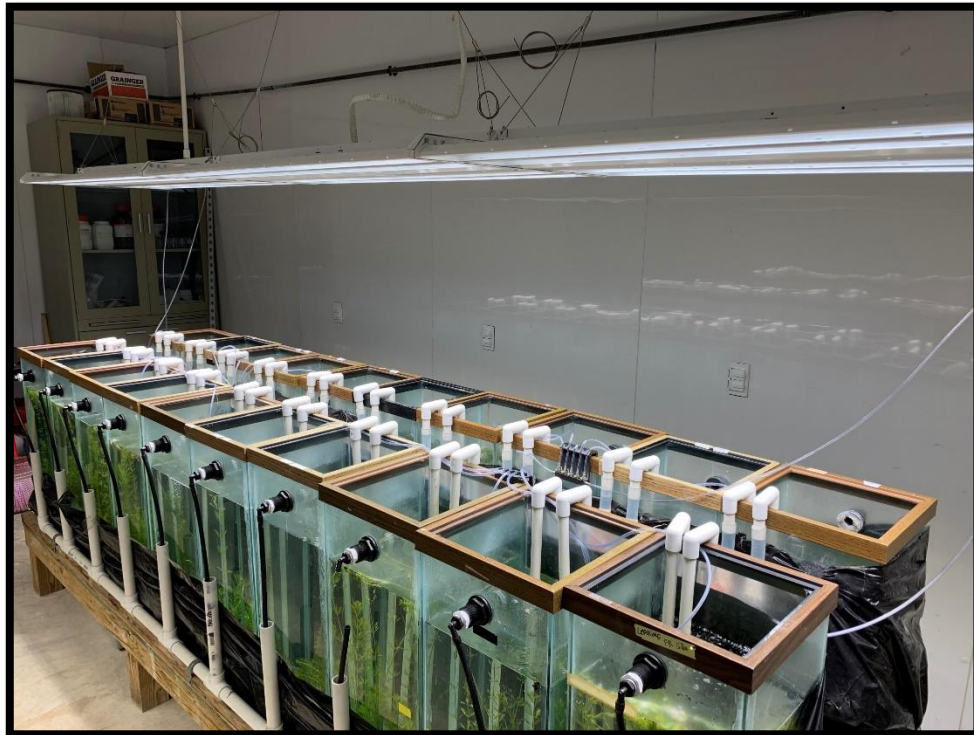
- small-scale testing to field verification





# In-House Facilities

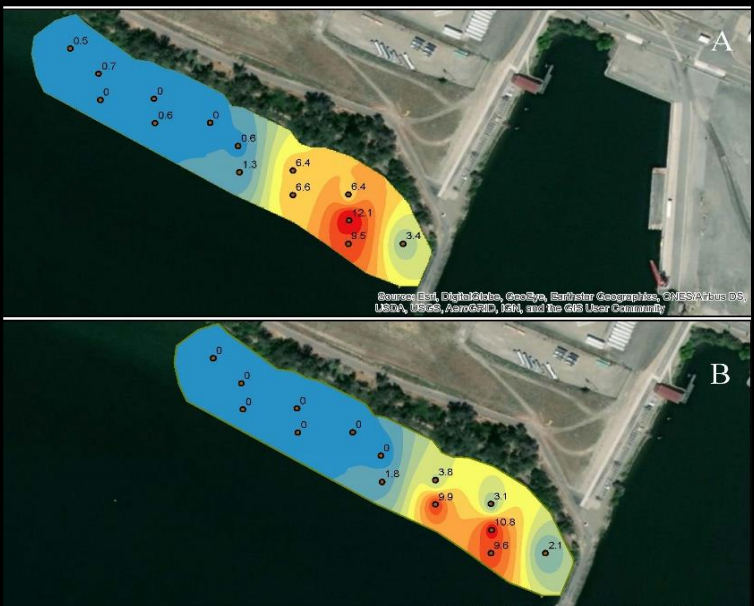
- Walk-in environmental growth chambers
- Green houses
- Outdoor mesocosms
- Experimental ponds





# Field Verification Studies

- Conducted Nationwide
- Operational scale





# Funding Sponsors

## Civil Direct:

- Aquatic Plant Control Research Program
- Aquatic Nuisance Species Research Program

## Recent Civil Reimbursables:

- CE Districts (Buffalo, New Orleans, Jacksonville, Omaha, Seattle, Walla Walla)
- State Agencies – FWC, LDWF, WIDNR, MNDNR, MDEQ
- Great Lakes Restoration Initiative





# Aquatic Plant Control Research Program (APCRP)



**Research Focus:** biology and ecology of invasive aquatic plant species;  
technologies to manage invasive aquatic plants

## **Focus Areas:**

- Chemical, biological, and integrated control methodologies
- Management strategies and applications
- Harmful algae

The APCRP is the only federally authorized R&D program for aquatic  
plant management



# Flowering Rush Control in Hydrodynamic Systems: SON-1173

Problem: Flowering rush (*Butomus umbellatus* L.) spreading throughout the Pacific Northwest

Goals: Develop effective, rapid-response treatment options to control and limit the spread of flowering rush in a run-of-the-river reservoirs



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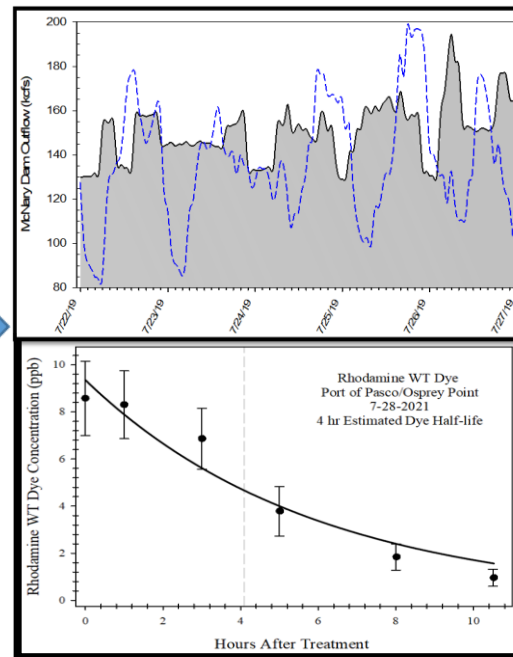
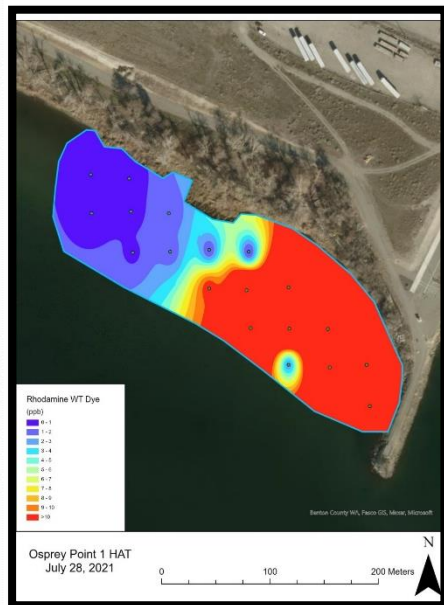


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# Objectives

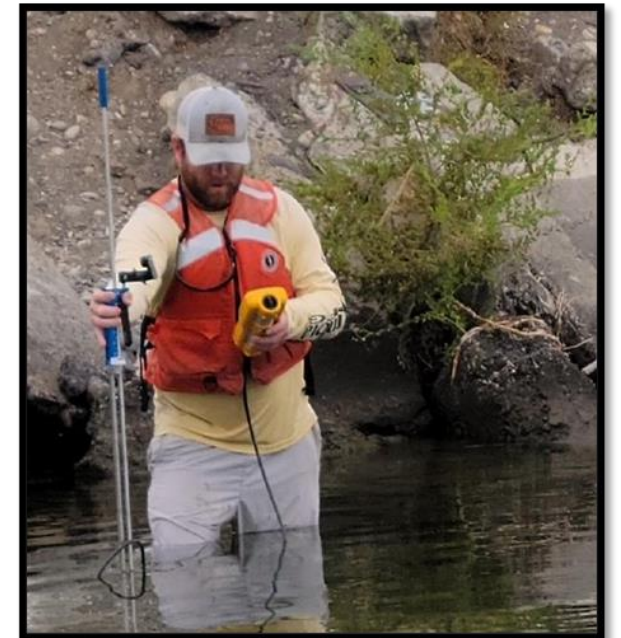
- 1) Field studies: Determine water-exchange patterns and investigate innovative methods for reducing water exchange to enhance herbicide concentration/exposure times (CETs)
- 2) Growth chamber/greenhouse studies: Determine herbicide CETs to control submersed flowering rush
- 3) Field Studies: Link herbicide CETs with *in-situ* water exchange patterns for selective control of submersed flowering rush





# Research Benefits

- Important new information on controlling flowering rush in hydrodynamic systems
- Development of innovative methods to reduce water exchange and increase herbicide CETs
- Operational guidance to CE Projects
  - Improve herbicide application strategies
  - Protecting critical habitat of threatened endangered species







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# Refining Foliar Herbicide Applications to Improve Control of Emergent Plants: SON #1300

## Problem:

- Herbicides are an effective tool for invasive species management
- Public concern over herbicide entry into water
- Toxicological risk assessment based on 100% herbicide deposition into water



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DISCOVER | DEVELOP | DELIVER



**Purpose:** Investigate herbicide interception by emergent, floating, and creeping aquatic plants following a foliar application

Some Herbicide Reaches Water...

*Complicated....so how much?*



■ What influences herbicide interception?

- **Plant density**
  - ▶ % canopy coverage
- **Application techniques**
  - ▶ Broadcast vs. spot spray
  - ▶ Spray/carrier volume (GPA)
  - ▶ Spray impact angle
  - ▶ Equipment (boom vs. handgun)
- **Plant structure/architecture**
  - ▶ Narrow vs. broadleaves
  - ▶ Waxy glabrous vs. pubescent leaves
  - ▶ Plant height and biomass



# Research Challenges

- No template – no established guidelines
- Require innovative methods/protocols for all phases of work

## Objectives:

- Develop methods for quantifying aqueous herbicide concentrations (Mesocosm/Field Scale)
- Evaluate influence of application technique, adjuvants, plant architecture, leaf surface morphology, and plant density on herbicide interception
- Provide guidance for managing plant stands with foliar-applied herbicides to maximize spray retention on the foliage



# Research Benefits

- Link spray techniques and use patterns to determine aqueous herbicide levels after foliar treatments of floating, emergent, and creeping plants
- Provide guidance to USACE Districts and other agencies to make science-based decisions regarding potential impacts of such treatments
- Overcome agency concerns in controlling invasive plants more efficiently and cost effectively, restoring valuable aquatic ecosystems
- Optimize BMPs for foliar herbicide applications



# Field Evaluations for Managing Monoecious Hydrilla using Florpyrauxifen-benzyl (ProcellaCOR®)

**Problem:** Data limited to small-scale CET & species selectivity studies; data supplementary to florpyrauxifen-benzyl (FPB) use in the field needed

**Goal:** Develop field verified FPB treatment strategies for managing monoecious hydrilla



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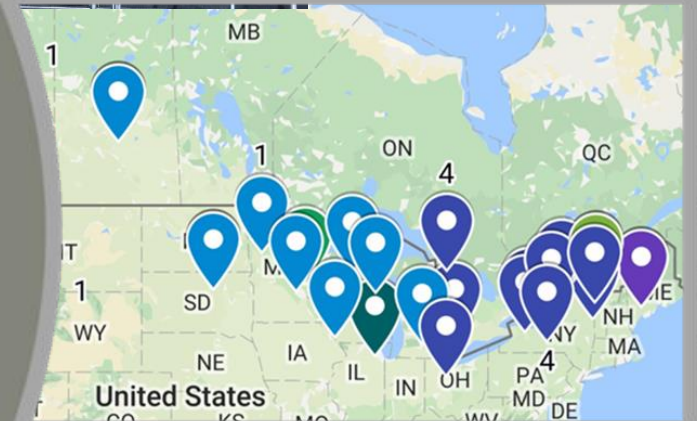


# Research Benefits

- Important new information for operational use of florpyrauxifen-benzyl targeting monoecious hydrilla in the field
- Improvement of herbicide application strategies and reduction of associated management costs over time
- Field verification approach has been proven to result in effective environmentally compatible aquatic herbicide labels for use in CE and other public water bodies
- Promotes sustainable ecosystem management and the protection of critical habitat for listed threatened/endangered species



# Genotypic Variability and Implications for Establishment, Spread, and Management of Flowering Rush (*Butomus umbellatus*): SON #1437 & 1471



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# Background:

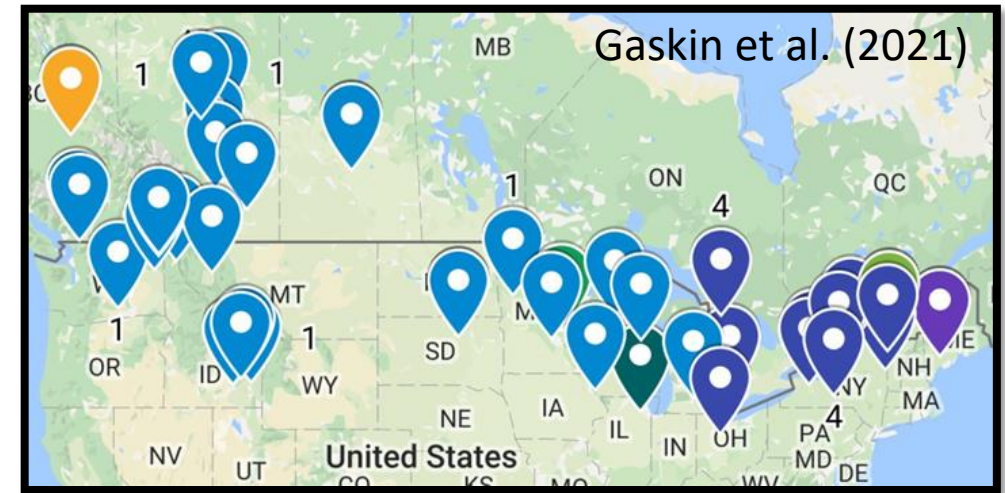
- Multiple genotypes in one of two cytotypes

Cytotype	Genotype
Triploid	G1
Diploid	G2, G3, G4, G5

- To date, the majority of research focused on
  - Ecological characteristics of diploid vs. triploid
  - Management of triploid plants

## Unknown Factors

- Successful establishment and spread of diploid vs. triploid plants
- Dynamics of spread (i.e. propagule production and viability)
- Management approaches to effectively and selectively control both cytotypes



Diversity and origins of *Butomus umbellatus* (flowering rush) invasion in North America

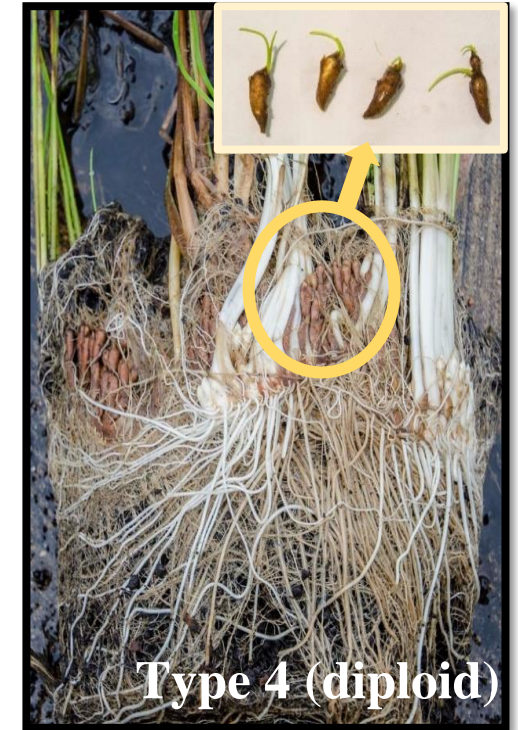
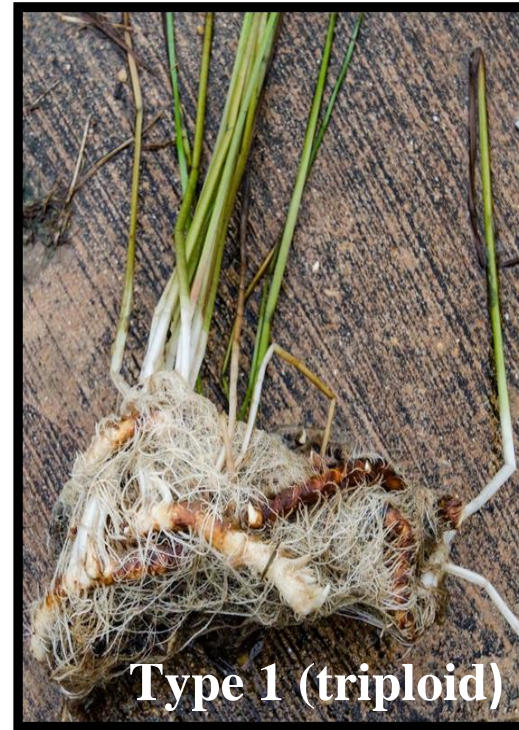
John F. Gaskin<sup>a,\*</sup>, Jennifer Andreas<sup>b</sup>, Brenda J. Grewell<sup>c</sup>, Patrick Haefliger<sup>d</sup>, Nathan E. Harms<sup>e</sup>

# Purpose:

- SON #1437 & 1471: CE Districts LRB & NWW
- Define the factors leading to the successful establishment and spread of cytotype and/or distinct genotype of flowering rush (e.g. propagule buoyancy, water depth, light, temperature, etc.)
- Determine whether each cytotype and/or distinct genotype will show a differential response to management



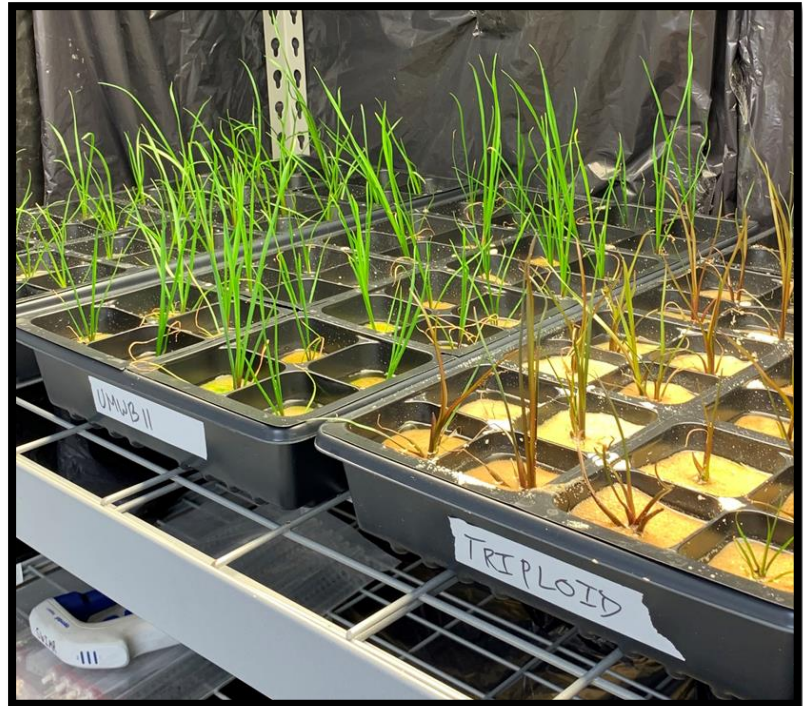
Recent infestation in Omaha, NE and evidence for importance of bulbils





# Research In Progress

- Spread-spatial dynamics and herbicide trial
- Shade and cold stratification impacts on propagule sprouting
- Growth response under different temperature regimes
- Herbicide screening trials
- Development of field verification trial



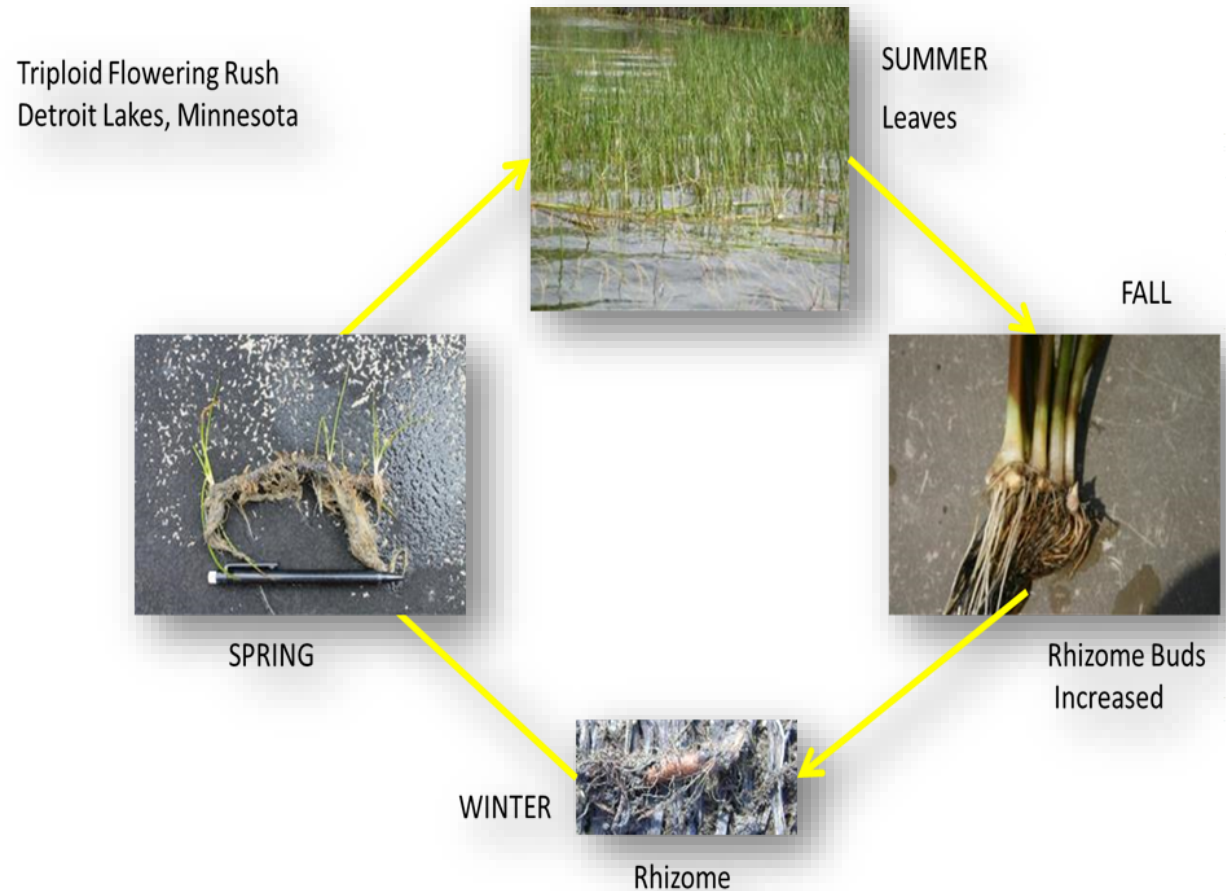


# Phenology-study of cyclic and seasonal natural phenomena, especially in relation to plant and animal life.

(i.e. the life history, seasonal growth, and carbohydrate storage patterns of target aquatic weeds)

## Why is it important to flowering rush management?

- Identify significant life history stages or structures to target for management
- Identify low points or dynamics in starch storage to facilitate management
- Ideally, collect data from sites spanning a large area



## Leveraging Opportunity?

Figure courtesy of Dr. John Madsen



# Phenology of Diploid Flowering Rush

- In 2020-2021, established three study sites:
  - Mentor Marsh in Lake Erie (Mentor, OH)
  - Tonawanda WMA (NY)
  - Unity Island (Buffalo, NY)
- Contract with MNSU- Mankato for
  - Biomass/ starch analyses
  - Supporting a M.S. Student- Max Gebhart
- Data collection May - November 2021
- Repeat data collection from May through November 2022



# How phenological “weak points” can maximize control

Control



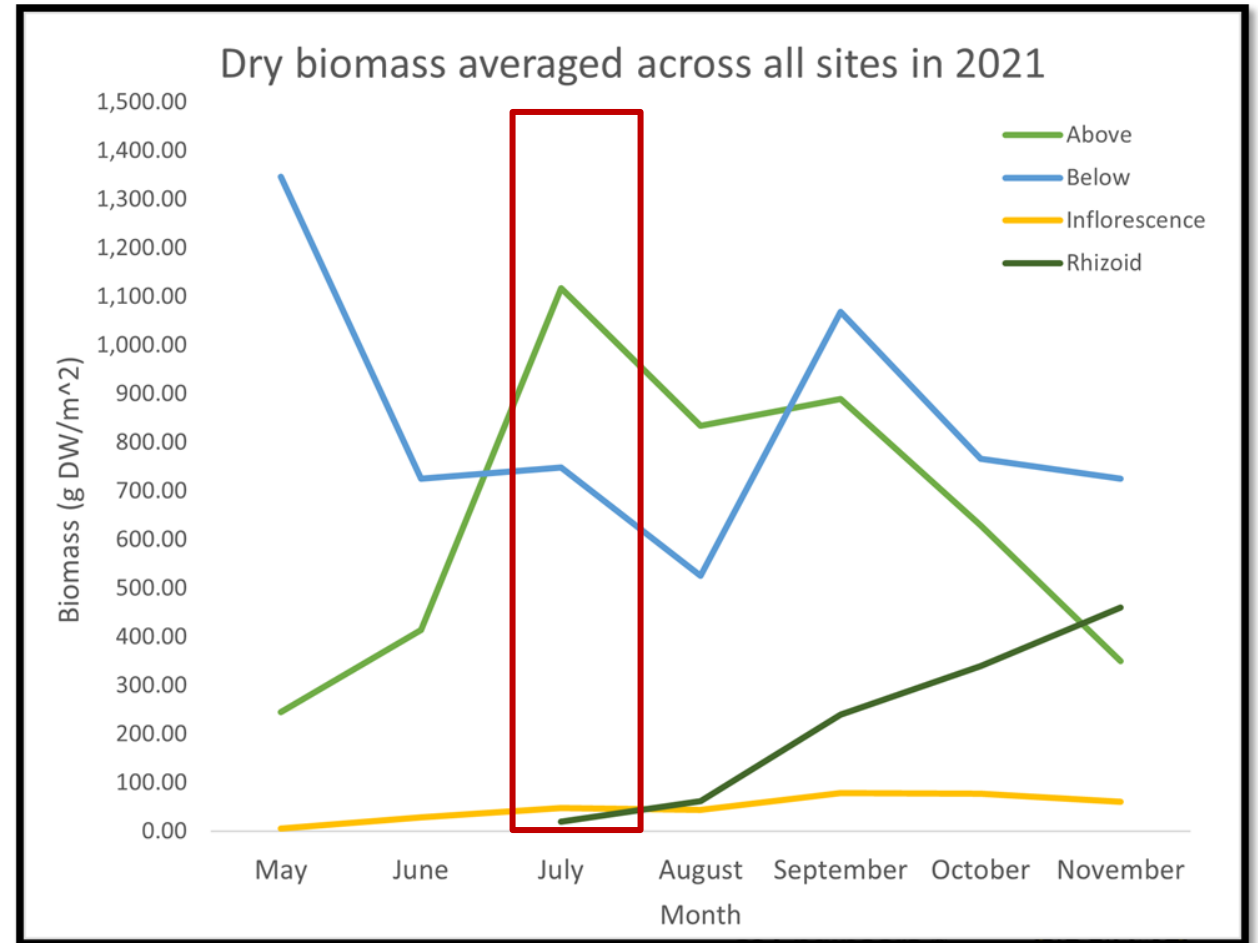
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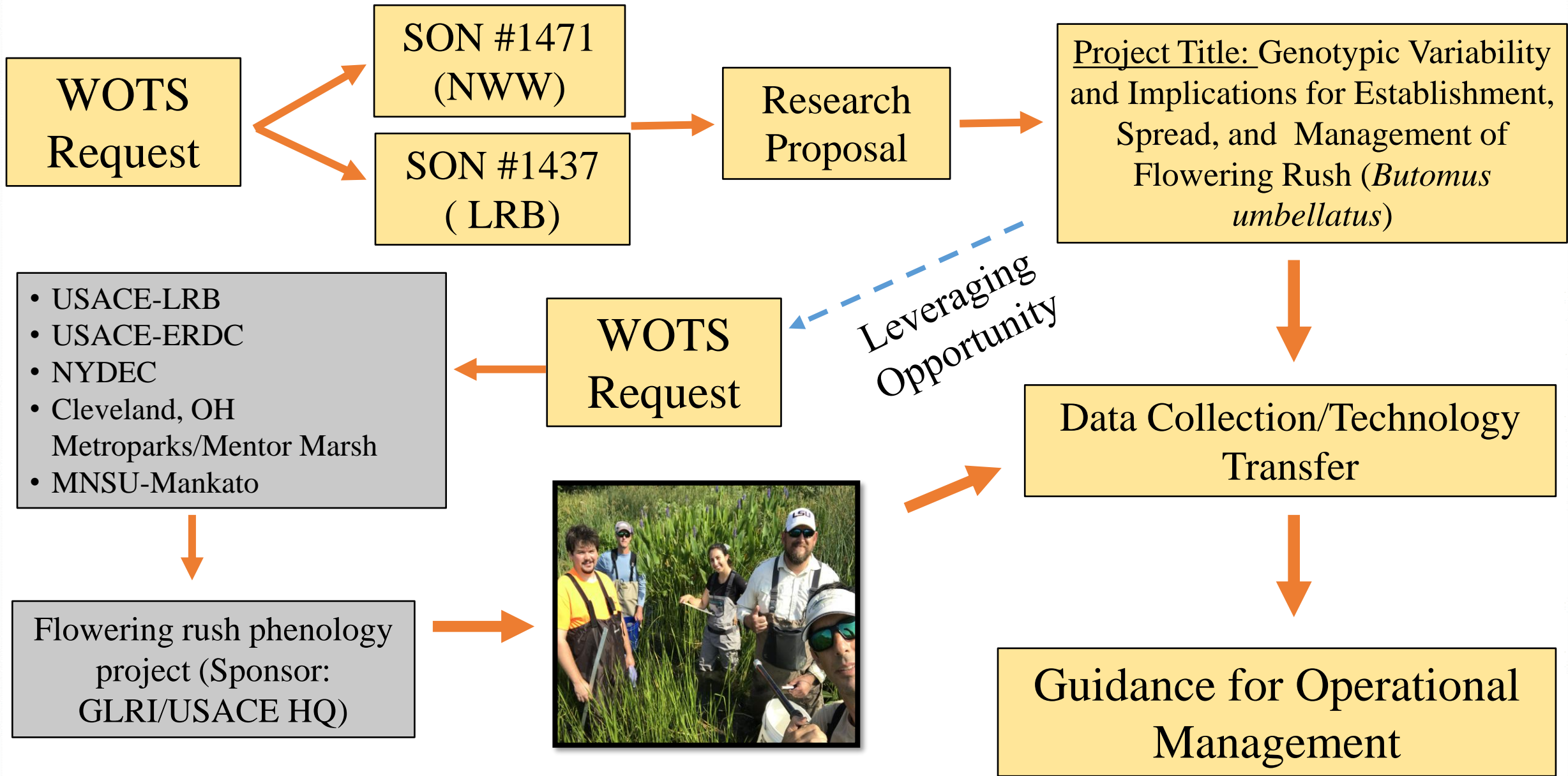
1 WAT

3 WAT

7 WAT







# APMT Recent Civil Reimbursable Research

## USACE-SAJ

- Application systems for floating plant control
- Evaluation of mechanical harvesting for water hyacinth control & nutrient mitigation in Lake Okeechobee, FL

## USACE-SAM

- Novel application techniques for hydrilla control in flowing systems

## USACE-NWW

- Herbicide demonstrations to control submersed flowering rush in the Columbia River Basin

## FL Fish and Wildlife Conservation Commission (FWC)

- Improving efficiency in APM operations
- New herbicide use pattern development for APM and invasive wetland species

## LA Department of Wildlife Fisheries (LDWFP)

- Herbicide screenings on invasive nuisance plants

## Private Industry and Non-profit Organizations

- Develop and evaluate products for use



# Questions?



## Contact Information:

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