WHITE WATER ASSOCIATES, INC.

White Water Associates, Inc.

(906) 822-7889

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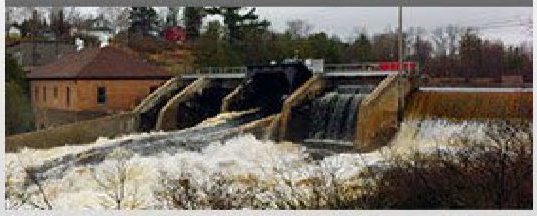
Analytical Laboratory | Environmental Consulting

About Us

Markets We Serve



Contact Our Staff

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Wastewater Epidemiology

Sample collection → Sample concentration → RNA extraction → PCR quantification

Covid, RSV, Norovirus, Influenza A&B, Bird Flu, Measles

OVERVIEW

WDNR Grants

Lake Ecology

- Riparian Area
- Littoral Zone
- Aquatic Plants

Surface Water Planning Grant

November 2023 Application - Awarded early 2024

- Examine historical WDNR water quality data
- Summarize WDNR shoreland/shallow water data
- Education (public presentation & floating workshop)
- Lake management plan

Early Detection & Response Grant

April 2025 Application - Awarded immediately

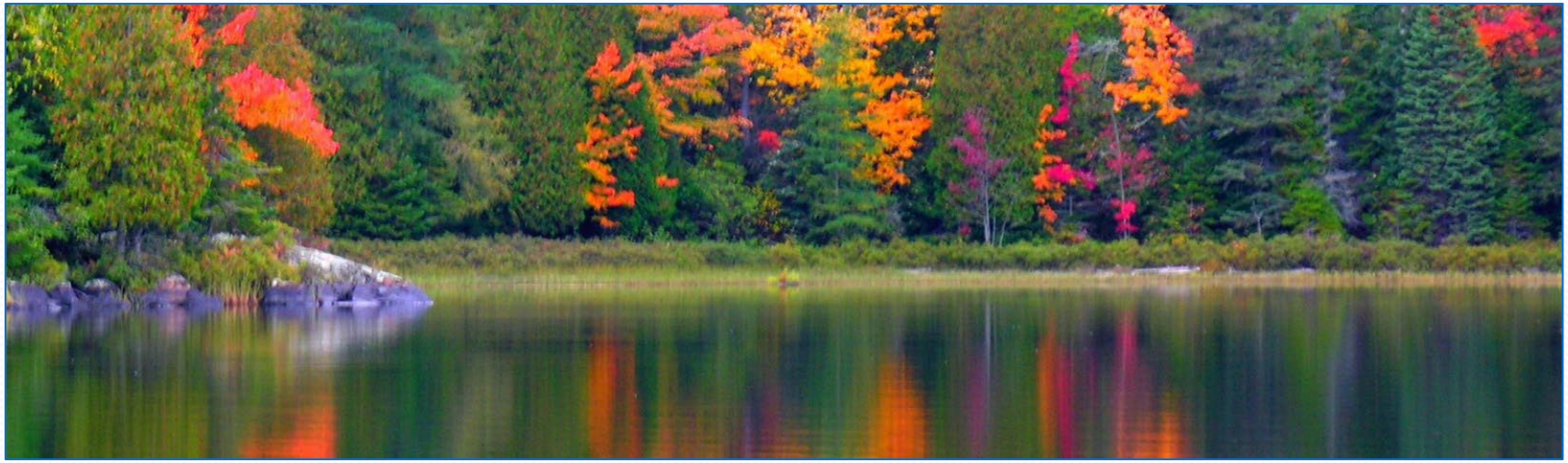
- Response to the discovery of Eurasian watermilfoil
- Meander surveys for Eurasian watermilfoil
- Point-intercept aquatic plant survey (all plants)
- Management action: volunteer hand-pulling & DASH
- Lake user survey
- Education

The timelines of the two grants have been integrated.

WHY?

Our lakes are rare

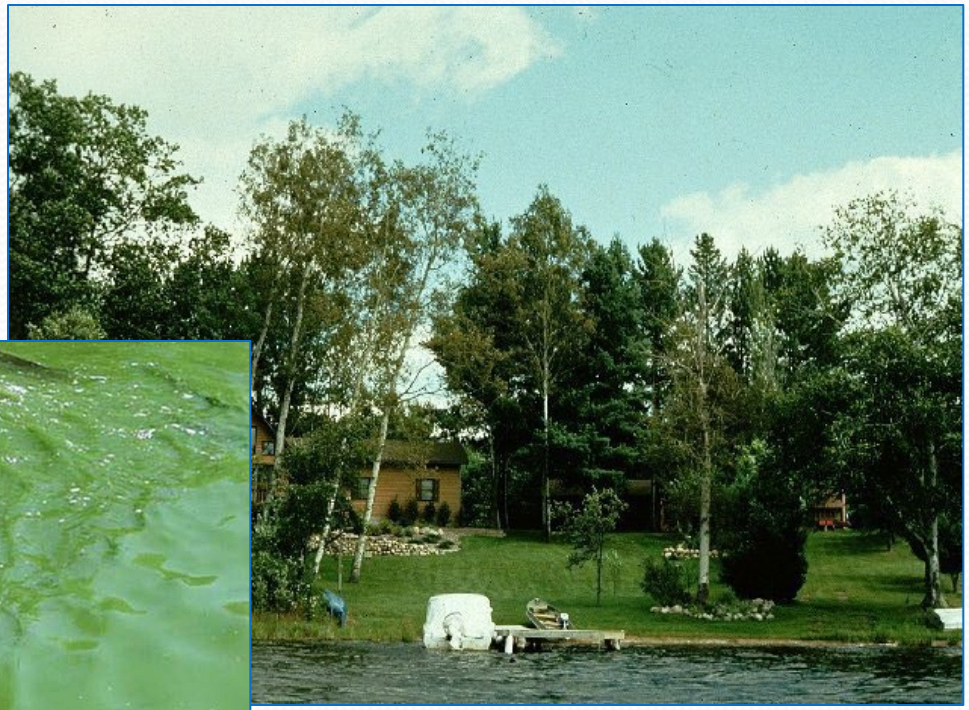
- 71% Earth's surface covered by water
- <1% Water on Earth is freshwater
- 0.009% of Earth's water is in freshwater lakes



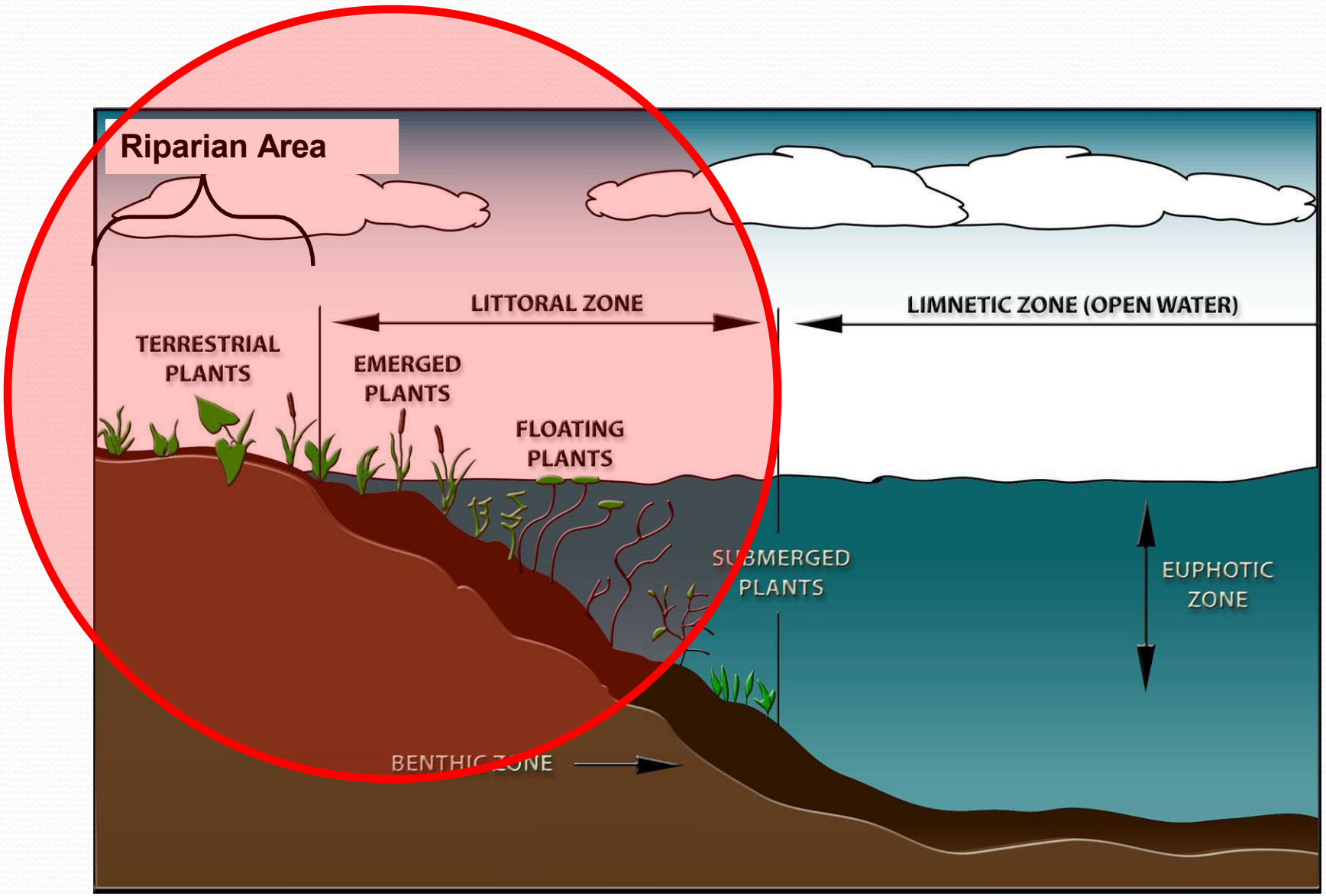

We live on
and influence
watersheds
and lakes

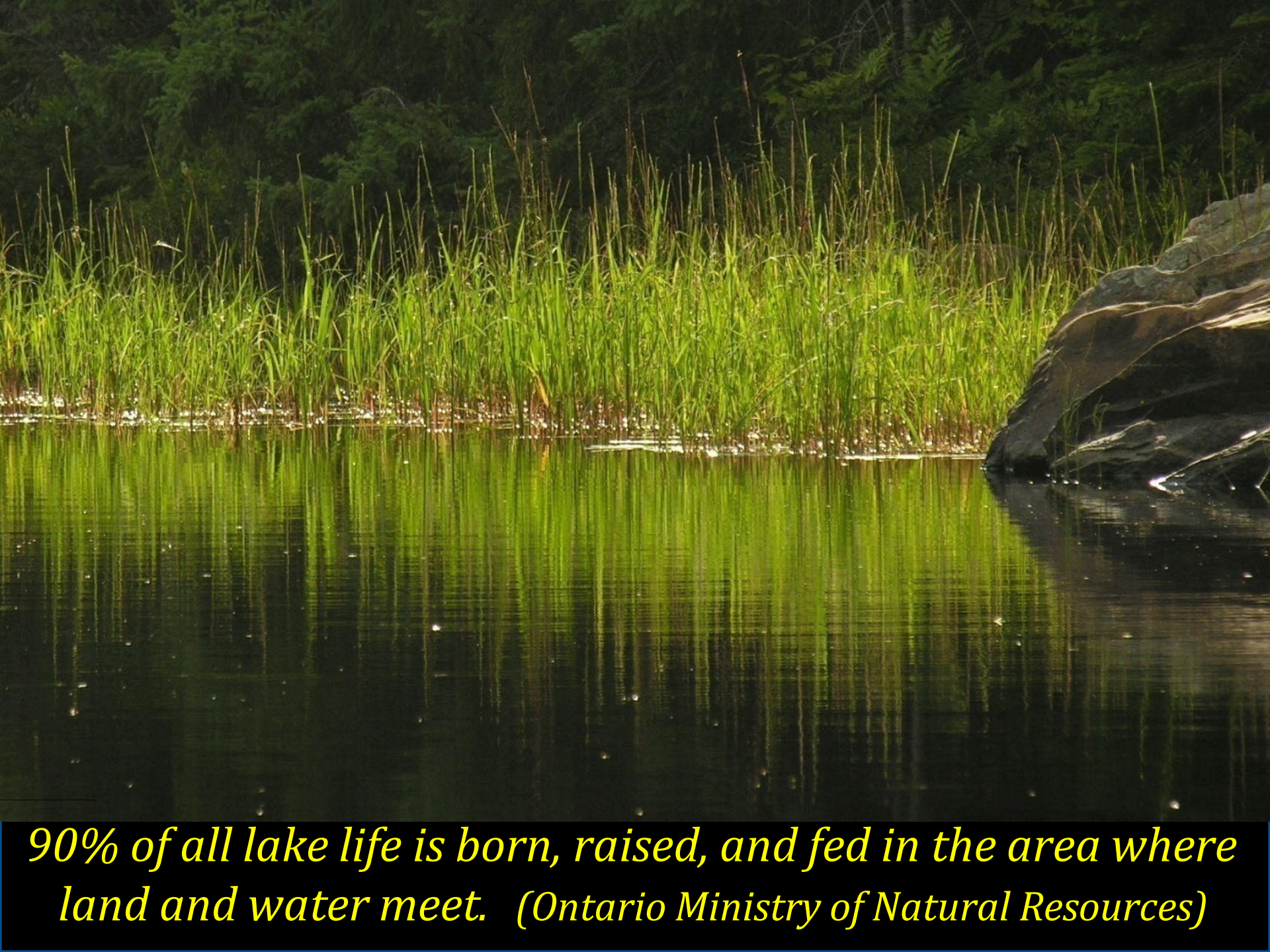
Lakes face many stressors:

- Algae blooms (phosphorus pollution)
- Degradation of shoreline habitat
- Non-native plants and animals



Lake Habitat Zones





90% of all lake life is born, raised, and fed in the area where land and water meet. *(Ontario Ministry of Natural Resources)*

Riparian Area

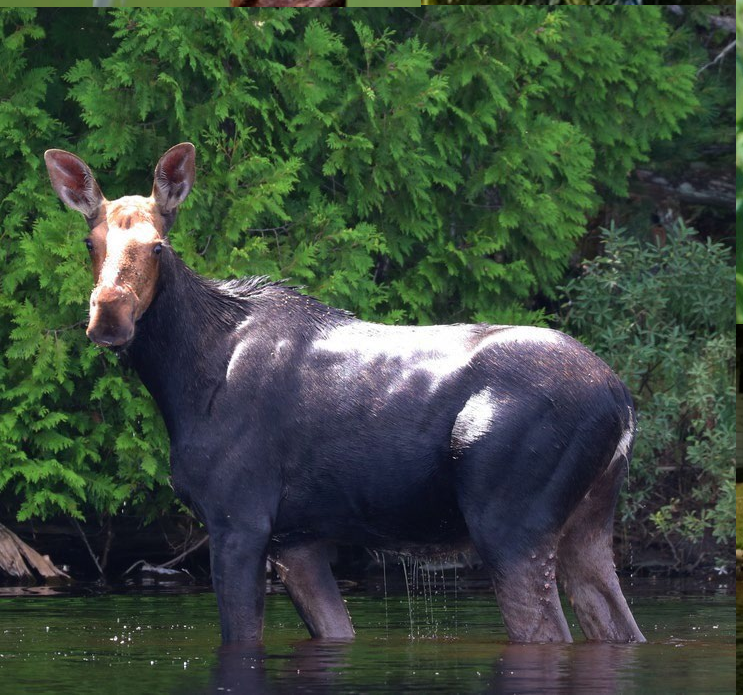
The area that both influences the water body and is influenced by the water body.

Riparian Area

Functions include:

- Buffer zone (filter)
- Stabilizes soils
- Habitat for many species
- Provides organics matter
- Provides shade & cover

How wide is
the Riparian Area?

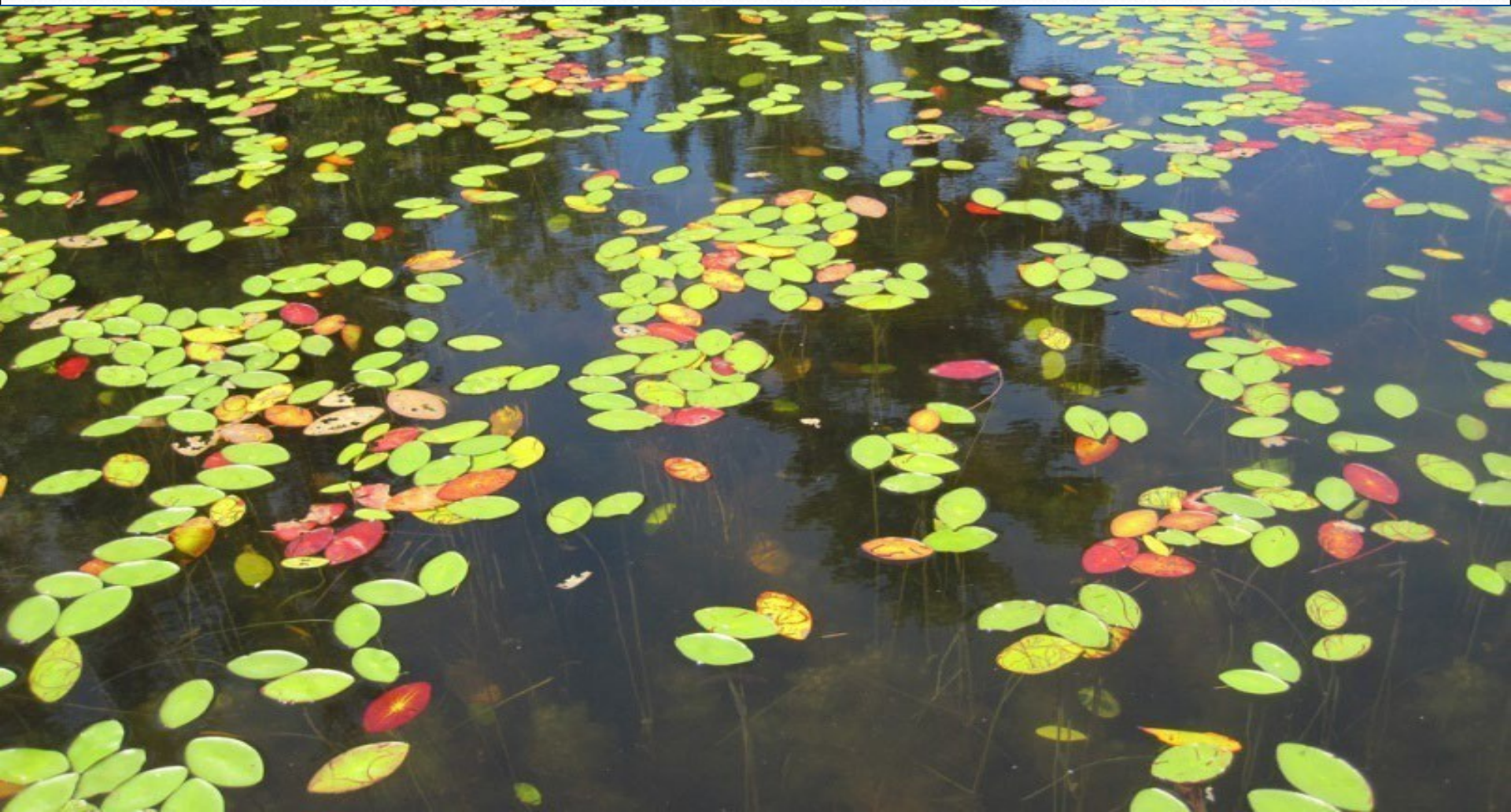


Degraded (Unhealthy) Riparian Areas

- Patchy/scrubby plant growth with bare patches
- Vegetation dominated by non-native species
- Soil compacted, eroded, with bare trails & paths
- Pavement
- Eroding or sloughing banks
- Limited diversity of plants and animals

Littoral Zone

The area of the lake that is shallow enough to have rooted vegetation.



Littoral Zone

What limits the distribution of rooted plants?

- Sunlight
- Substrate
- Nutrients
- Herbivores
- Mechanical forces

Littoral Zone Functions:

- Intercepts nutrients
- Refuge from predators
- Nursery for fish
- Productive of invertebrates
- Contribution to food web
- Dissipates energy of waves

Threats to Lakes

- Poor lakeshore habitat (riparian vegetation) is the #1 stressor of lake ecosystems.
- Poor littoral zone habitat is the #2 stressor of lakes.

The 2007 National Lakes Assessment

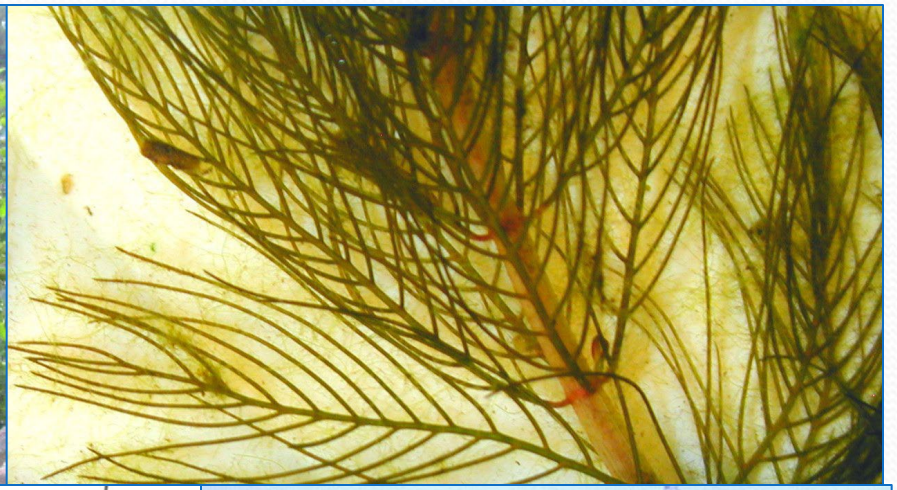
Threats to Lakes

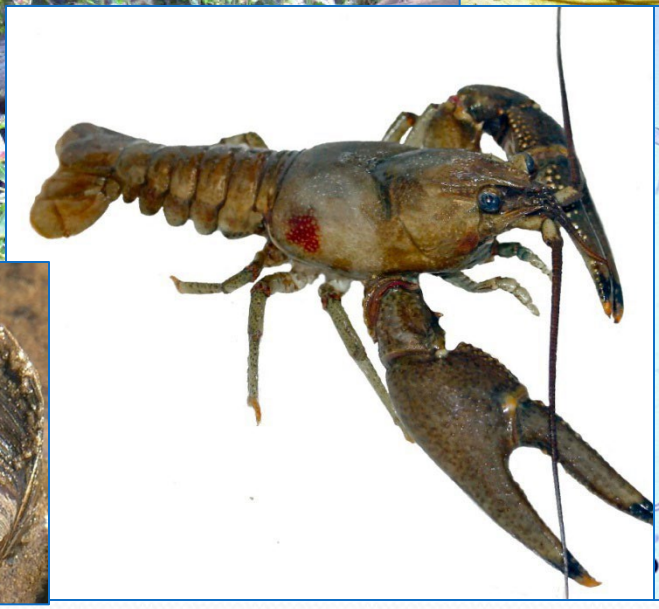
- By managing for healthy lakeshores (both littoral and riparian), we can make a difference in lake biological integrity (health).
- This means both development standards (shoreland ordinances) as well as BMP's (leave wood in place, minimize clearing of littoral vegetation, natural armoring, etc).

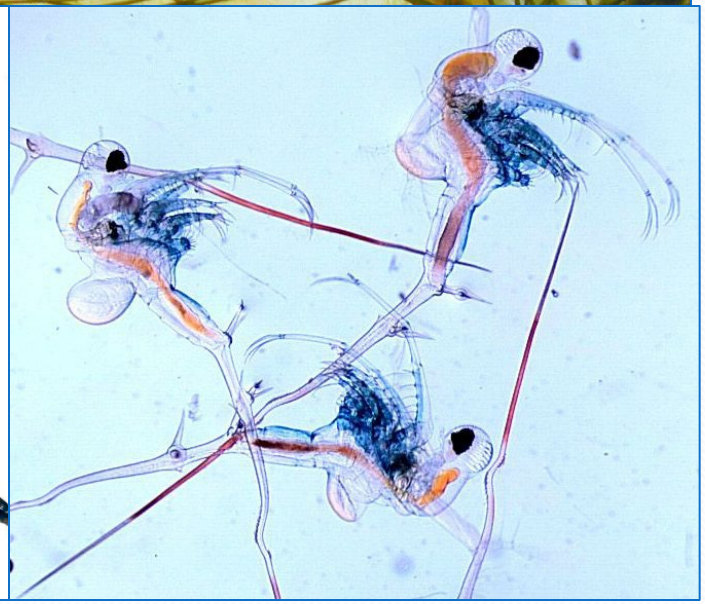
The 2007 National Lakes Assessment

Other Threats to Lakes: Nutrients

Other threats to lakes: non-native species





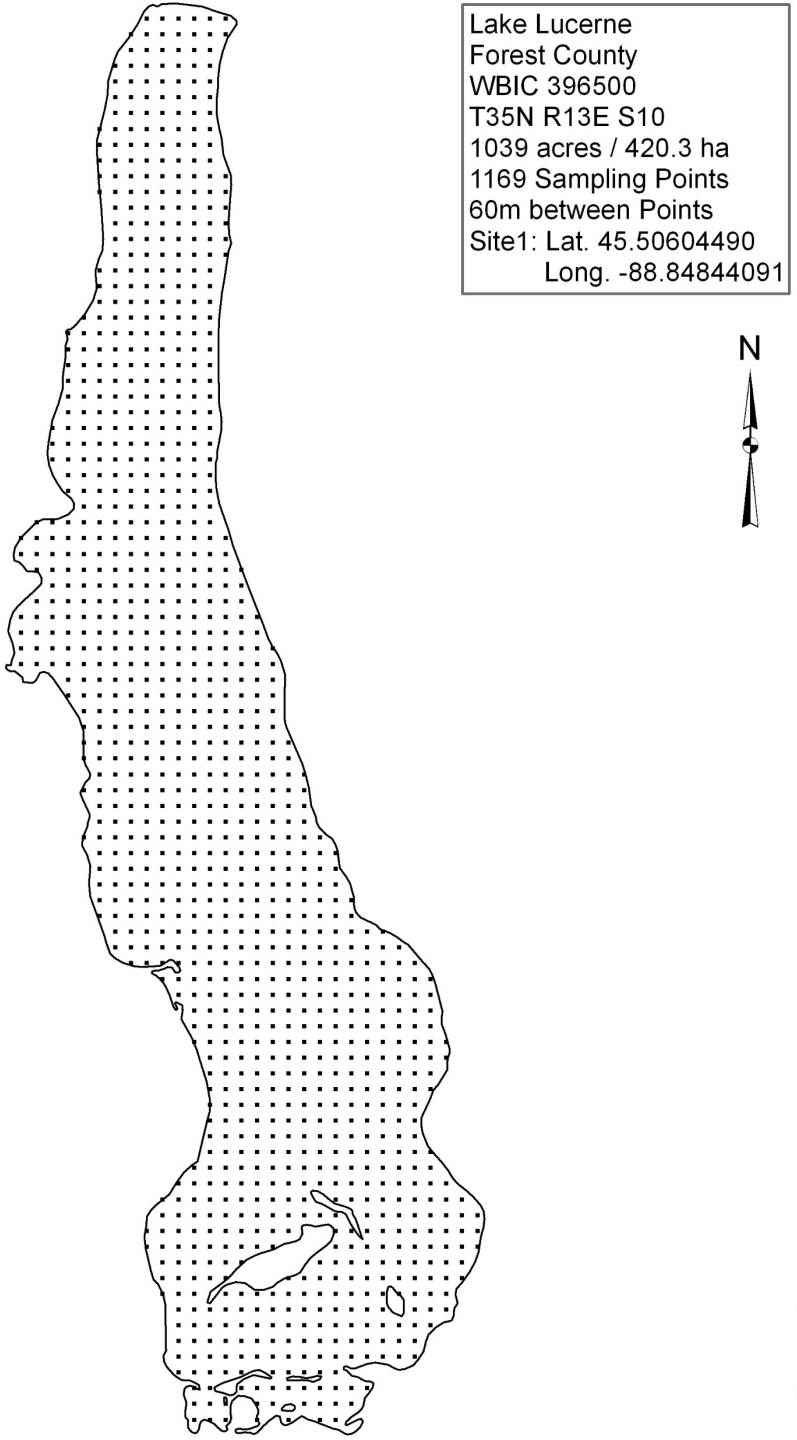


Native Aquatic Plants

- Rarely get respect they merit
- "*Weed"* or "*weed bed"*
- *"Weed"* connotes unwanted & aggressive growth
- Not true for vast majority of aquatic plants
- Essential to lake health (habitat, oxygen, nutrient uptake, protect shorelines and more)

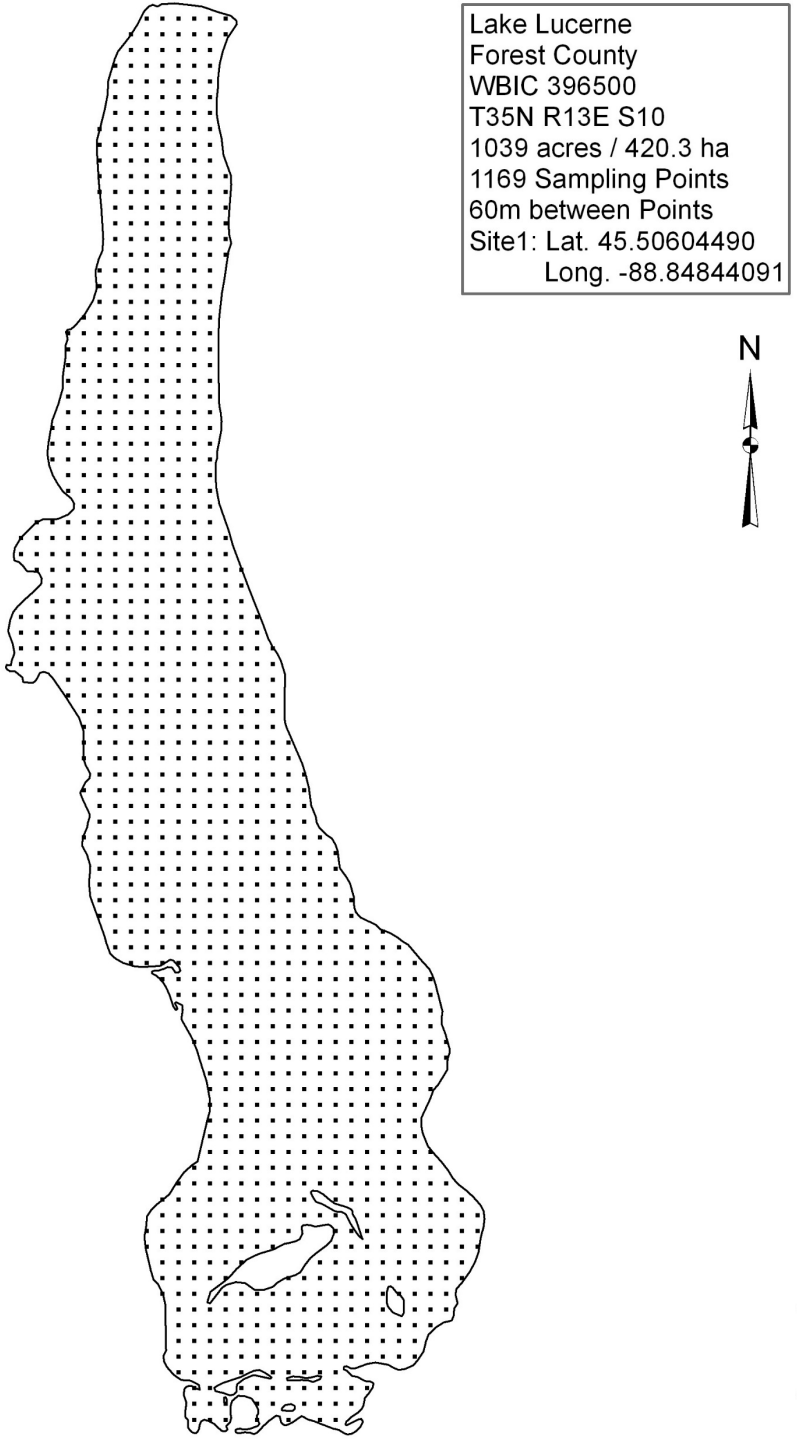
Aquatic Plant Survey

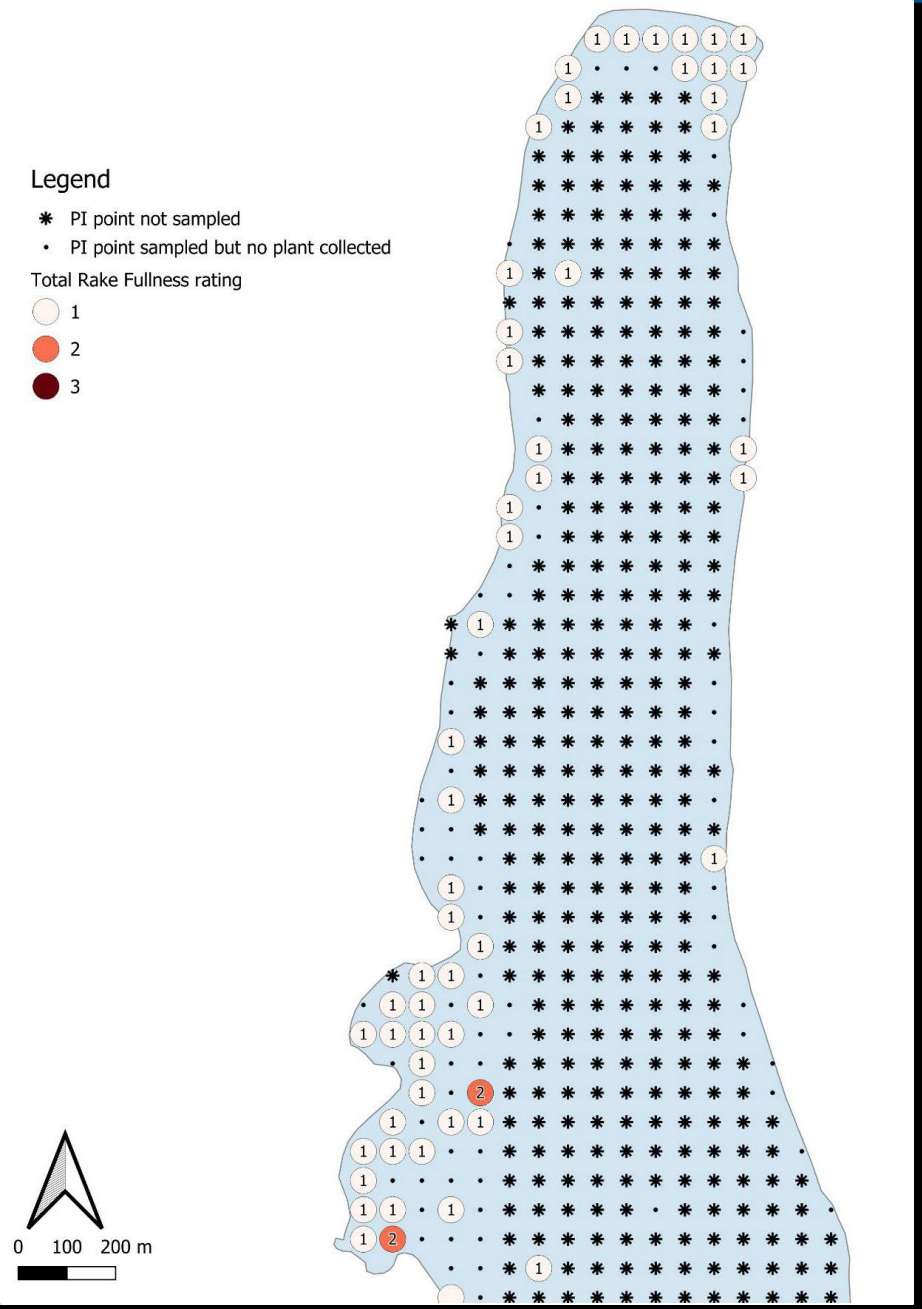
Point-Intercept Aquatic Plant Survey

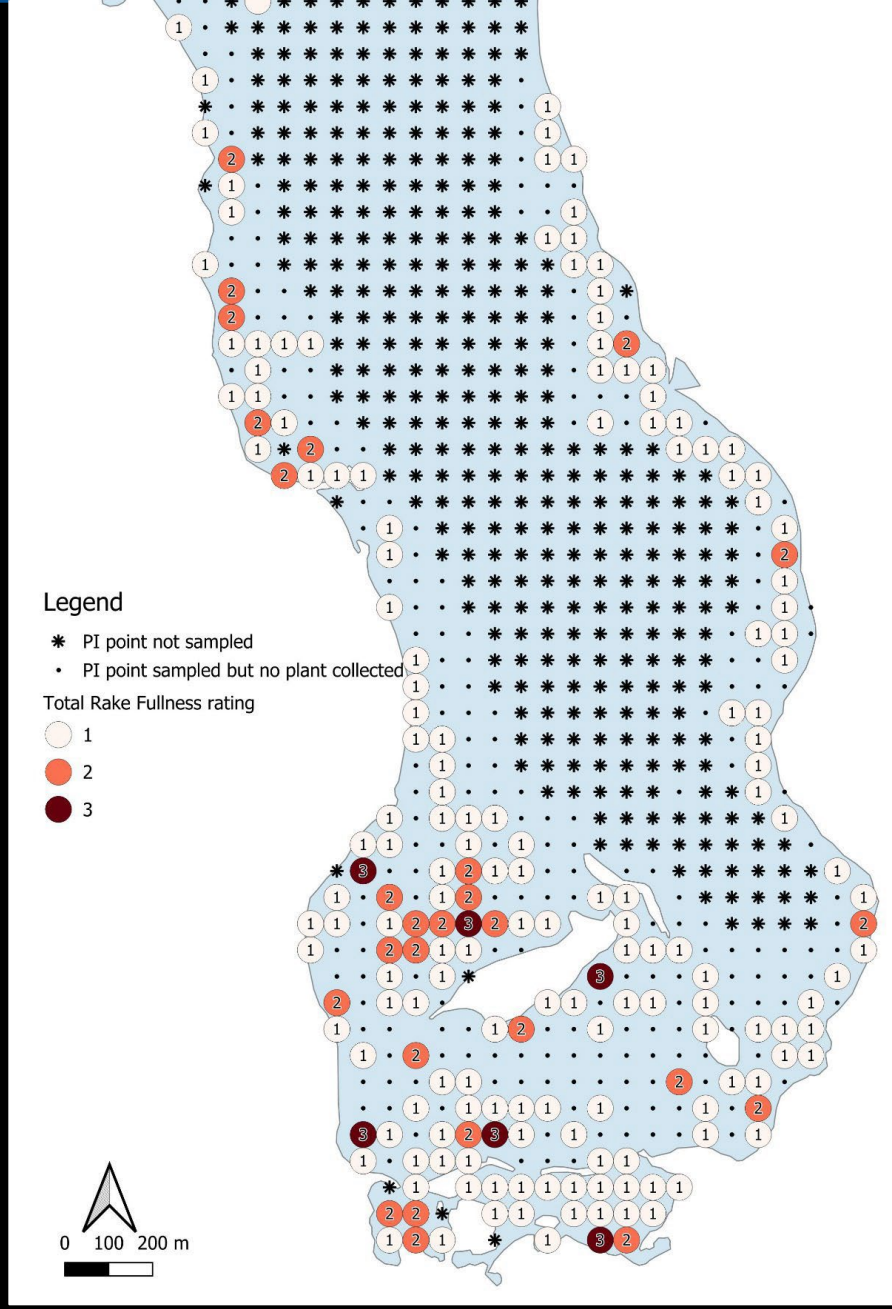


P-I Aquatic Plant Survey

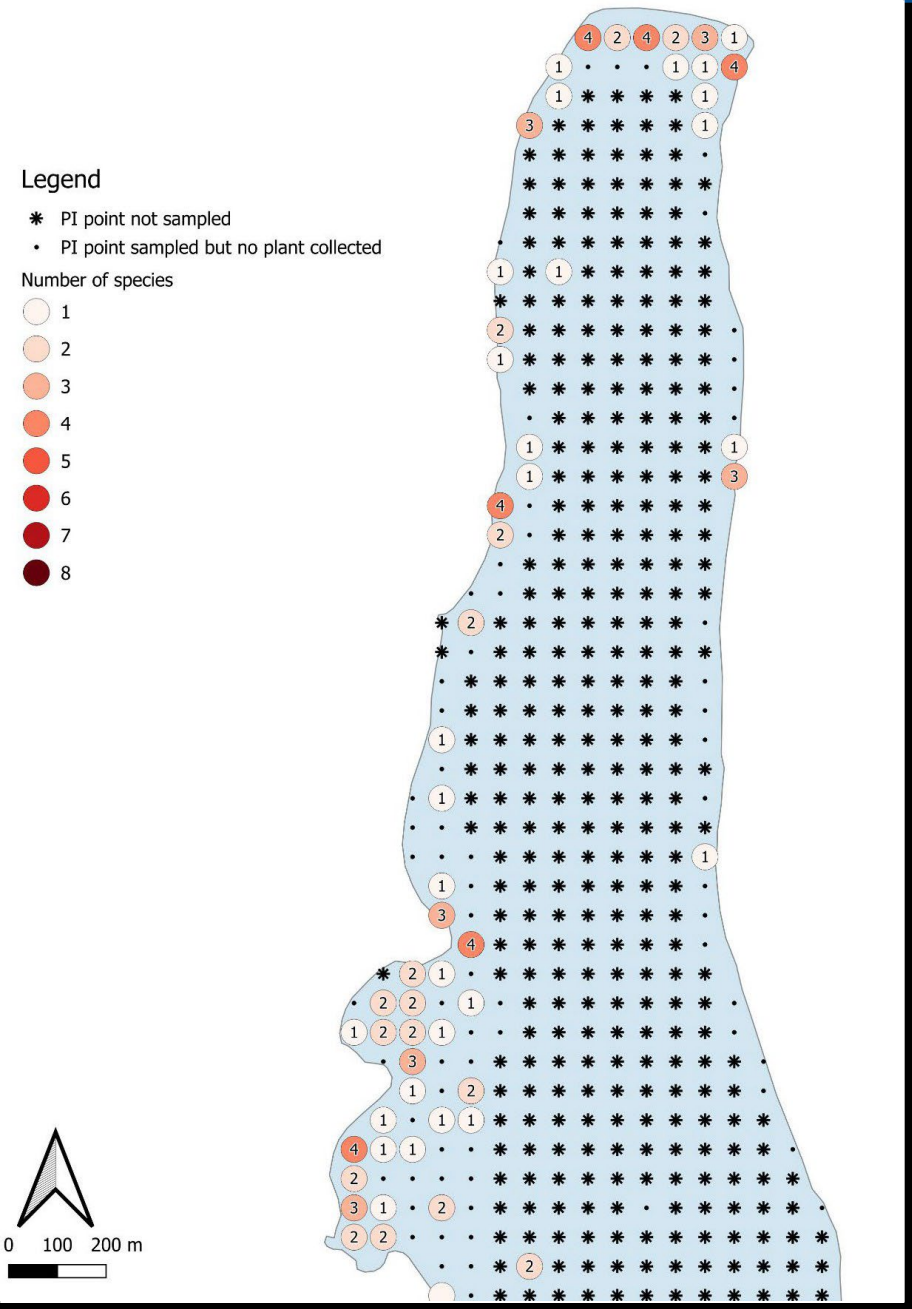
- Three-person team
  - Driver-Navigator
  - Aquatic Plant Botanist
  - Scribe
- Rake probes bottom
  - Record depth
  - Record substrate
  - Collect plants 1m sweep
- Plants identified
- Rake fullness recorded
- Navigate to next point
- Systematic and repeatable

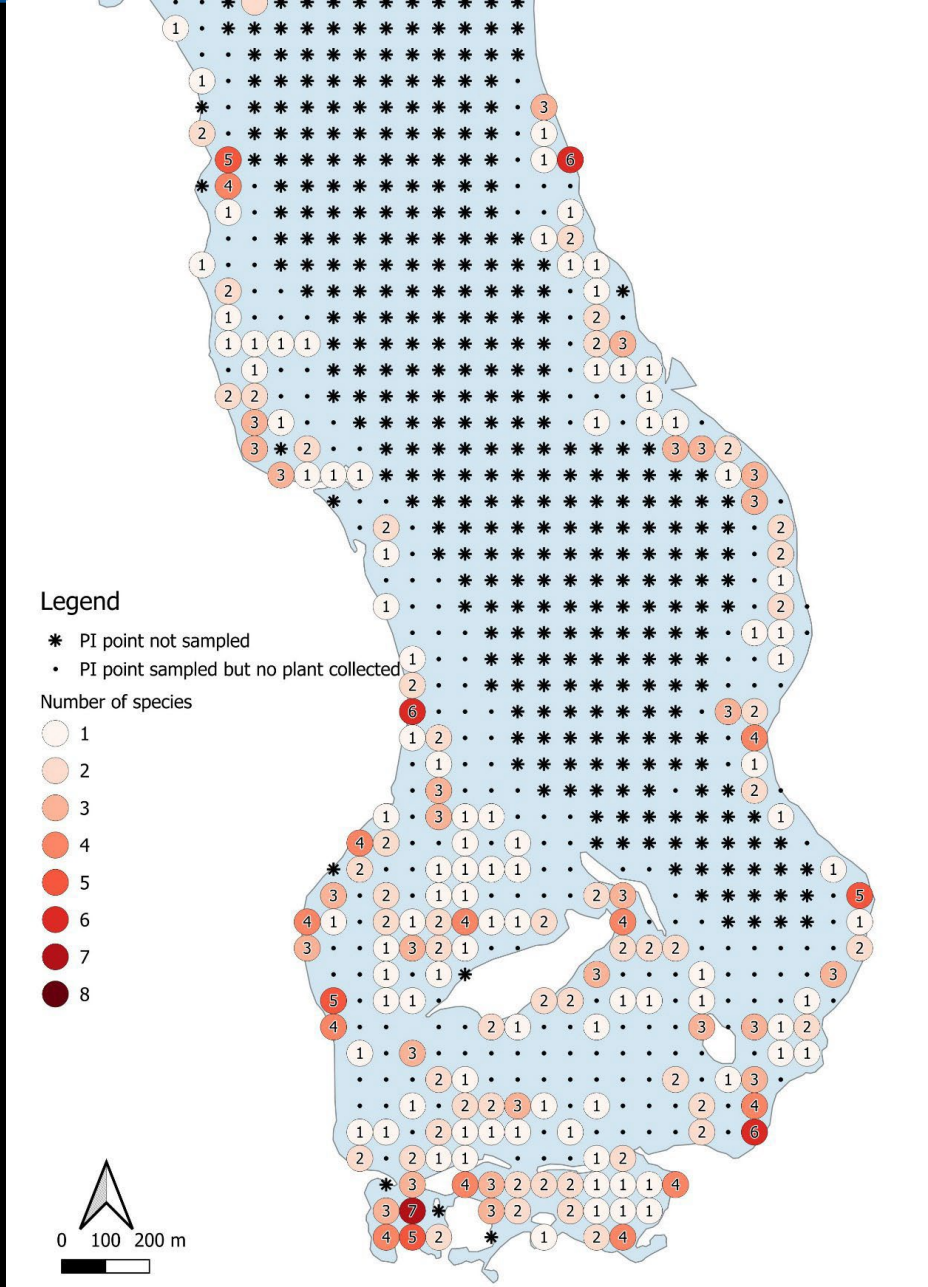




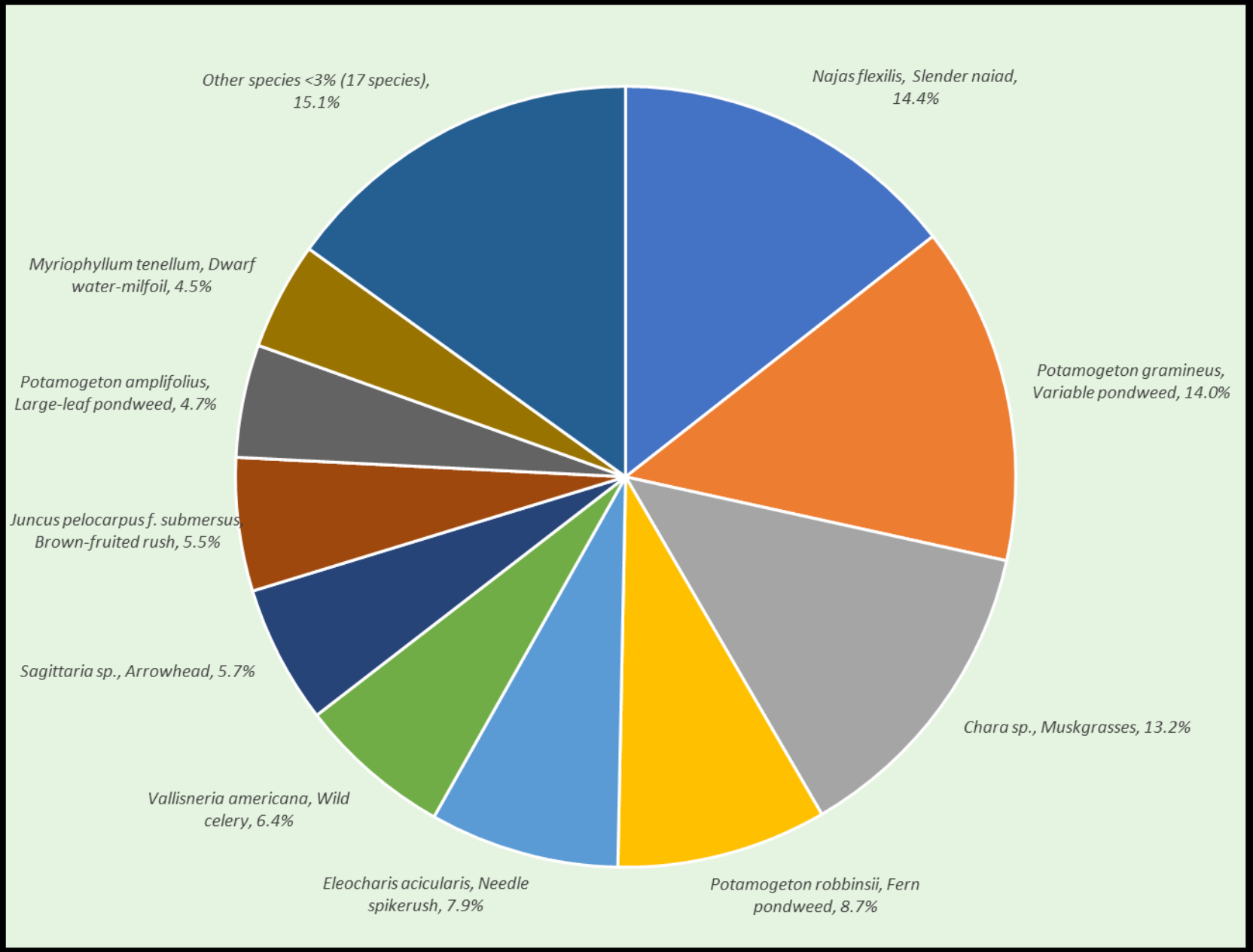


Total Rake Fullness 2025





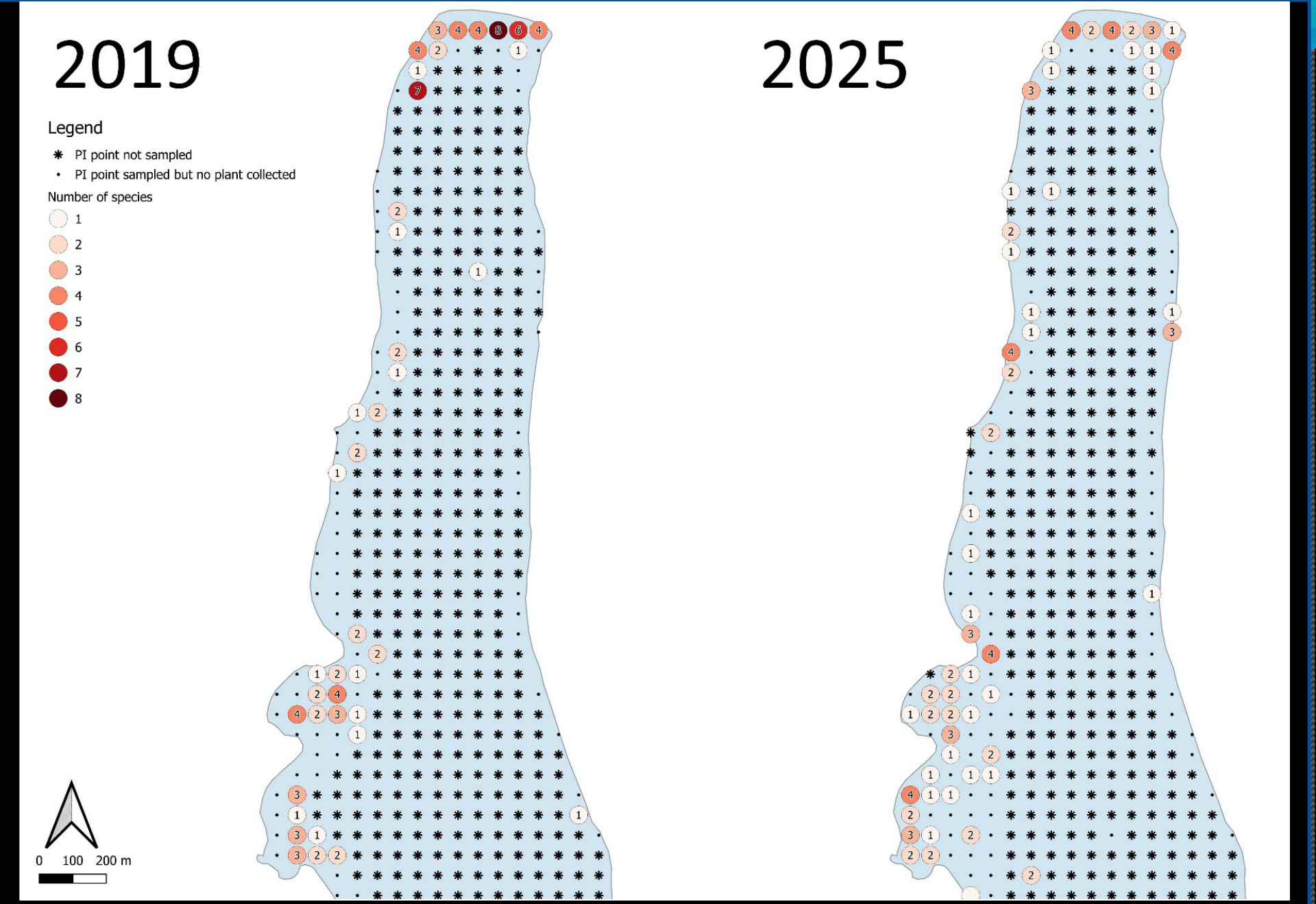
Number of aquatic plant species per point



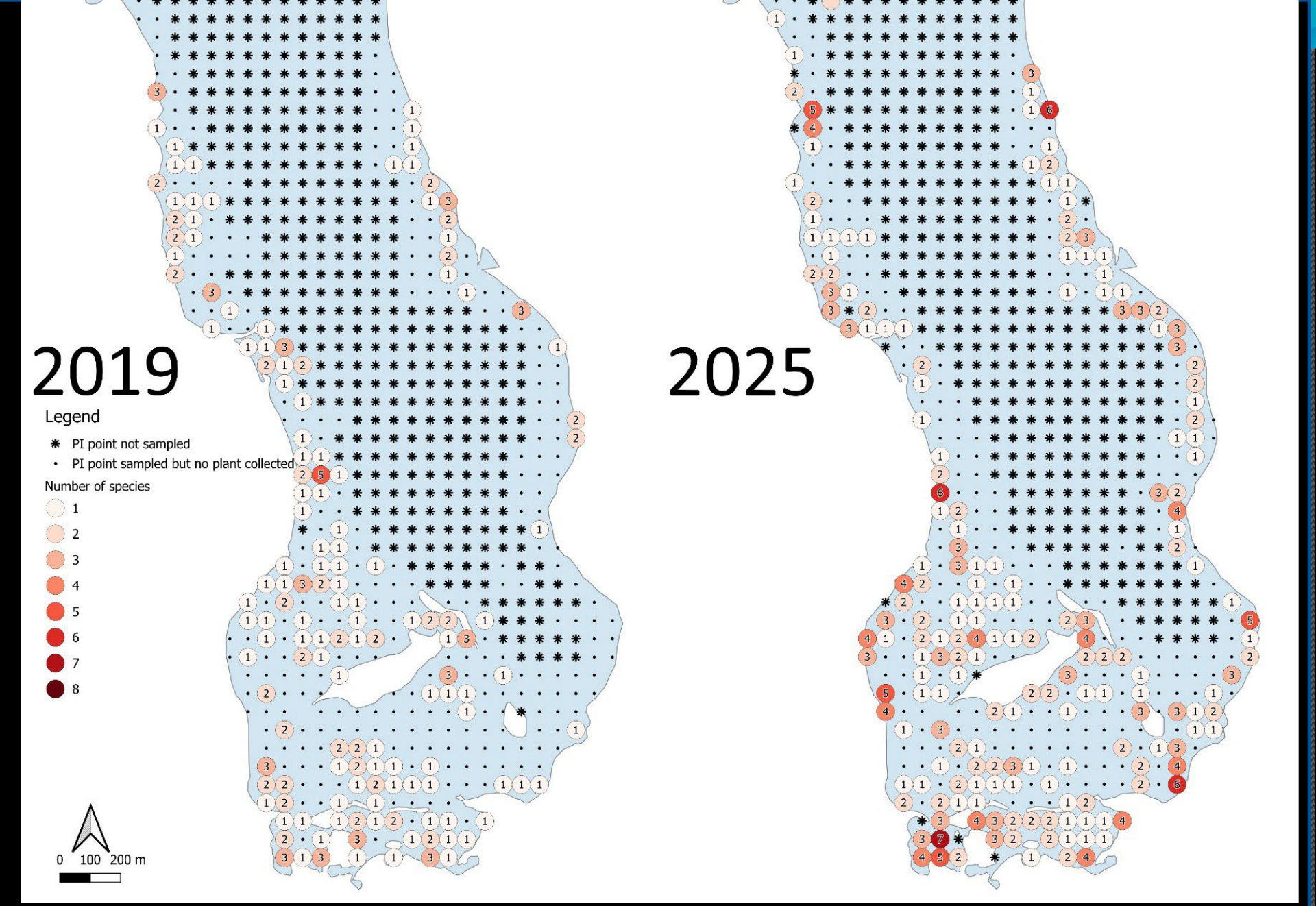
Aquatic plants relative frequency of occurrence

Summary stats for 2019 & 2025 aquatic plant surveys

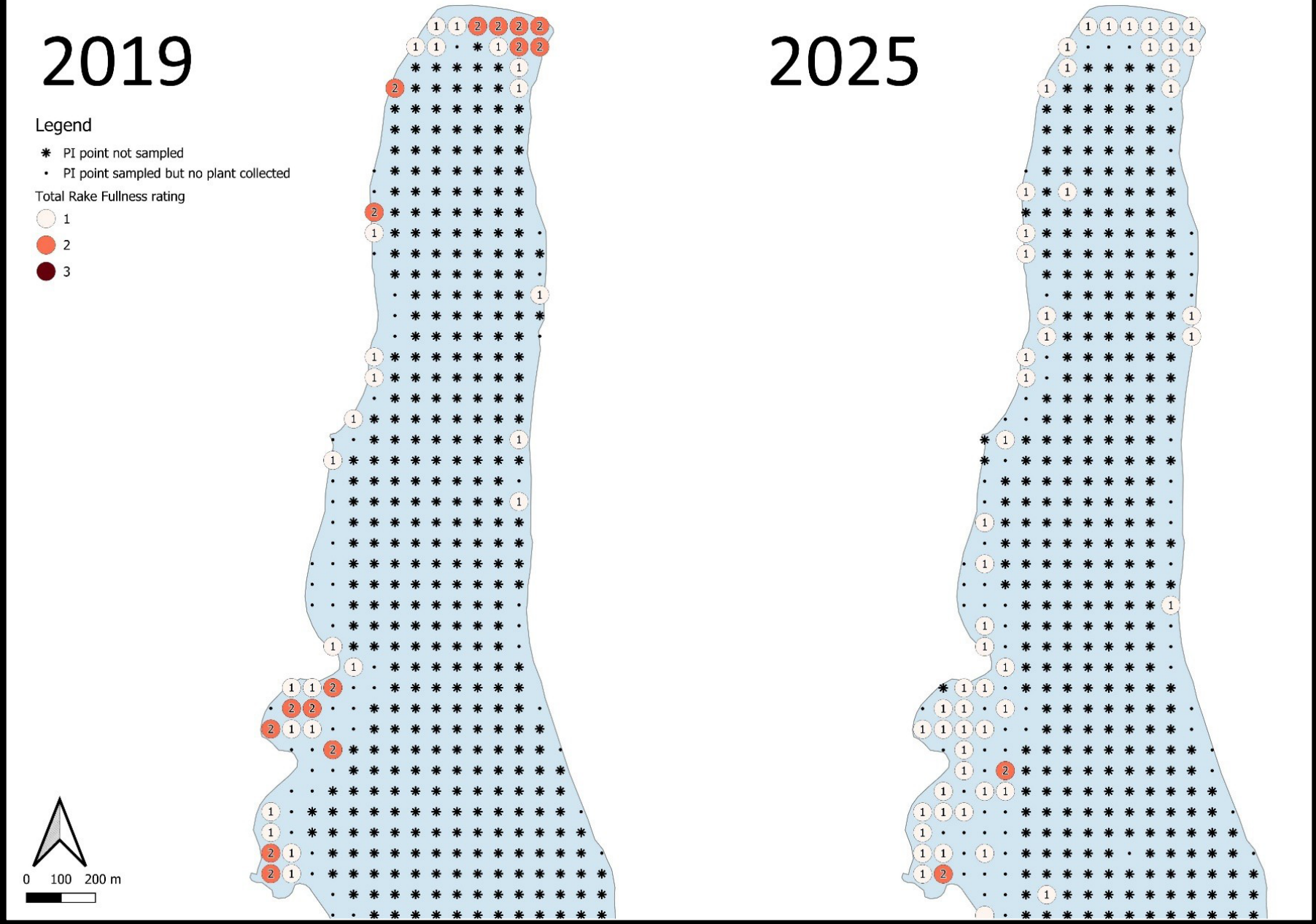
Summary Statistic	2019	2025
Total number of sites with vegetation	186	248
Total number of sites shallower than maximum depth of plants	456	496
Frequency of occurrence at sites shallower than maximum depth of plants	40.79	50.00
Simpson Diversity Index	0.92	0.91
Maximum depth of plants (ft.)	21	24.5
Average number of all species per site (shallower than max depth)	0.68	0.95
Average number of all species per site (vegetated sites only)	1.68	1.90
Average number of native species per site (vegetated sites only)	1.68	1.90
Species Richness	35	27
Species Richness (including visuals)	43	31
Floristic Quality Index (FQI)	40.56	34.32
Average rake fullness	1.23	1.17



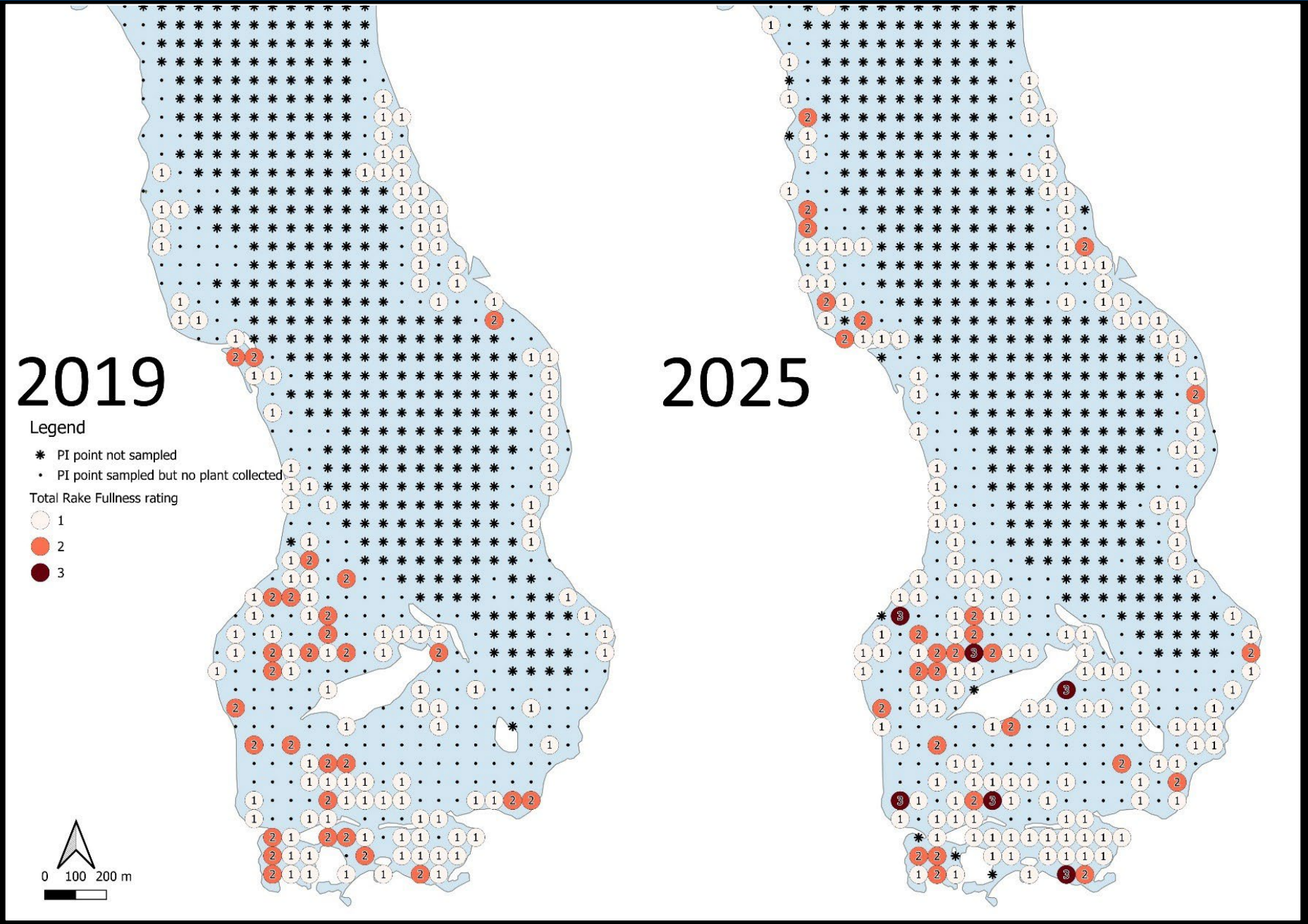
North part Lake Lucerne # of plant species in 2019 & 2025



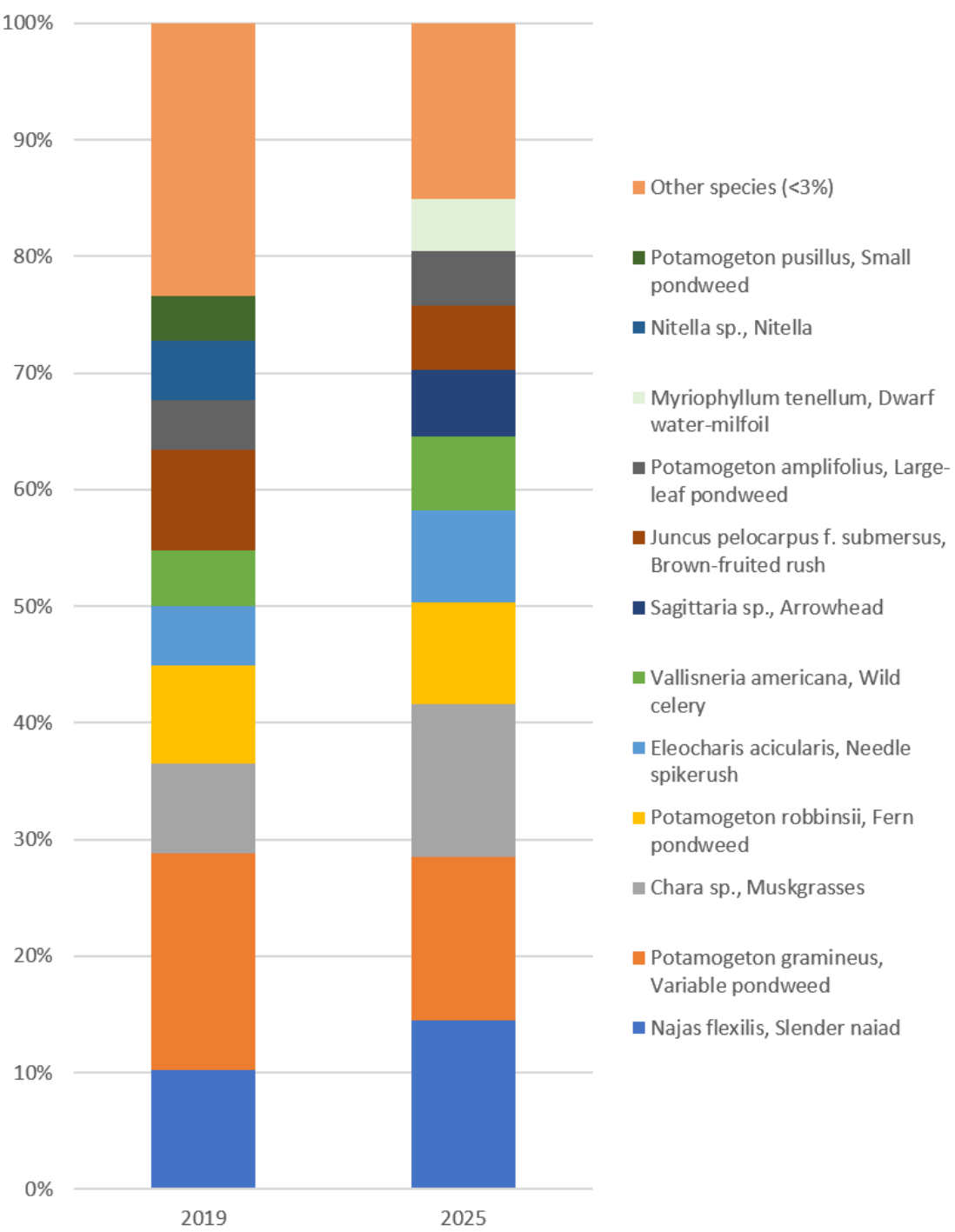
South part Lake Lucerne # of plant species in 2019 & 2025



North part Lake Lucerne total rake fullness in 2019 & 2025



South part Lake Lucerne total rake fullness in 2019 & 2025



2019 and 2025 Lake Lucerne aquatic plant relative frequencies

Aquatic Plant Community Highlights

- *Lake ecosystems are dynamic - change is the norm.*
- *Number of sites with plants increased between 2019 & 2025.*
- *Maximum depth of plants increased between 2019 & 2025.*
- *Diversity has remained consistently high (species richness, Simpsons Diversity Index, and Floristic Quality Index).*
- *The number of species per point-intercept site has increased over time.*
- *This is a diverse and healthy aquatic plant community.*

Aquatic Plant Community Highlights (cont'd)

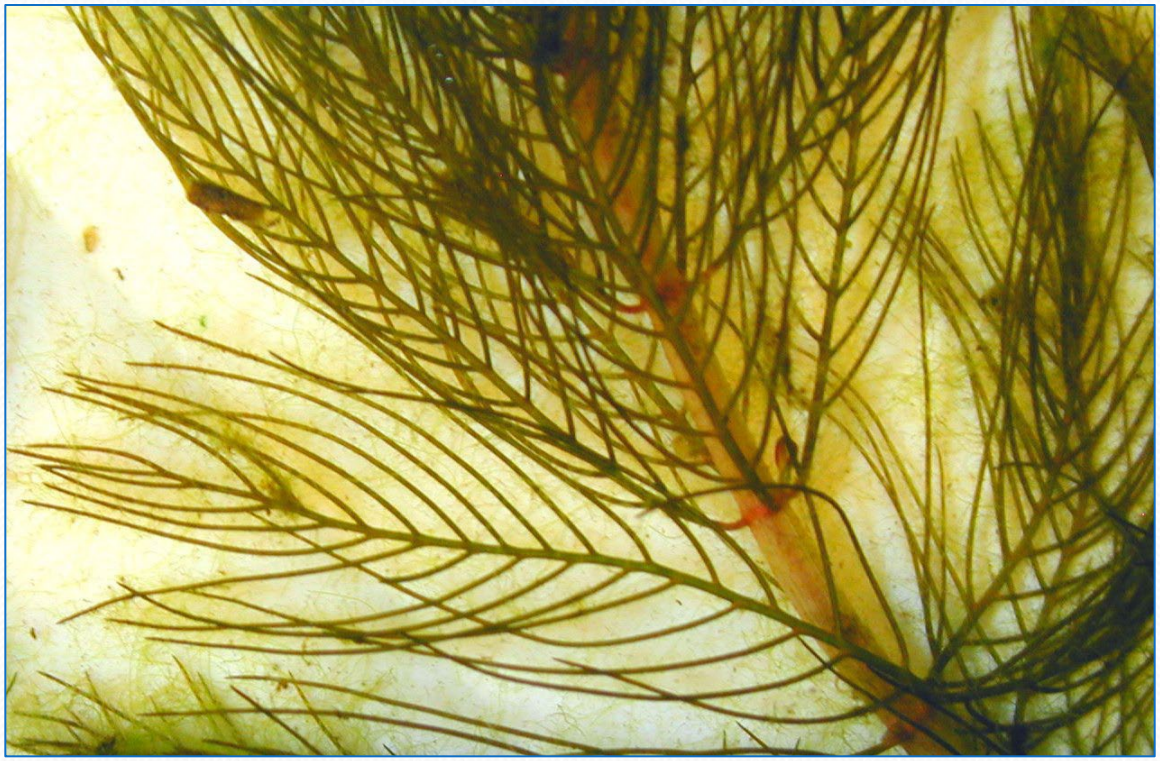
- *2025 percent relative frequencies do not show any dominant species.*
- *The frequencies of occurrence reflect a very diverse and dynamic aquatic plant community. Individual plant species increase and decrease from year to year.*
- *Over the surveys, the average rake fullness of all plants has been stable indicating a stable biomass.*

Non-native species – Aquatic Invasive Species

- A non-native species is an organism that does not occur naturally in a particular region but has been introduced there through deliberate or accidental human activities.
- Examples: brown trout, rainbow trout, rusty crayfish, Chinese mystery snail, freshwater jellyfish, Eurasian watermilfoil
- Not all non-native species act invasively. They are considered invasive if they cause measurable harm.
- An aquatic invasive species does not act invasively in every circumstance

Eurasian watermilfoil

- Documented in 2024
- Several species of native milfoils
- EWM only sometimes behaves invasively
- Provides some of the same benefits as native plants.



Management of Eurasian watermilfoil

"***First, do no harm***" - core principle in medical ethics

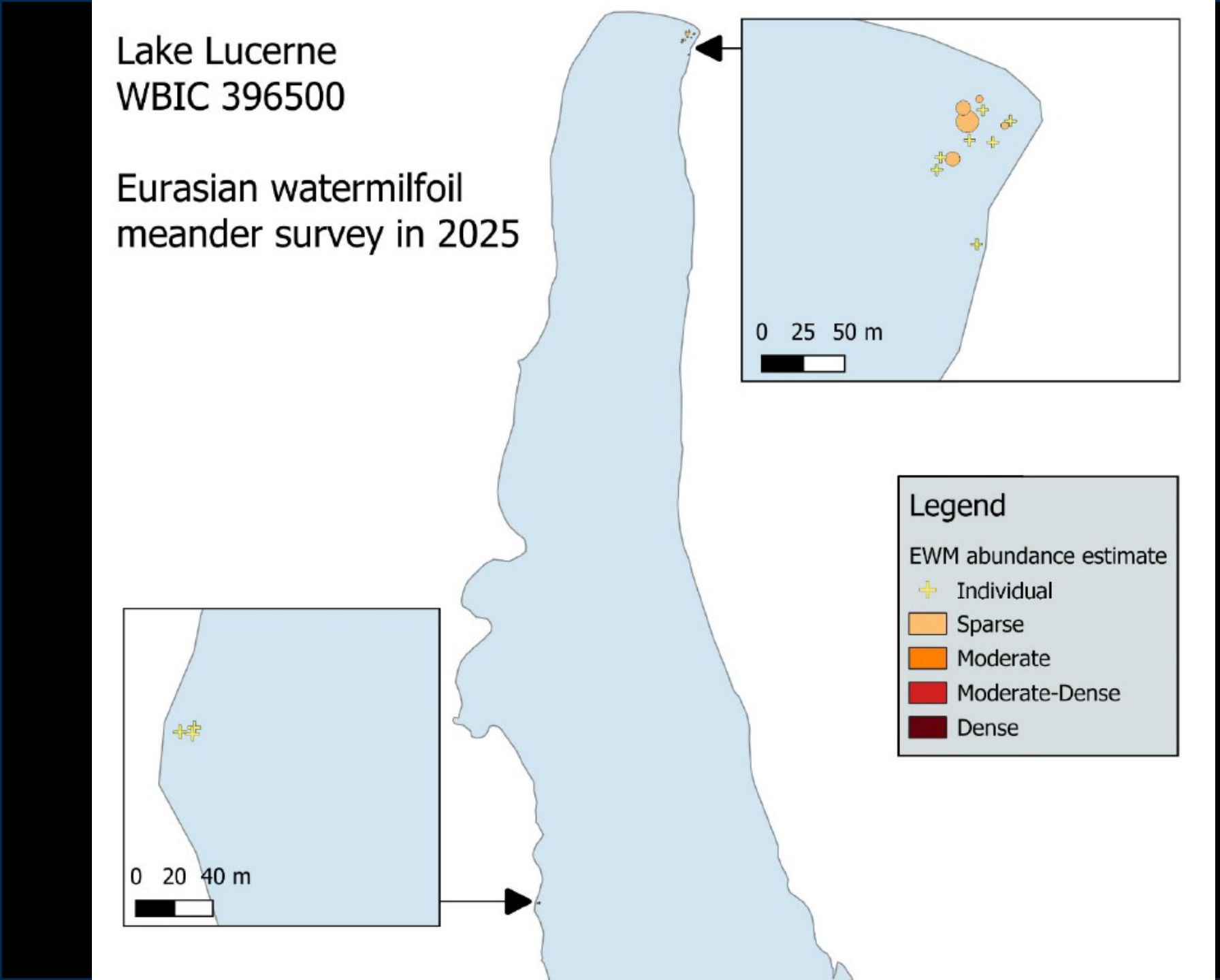
Any action taken is justified by benefits outweighing risks.

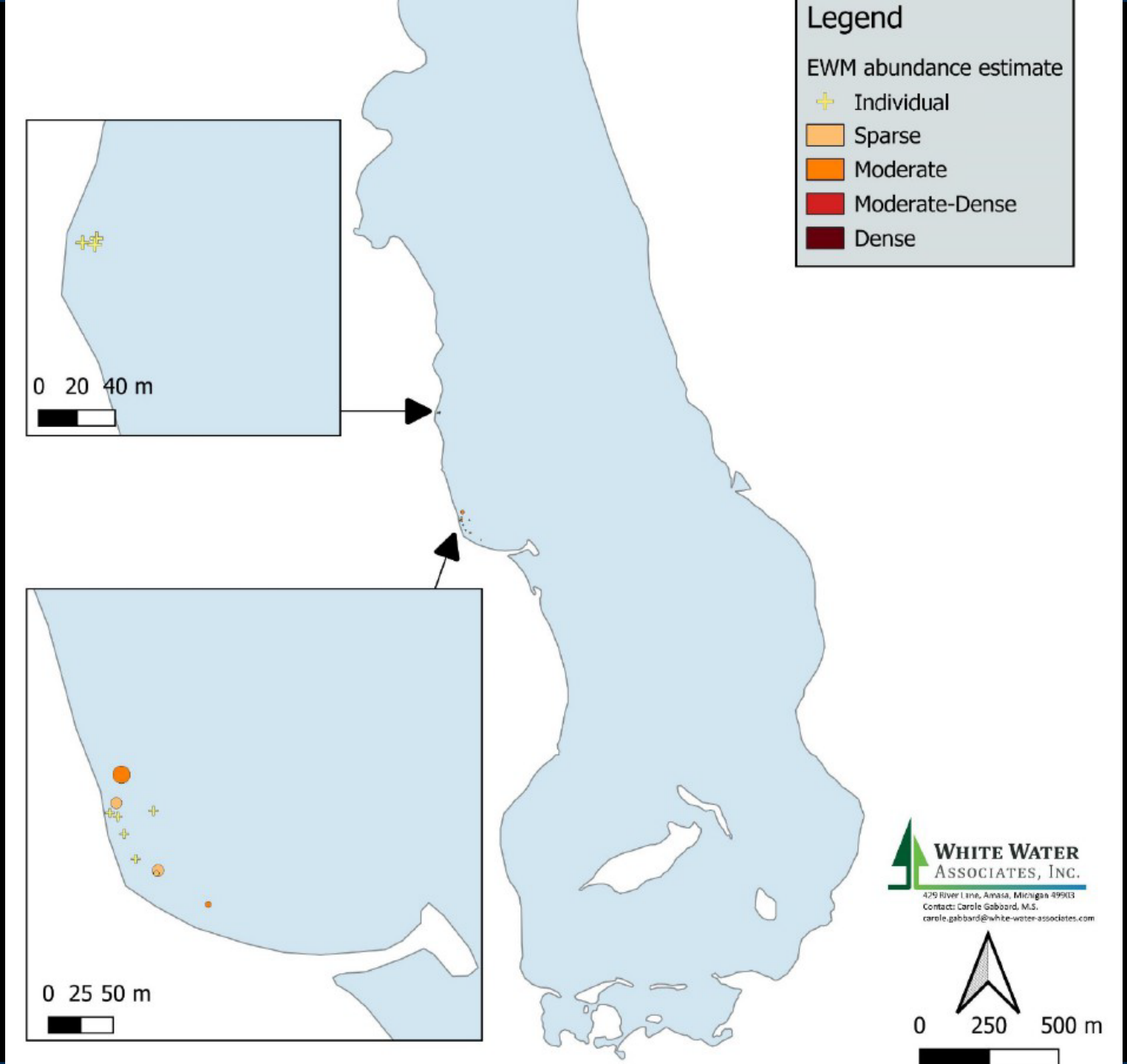
No management action is done in isolation.

Eradication is not possible.

EWM management options for lakes include:

- Prevent introduction in the first place
- Biological control: milfoil weevil
- Manual removal: cutting, raking or hand-pulling
- Diver Assisted Suction Harvesting (DASH)
- Mechanical harvesting
- Chemical (herbicide)


Lake Lucerne
WBIC 396500
Eurasian watermilfoil
meander survey in 2025
0 25 50 m
0 20 40 m
Legend
EWM abundance estimate
Individual
Sparse
Moderate
Moderate-Dense
Dense


Legend
EWM abundance estimate
Individual
Sparse
Moderate
Moderate-Dense
Dense
0 20 40 m
0 25 50 m
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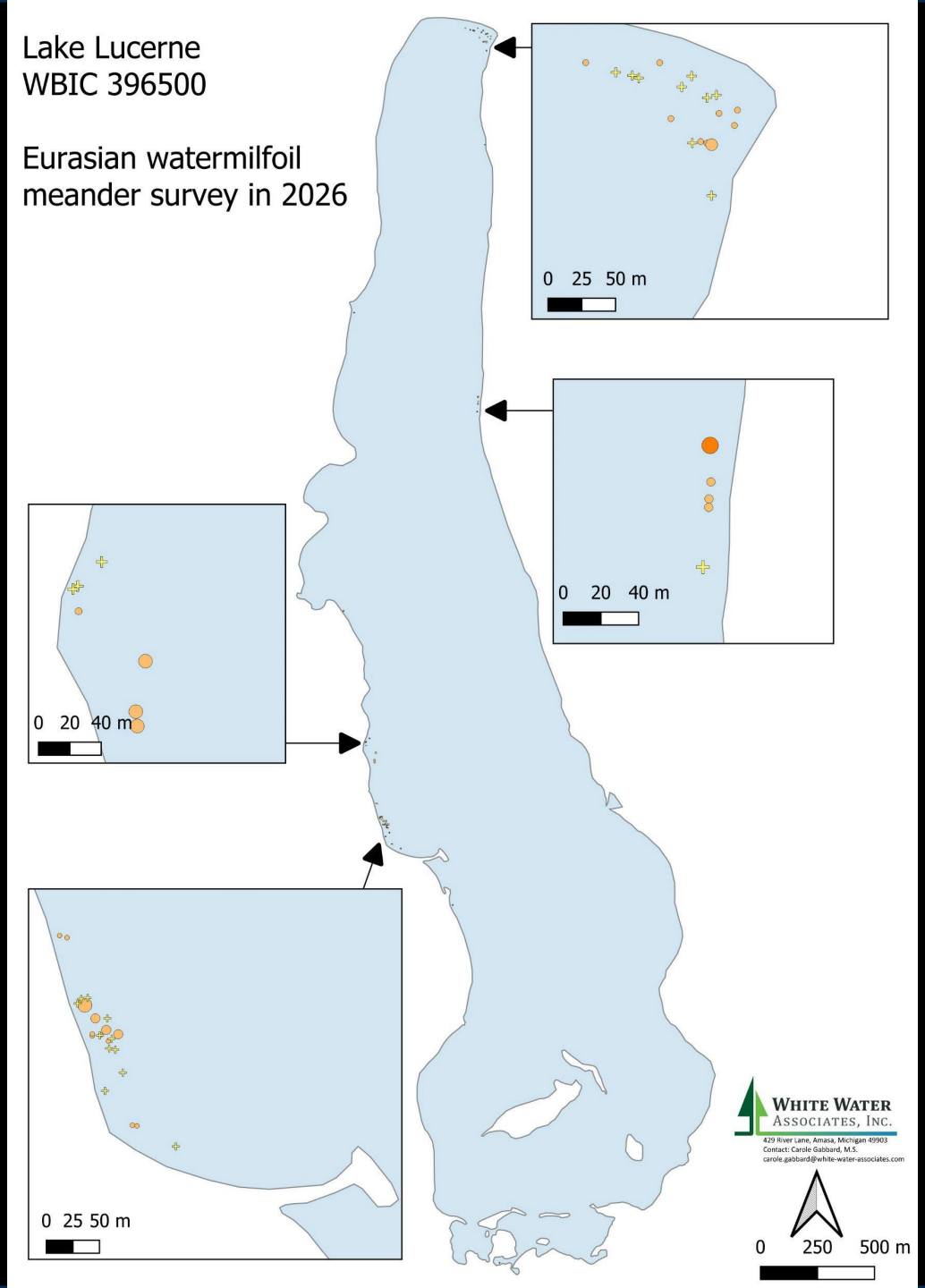
0 250 500 m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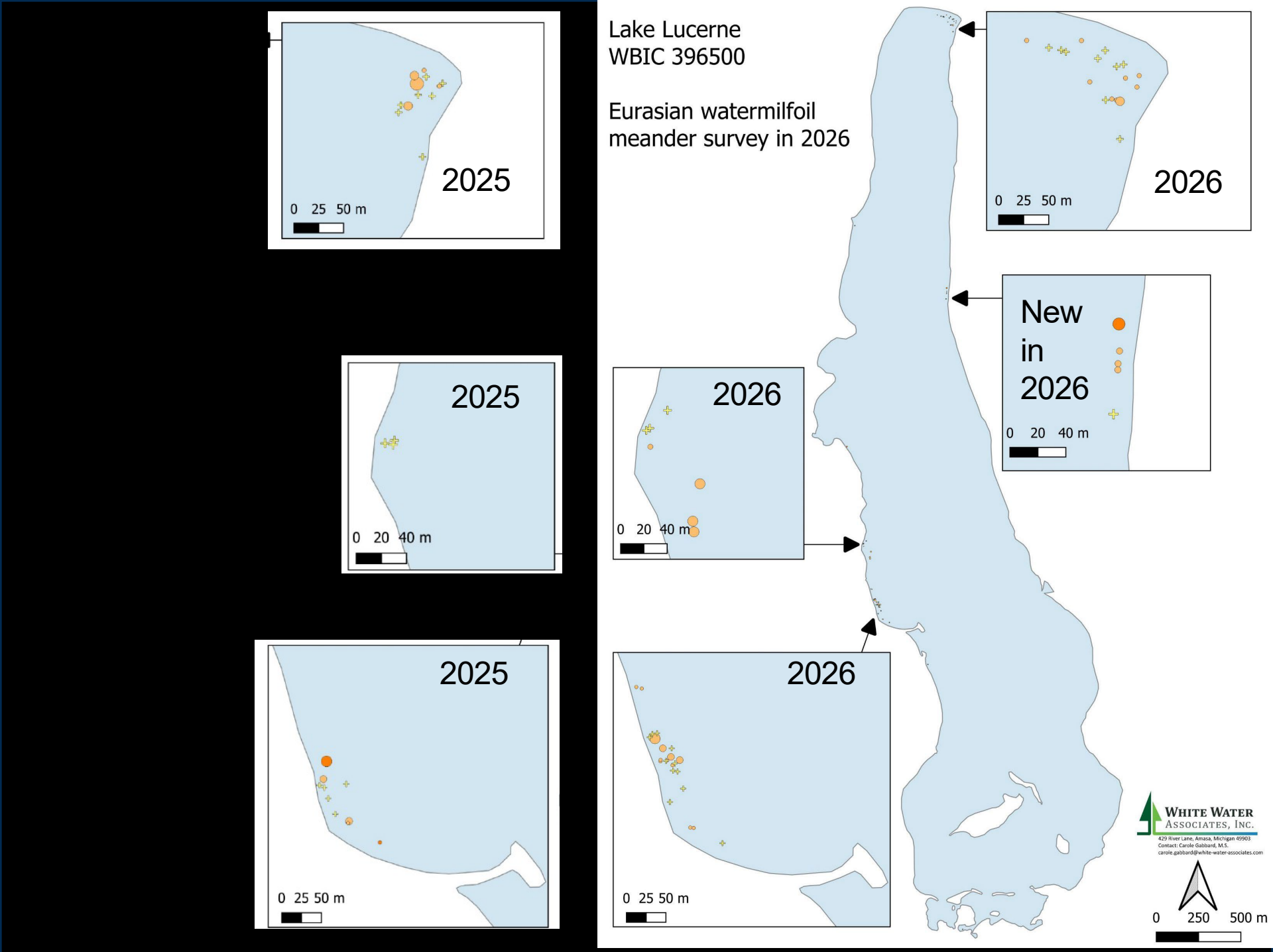
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429 River Lane, Amasa, Michigan 49903
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carole.gabbard@white-water-associates.com
0 250 500 m

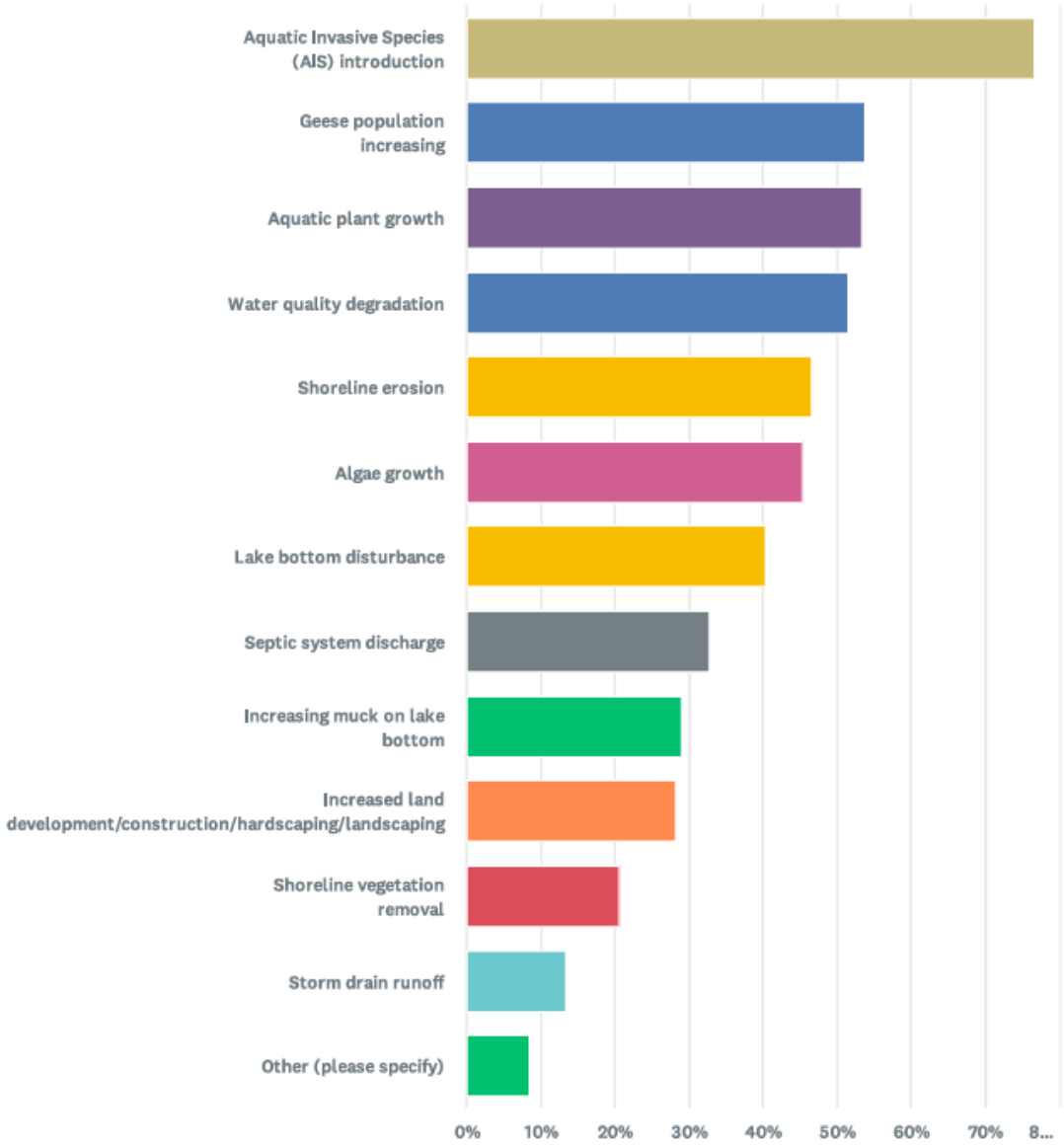
Thanks!

Questions?

Extra slides

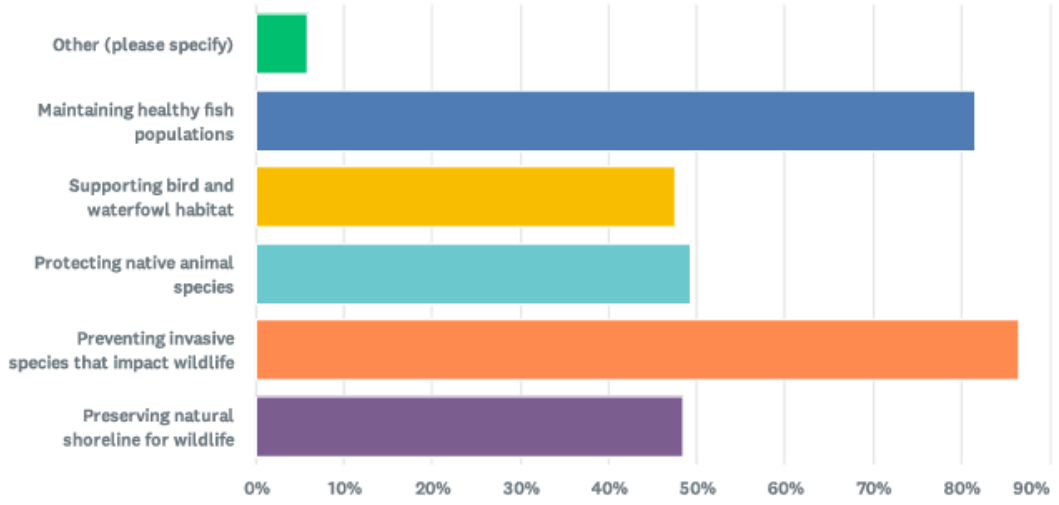
Q14 From the list below please select your Water Quality concerns on Lake Lucerne.

Answered: 223 Skipped: 9



Q16 What aspects of wildlife and habitat are most important to you when considering the future of Lake Lucerne? (Please check all that apply)

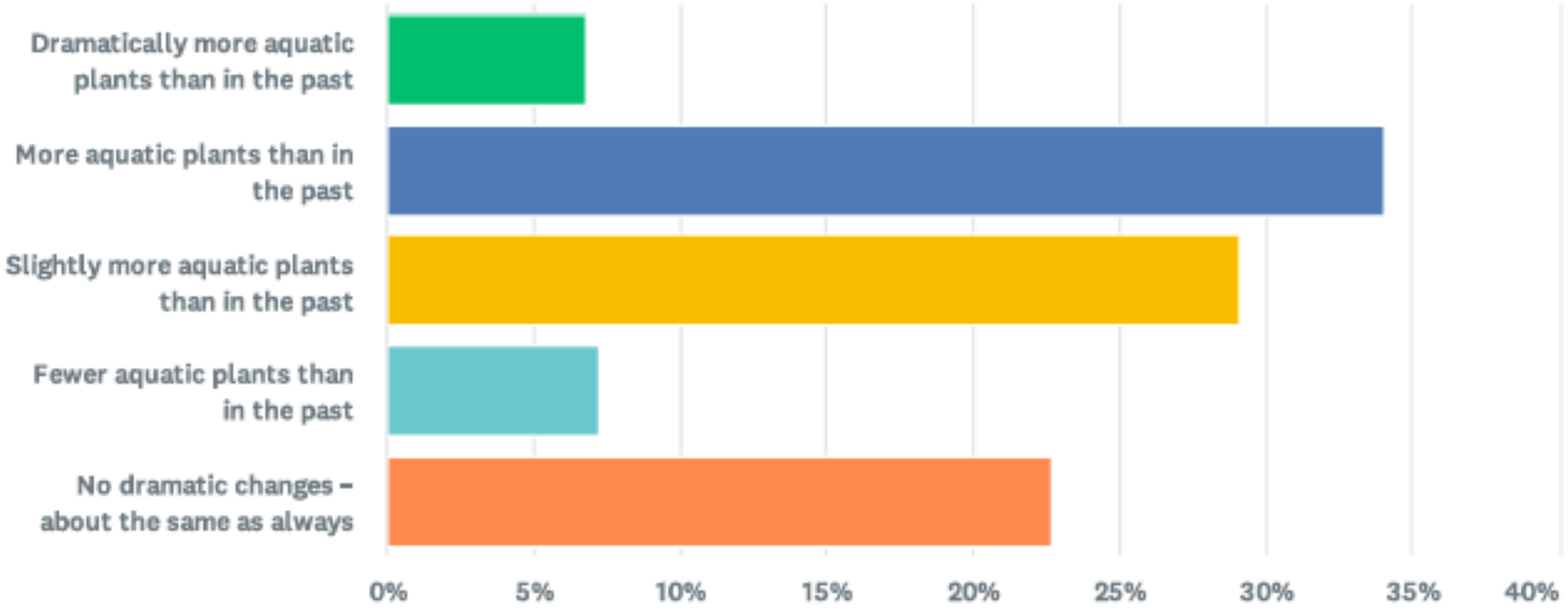
Answered: 223 Skipped: 9



#	OTHER (PLEASE SPECIFY)	DATE
1	Loons	3/28/2026 8:31 AM
2	Protection of loons, but not geese.	3/25/2026 6:18 PM
3	I know that people that have not used the lake for a lot of years. Do not realize how much dirtier the water is now than what it was 40 years ago. I die of a lot in the lake over the years and it is by far dirtier now than what it used to be	3/24/2026 1:19 PM
4	I would like more work done to eradicate invasive species such as the milfoil and the geese population. Swimmers itch has become prevalent which never happened before.	3/18/2026 6:00 PM
5	Understand and eliminate swimmers itch.	3/18/2026 5:59 PM
6	Preserving shoreline to control erosion	3/16/2026 1:28 PM
7	Preserving natural shoreline for people too!	3/15/2026 2:58 PM
8	Quiet environment for all	3/13/2026 2:26 PM
9	Loon protection	3/13/2026 2:16 PM
10	Attracting water fowl (ducks and geese) by feeding and providing unrestricted access by lawns down to the water's edge increases population and fertility of the water. Feeding deer is altering the native flora around the lake, deer are browsing off the Ground Hemlock and other conifers/ground level plants. If Zebra/Quagga mussels or Spiny Water Fleas are introduced	3/10/2026 9:36 AM

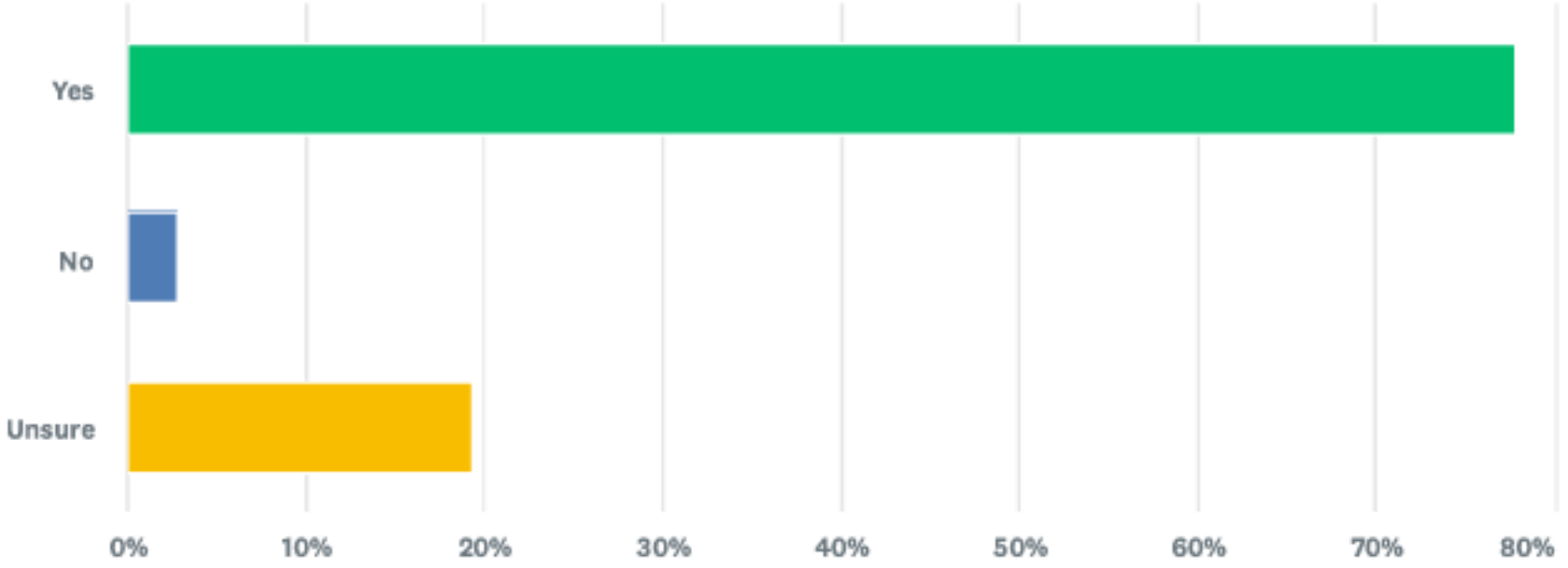
Q21 During the years you have been familiar with Lake Lucerne, what changes, if any, have you seen in the aquatic plants?

Answered: 220 Skipped: 12



Q28 Do you believe that aquatic plant management is needed on Lake Lucerne?

Answered: 217 Skipped: 15



Q34 An Aquatic Plant Management (APM) Plan can have several goals. We would like to know where you think the plan for Lake Lucerne should place its emphasis. Rank the following list of APM goals (1 for being the most important and 5 being the least important)

Answered: 215 Skipped: 17