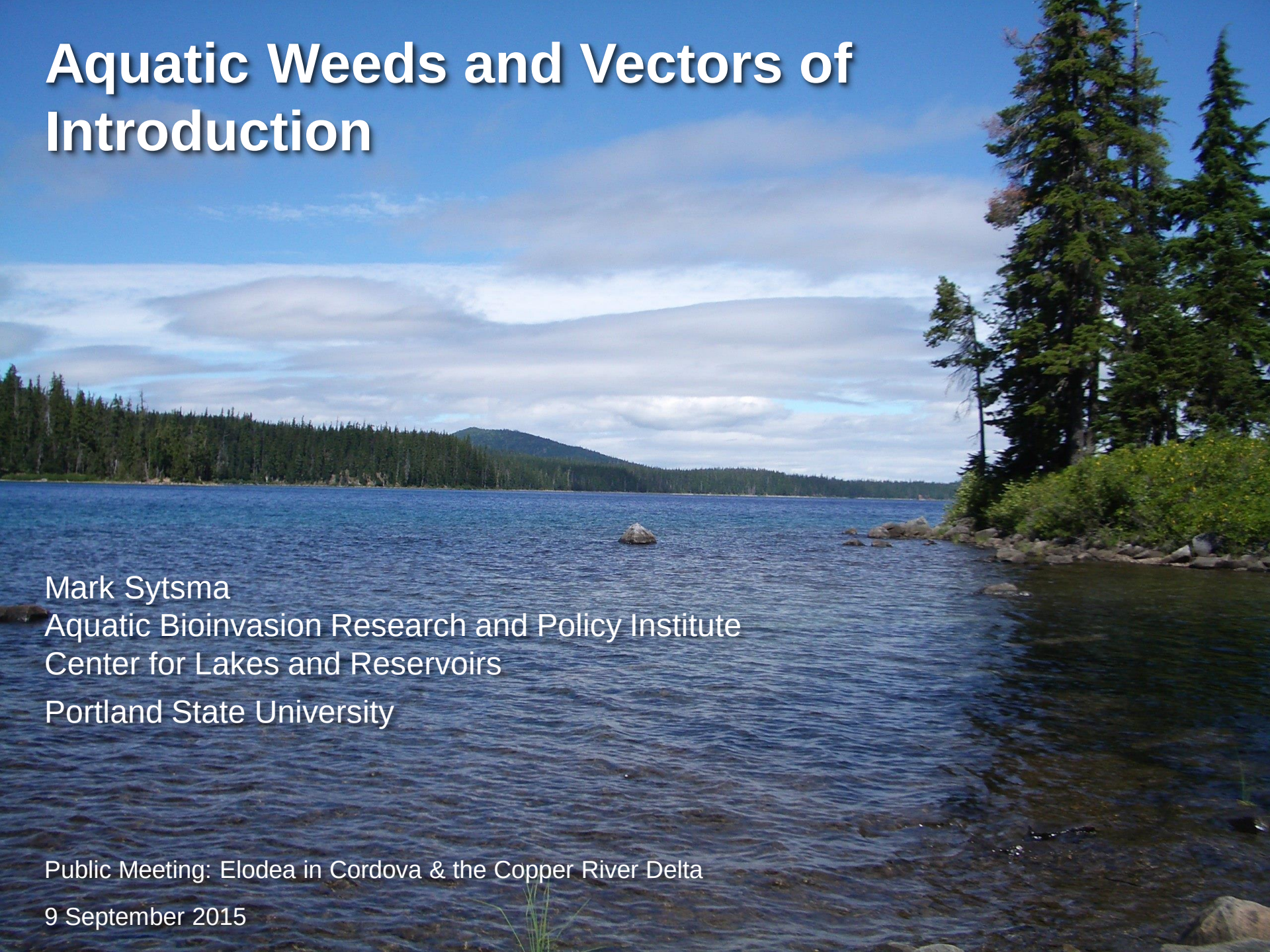
Aquatic Weeds and Vectors of Introduction

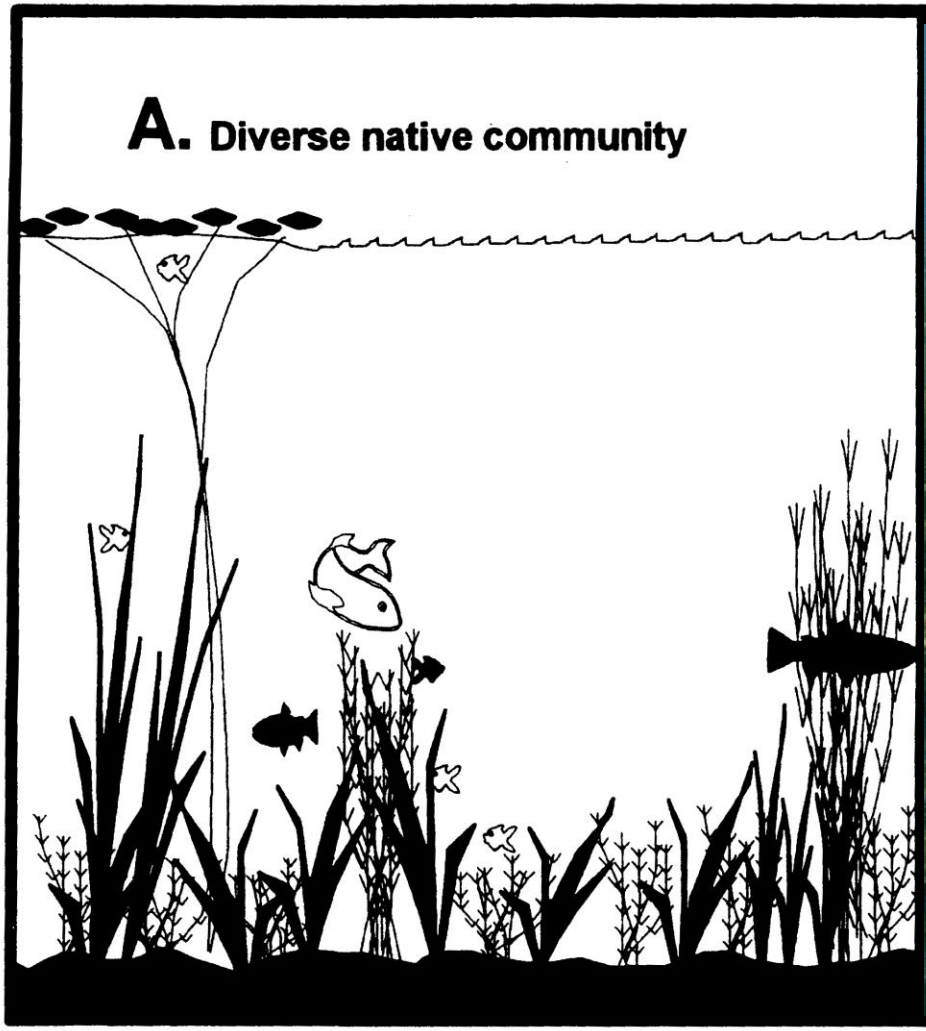


Mark Sytsma
Aquatic Bioinvasion Research and Policy Institute
Center for Lakes and Reservoirs
Portland State University

Public Meeting: Elodea in Cordova & the Copper River Delta

9 September 2015

Impacts
Invasion Process
Vectors of Introduction
Weeds to Watch For



Open water surface

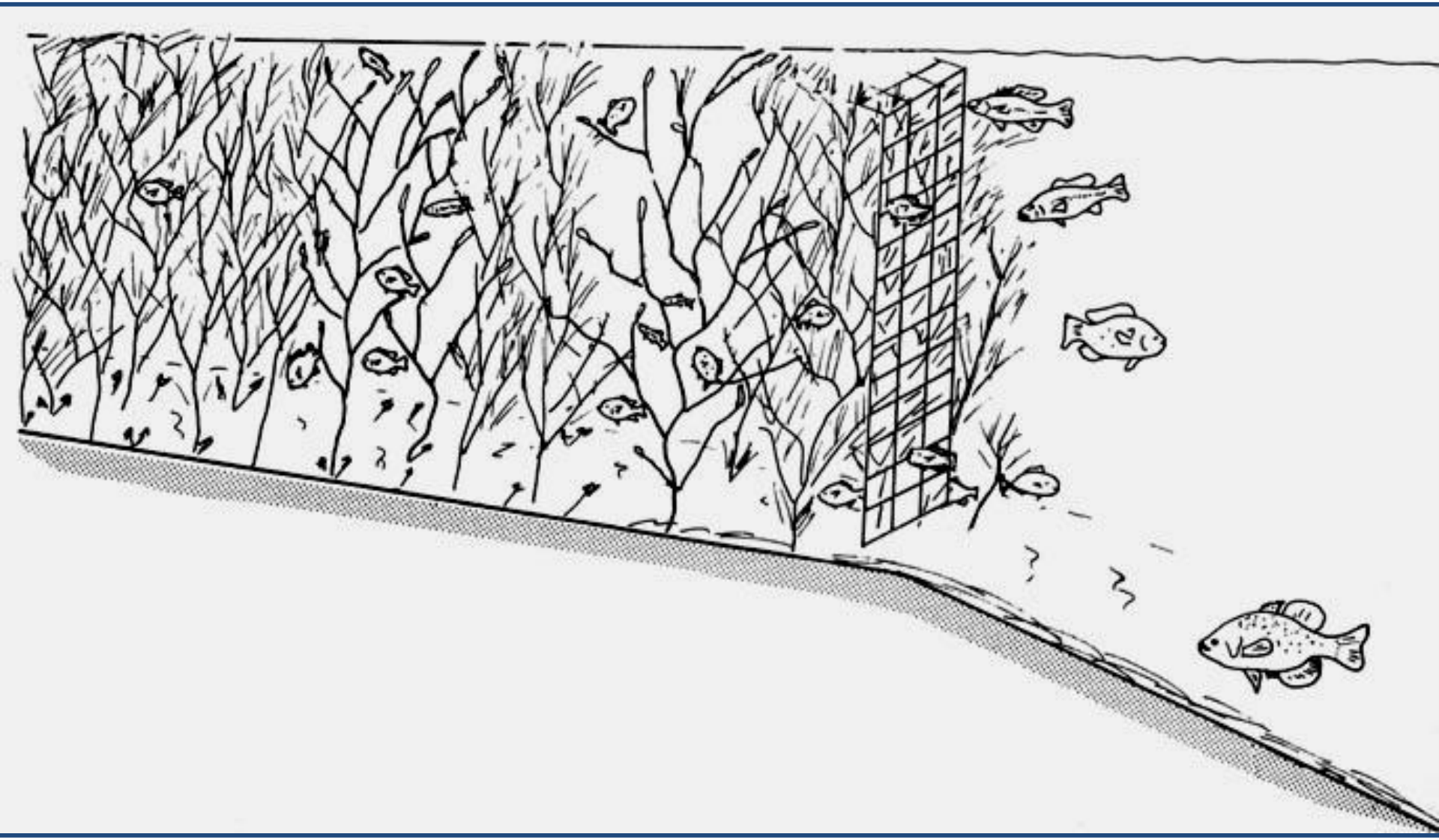
Patchy vegetation = habitat for invertebrates (fish food)

Good dissolved oxygen concentration and pH

Surface mats impact recreation/boating/taxiing

Large temperature, dissolved oxygen, and pH fluctuations

Stunted fish



Ecosystem Services Provided or Derived from FW Aquatic Systems

- Provisioning
  - Food
  - Freshwater
  - Fiber and fuel
  - Biochemical
  - Genetic materials
  - Biodiversity
- Regulating
  - Climate regulation
  - Hydrologic flows
  - Pollution control and detoxification
  - Erosion
  - Natural hazards
- Cultural
  - Spiritual and inspirational
  - Recreational
  - Aesthetic
  - Educational
- Supporting
  - Nutrient cycling
  - Pollination

Source: Ecosystems and Human Well-being. Vol. 1. Current State and Trends. Millennium Ecosystem Assessment Series

Loss of Ecosystem Services Due To Aquatic Weeds

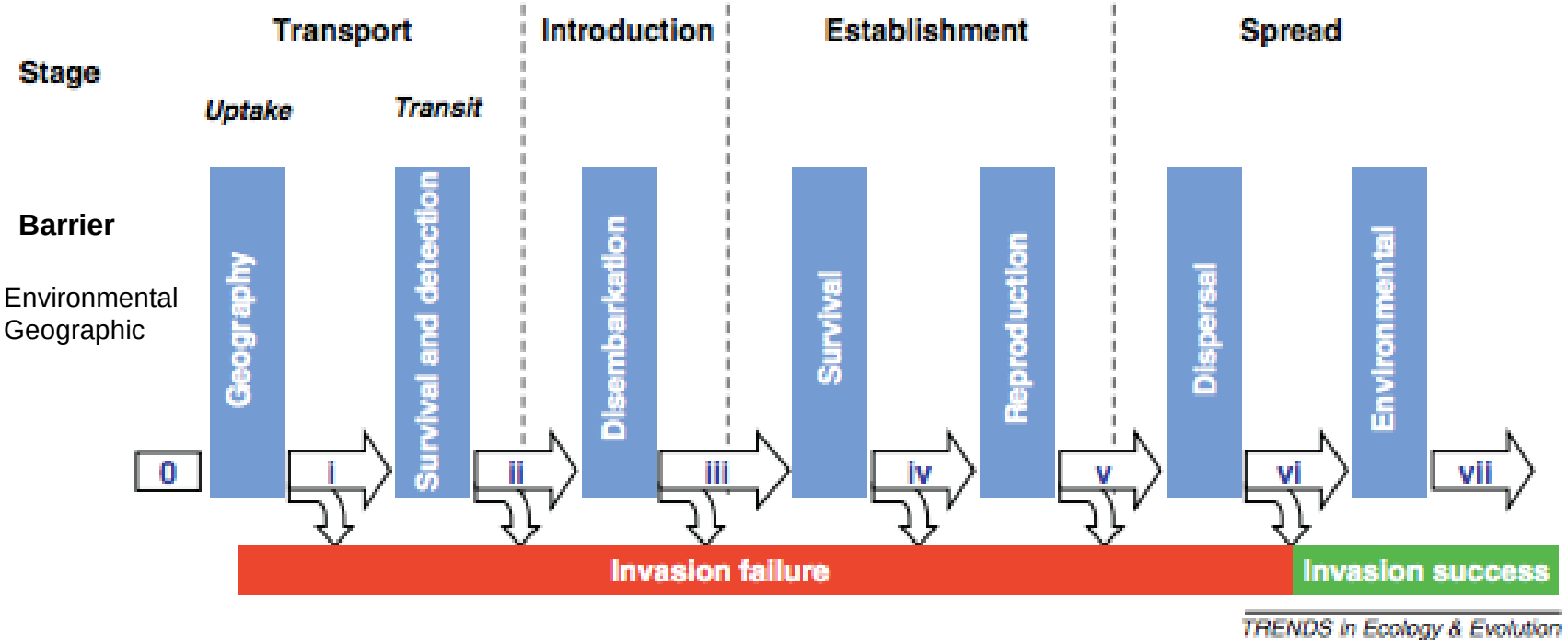
Flood Control

$1,000,000,000	11 counties in South FL	Rockwell 2003

Recreation

$1,300,000	3 lakes in IL	Singh et al. 1984
$10,000,000	2 lakes in FL	Milon et al 1986
$100,000,000	Guntersville Reservoir, AL	Henderson 1995
$45,000,000	4 lakes in Truckee watershed, CA	Eiswerth et al 2000
$84,000,000	BC (total EWM control program benefits = $450M)	Newroth and Maxnuk 1993

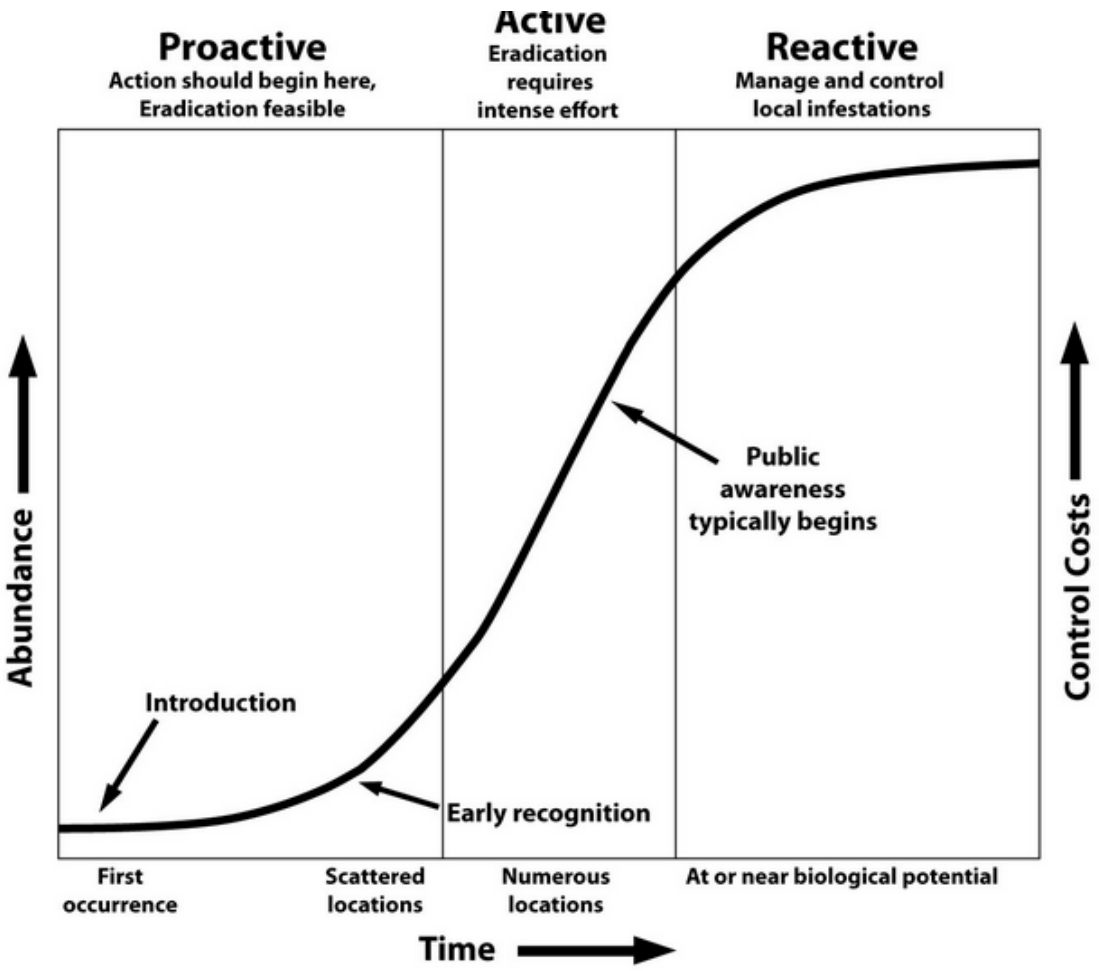
The Invasion Process



Modified from Chapple et al. 2012 TREE 27:57-63

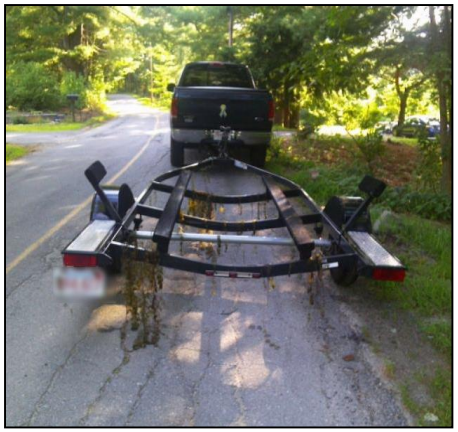
Causes of long lag periods

- Long juvenile periods delay reproduction (trees)
- Pollen limitation (spartina in Willapa Bay Washington)
- Genetic adaptation to new environment (polyploidy)
- Long-term evolution of improved competitive abilities
- Low propagule pressure results in genetic bottlenecks and lack of genetic diversity
- Changes in biotic resistance (removal of a predator)
- Shifts in abiotic environment (nutrient regime, sediment quality, climate change)



Human Vectors of Dispersal

- Ballast Water
- Live Bait
- Aquaculture
- Aquarium and Pet Trade
- Recreational Boating
- Hunting and Angling
- Intentional Release
- Horticultural escapes
- Wildlife Restoration
- **Float planes**



Human Vector Management

Floatplanes

INVASIVE AQUATIC PLANTS and FLOATPLANE OPERATIONS:
Help prevent new infestations

It is important to take steps now to prevent new introductions and to prevent the further spread of invasives that are already found in the region. Floatplane pilots can help to reduce potentially harmful infestations by learning more about aquatic invasive species, reporting them and following these simple steps:

Before entering the aircraft

Inspect/remove plants from floats, wires or cables, and water rudders.
Also, check the transom, bottom, chine, wheel wells, and float step area.
Pump water from floats.

Before takeoff

Do not taxi through heavy aquatic plant growth prior to takeoff.
Raise and lower water rudders to clear off plants, minimize cable stretch and improve steering effectiveness.

After takeoff

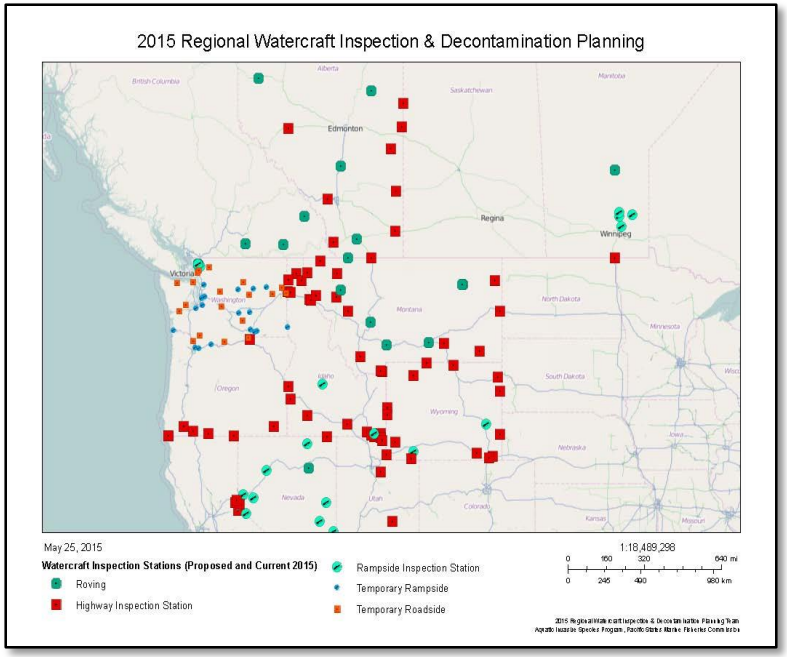
Raise/lower water rudders several times to free aquatic plant fragments while over the waters you are leaving or over land.

Human Vector Management

Ballast Water

Human Vector Management

Watercraft

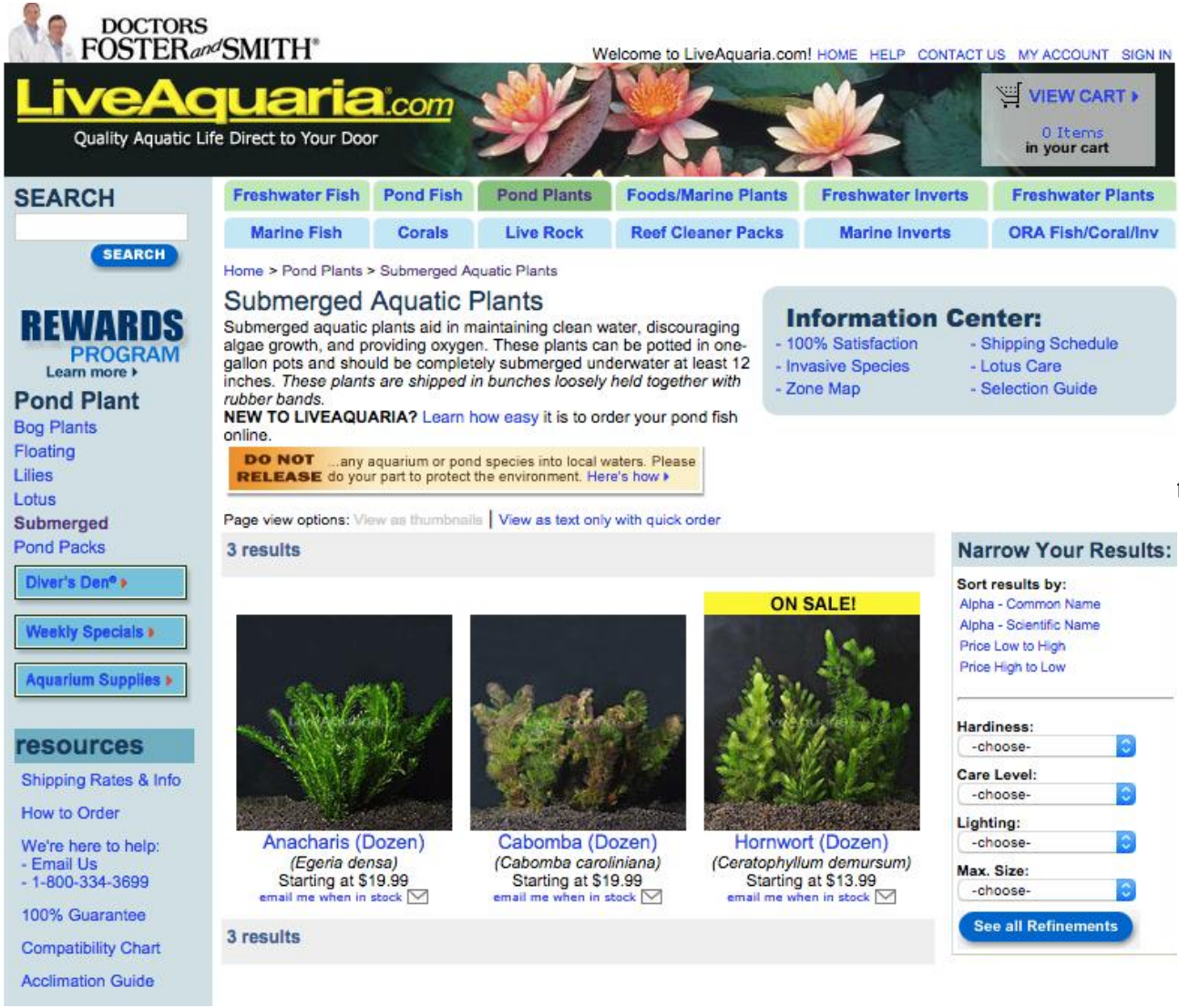


Human Vector Management

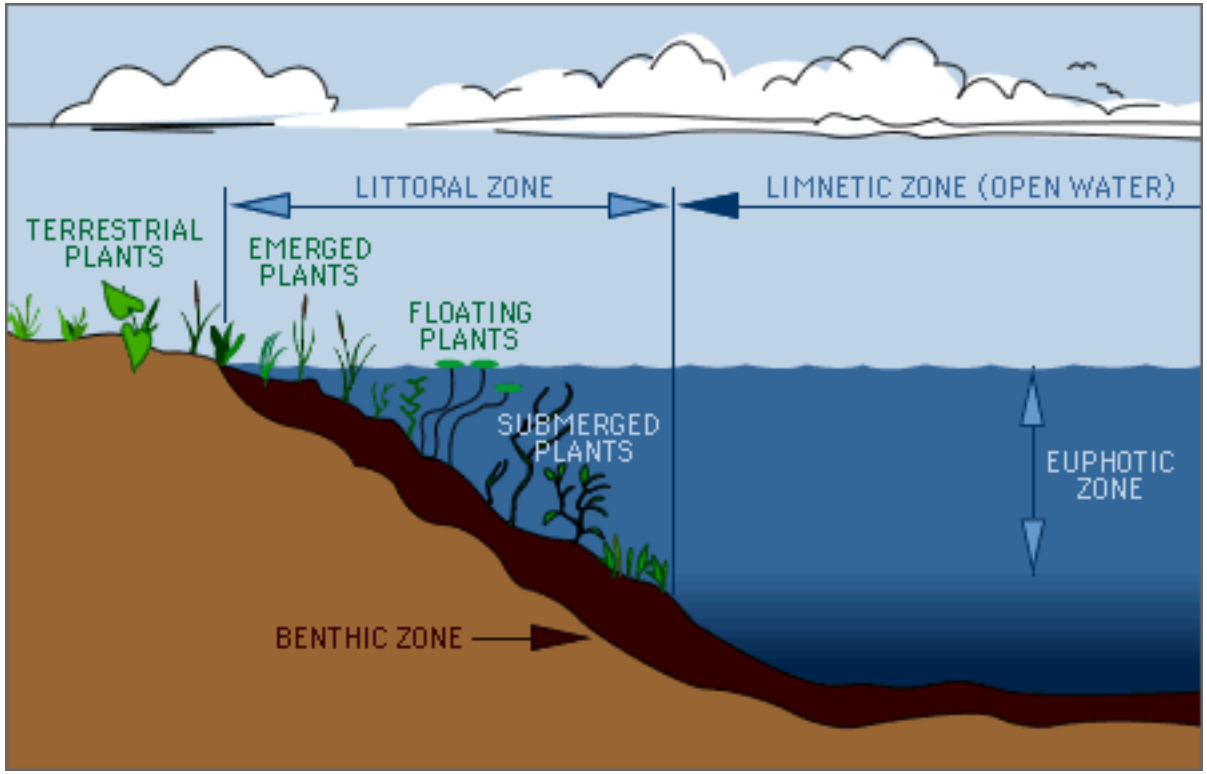
Horticultural Trade

Human Vector Management

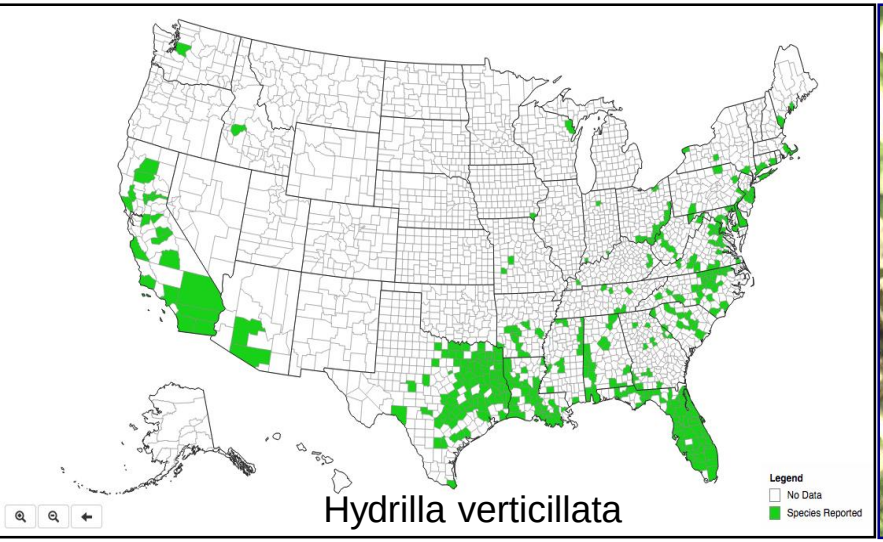
Internet



Weeds to Watch For

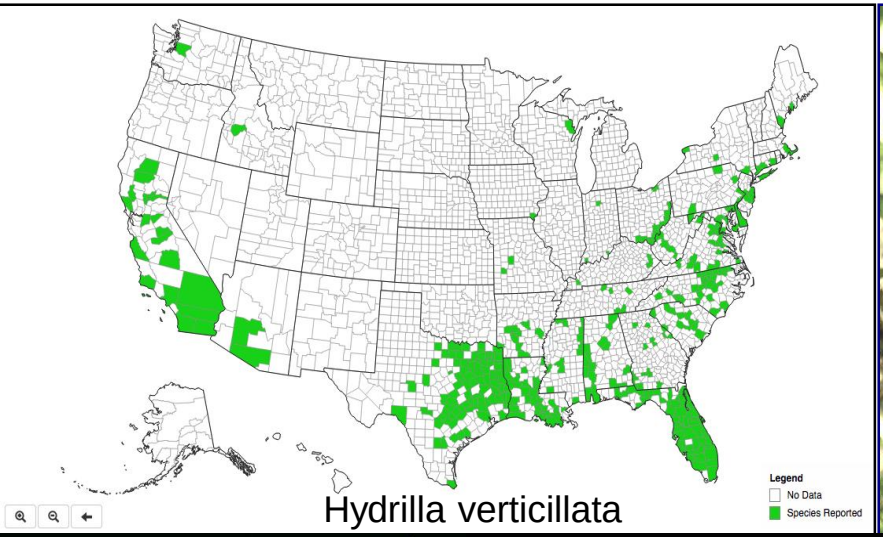


Hydrilla



Hydrilla verticillata

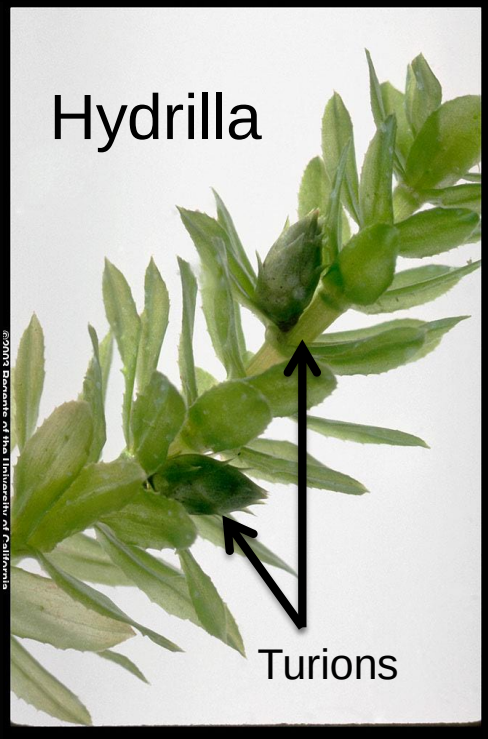
Hydrilla



Hydrilla verticillata


Elodea


Egeria

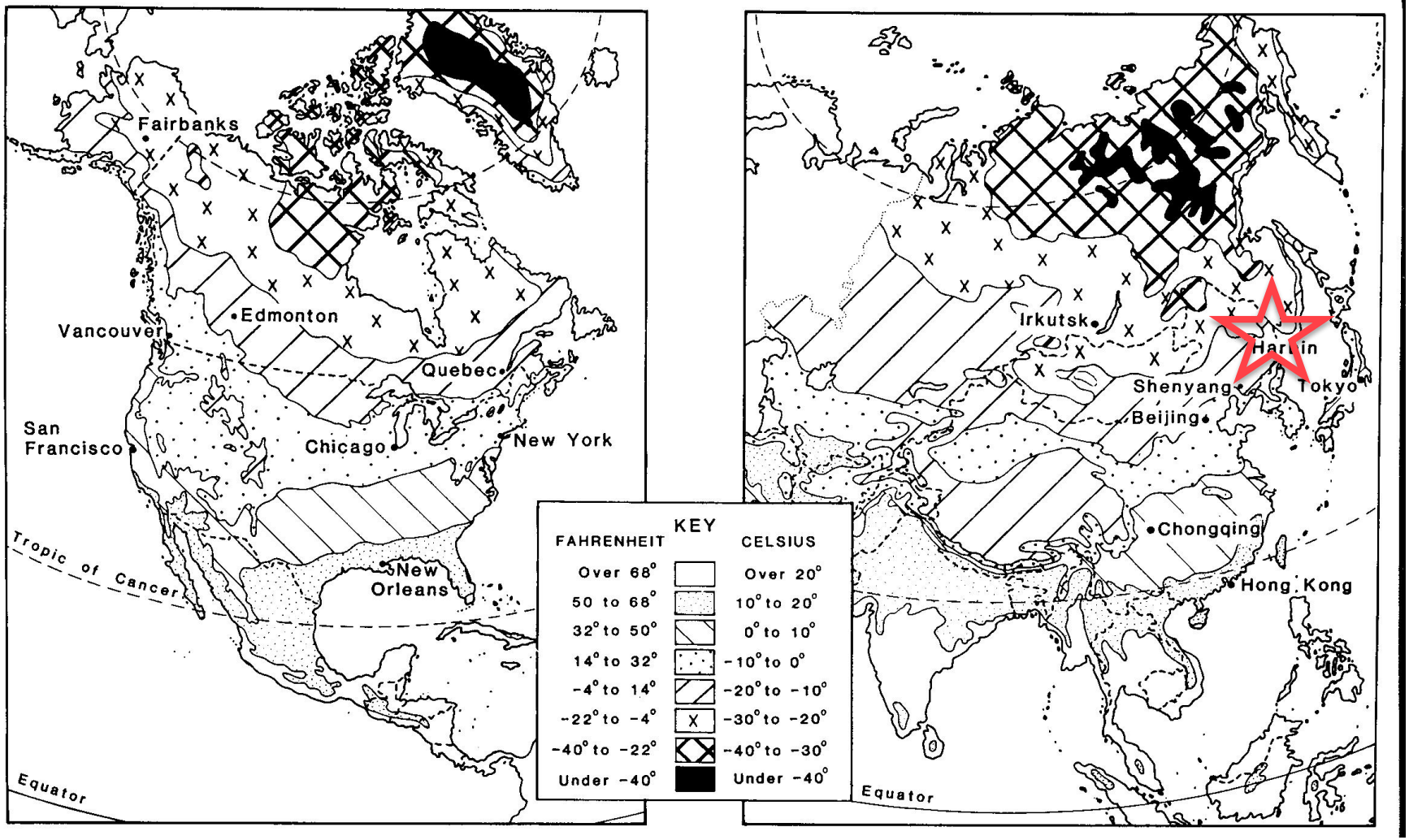


Native Range of Hydrilla

(Balciunas and Chen 1993)

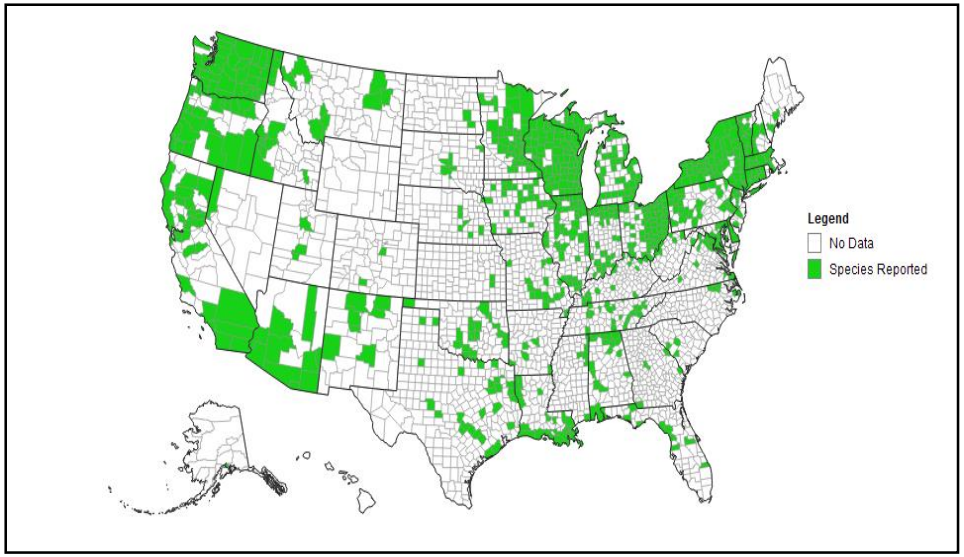
Hydrilla verticillata

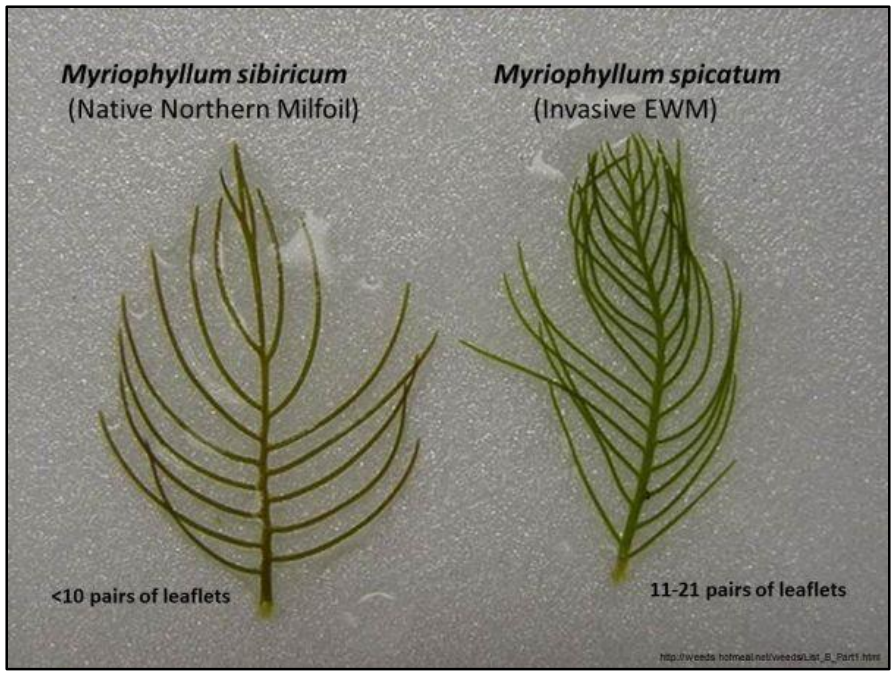
Comparison of mean January temperature in native and potential North American range



Balciunas and Chen 1993

Eurasian watermilfoil

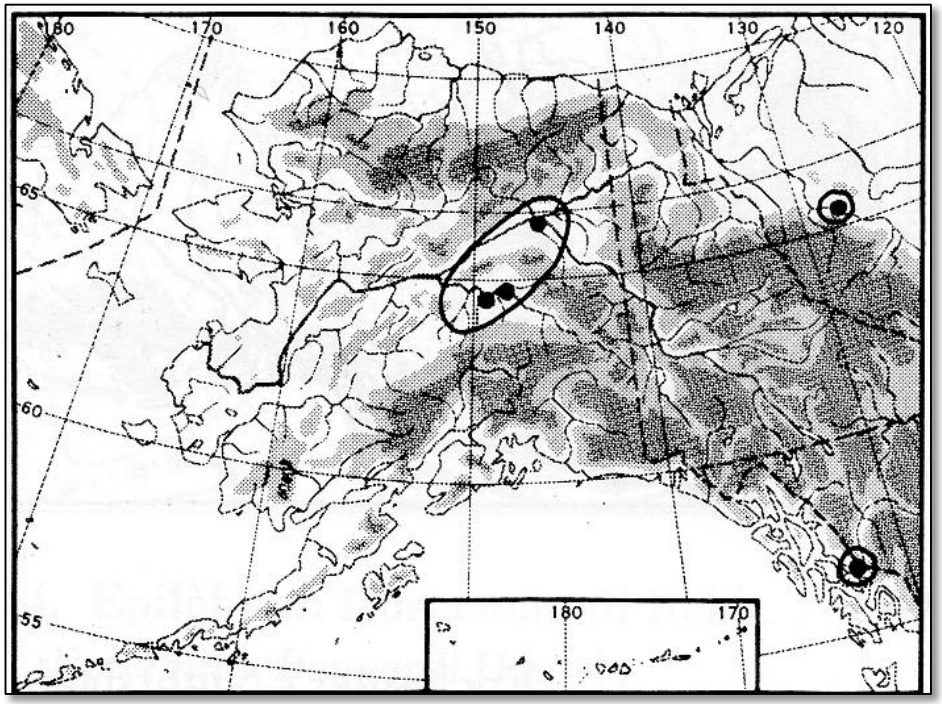




Myriophyllum species in Alaska

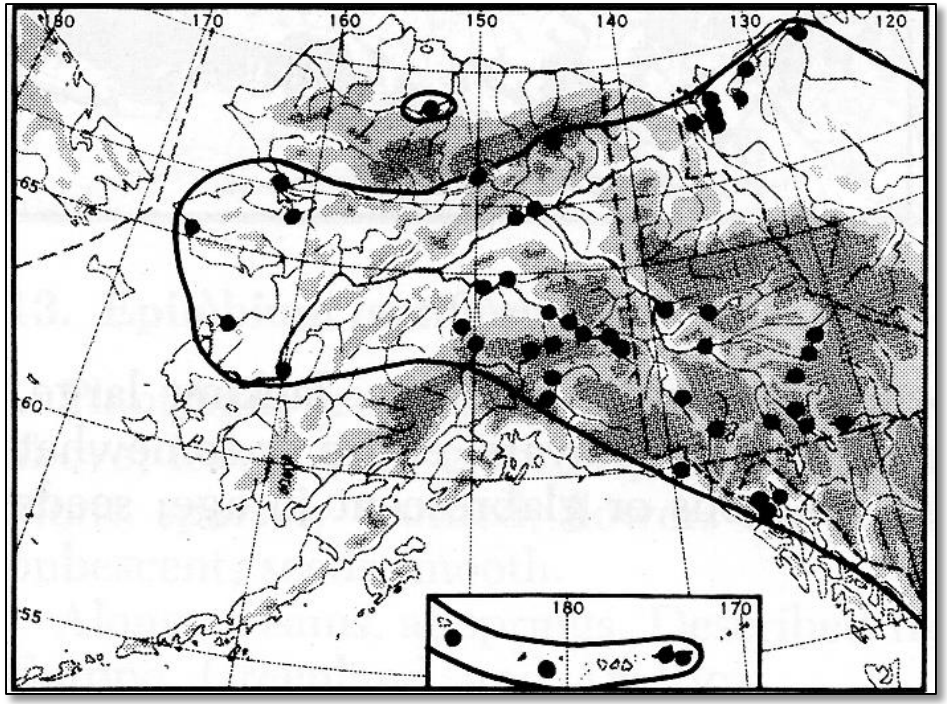
*Flora of Alaska (*Hulten 1968)

M. verticillatum

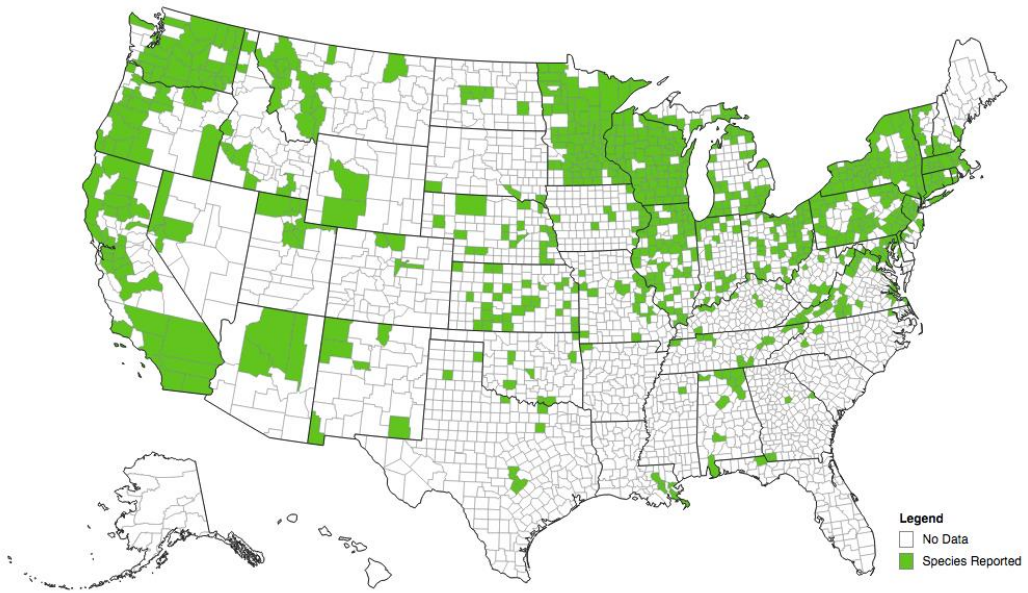


M. spicatum var excalbescens =

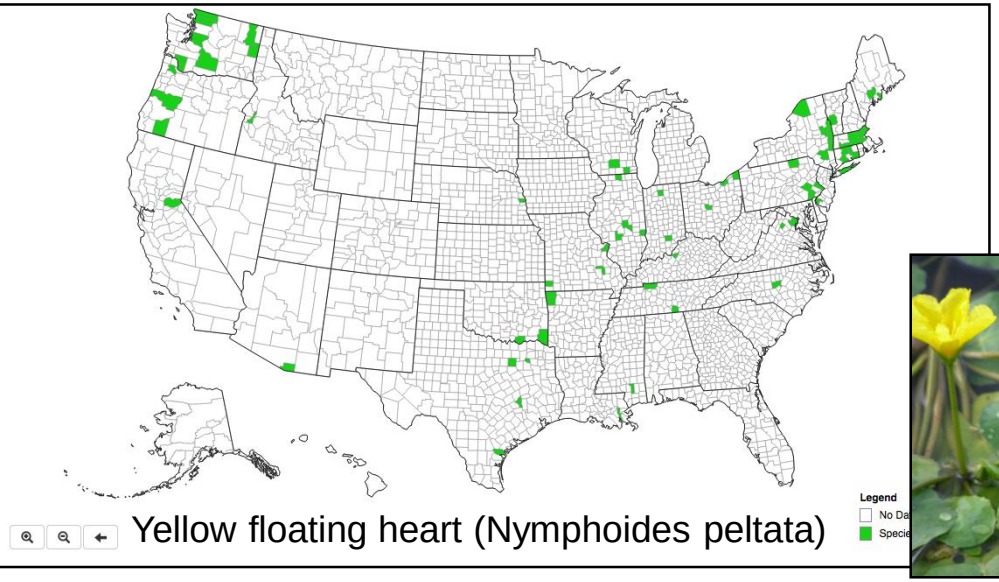
M. sibiricum



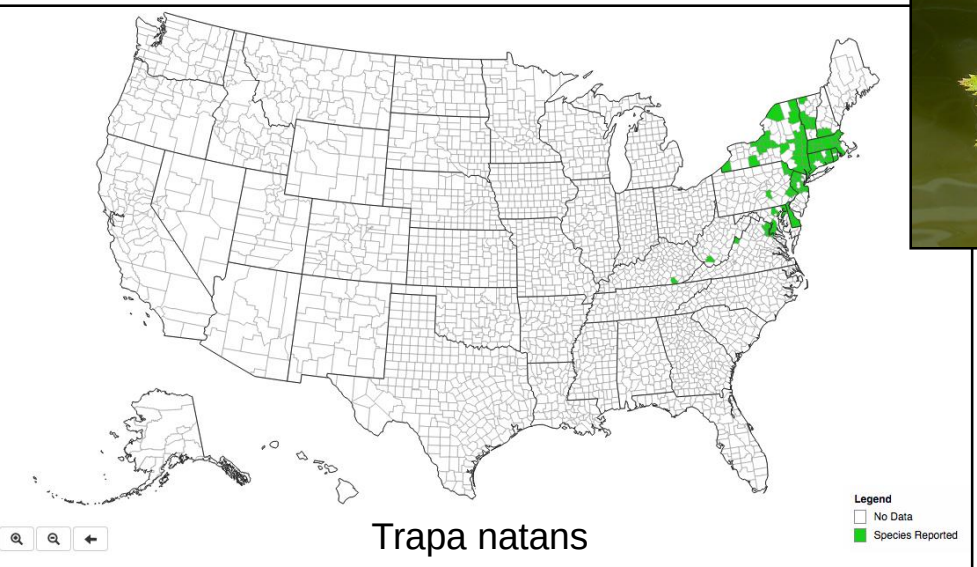
Curly leaf pondweed



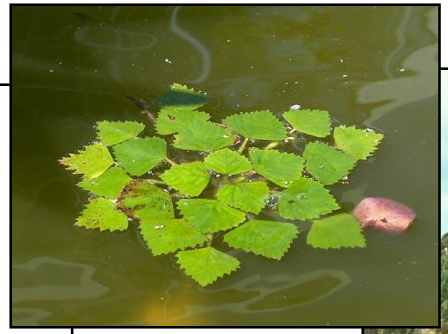
Floating leaf plants



Yellow floating heart (Nymphoides peltata)



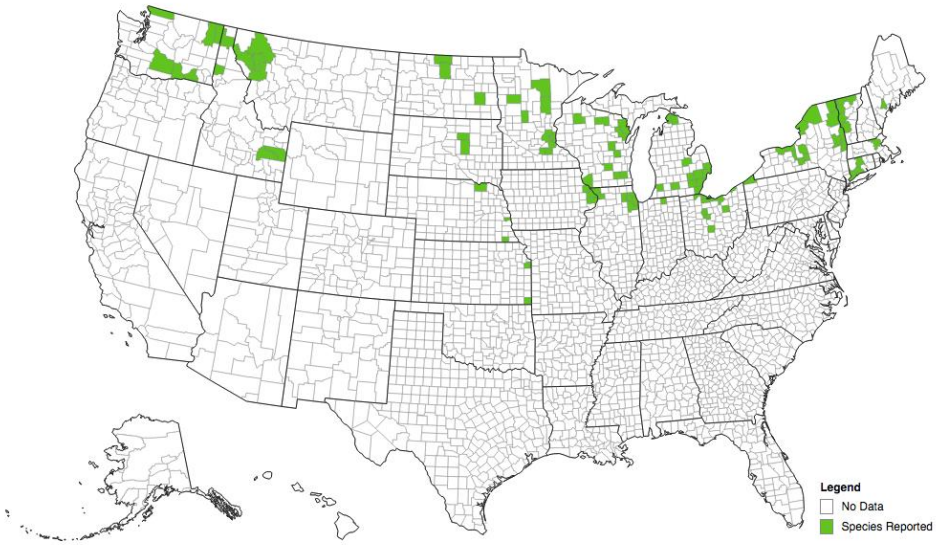
Trapa natans

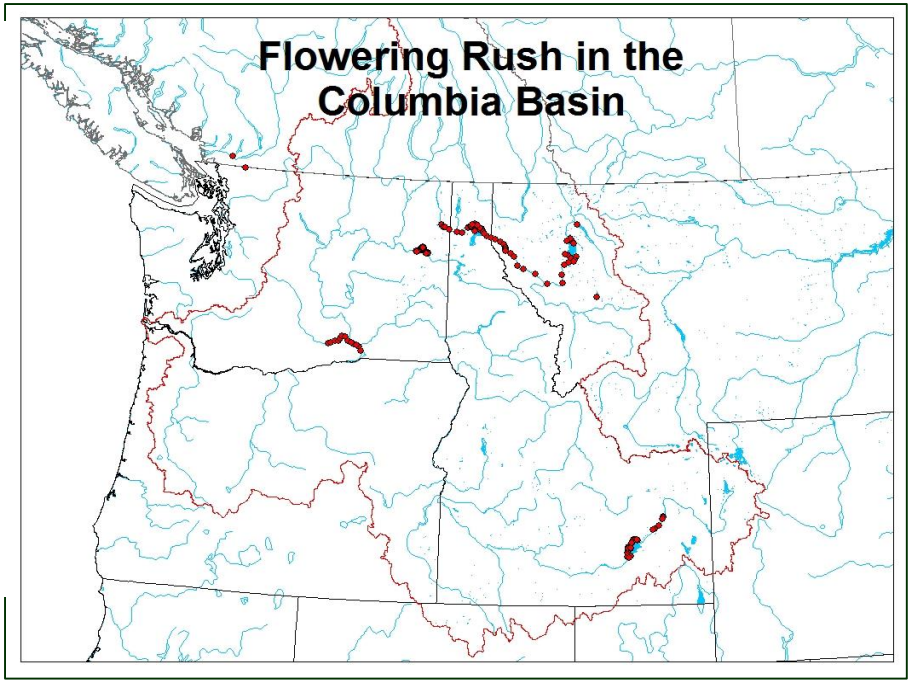


Flowering Rush

East Bay, Flathead Lake, MT

Flowering rush





circa 1895-1905: St. Lawrence River region

1949: Snake River Idaho (Idaho Falls)

1964: Flathead Lake (north shore: Peaceful Bay)

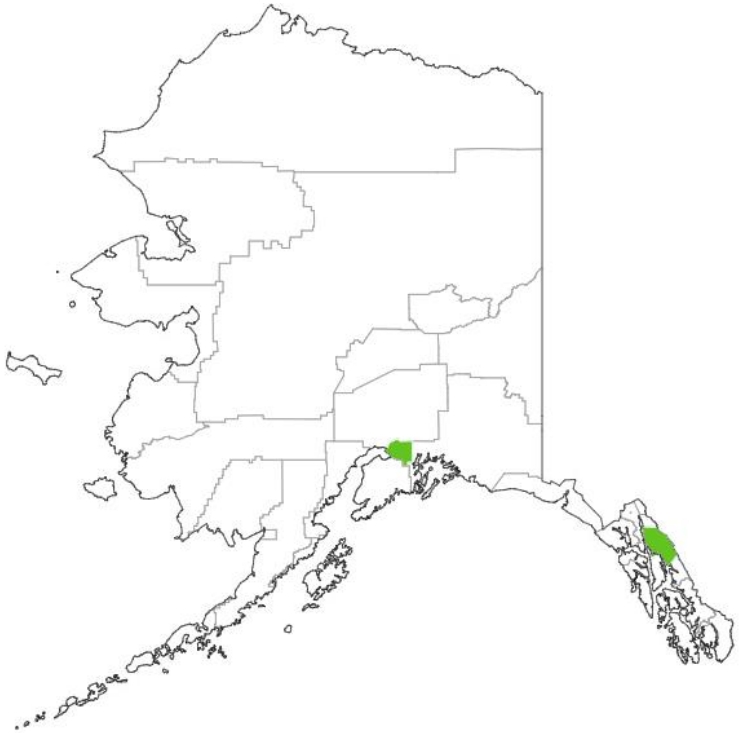
1997: Silver Lake, Whatcom Cty, (currently ~4.5 acres)

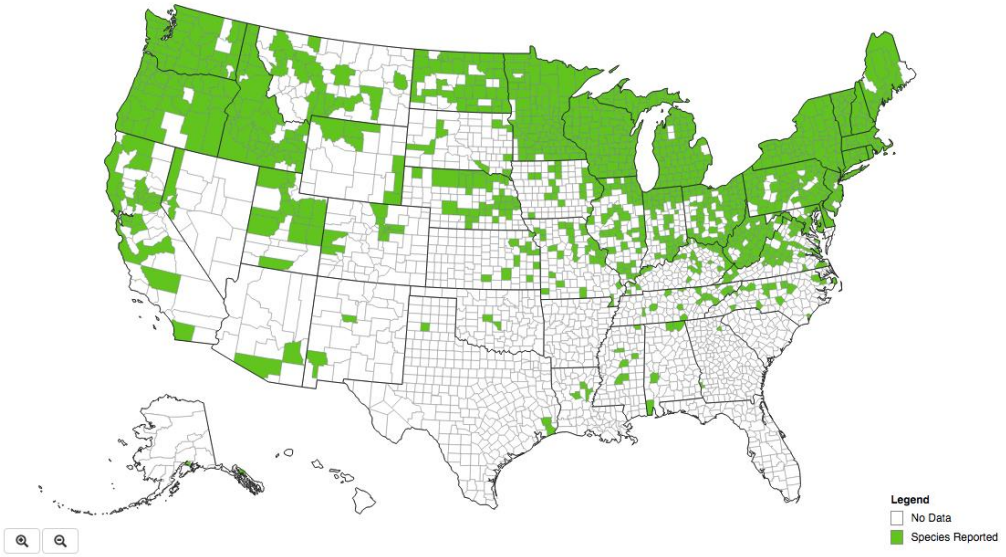
2010: Long Lake, Spokane River

2008: Yakima River

2014: Columbia River @McNarry Dam

Purple loosestrife





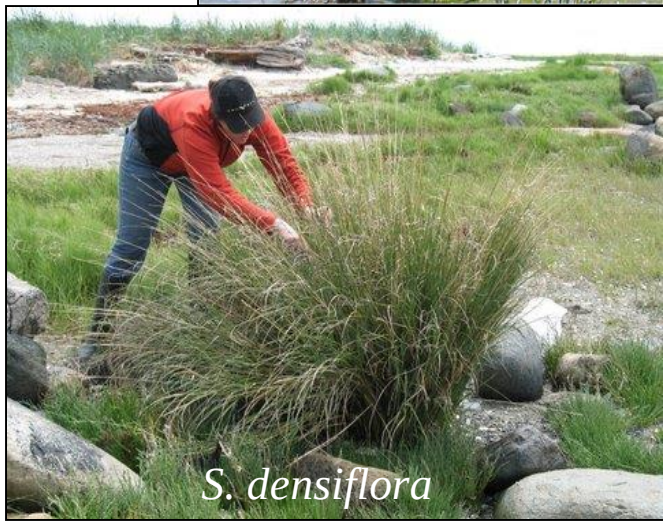
Introduction to Common Native & Potential Invasive Freshwater Plants in Alaska

Introduction to Common Native & Potential Invasive Freshwater Plants in Alaska

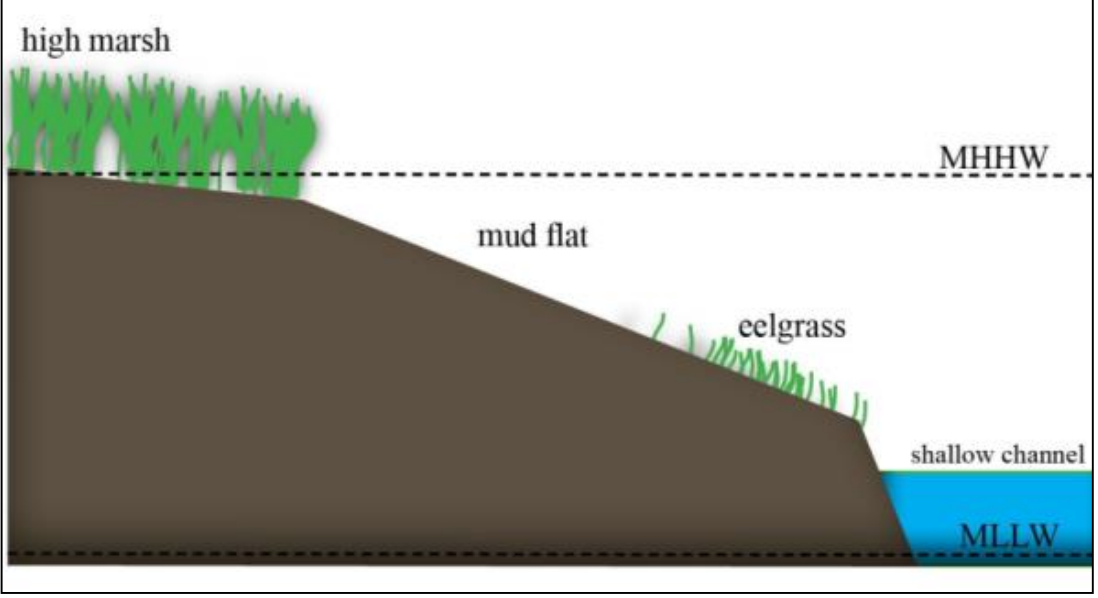
This document is based on *An Aquatic Plant Identification Manual for Washington's Freshwater Plants*, which was modified with permission from the Washington State Department of Ecology,
by the
Center for Lakes and Reservoirs at Portland State University
for
Alaska Department of Fish and Game
US Fish & Wildlife Service - Coastal Program
US Fish & Wildlife Service - Aquatic Invasive Species Program

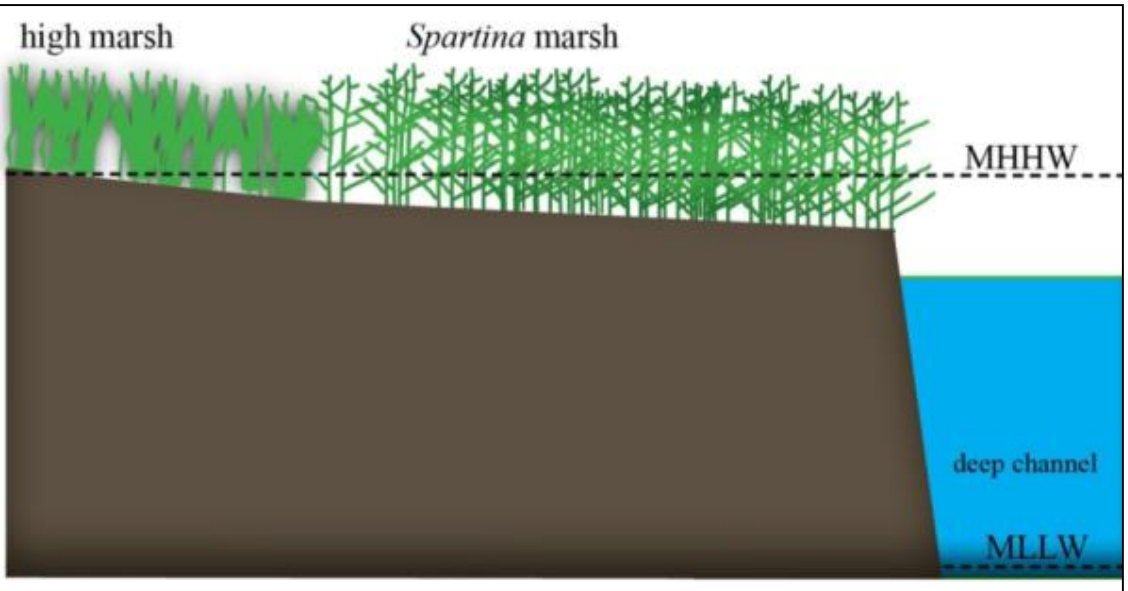
December 2009

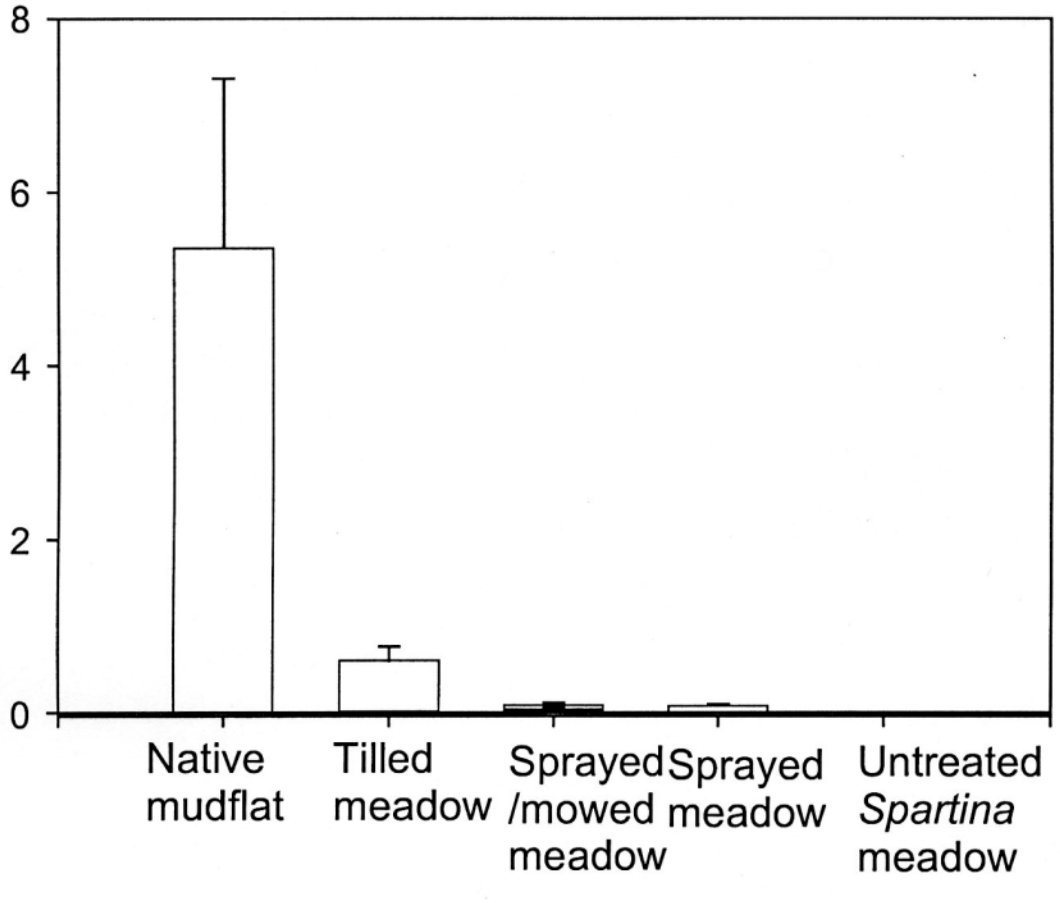
Spartina spp.



- 1 native in CA (*S. foliosa*)
- 4 non-native, invasive species
  - *S. alterniflora* (Eastern & Gulf coast of North America)
  - *S. patens* (Eastern & Gulf coast of North America)
  - *S. anglica* (hybrid of English *S. maritima* & *S. alterniflora*)
  - *S. densiflora* (South America)
  - *S. foliosa* x *S. alterniflora* hybrid


high marsh
MHHW
mud flat
eelgrass
shallow channel
MLLW

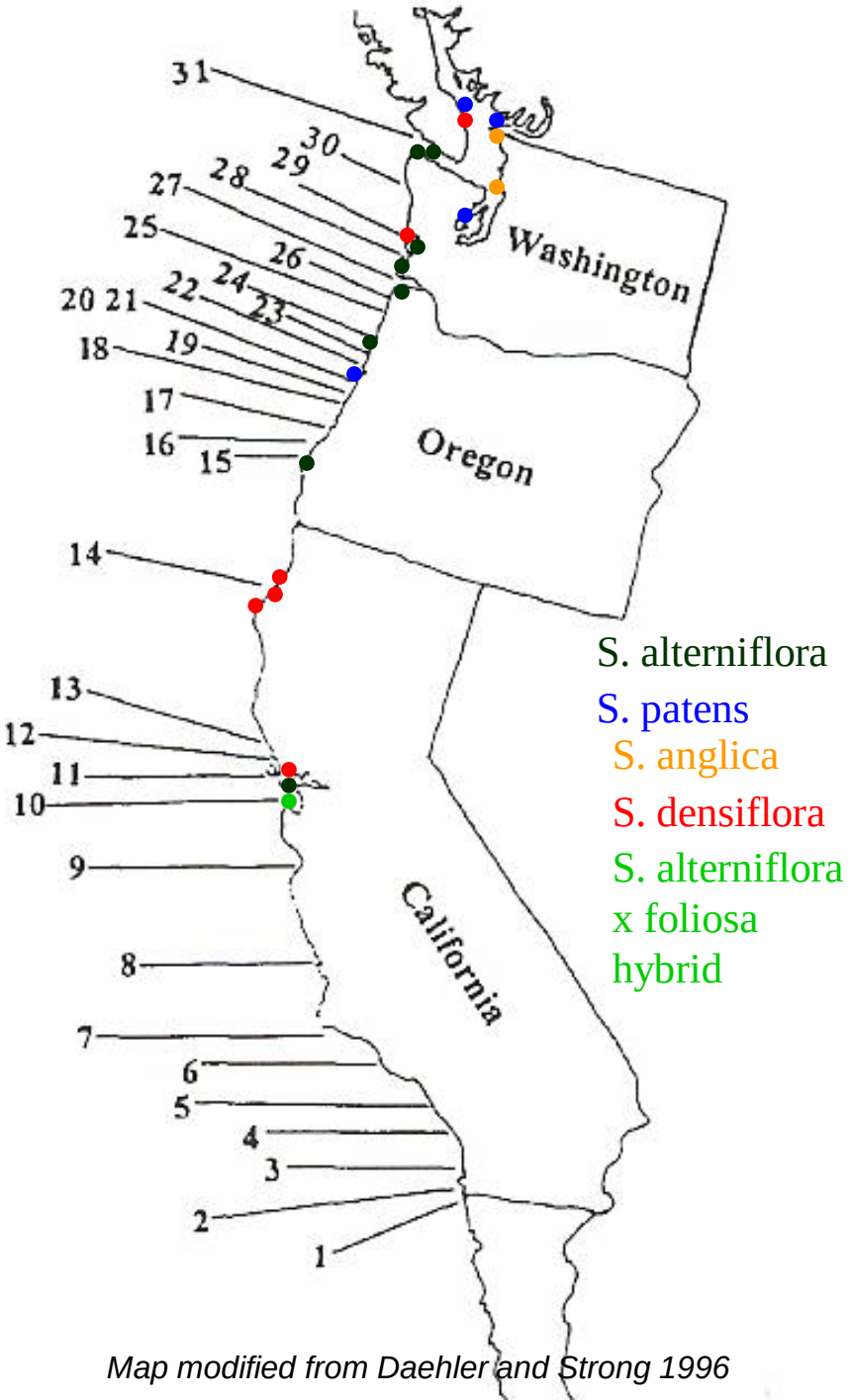

high marsh
Spartina marsh
MHHW
deep channel
MLLW



From: Patten, K. Shorebird, waterfowl, and birds of prey usage in Willapa Bay in response to Spartina control efforts. WSU Long Beach Extension Unit

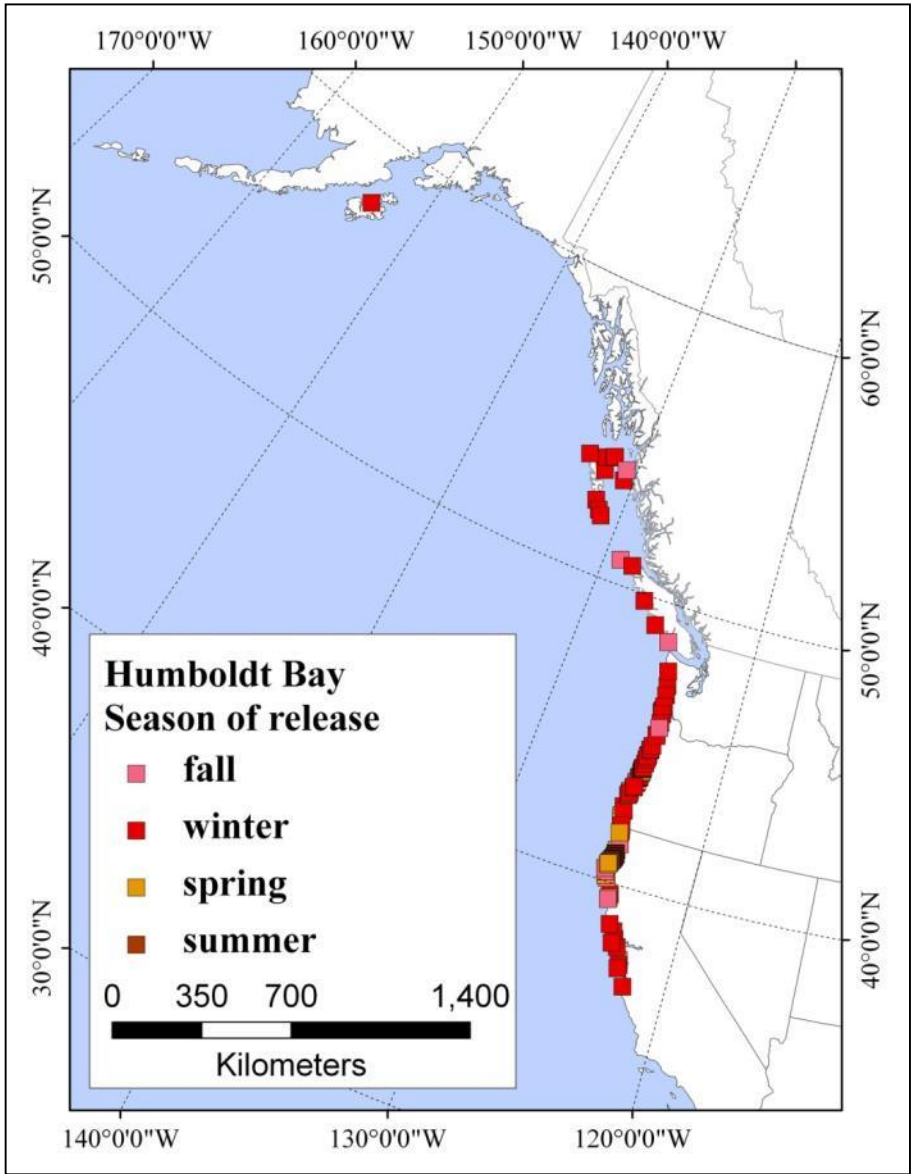
Spartina spp. Distribution

Comox Harbor, BC
Baynes Sound, BC
Fanny Bay, BC
Boundary Bay, BC
Puget Sound, WA
Gray's Harbor, WA
Willapa Bay, WA
Siuslaw River, OR
Coos Bay, OR
Sand Lake, OR
Humboldt Bay, CA
San Francisco Bay, CA



Map modified from Daehler and Strong 1996

Drift card study demonstrates that Spartina is a regional problem



Alaska *Spartina* Prevention, Detection and Response Plan

Prepared for:

National Marine Fisheries Service
Alaska Region
Juneau, AK

Prepared by:

Vanessa Howard Morgan and Mark Sytsma
Aquatic Bioinvasion Research & Policy Institute
Center for Lakes and Reservoirs
Portland State University
Portland, OR

January 2010

WEST COAST GOVERNORS' AGREEMENT on OCEAN HEALTH

WASHINGTON OREGON CALIFORNIA

Action Plan

THE OFFICE OF THE GOVERNORS
WASHINGTON, OREGON, AND CALIFORNIA

2006


Questions?