

Economic Impacts of Freshwater Weeds in the PNW and a Regional Approach to Managing Flowering Rush



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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
 - Soil formation
 - Nutrient cycling
 - Pollination

Total Economic Value of Ecosystem Services Provided by Wetlands

| | \$/ha/yr |
|-----------------------|---------------|
| Provisioning services | 601 |
| Cultural services | 1373 |
| Regulating services | 1086 |
| Supporting services | 214 |
| Total value | 3,274 |
| | (1,325/ac/yr) |



Photo: USEPA.2009. National Lakes Assessment

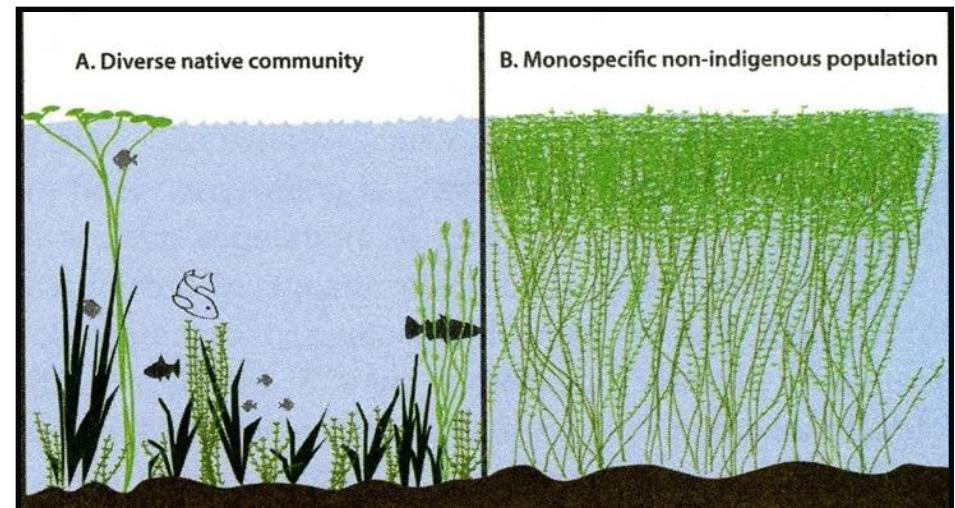
Economic Impacts of Weeds in Oregon

| | acres | \$ | \$/acre |
|-------------------------------|------------|------------|---------|
| Yellowstar thistle | 1,873,407 | 3,416,849 | 1.82 |
| Knapweeds | 3,622,380 | 6,083,434 | 1.68 |
| Leafy spurge | 12,700 | 44,328 | 3.49 |
| Wht top/Perennial pepper weed | 2,322,187 | 94,577,672 | 40.73 |
| Scotch thistle | 1,011,134 | 1,896,577 | 1.88 |
| Med. Sage | 1,275,077 | 837,666 | 0.66 |
| Hawkweeds | 600 | 575 | 0.96 |
| Tansy ragwort | 3,260,000 | 5,826,638 | 1.79 |
| Rush skeletonweed | 2,000,000 | 4,605,000 | 2.30 |
| Scotch broom | 16,000,000 | 14,221,200 | 0.89 |
| Gorse | 300,000 | 297,261 | 0.99 |
| Purple loosestrife | 3,646 | 1,482,695 | 406.66 |
| Egeria | 90,000 | 3,538,860 | 39.32 |
| Spartina | 12800* | 8,525,584 | 666.06 |

* potential infestation

Loss of Ecosystem Services Due To Aquatic Weeds

- Flood control
 - \$1 billion (est) in 11 counties in south FL (Rockwell 2003)
- Recreation
 - \$1.3 million, 3 lakes in IL (Singh et al 1984)
 - > \$10 million, 2 lakes in FL (Milon et al 1986)
 - >\$100 million, Guntersville Res, AL (Henderson 1995)
 - \$30-45 million, 4 lakes in Truckee watershed, California (Eiswerth et al. 2000)



Loss of Ecosystem Services Due To Aquatic Weeds in the PNWER Region

Eurasian watermilfoil in British Columbia

- \$84 million (Total eurasian watermilfoil control program benefits = \$450 million) (Newroth and Maxnuk 1993)

Eurasian watermilfoil in King County WA

- Average \$94,385 reduction in lakeshore property (19% decline) (Olden and Tamayo 2014)

Parrotfeather milfoil in Chehalis River (Kuehne et al. 2016)

- Near hypoxic conditions
- Strongly associated with nonnative fishes

Spartina in Oregon

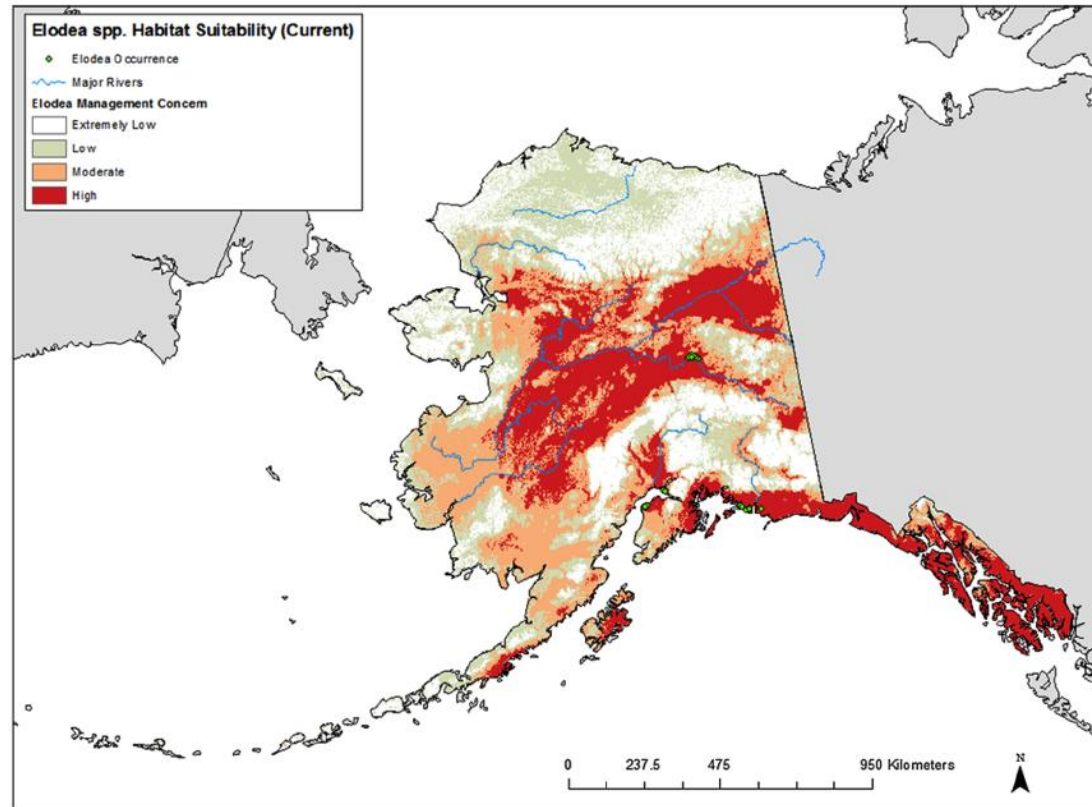
- Aquaculture/wildlife habitat
- \$8,524,584 potential impact (OR Dept Agriculture 2001)



Loss of Ecosystem Services Due To Elodea Invasion of Alaska



<http://www.fairbanksweeds.org/elodea-photos.php>



High risk to subsistence harvest of Chinook and whitefish, which make up 24% of harvest in Athabascan cultural linguistic domain.

Flowering rush

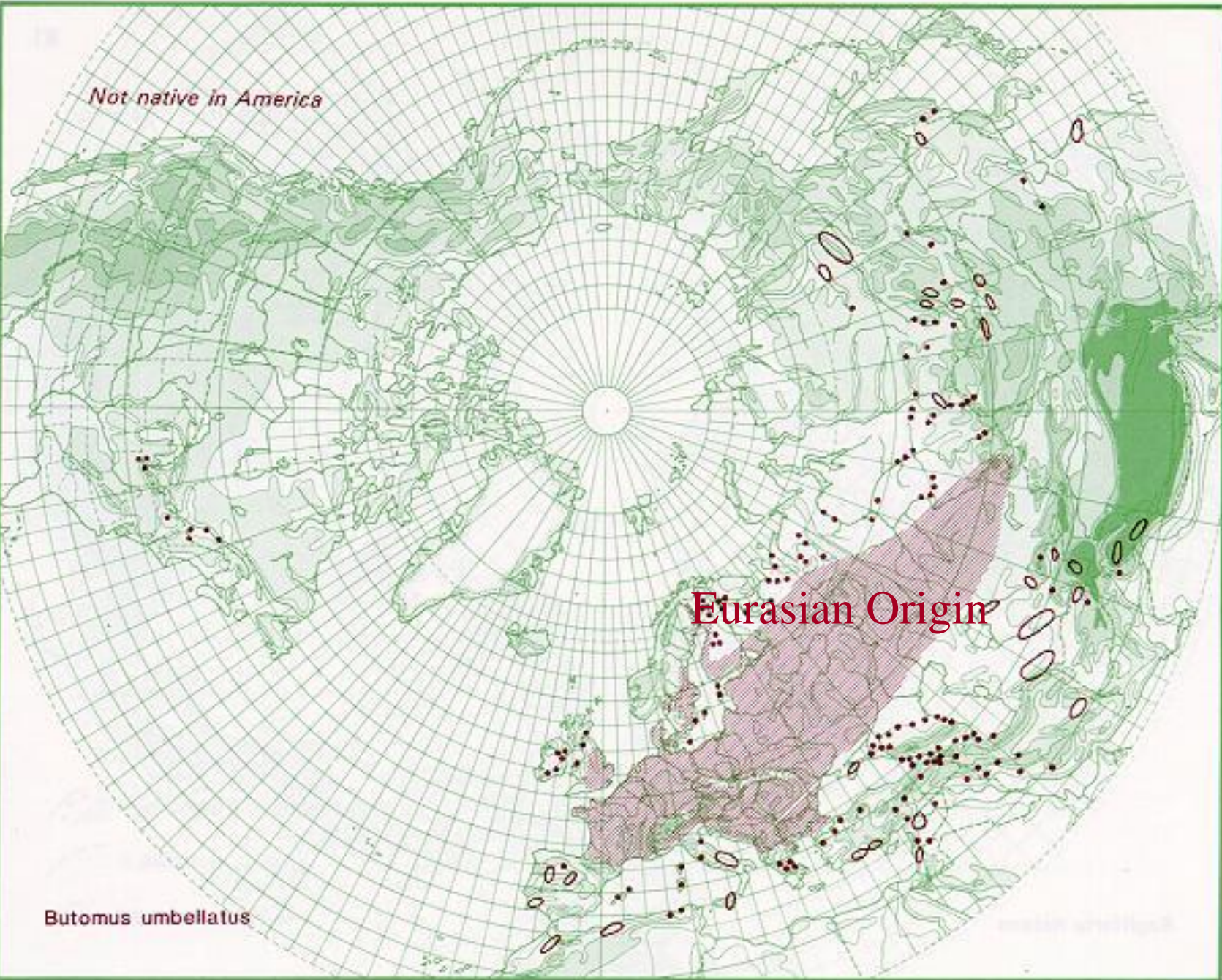
- ~30 flowers/umbel
(western, triploid
biotype flowers
infrequently=low seed
production)
- Sterile triploid plant
dispersal by vegetative
rhizome fragments
- Diploid plants produce
seed and bulbils on
rhizome and
inflorescence



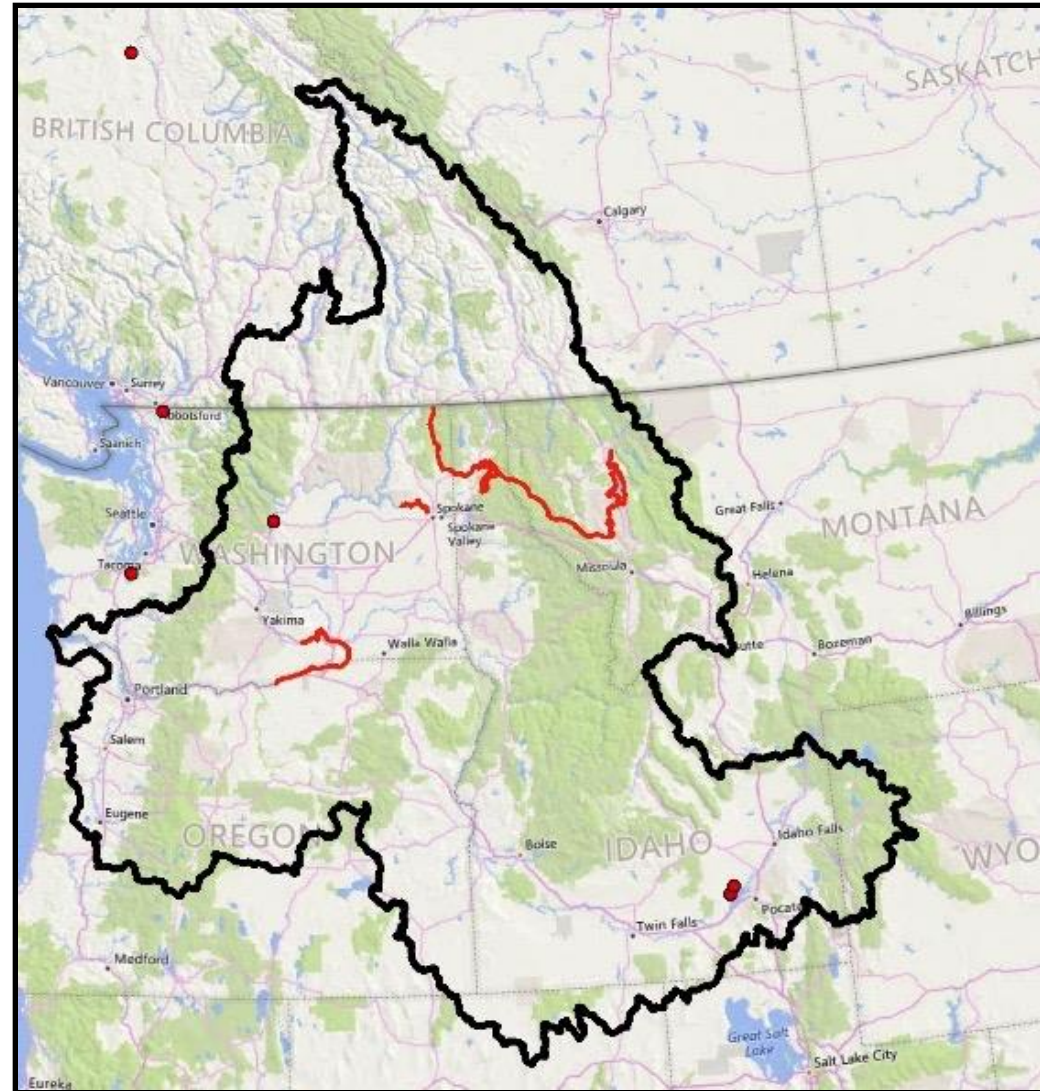
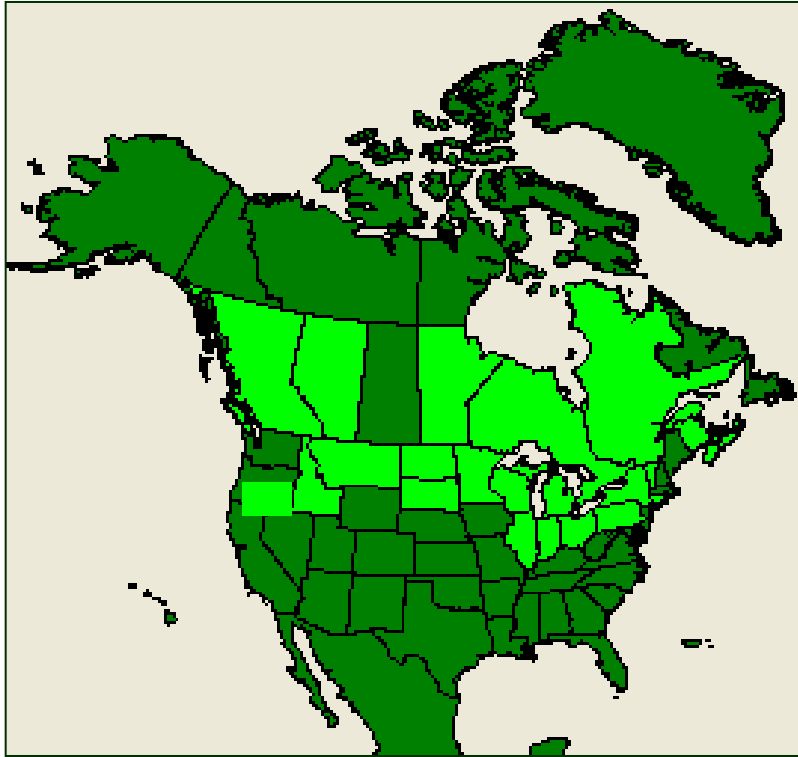
Not native in America

Eurasian Origin

Butomus umbellatus



North American Invasion



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, WA (~4.5 acres)

2008 Yakima River

2014 Lower Columbia (Below McNary Dam)



East Bay, Flathead Lake, MT

Flathead Valley Pablo Reservoir Irrigation Canal

6.7 Million Acres Irrigated by Withdrawals From
Columbia River System



Northern Pike Spawning in Macrophyte Beds
(Macrophytes Increase Water Temperatures &
Reduce Predation of Northern Pike Eggs & Juveniles)



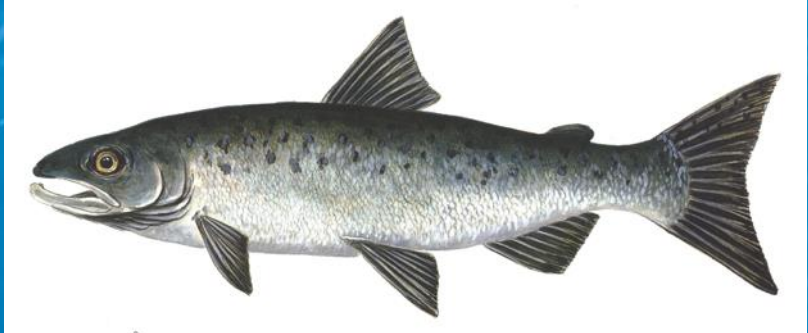
Cooper 2008



**Introduced Piscivorous Fish
Are Adapted to Vegetated Habitats**

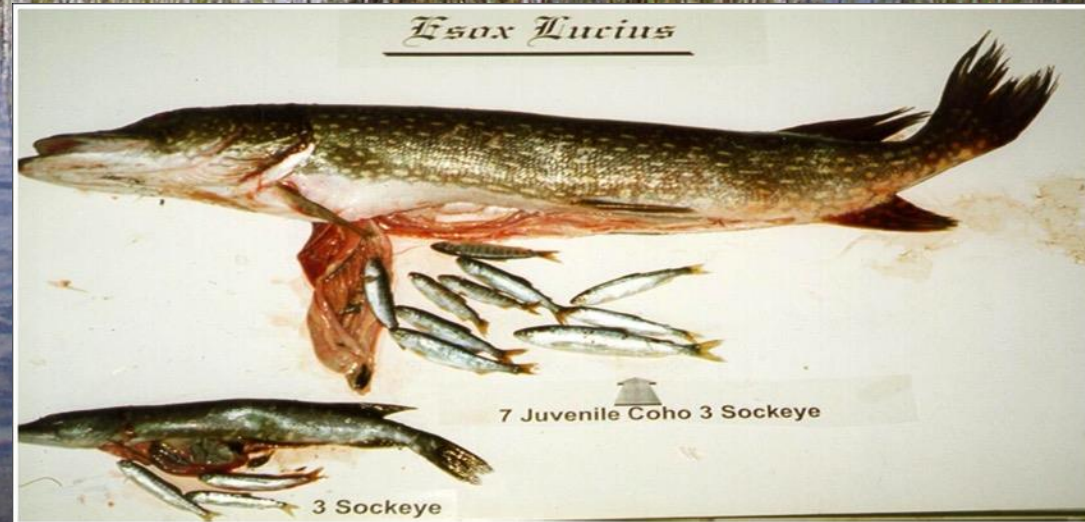
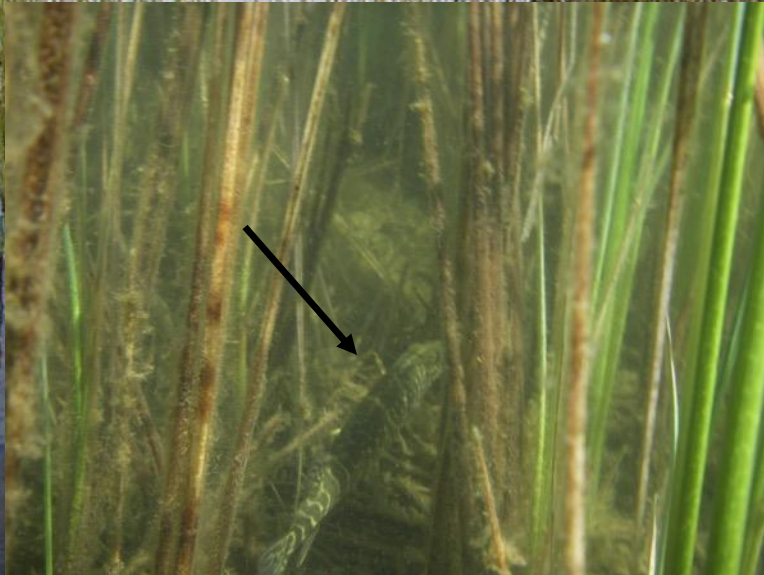


Native Salmonids Are Open Water Species



(Dibble et al 1997)

Northern Pike Predation on Salmonids



Northern Pike Bioenergetics Study

Prey items

| <u>Season</u> | <u>WCT*</u> | <u>BULL**</u> |
|---------------|---------------|---------------|
| Winter | 686 | 380 |
| Spring | 2,015 | 2,922 |
| Summer | 9,428 | 0 |
| Fall | 1,250 | 156 |
| Totals | 13,379 | 3,457 |



Bull Trout & Cutthroats Are Being
Significantly Depredated by
Northern Pike



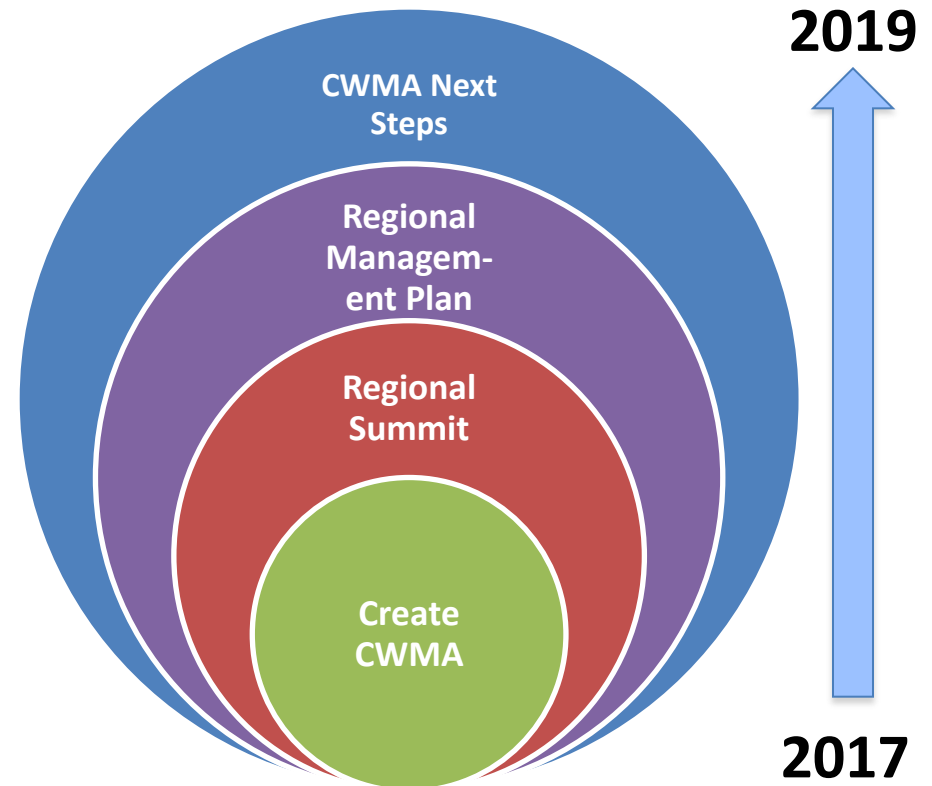
Muhlfeld et al. (2008)

- There are multiple economic and ecological impacts of invasive aquatic plants
- Management of aquatic plants is complicated
 - Invasive plants degrade salmonid habitat
 - Presence of T&E salmonids inhibits management
- Management of existing widespread species and management of species with currently limited distribution in the Columbia River Basin requires regional coordination
- The CRB Cooperative Weed Management Area serves this purpose

Columbia Basin States

Cooperative Weed Management Area

- National Fish and Wildlife Foundation Pulling Together Initiative Funded
- January 2, 2017 to December 31, 2019
- \$65,000 awarded; \$66,320 non-federal matching funds



NFWF



ISAN
INVASIVE SPECIES ACTION NETWORK



WASHINGTON STATE
RECREATION AND CONSERVATION OFFICE
Washington Invasive
Species Council

Columbia Basin States

Cooperative Weed Management Area

Outcomes:

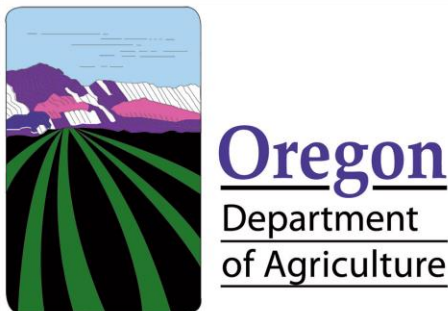
- Sustainable leadership
 - Steering Committee
- Information sharing
 - Regional Email Listserv
 - Regional flowering rush summit
- Regional coordination
 - Regional management plan



Columbia Basin States

Cooperative Weed Management Area

Steering Committee:



Columbia Basin States

Cooperative Weed Management Area

Information sharing:

- Regional Email Listserv
 - columbiabasincwma@lists.wsu.edu
 - 58 members
- 2018 Regional flowering rush summit
 - Location TBD
 - 1.5 days within
 - February 5th to 9th
 - February 29th to March 2nd

Columbia Basin States

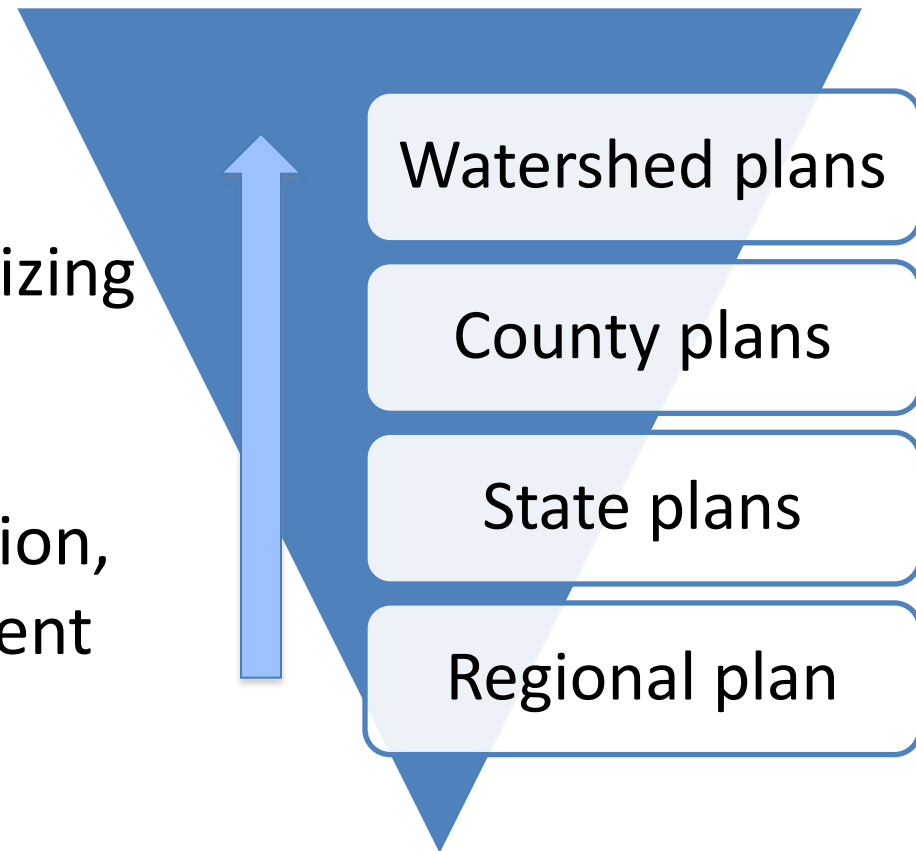
Cooperative Weed Management Area

Regional Coordination:

Regional flowering rush management plan

- Prevention
- Planning and Prioritizing
- Tactics and Implementation
- Monitoring, Evaluation, Adaptive Management and Data Sharing

Landscape-scale harmonized planning





Willingness to pay to prevent invasive species problems

US\$/household

- Condition 1
 - Delay low impacts 1 year
- Condition 2
 - Delay high impacts 1 year
- Condition 3
 - Delay high impacts 10 years

| Species group | Measures | Condition 1 (1 year) | Condition 2 (1 year) | Condition 3 (10 years) |
|---------------|----------|----------------------|----------------------|------------------------|
| Fishes | N | 376 | 368 | 361 |
| | Mean | \$57 | \$53 | \$122 |
| | Median | \$10 | \$20 | \$25 |
| | Mode | \$0 | \$0 | \$0 |
| | St. dev. | \$276 | \$118 | \$357 |
| Crustacean | N | 415 | 410 | 392 |
| | Mean | \$51 | \$76 | \$161 |
| | Median | \$10 | \$10 | \$25 |
| | Mode | \$0 | \$0 | \$0 |
| | St. dev. | \$150 | \$292 | \$615 |
| Mollusk | N | 380 | 378 | 364 |
| | Mean | \$41 | \$59 | \$170 |
| | Median | \$10 | \$20 | \$25 |
| | Mode | \$0 | \$0 | \$0 |
| | St. dev. | \$164 | \$142 | \$375 |
| Plant | N | | | |
| | Mean | \$54 | \$74 | \$189 |
| | Median | \$10 | \$20 | \$25 |
| | Mode | \$0 | \$0 | \$0 |
| | St. dev. | \$188 | \$279 | \$812 |
| All | N | 355 | 355 | 351 |
| | Mean | \$62 | \$79 | \$246 |
| | Median | \$10 | \$20 | \$25 |
| | Mode | \$0 | \$0 | \$0 |
| | St. dev. | \$281 | \$295 | \$1024 |

1,533,430 households in Oregon (2011-2015, US Census Bureau)