



USU Wetland Ecology
& Restoration Laboratory

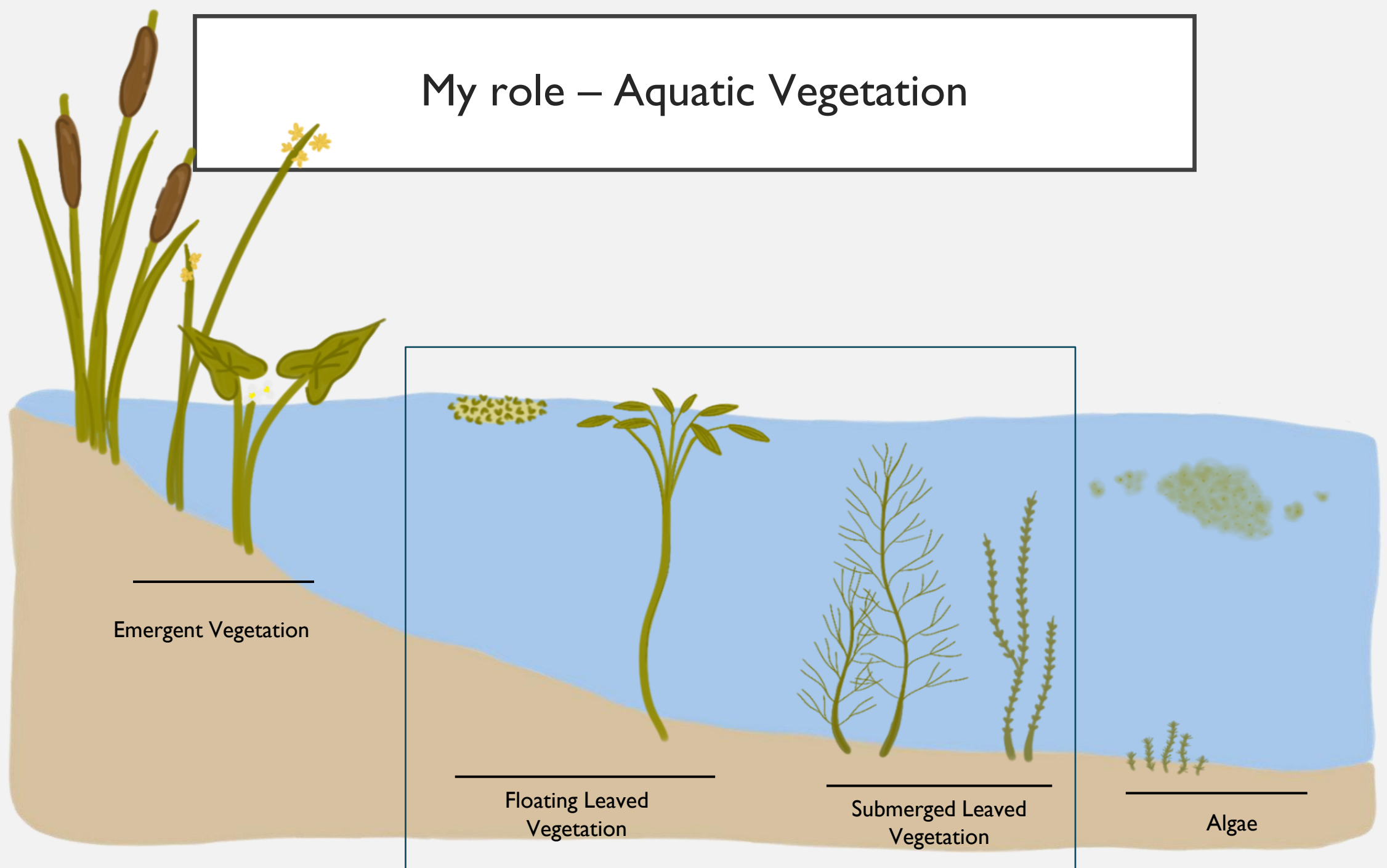


UtahStateUniversity
DEPARTMENT OF
WATERSHED SCIENCES

Submerged Aquatic Vegetation Restoration: Experimental Results and Propagation Recommendations

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Karin Kettenring's Wetland Ecology and Restoration Lab
Utah State University

My role – Aquatic Vegetation



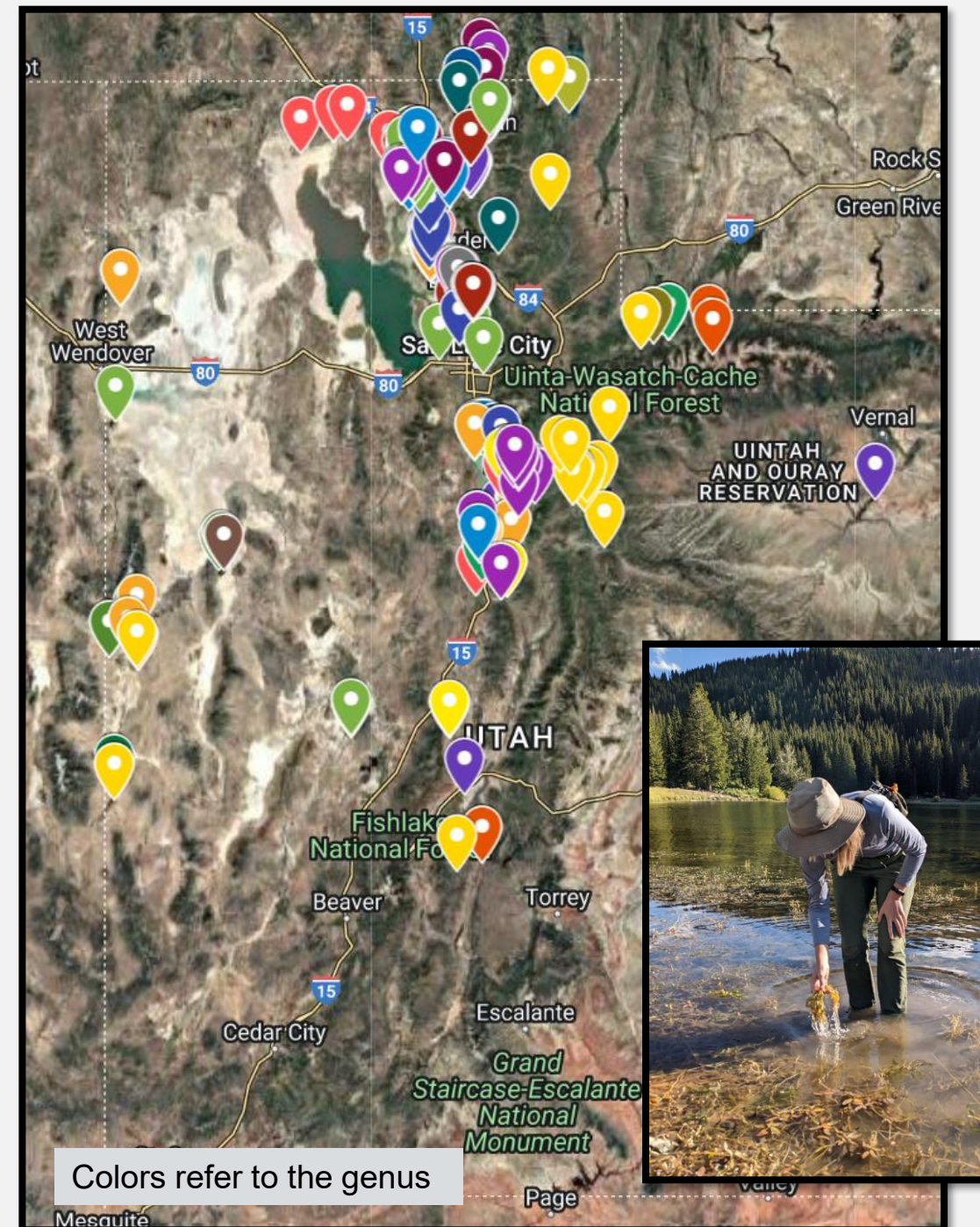


Aquatic plant roles & importance

- Oxygen, food, and habitat for wildlife
- Improve water quality
 - Absorb excess nutrients
 - Decrease erosion
- Large population decreases and degradation
- Need to build the capacity for restoration
- Large lack of knowledge
 - Information
 - Restoration
 - Propagation

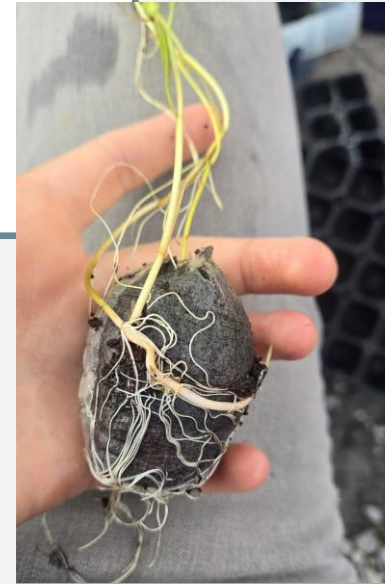
IDENTIFY AQUATIC PLANT SOURCES

- Data gathered while scouting
- With absence of aquatic plant vendors, mapping resource = easy!
- ~345 recorded plant sightings in Utah, of 36 species.



PROJECT QUESTIONS:

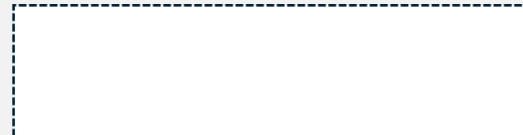
1. How does aquatic plant performance vary by species in restoration?
2. What are the best reintroduction methods for different aquatic plant species?
 - Cuttings vs. pellet plugs
3. What are the best practices to restore aquatic plant communities in the face of carp?
 - Fencing vs. open areas



Pellets



Cuttings



SPECIES USED:



Spiny naiad | *Najas marina*



Water smartweed | *Polygonum amphibium*



Longleaf pondweed | *Potamogeton nodosus*



Spiral ditchgrass | *Ruppia cirrhosa*



Small pondweed | *Potamogeton pusillus*



Horned pondweed | *Zannichellia palustris*



White water crowfoot | *Ranunculus aquatilis*



Sago pondweed | *Stuckenia pectinata*

Waterfowl Management Areas at Great Salt Lake



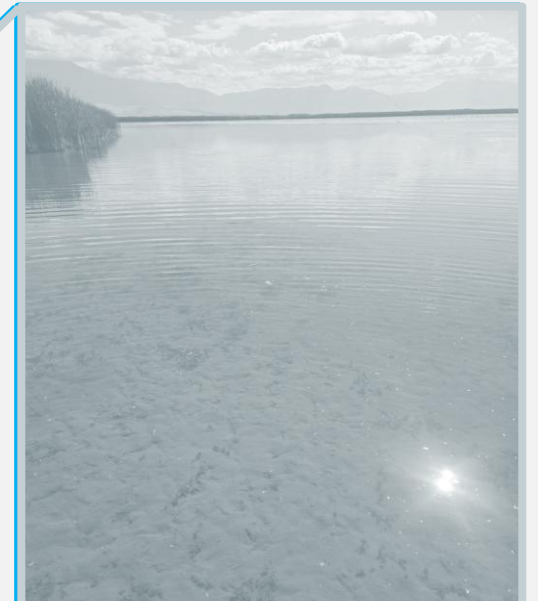
Public Shooting Grounds: Duck
Lake



Harold Crane North-West Pond



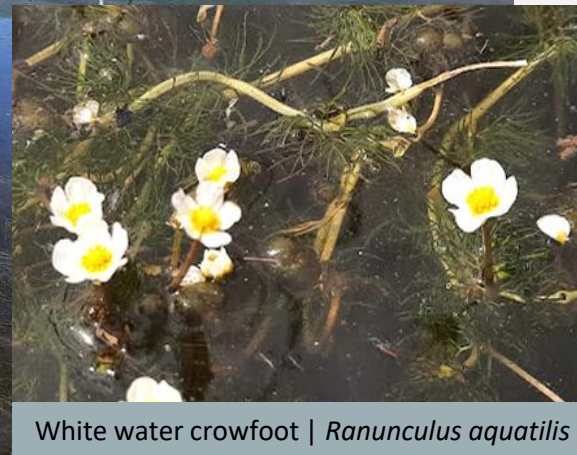
Farmington Bay: Unit 1



Harold Crane South pond

FARMINGTON BAY: UNIT I

- Fencing and open areas for carp.
- Lots of natural diversity
- Several successful plantings



White water crowfoot | *Ranunculus aquatilis*

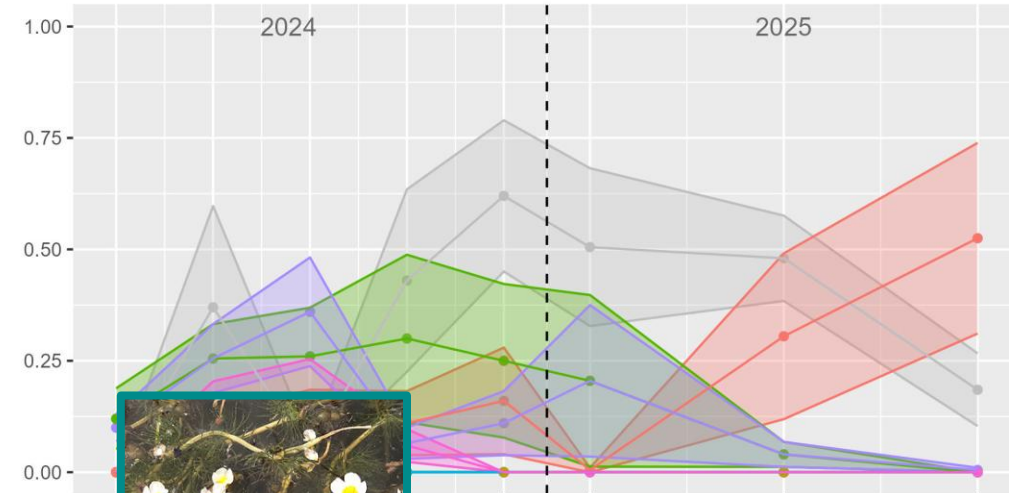
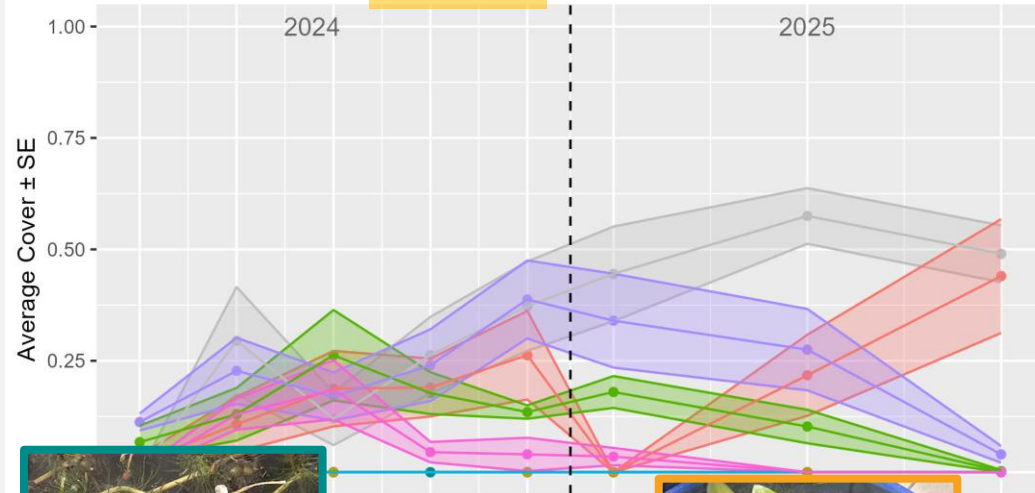


Longleaf pondweed | *Potamogeton nodosus*

Raw data from Farmington Bay: years 1 and 2

FB Fenced: Inner Control

Outer Control



White-water crowfoot



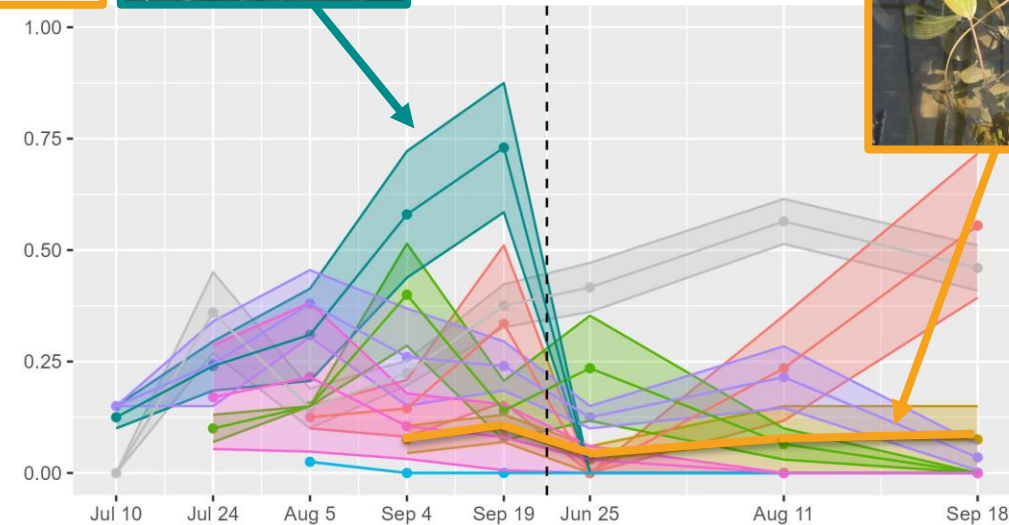
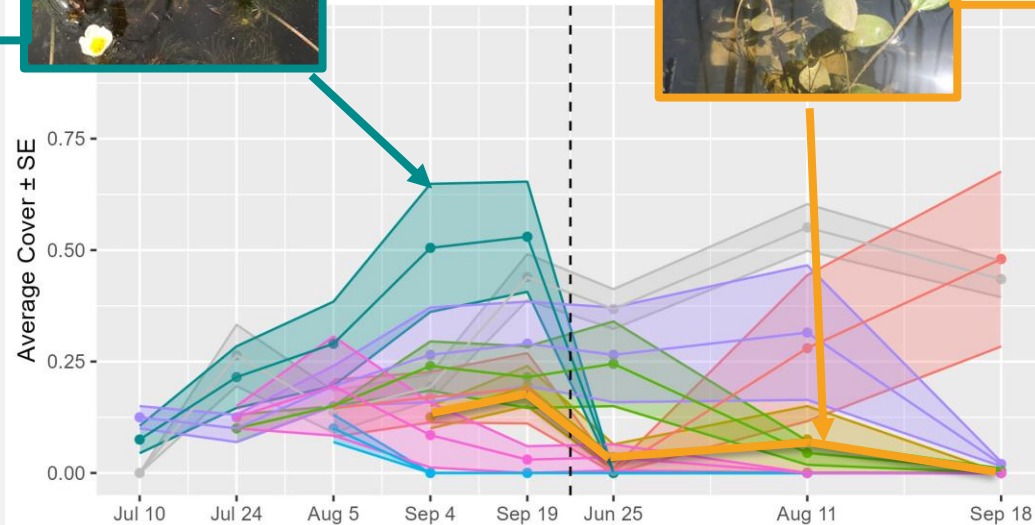
Pellets



Longleaf pondweed

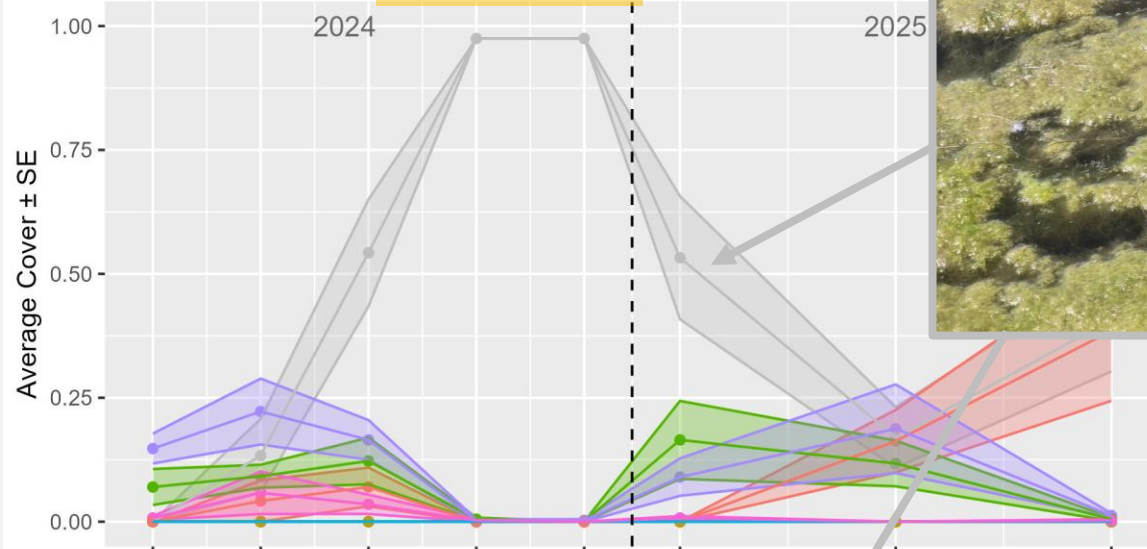


Cuttings

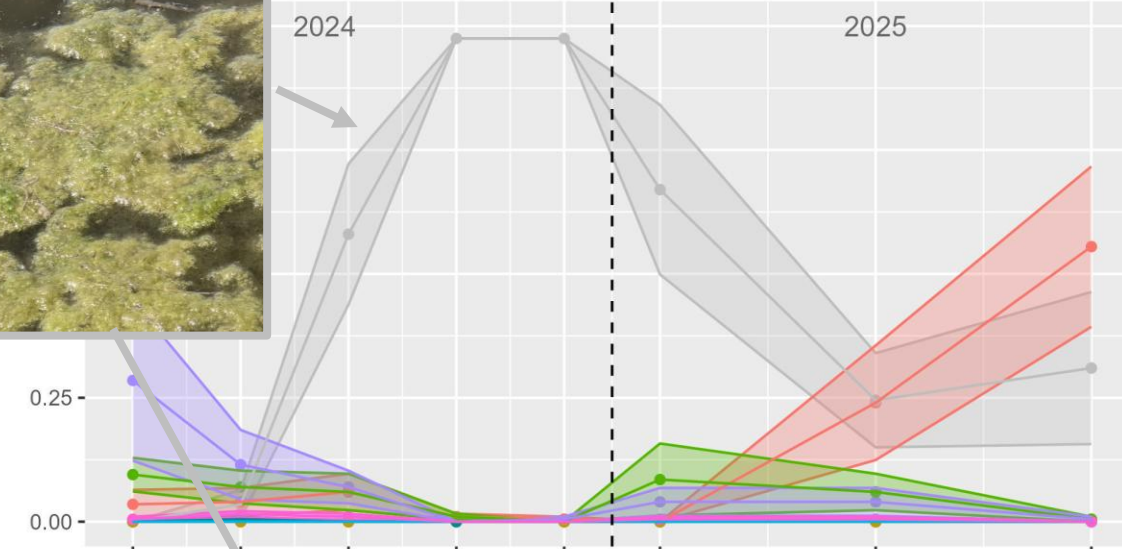


Species — Algae — *N. marina* — *P. nodosus* — *P. pusillus* — *R. aquatilis* — *R. cirrhosa* — *S. pectinata* — *Z. palustris*

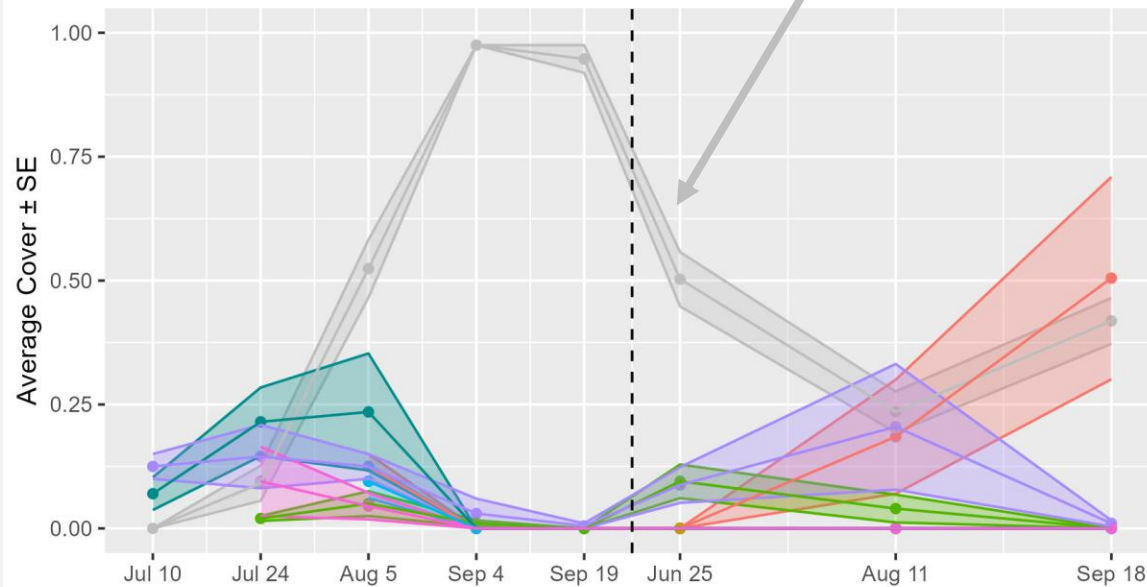
FB Open Area: Inner Control



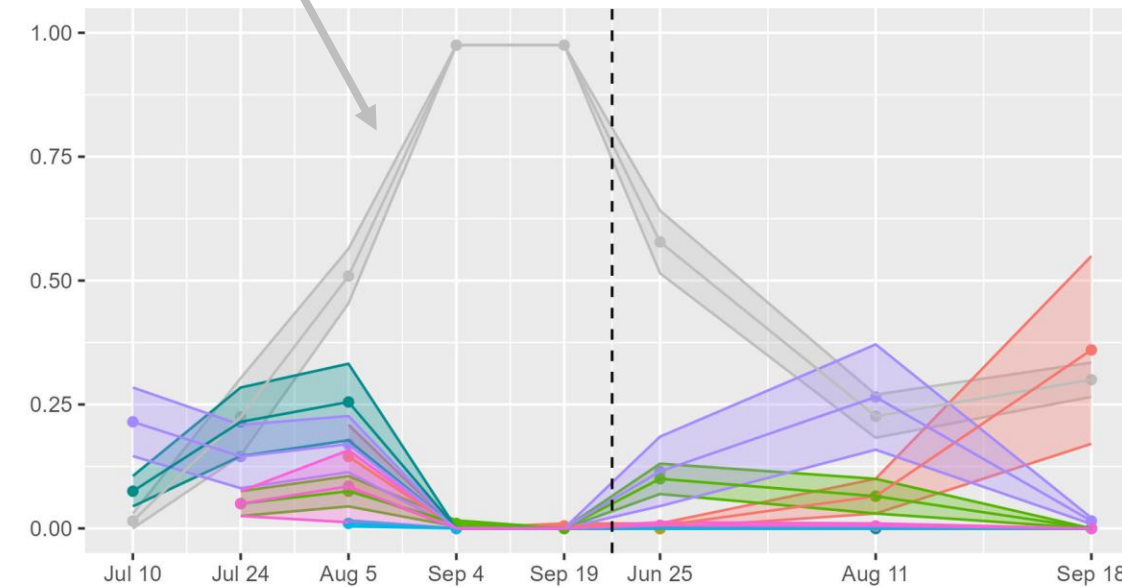
Outer Control



Pellets



Cuttings



Species Algae *N. marina* *P. nodosus* *P. pusillus* *R. aquatilis* *R. cirrhosa* *S. pectinata* *Z. palustris*

2025: HAROLD CRANE North-West Pond

- Plenty of native vegetation
- Some carp but no fencing
- Some successful plantings
- Used salinity acclimation protocol



Longleaf pondweed | *Potamogeton nodosus*



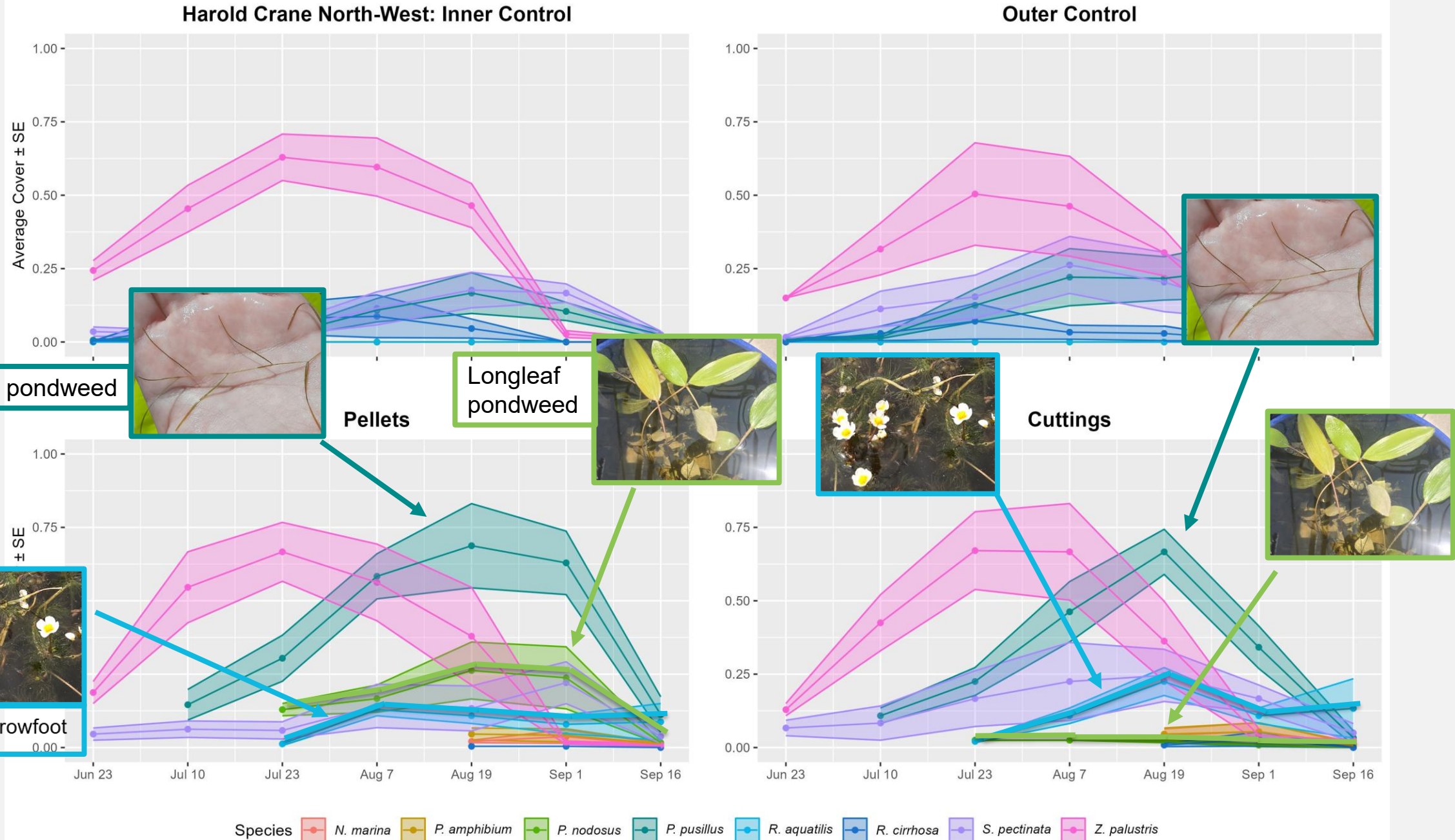
Small Pondweed | *Potamogeton pusillus*



White water crowfoot | *Ranunculus aquatilis*



Raw data from Harold Crane, North-West Pond



Conclusion: which are the best species for restoration under which method?

- **Three different species**
- *Ranunculus aquatilis* – white water crowfoot **cuttings**
 - Short term plantings to fill an area early in season.
- *Potamogeton nodosus* – longleaf pondweed **pellets**
 - Very hardy, grows well, and roots substantially
- *Potamogeton pusillus* – small pondweed
 - Specifics in growth with pellets- <3-4 weeks
 - Fast growing with lots of duplication



White water crowfoot | *Ranunculus aquatilis*



Longleaf pondweed | *Potamogeton nodosus*



Small Pondweed | *Potamogeton pusillus*

Propagation



Spiny naiad | *Najas marina*

- Must be placed into the soil
- Decays very fast after collection
- Comes up much later than other plants, mid June



Longleaf pondweed | *Potamogeton nodosus*

- Comes up much later than other plants, early June
- Travels through rhizome production and roots
- Does well with pellets and/or already established roots



Water smartweed | *Polygonum amphibium*

- Take off the leaves, especially floating leaves and allow the top of the plant access to air
- Grows much faster this way with less decayed matter building up



White water crowfoot | *Ranunculus aquatilis*

- Appears early in the season, late April/ early May
- Often starts out floating before settling
- Could be an annual plant based off of experience

Propagation continued...



Spiral ditchgrass | *Ruppia cirrhosa*

- Travels close to the ground using rhizomes
- Does very poorly in pellets
- Tolerates salinity very well often found in brackish conditions
- Comes up later (mid May)



Small Pondweed | *Potamogeton pusillus*

- When propagating, do not plant for more than 3 weeks
- Roots and grows extremely fast
- Duplicates very fast
- Don't let it run out of room



Horned pondweed | *Zannichellia palustris*

- Also travels close to the ground using rhizomes
- Does very poorly with pellets
- Very fast grower once established
- Emerges very early in the year (April-May)



Sago pondweed | *Stuckenia pectinata*

- Grows early in the year (early May)
- Found in many areas

Recommendations for sites and plantings

- Always look at aquatic vegetation site the year before during peak growth
- Evaluate all of your options: sites, native growth, salinity, water depth, carp presence/fencing, etc.
- Always plant at least 2x what you need.
- Propagation, especially in the beginning, will have a lot of errors and many plants will not survive
 - Lack of research
 - Very sensitive plants
 - Transportation



Planting recommendations continued...

- Plugs and cuttings work for some but are labor intensive
- Plant in buckets with soil (autoclaved if possible) to use in restoration sites.
- Much more scalable
 - *Zannichellia palustris* – horned pondweed
 - *Ruppia cirrhosa* – spiral ditchgrass
- Allowing free rhizome movement and root buildup.
- Salinity acclimation- allow a much broader area to be restored with multiple plants that would otherwise struggle.



PLI

Public Lands Initiative



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QUESTIONS?

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