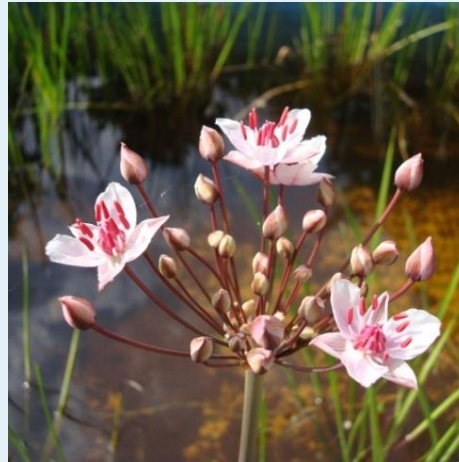


# Biocontrol Efforts on Flowering Rush



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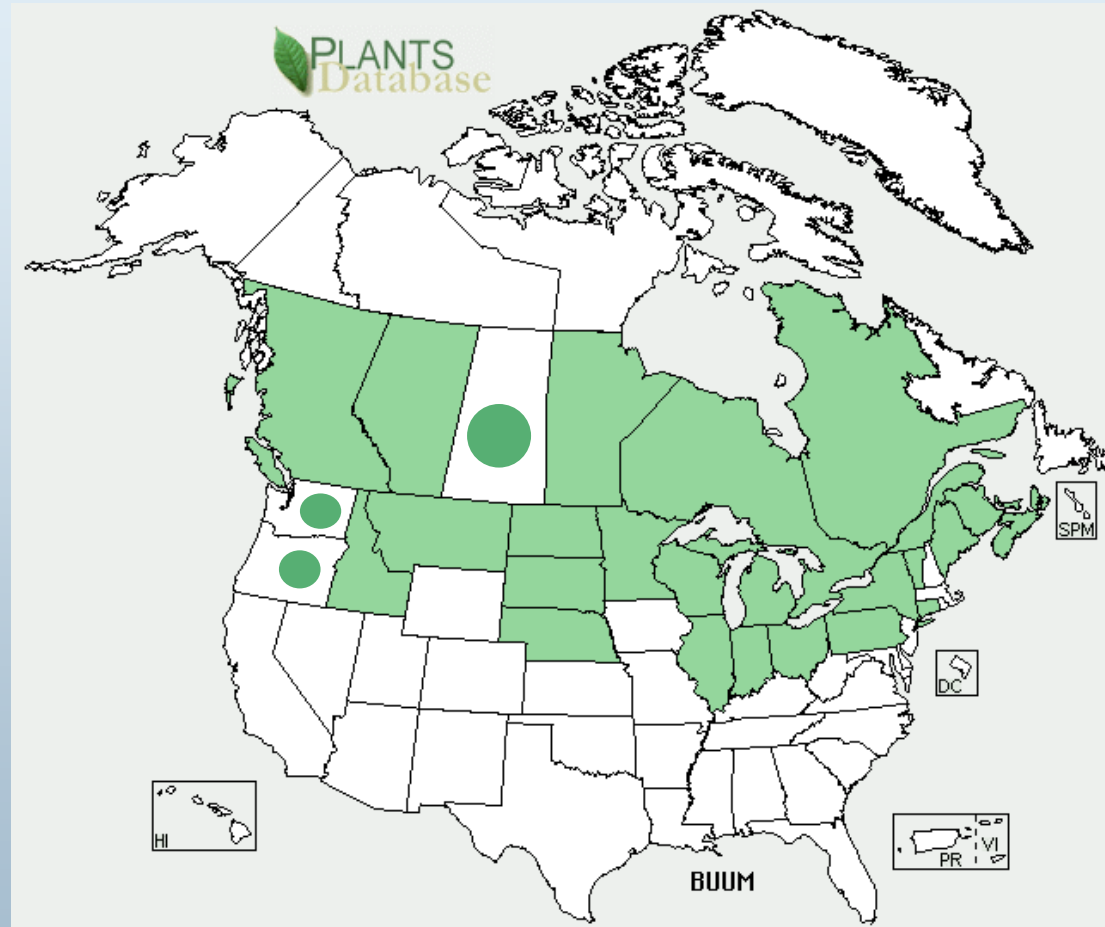
# *Butomus umbellatus*

- Fresh water aquatic invasive species
- Emergent & submerged growth forms
- Colonizes wetlands, slow-moving rivers, canals & irrigation ditches
- Diploid & triploid cytotypes
- Disperses through rhizome fragments & rhizome buds

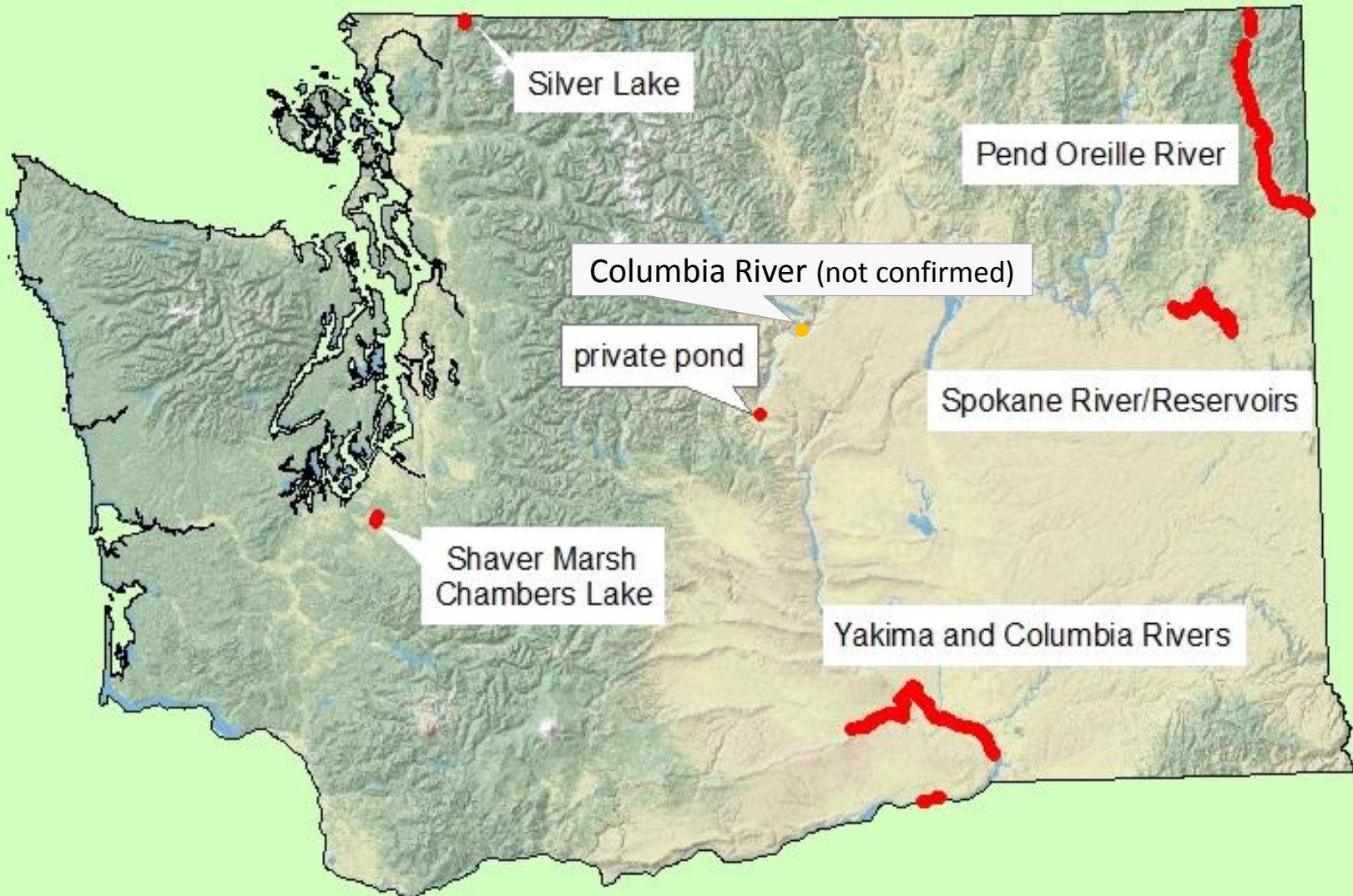


# Flowering Rush Distribution

- Found in North American temperate zone
- In PNW found in
  - ID, MT, OR, WA
  - AB, B.C., SK
- Early Detection – Rapid Response species



# Flowering Rush known locations 2014

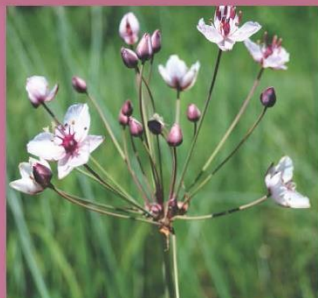


# Early Detection Through Education

## Have you seen this invasive plant?

**Flowering rush** is a freshwater plant that can rapidly colonize wetlands, shorelines, slow-moving rivers, and canals.

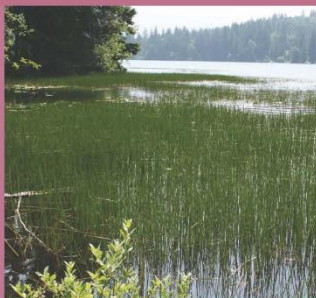
Learn more at [www.nwcb.wa.gov](http://www.nwcb.wa.gov)



The flower stalk can grow up to 3 feet above the water and bears a single cluster of white to pink flowers, each with 3 petals and 3 sepals. Not all plants flower, though, so it's important to recognize the leaves, too.



Emergent leaves are fleshy, 3-sided at the base and then flatten out towards the tip. They have a distinctive, slow spiral or twist.



Flowering rush can be found as scattered plants growing among other wetland vegetation or in dense stands such as this one. Leaves can grow above the water's surface or can be completely submerged.

- Developed simple, user-friendly educational material to reach a broad audience
- English & Spanish

### Why is flowering rush (*Butomus umbellatus*) a noxious weed?

- Flowering rush forms dense stands in previously unvegetated areas, which can reduce swimming, fishing, and boating. It can rapidly disperse and colonize new areas through rhizome fragments and rhizome buds.

### Where do you find flowering rush?

- Flowering rush grows along freshwater shorelines and riverbanks, and in standing water. It can also be found in irrigation canals and ditches.
- Its distribution in Washington is still limited, though it is already a serious problem in parts of Montana.

### What can you do?

- Learn to correctly identify this invasive plant.
- Please note that it is a Class A noxious weed and a prohibited plant that cannot be bought or sold in WA.
- Our goal is to treat current populations and prevent new ones. Please help us by reporting any sightings to your county noxious weed control board or to [noxiousweeds@agr.wa.gov](mailto:noxiousweeds@agr.wa.gov).



WASHINGTON STATE UNIVERSITY  
EXTENSION



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## ¿Ha visto esta planta invasora?

La **juncos florido** (flowering rush en Inglés) (*Butomus umbellatus*) es una planta de agua dulce que puede colonizar rápidamente pantanos, orillas de acuíferos, ríos de caudal lento, y canales.

Para aprender más vislte: [www.nwcb.wa.gov](http://www.nwcb.wa.gov)



El pedúnculo o ramita que sostiene las flores puede crecer hasta 3 pies por encima del nivel del agua y produce un solo racimo de flores de color blanco a rosado, cada una con tres pétalos y tres sépalos. No todas las plantas florecen, por lo que, es importante el reconocer las hojas también.



Las hojas emergentes son carnosas, triangulares en la base y planas hacia las puntas. Tienen una leve torcedura espiral distintiva.



Las juncos florido pueden encontrarse disperso entre la vegetación en pantanos o áreas densas como estos. Las hojas pueden crecer por encima de la superficie del agua o pueden estar completamente sumergidas.

# Flowering Rush Control

- Herbicide
- Covering
- Hand-pulling, digging, diver assisted suction
- Mechanical



# Flowering Rush Biocontrol Consortium

- Difficult to control
- Only species in Butomaceae family
  - increases likelihood for a host-specific biocontrol agent
- Biocontrol may provide long-term solution
  - rhizome-feeder needed for maximum impact
- Consortium formed in 2012
  - partnership between CABI Switzerland, WA, MT, ID, B.C., AB, MN, MS, OR
- CABI
  - international not-for-profit organization
  - experts in biocontrol research & development
- Pursue funding sources

# Project Funding

- Funding 2013-2015: \$262,000 U.S.
- Funding sources
  - Montana Noxious Weed Trust Fund
  - Washington Department of Agriculture
  - Washington Department of Ecology
  - Washington Department of Natural Resources
  - U.S. Army Corps of Engineers (Mississippi)
  - British Columbia - Ministry of Forest, Lands & Natural Resources Operations (FLNRO)
  - U.S. Bureau of Land Management – Montana
  - Kalispel Tribe

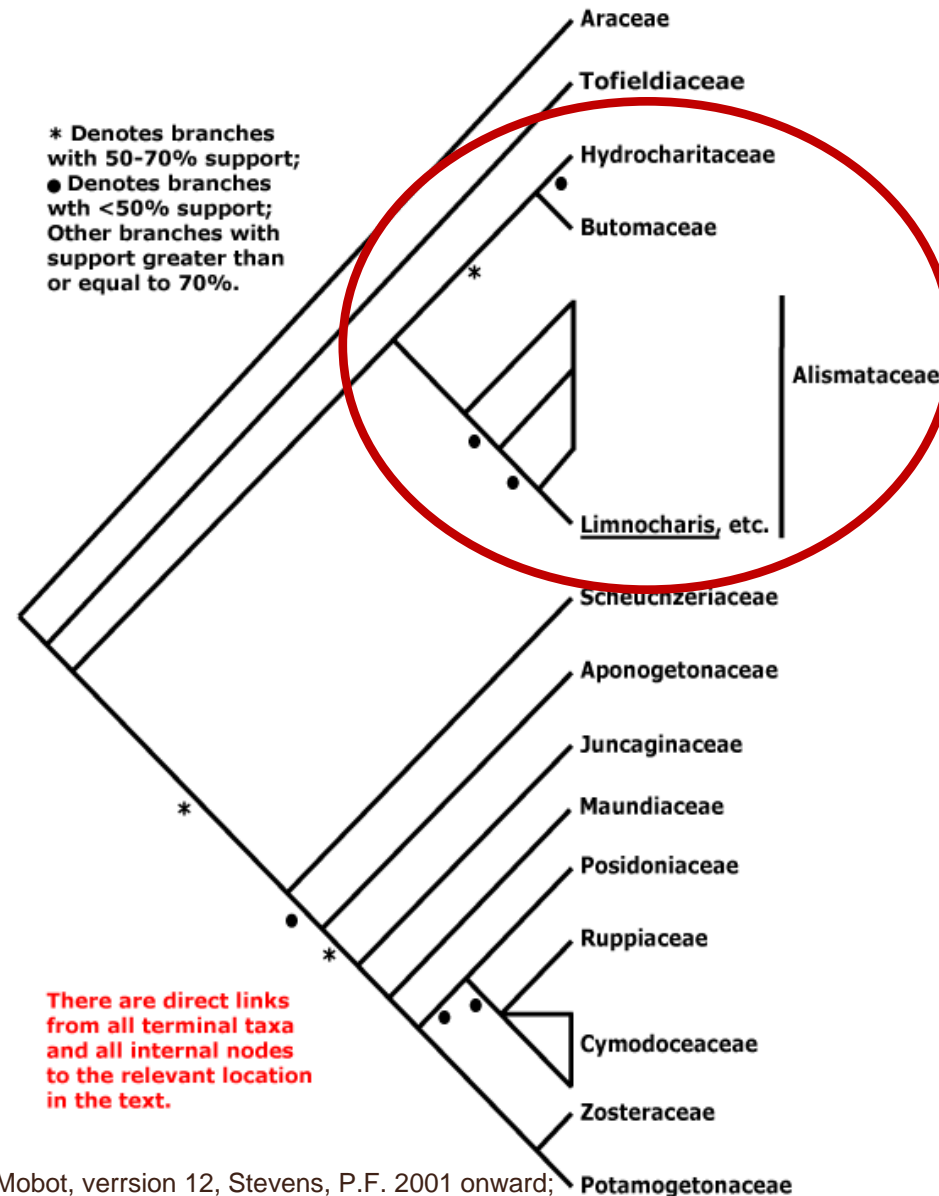


# Work Plan

- Develop a test plant list for host-specificity testing
  - ensure potential biocontrol agents only attack flowering rush
- Assess & compare ploidy cytotypes between North America & Europe
  - ensure potential biocontrol agents attack North American flowering rush
- Overseas research & development – CABI Switzerland
  - conduct literature & field surveys to find potential agents
  - conduct host-specificity tests
  - conduct impact studies to assess potential attack rates

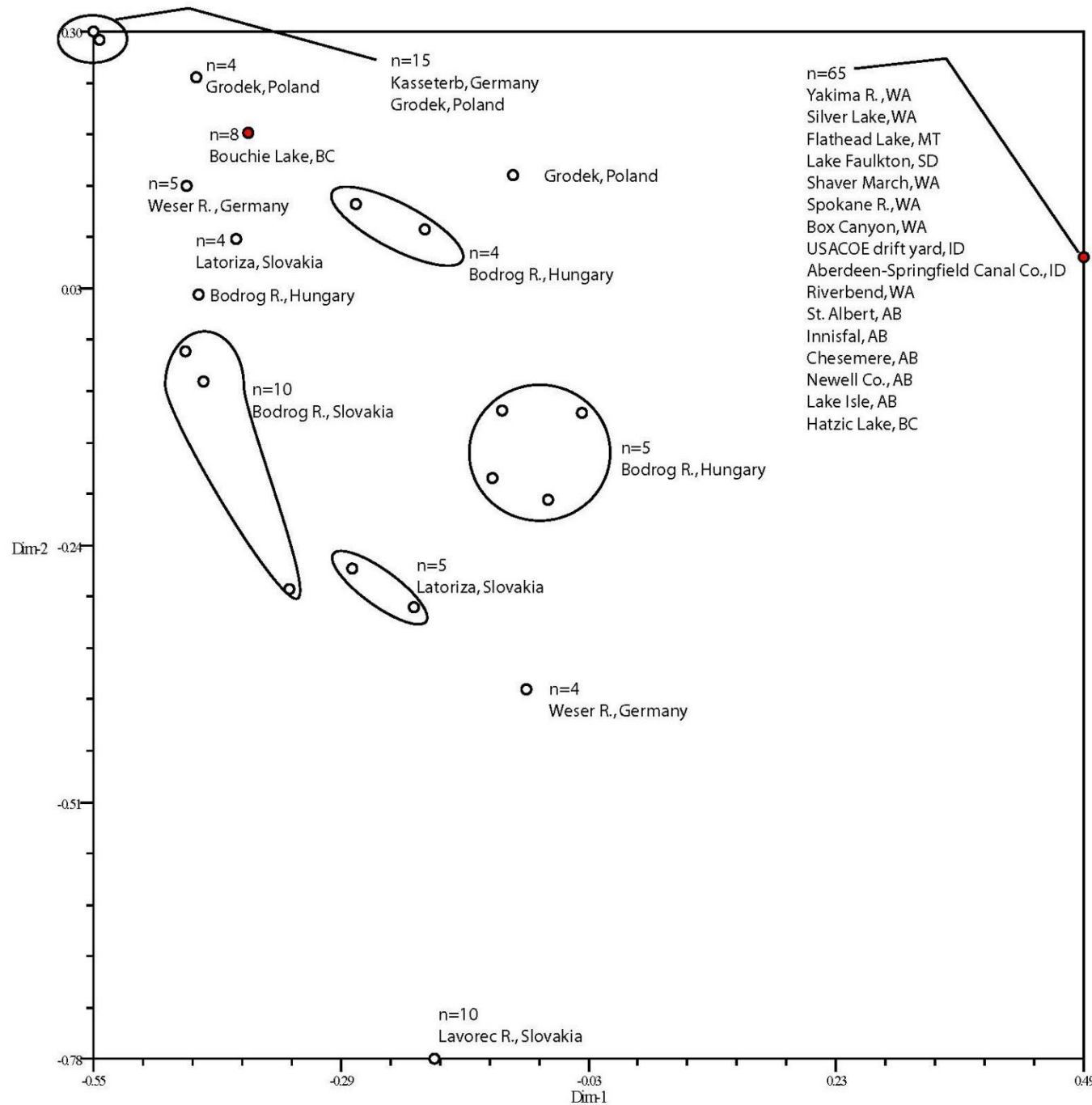
# Test Plant List

- 47 test plant species
  - primarily from 3 closely related families
- 27 species collected
- Collect & ship test plants to Switzerland



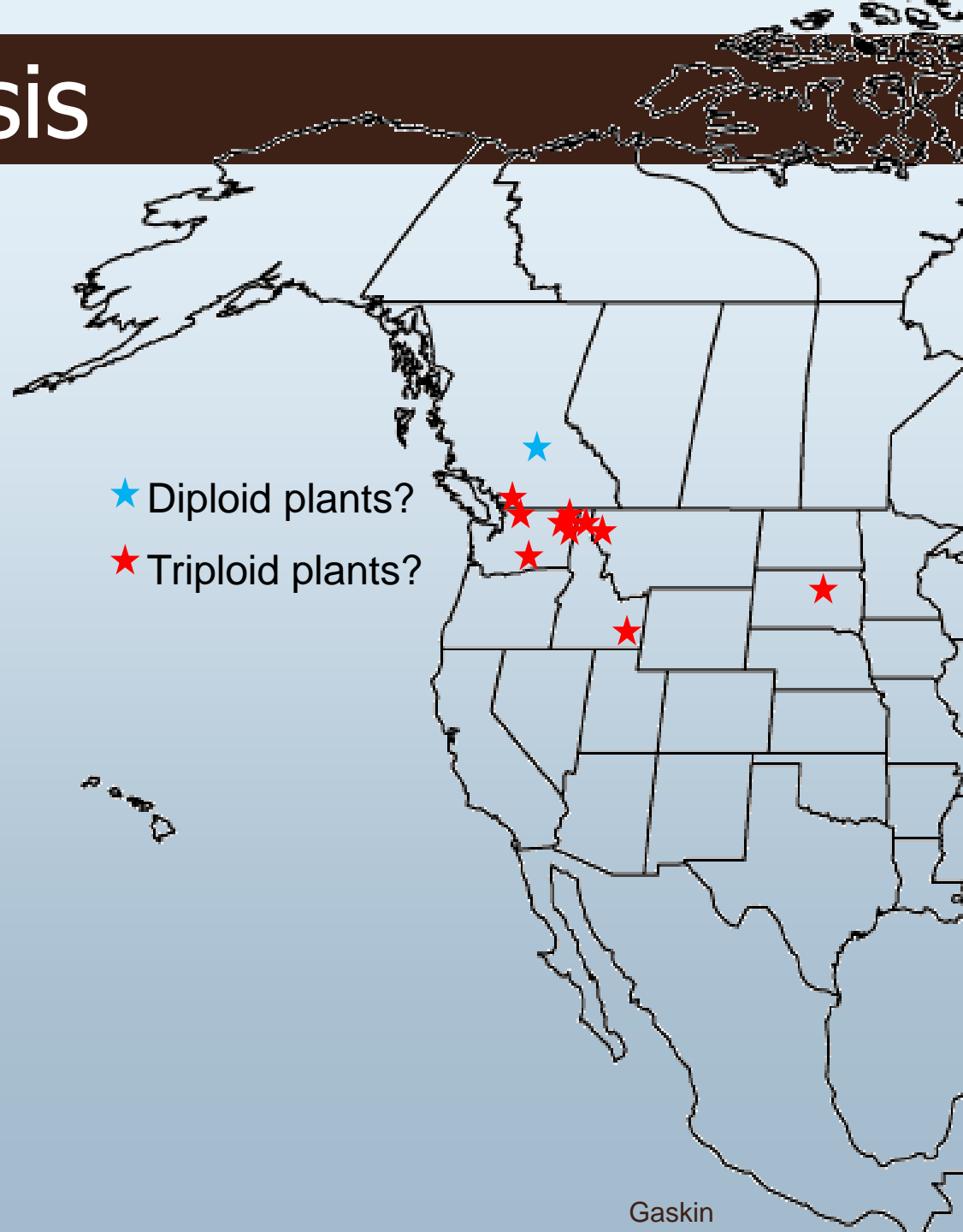
# Genetics

- Collect plant material for genetic analysis
- All samples in NA same genotype except Bouchie Lake B.C.
- EU samples differ from NA



# Ploidy Analysis

- Most populations in NA likely triploid
- Confirmation of ploidy to be determined in 2015
- Additional samples needed, particularly from eastern NA

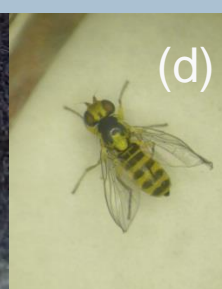
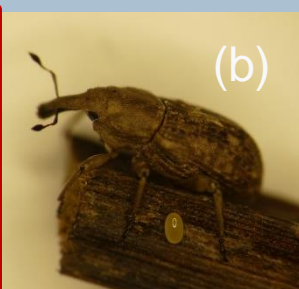


# CABI Overseas Field Surveys

- sites visited in Germany, Czech Republic, Slovak Republic, Hungary, Serbia, Poland, Switzerland

<i>Bagous nodulosus</i> (a)	weevil	monophagous
<i>Bagous validus</i> (b)	weevil	monophagous
<i>Donacia tomentosa</i> (c)	leaf beetle	monophagous
<i>Phytoliriomyza ornata</i> (d)	agromyzid fly	monophagous
<i>Hydrellia concolor?</i> (e)	ephydrid fly	monophagous
<i>Glyptotendipes viridis?</i> (f)	chironomid fly	monophagous

ID of some insects still needs confirmation



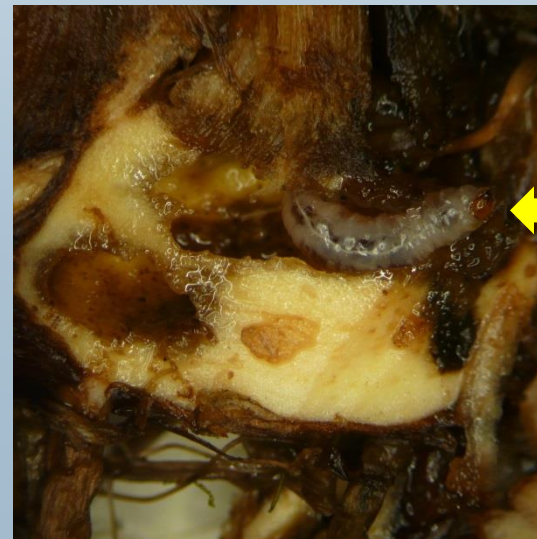
# *Bagous nodulosus*

- Typical adult feeding damage facilitates confirming presence at field sites
- Larvae develop in leaves & rhizomes
- Began preliminary host-specificity tests in 2014 & 2015



# Preliminary Results – *B. nodulosus*

- Developing rearing protocol
- Initial host-specificity tests are positive
  - no-choice oviposition (egg-laying) tests
  - 22 test plant species; eggs only laid on flowering rush
- Impact study conducted in 2015



*Bagous nodulosus* larva mining flowering rush rhizome

# *Bagous validus*

- Found in South Slovakia in 2015
- Little known about this weevil
- Confirmed weevil attacks flowering rush rhizomes
- Currently developing rearing protocol



*Bagous validus* larva mining flowering rush rhizome





# Future Plans

- Continue research & development activities
- Finalize flowering rush genetic & ploidy analysis
- Pursue additional funding



## **For More Information:**

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# Project Partners

Jenifer Parsons – WA Department of Ecology  
Peter Rice – University of Montana  
Greg Haubrich – WA State Department of Agriculture  
Harriet Hinz & Patrick Häfliger – CABI  
Al Cofrancesco – Army Corps of Engineers  
John Gaskin – USDA ARS NPARL  
Susan Turner – B.C. Ministry of FLNRO  
Ken Merrill – Kalispel Tribe



# Hand Pulling/Digging



- ❑ Must get all rhizomes and rhizome buds
- ❑ Successful if persistent – must dig multiple times/growing season
- ❑ Normally get 30-60% regrowth
- ❑ Use divers for deeper plants

# Covering



- ▣ Idaho study found -  
Need to leave in place multiple years
- ▣ Appropriate for small to medium-size patches
- ▣ Must anchor the material
- ▣ Use landscape fabric, rubber, dense natural fibers



← 3 years of cover, it's still growing!

# Mechanical

- ▣ Can temporarily clear irrigation canals
- ▣ Can increase spread - depending on method used



# Herbicides

## Dry Ground Treatments

### Lk Pend Oreille, ID

- Pre-emergent
- Used
  - Fluridone
  - Imazamox
  - Imazapyr
  - Triclopyr
  - Acetic acid
- No significant reduction

### Flathead Lk, MT

- Post emergence, pre-water return
- Good control with imazapyr



# Herbicides

## Emergent Growth

- ▣ Trials in WA, MN, MT, by SePro
- ▣ Need > 2 ft of leaf above water
- ▣ 50-75% control with
  - Imazapyr - best
  - Glyphosate



# Herbicides

## Submersed plants

### Contact herbicides

- ▣ Diquat – significant reduction in leaf and rhizome biomass in WA and MN field trials
- ▣ Endothall – mixed results
- ▣ Flumioxazin – mixed results





# Herbicides

## Submersed Plants

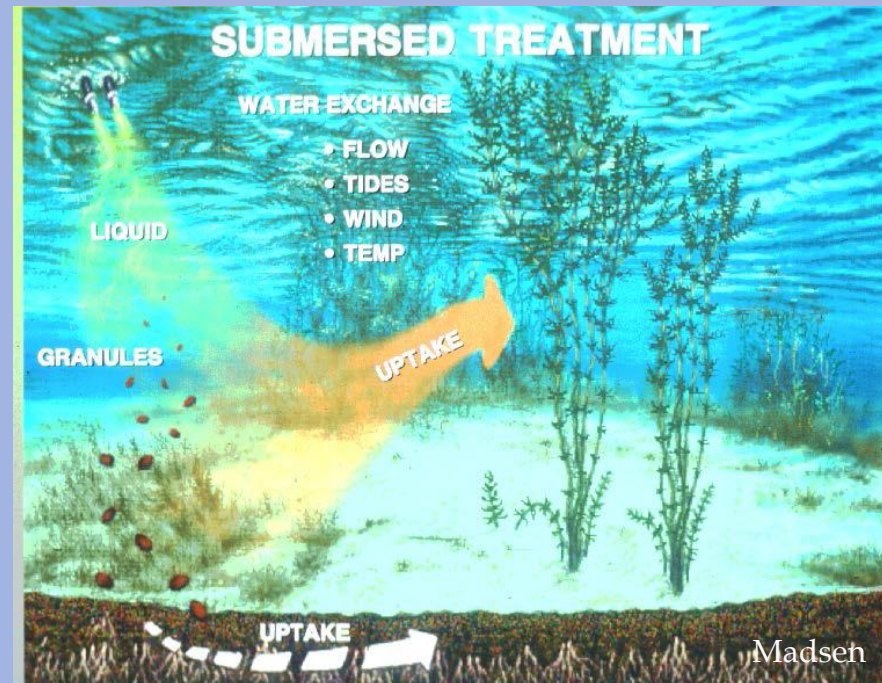
### Systemic

- ▣ 2,4-D/triclopyr mixed – 70% reduction in WI, nothing in WA field trials
- ▣ 2,4-D/endothall good initial results in MT
- ▣ Imazamox – mixed results

**Contact Time** is a problem



Baldwin



Madsen