NC STATE UNIVERSITY

Overview of 2024 Aquatic Plant Monitoring Activities at Chautauqua Lake

North Carolina State University

Raleigh, NC

North Carolina State University

- NCSU responded to survey RFP in 2020
  - NCSU surveys macrophytes on more large waterbodies than any other univer
  - Personnel trained in aquatic plant identification and survey methods
  - Some of same personnel in 2024 as first survey

- 20 years of Aquatic Plant Management research and extension
  - International: NIWA (New Zealand), Victoria (Australia), MNR (Ontario, Canada)
  - US: California, Florida, Idaho, New York, Pennsylvania, Puerto Rico, etc.

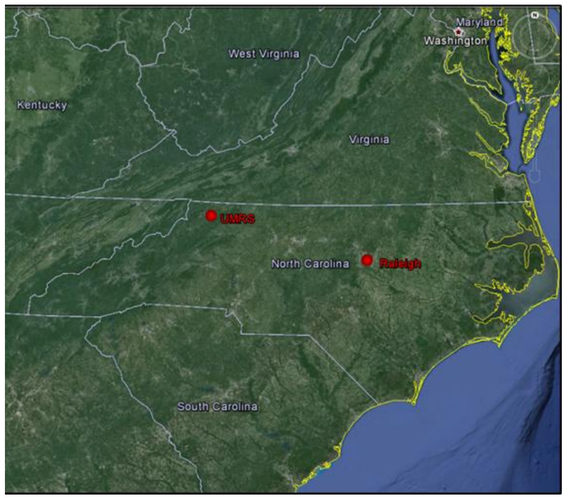




NCSU Research Facilities

- Greenhouses and mescosms in Raleigh, NC
  - Hardiness zone 8a (330 ft elevation)
- Mesocosm facility in Laurel Springs, NC
  - Elevation 3,200 ft; cooler, more rain and cloud cove
  - Hardiness zone 6b/7a



Chautauqua Lake

Physical Characteristics

- **Location:** Chautauqua County, NY
  - Covers towns of:
    - Busti
    - Chautauqua
    - Ellery
    - Elliott
    - North Harmony
- **Shoreline Length**: 42.5 Miles
- **Surface Area**: 13,422 Acres
- **Watershed Area:** 115,349 Acres
- **Mean Depth:** 25.6 Feet

Chautauqua Lake

Economic Impact

- Fishing (Muskellunge, Bass, Walleye)
- Boating & Recreation
- Tourism
  - Chautauqua Institution
  - Downtown Bemus Point
  - Long Point State Park
  - Midway State Park
  - Chautauqua Belle Steamship
- Class A Waterbody

1885

Image Source: https://www.knowol.com/information/new-york/lake-chautauqua-1885/

2021

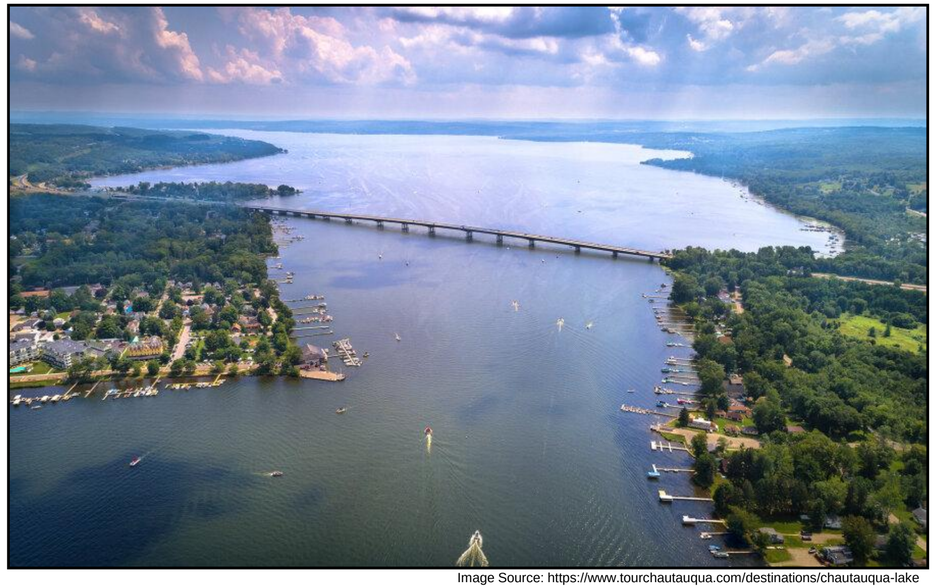


Image Source: https://www.tourchautauqua.com/destinations/chautauqua-lake

Chautauqua Lake

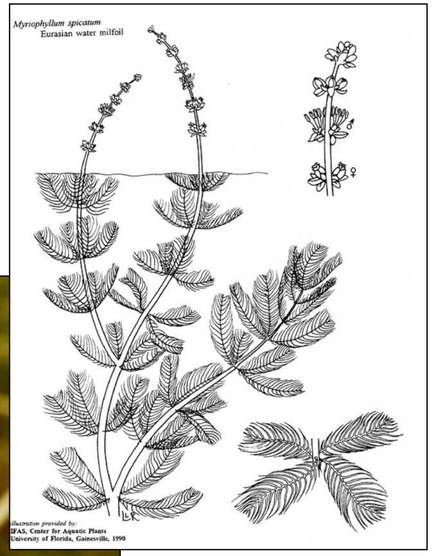
Environmental Challenges




- **Invasive Species**
  - Curly Leaf Pondweed
  - Eurasian Watermilfoil
  - Water Chestnut
  - Brittle Naiad
  - Starry Stonewort
  - Common Carp
  - Goldfish
  - Zebra Mussels
  - Asian Clam
- **Water Quality**
  - HAB’s
- **Nutrient Loading**
  - Watershed Runoff
  - Legacy nutrients
  - Excessive Plant Growth

Eurasian Watermilfoil

Myriophyllum spicatum



- First documented in the US in 1902
- First documented in Chautauqua Lake in 1972
- Capable of aggressive growth and spread habits:
  - Reproduces through fragmentation, seed, stolons
  - Able to form dense vegetative mats
  - Can outcompete native species
- Listed as a Prohibited and Regulated Invasive Plant in the State of New York

Curly-leaf Pondweed

Potamogeton crispus

- First documented in the US in 1859
- First documented in Chautauqua in 1937
- Unique life history:
  - *Spring*: Peak vegetative growth
  - *Summer*: Turion Production
  - *Late Summer/Early Fall*: Biomass senesces*
  - *Winter*: Turions break dormancy

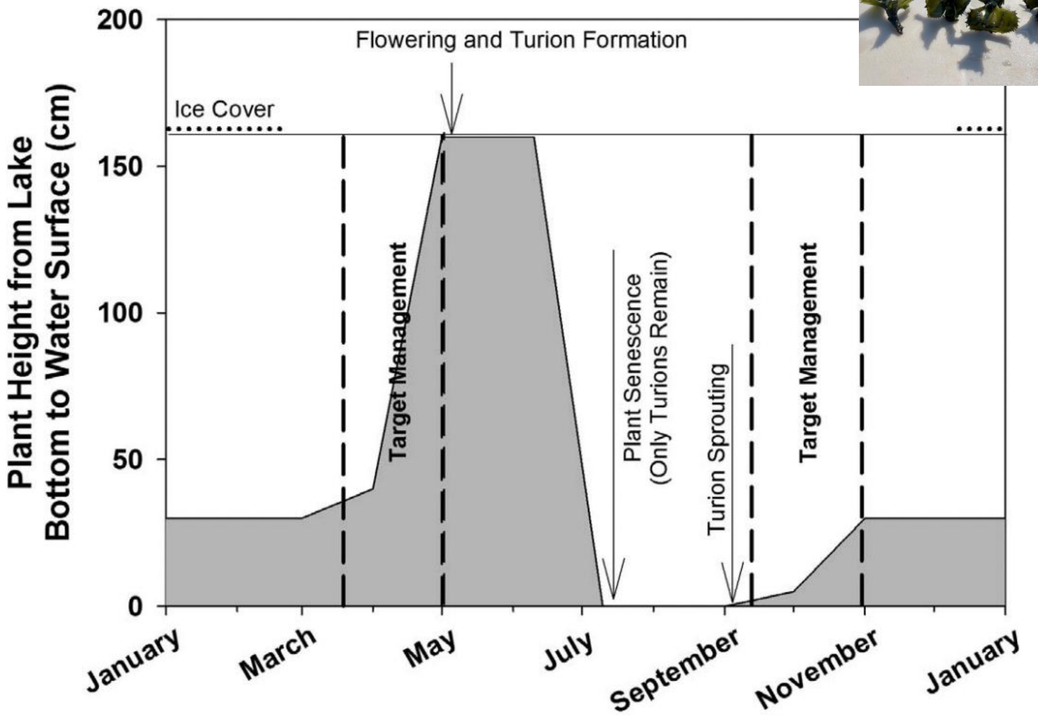


Figure 3. Conceptual diagram based on curlyleaf pondweed phenology for timing management based on seasonal phenology (adapted from Turnage et al. in press).

** Early senescence of biomass causes challenges with survey timing*

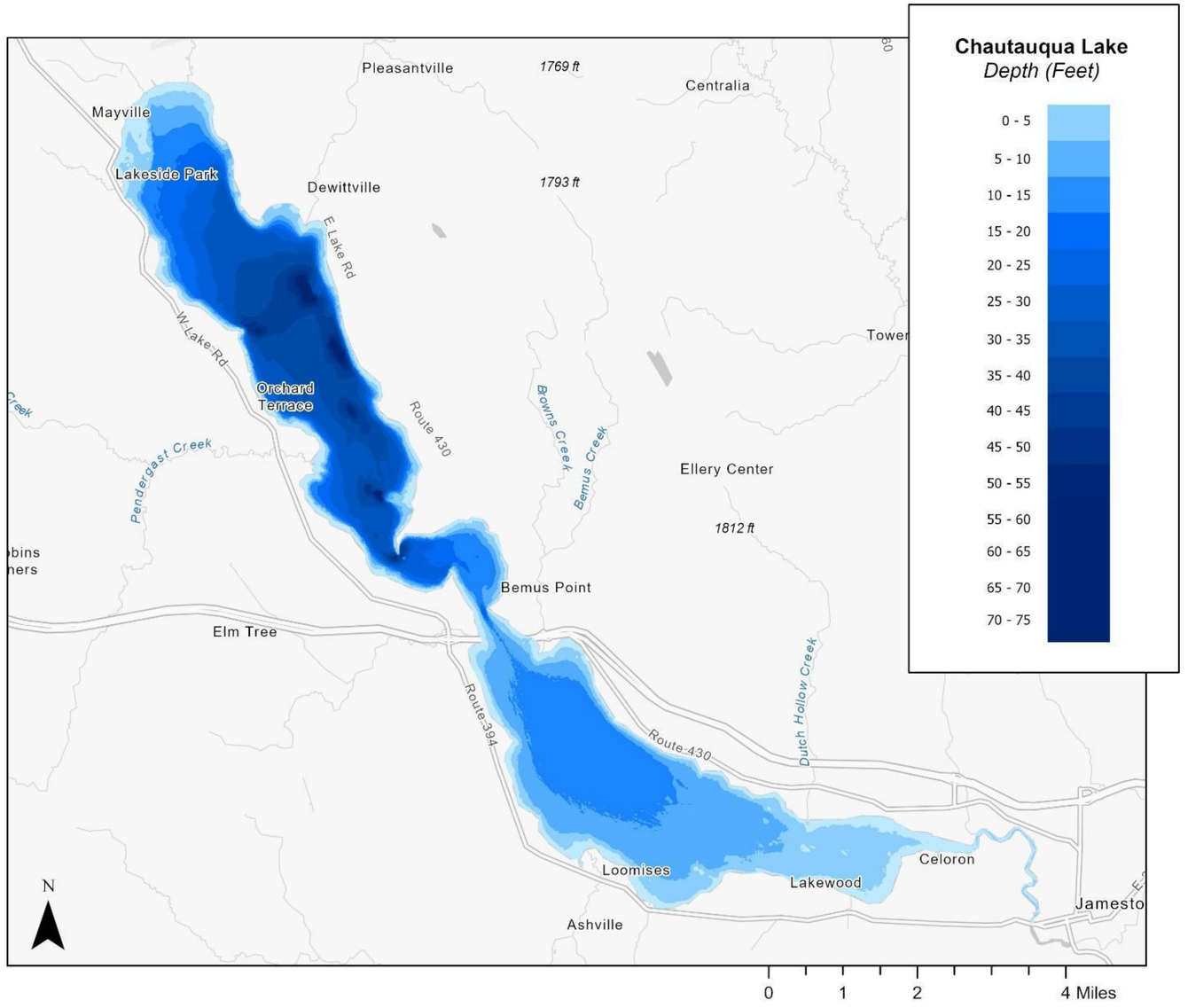
Image source: Wersal and Madsen (2018)

SAV Monitoring and Management Timeline

- **1937**: First formal SAV survey by NYSDEC
- **1948:** “Jungle-thick weeds that ensnarl boats… and make swimming impossible”
- **1952**: Plant Harvesting Began
- **1955**: Herbicide Treatments Began
- **1993:** Herbicide Treatments Paused
- **2002**: Biocontrol Introductions Began
- **2016**: Herbicide Treatments Restarted
- **2020: First NCSU 1,000 Point SAV Survey**

Chautauqua Lake Survey Design

- Efforts focused in the lake's littoral zone
  - South Basin: 10 Feet or Less
  - North Basin: 12.5 Feet or Less



Chautauqua Lake Survey Design

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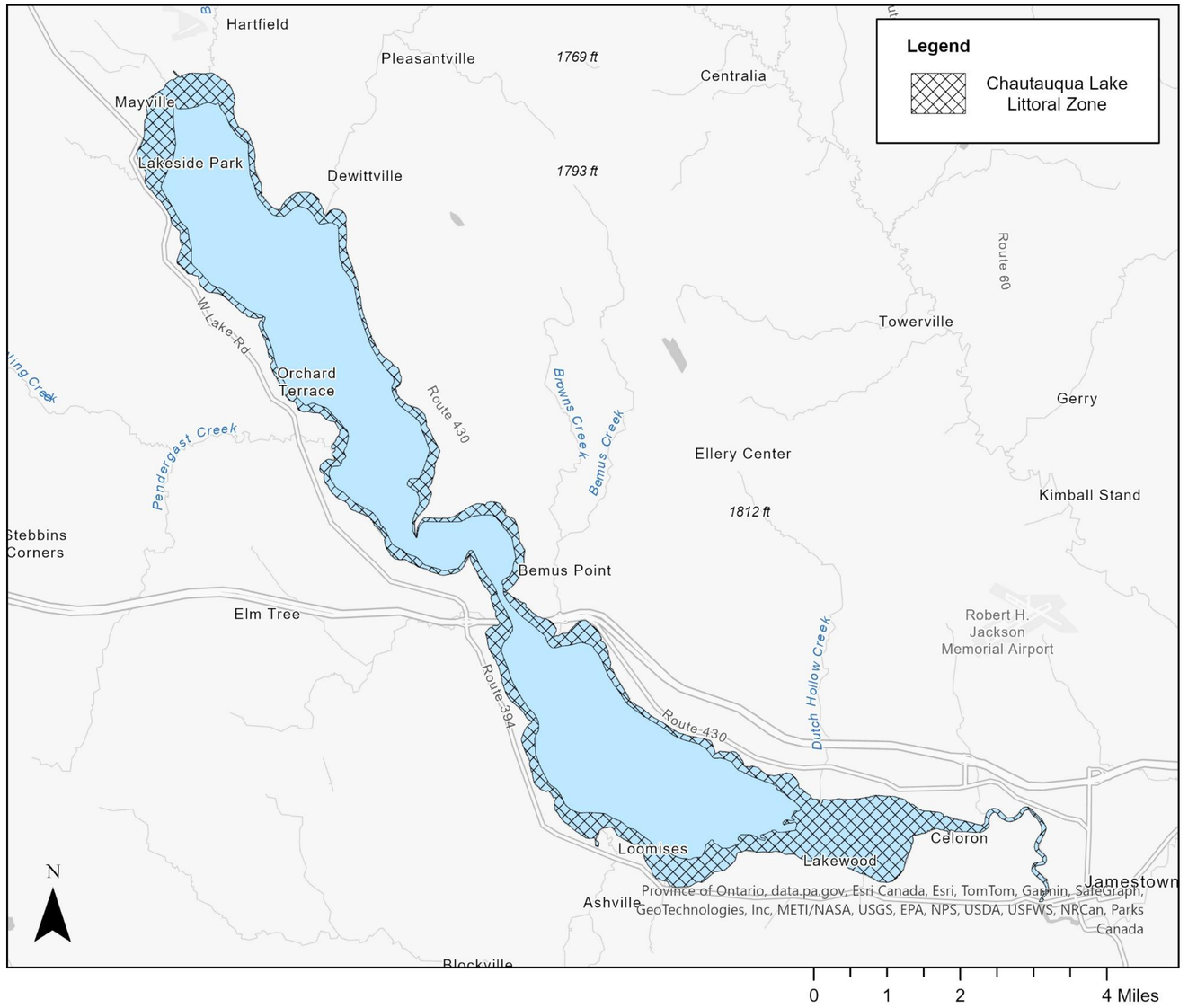

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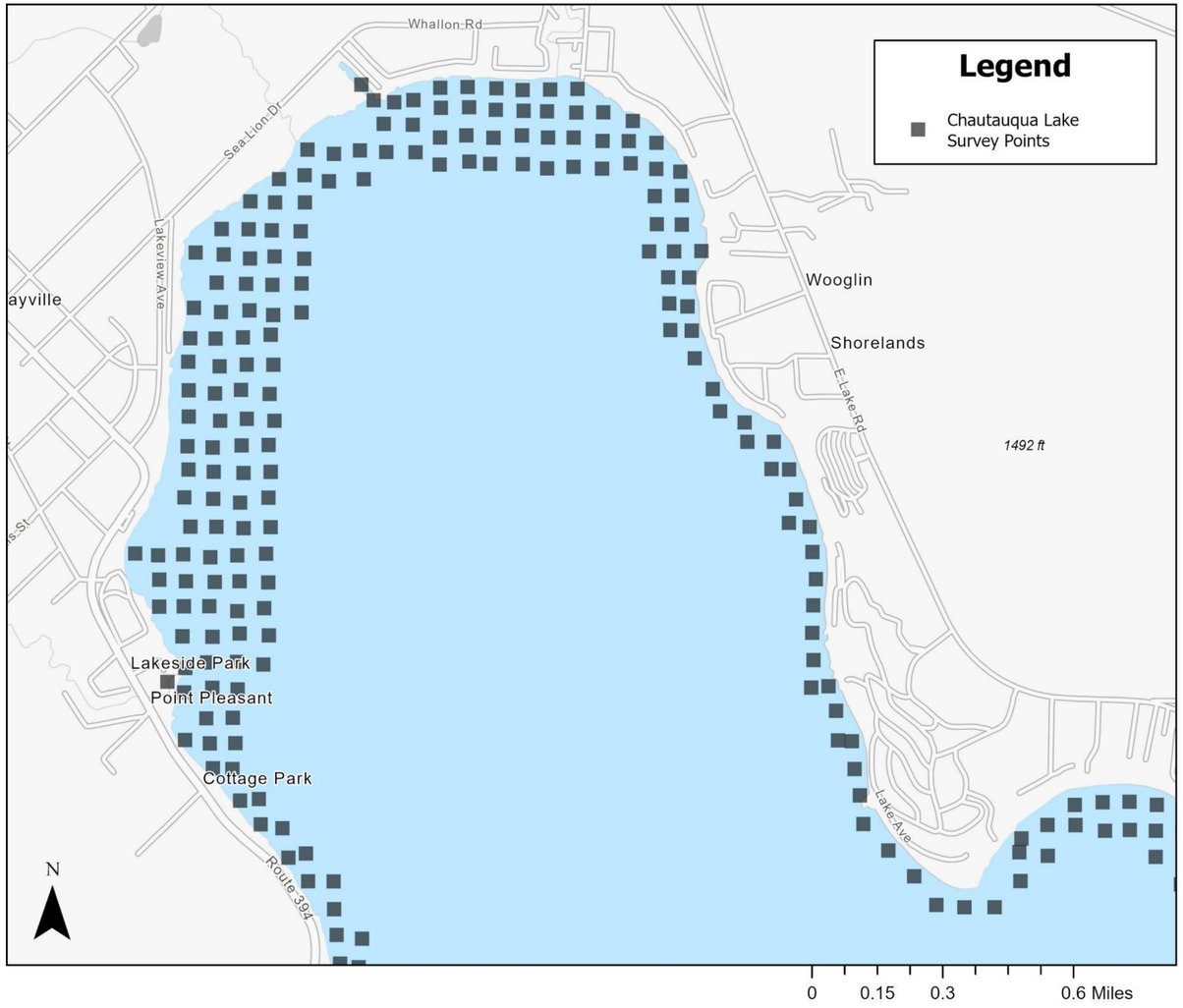

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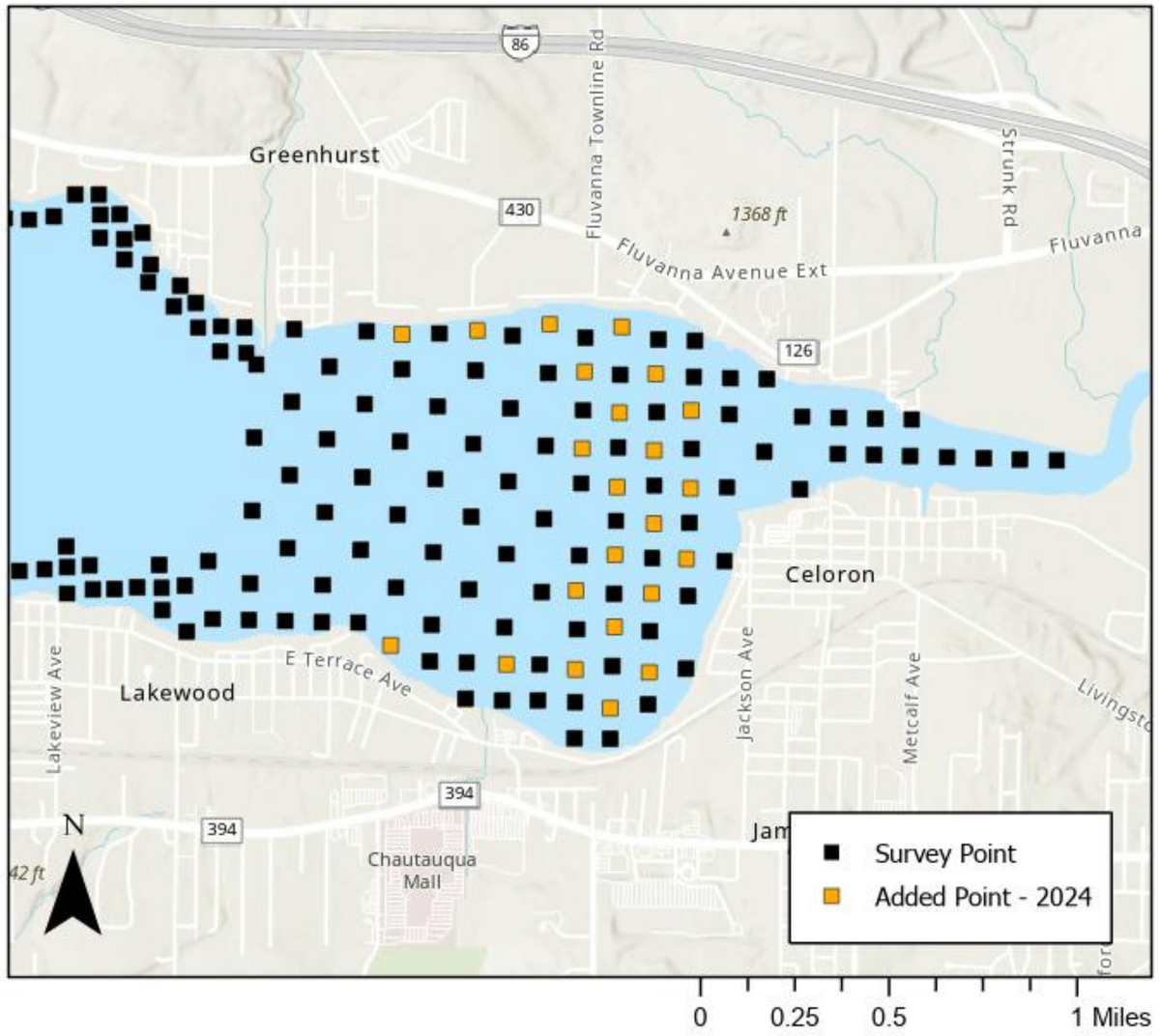
- 2024: 70 additional survey points added to increase resolution in selected areas of the lake



SAV Monitoring Methods

A. Point-Intercept Survey:

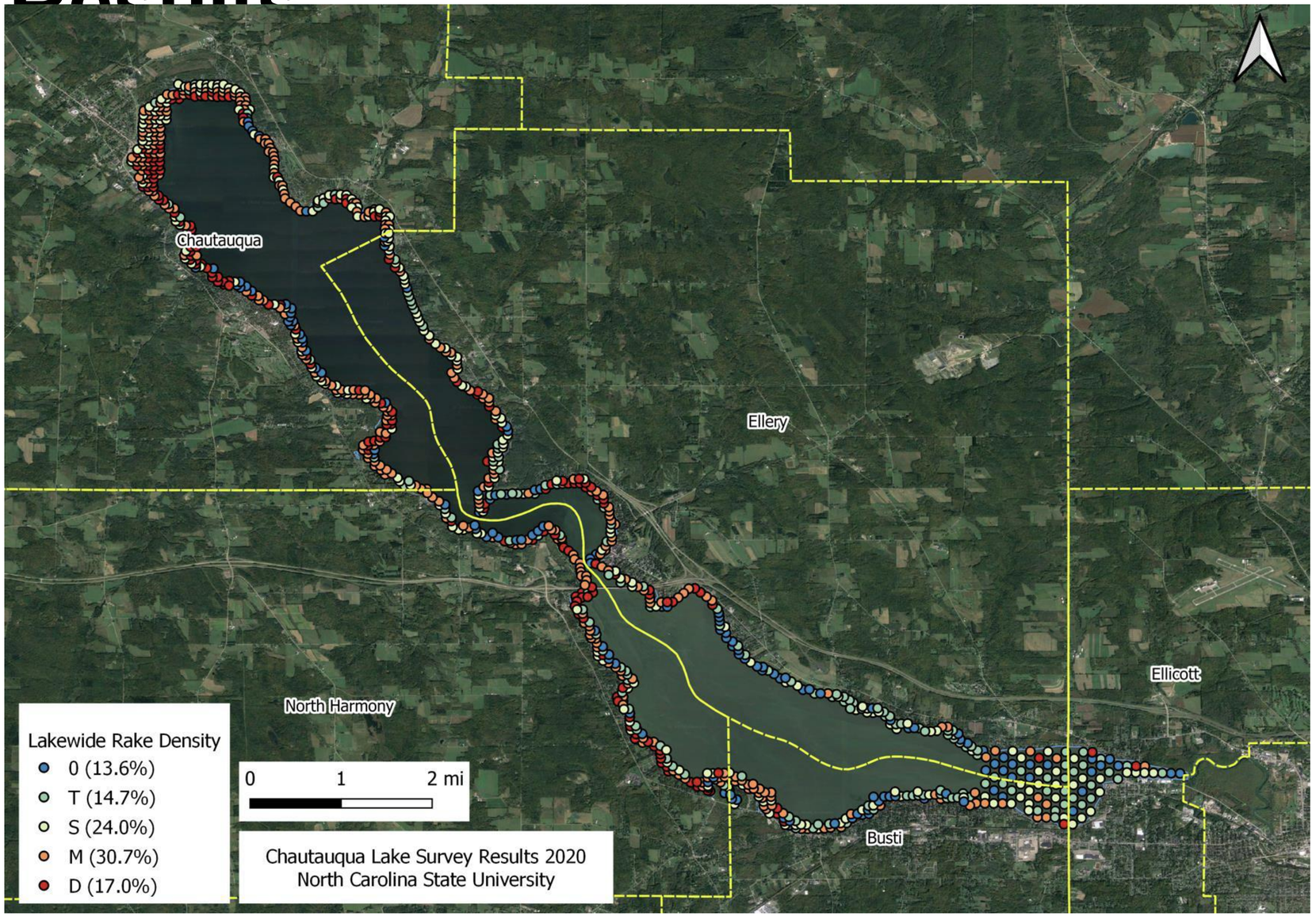
- Late summer surveys: 1,070 proposed sample sites (2024)
- Two rake tosses at each sample point
  - Visual whole-rake density rating (*none, trace, sparse, moderate, de*
  - Species-specific relative abundance estimate (0-100%)

B. Hydroacoustic Biovolume Survey:

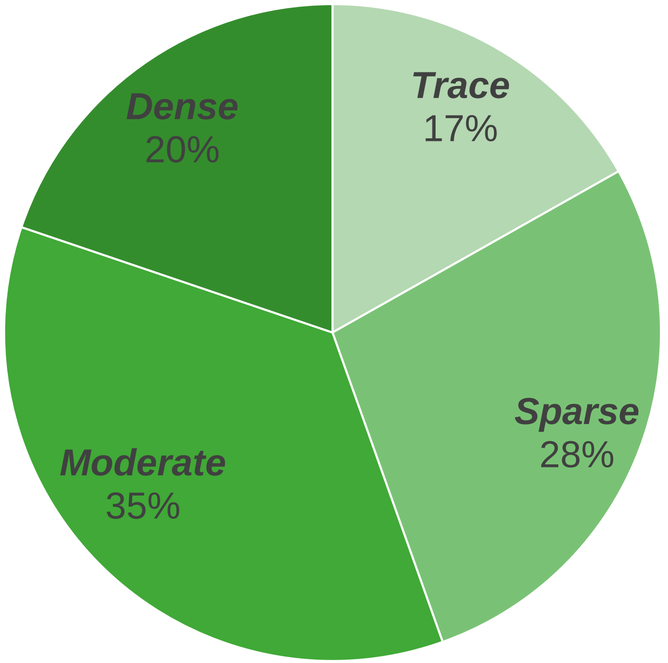
- Sonar tracks recorded passively at and between surveyed points
- Post-processing determines SAV biovolume and water depth

➢ NCSU uses similar methods on ~100,000 acres of lake/reservoirs surveys in NC and VA annually

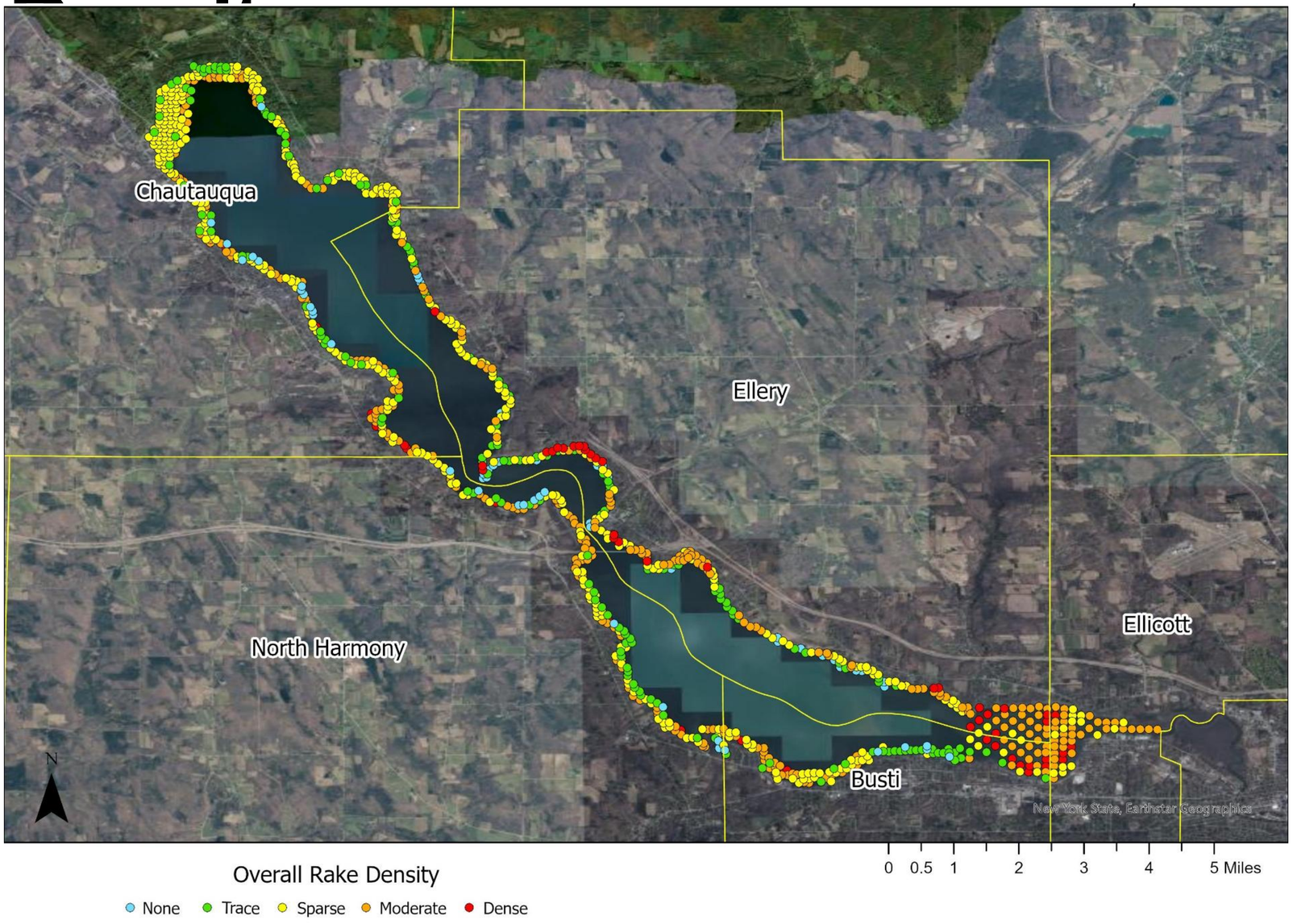
2020 Point Intercept Results



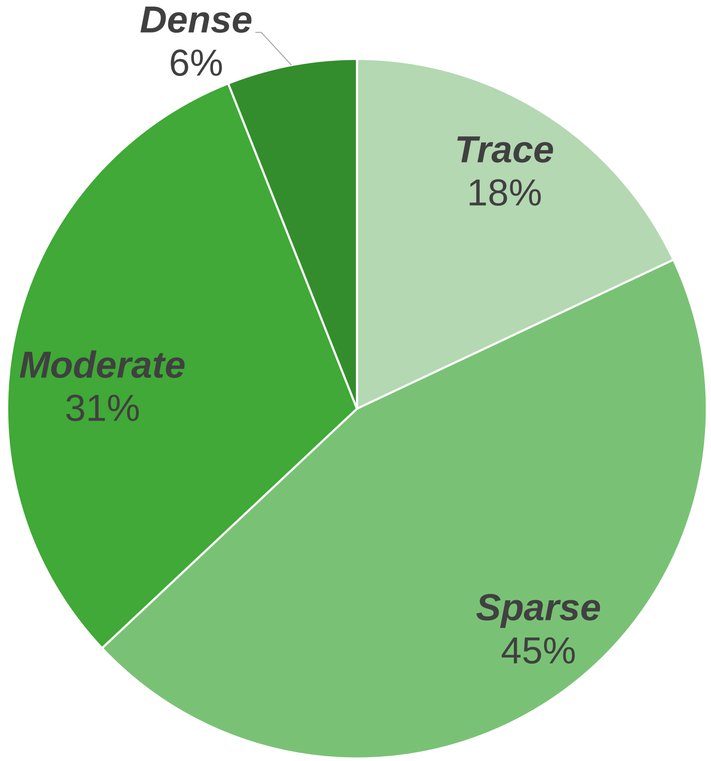
- 980 point-intercept sites visited
- 88% of sites contained vegetation



2024 Point Intercept

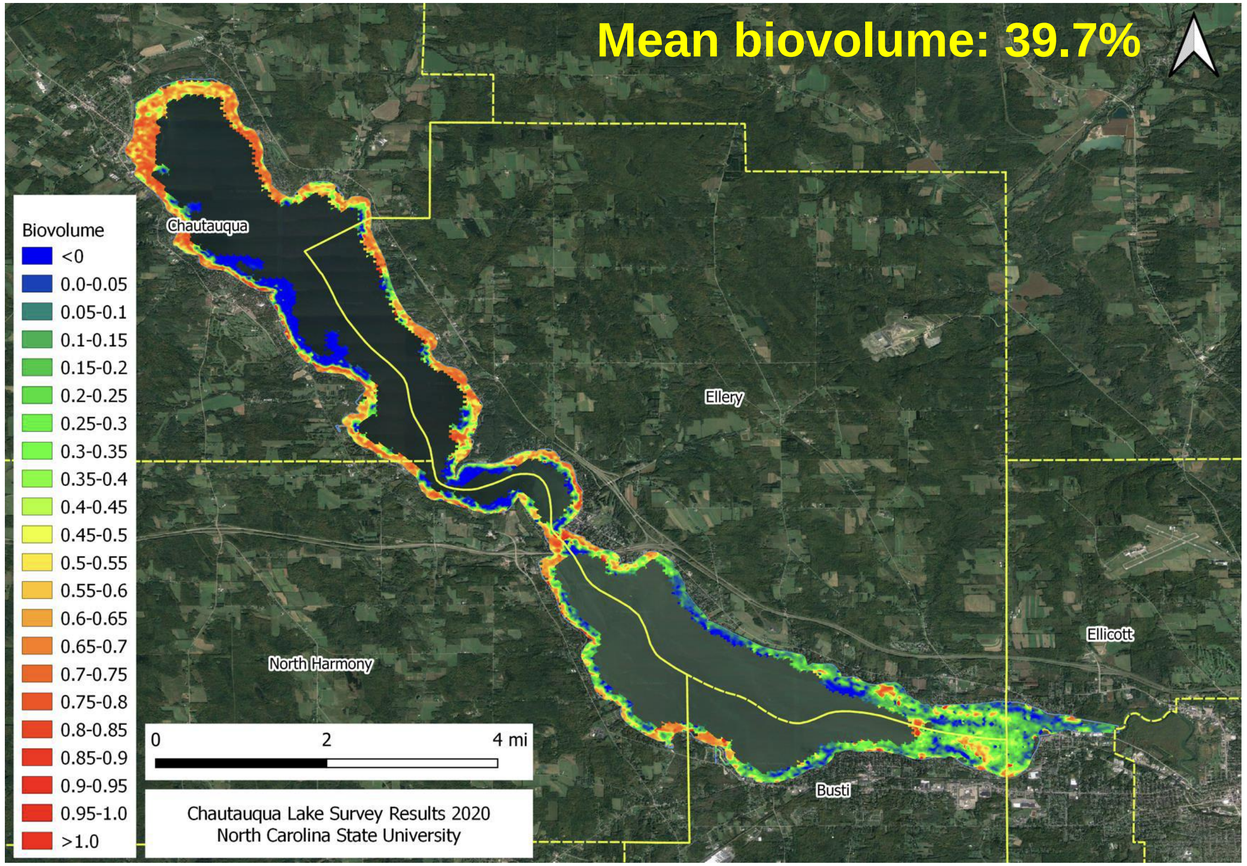


- 1002 point-intercept sites visited
- 94% of sites contained vegetation

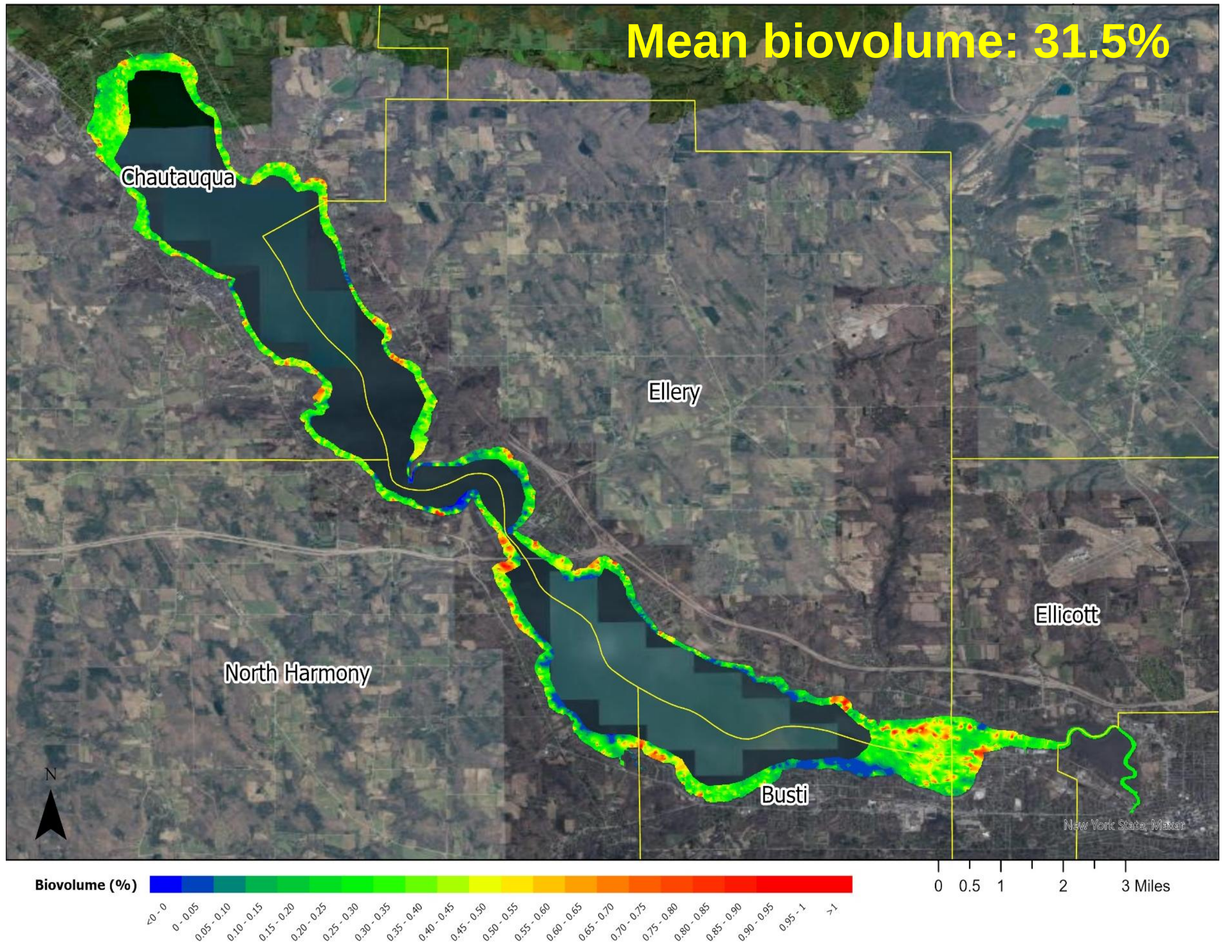


Biovolume Results

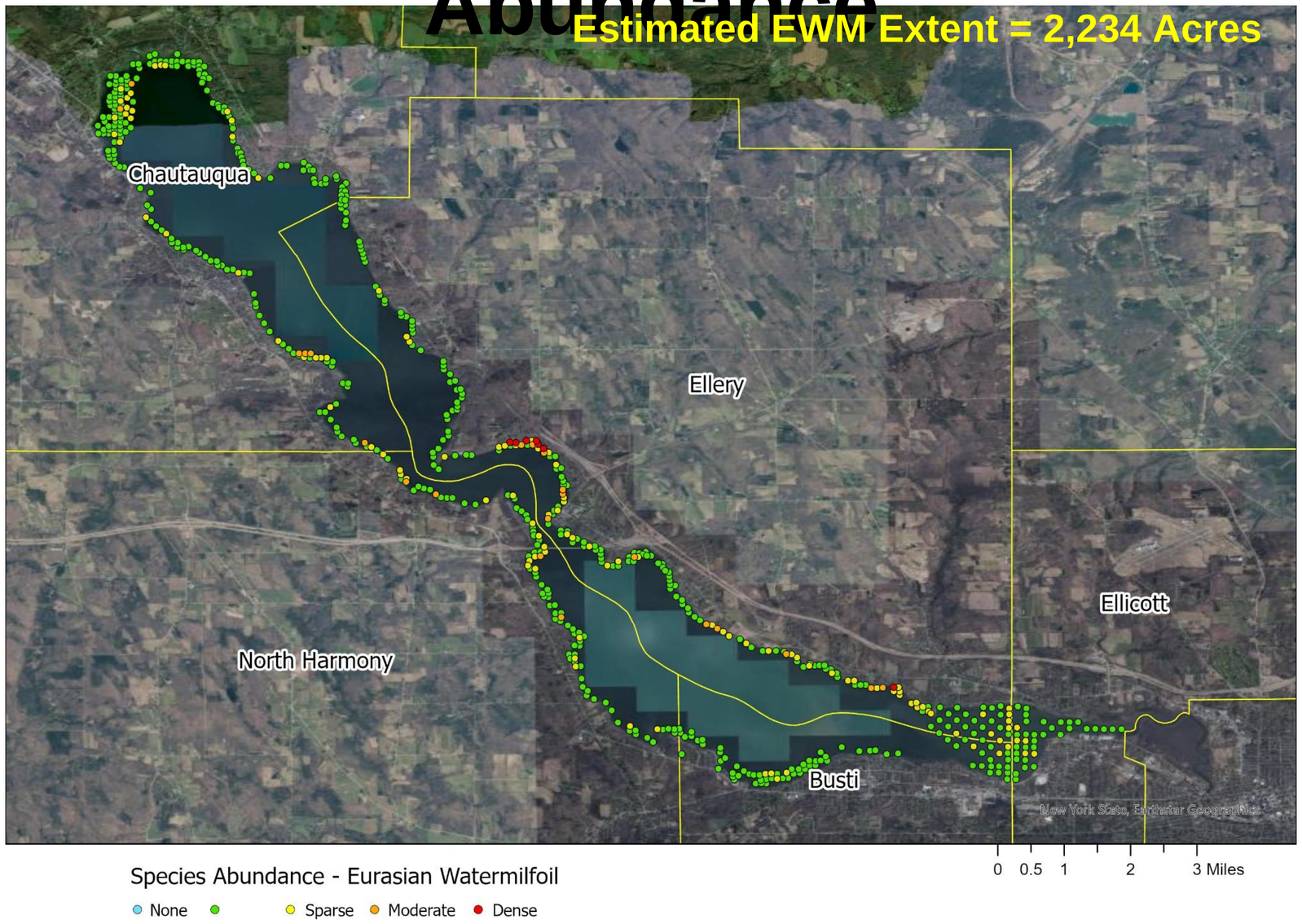
2020



2024



2024 Eurasian Watermilfoil Distribution and Abundance



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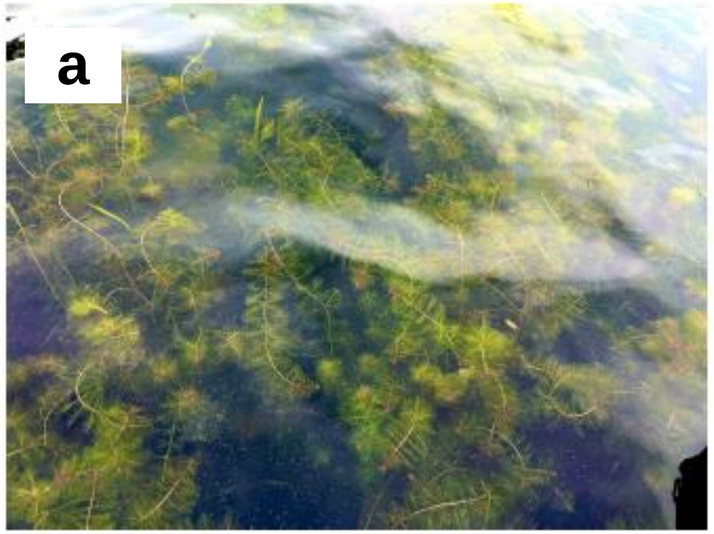


a) dense EWM biomass in Burtis Bay

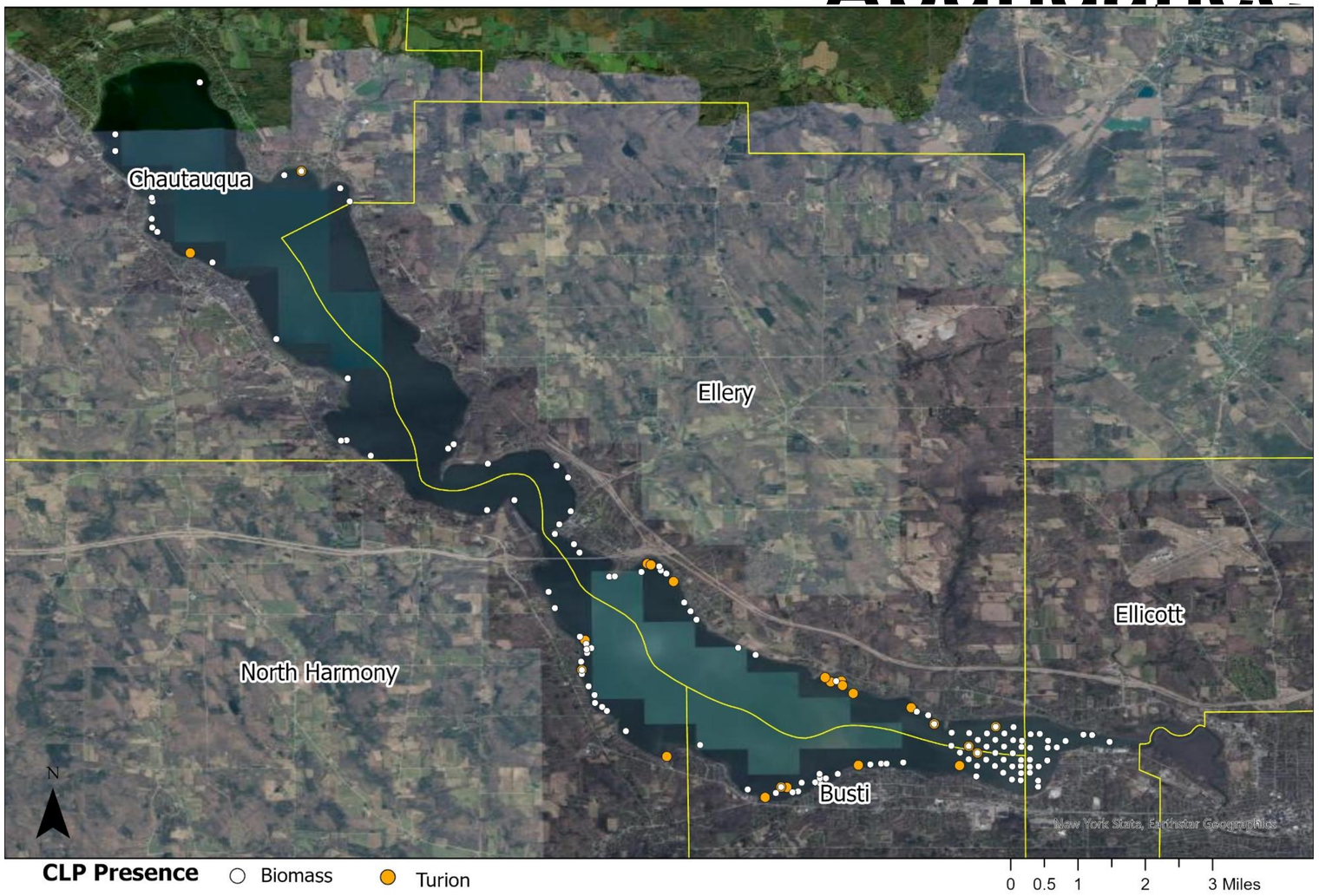
b) sample of healthy EWM from Burtis Bay

c) stem tip with biocontrol damage found in the South Basin

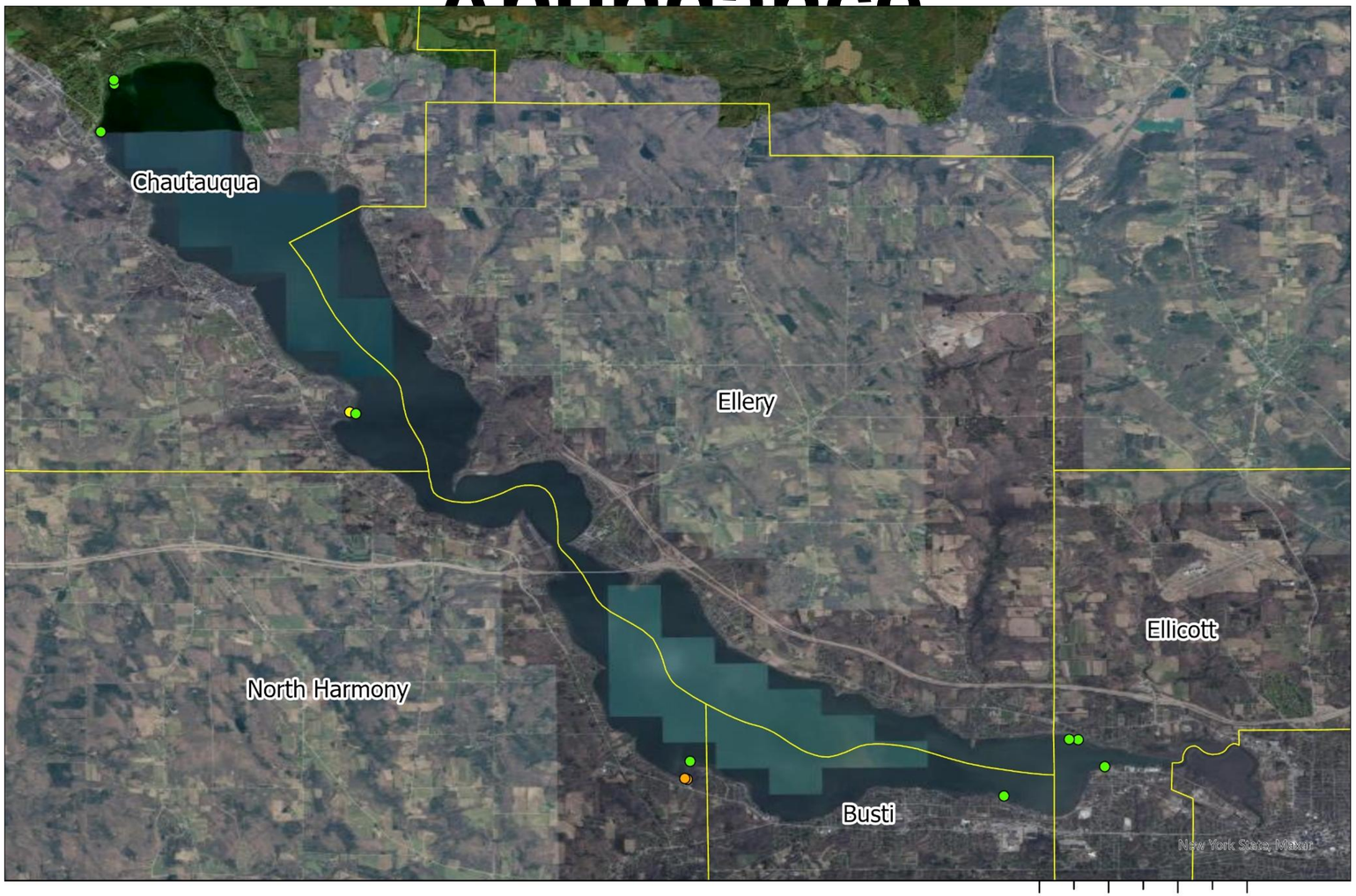
d) flowering EWM in Burtis Bay

e) EWM stem fragments with adventitious root formation.

2024 Curly-leaf Pondweed Distribution and Abundance



2024 Starry Stonewort Distribution and Abundance



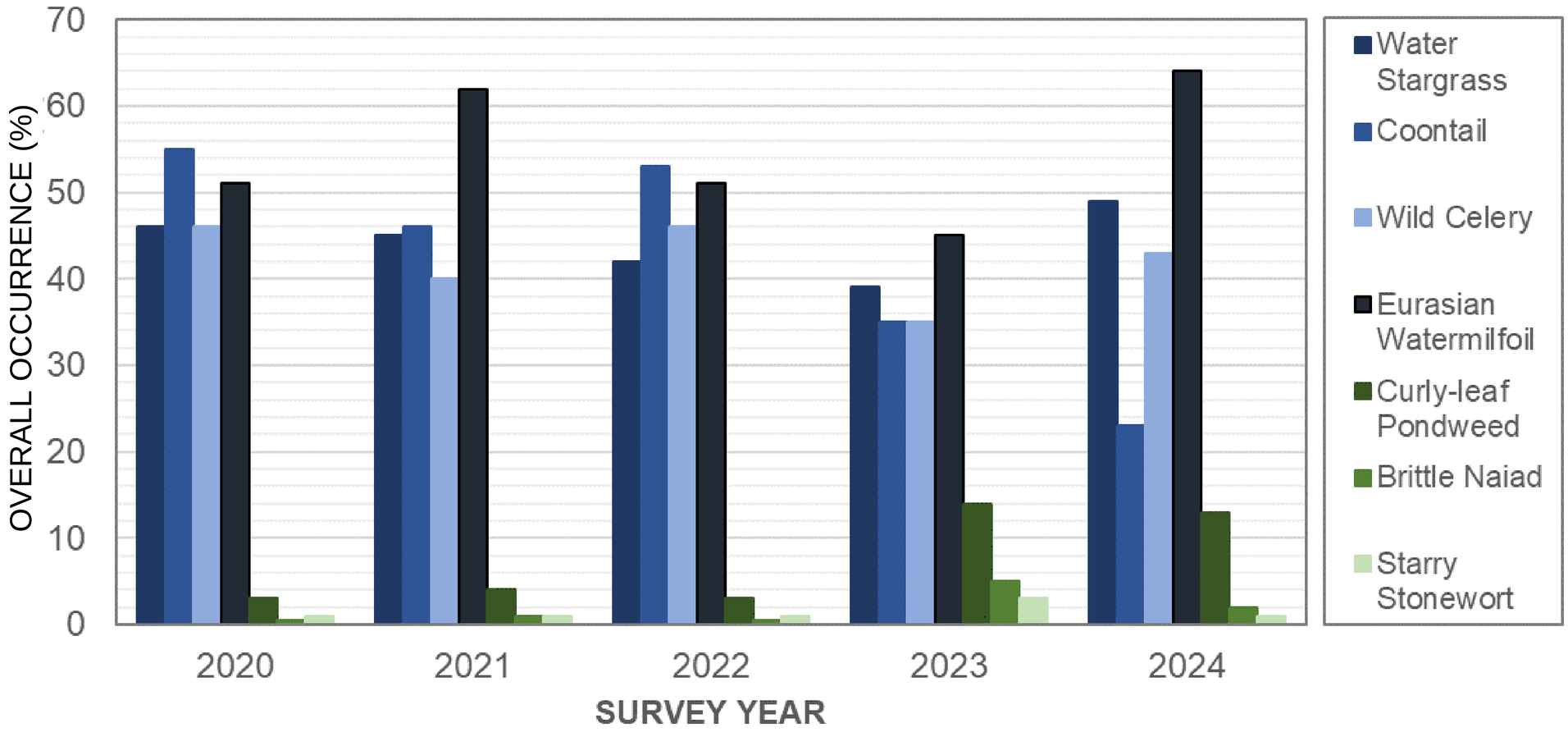
2024 Starry Stonewort Images

Overview of Species Presence and Abundance

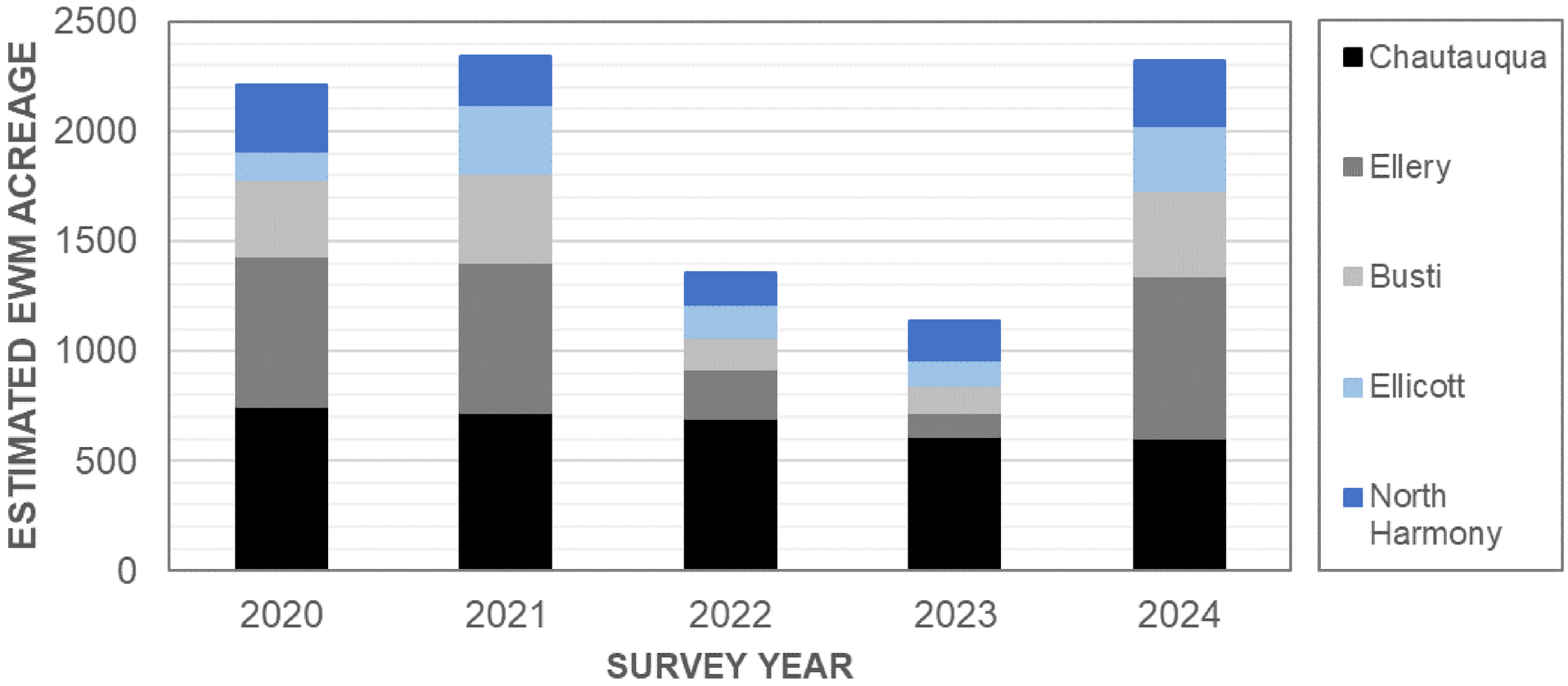
	2020		2022		2024	
Total SAV Species Detected	**25**		**21**		**23**	
Dominant Species (% Occurrence)	1. Eurasian Watermilfoil	62%	1. Coontail	53%	1. Eurasian Watermilfoil	64%
	2. Coontail	46%	2. Eurasian Watermilfoil	51%	2. Water Stargrass	49%
	3. Water Stargrass	45%	3. Wild Celery	46%	3. Waterweed	45%
	4. Wild Celery	40%	4. Water Stargrass	42%	4. Wild Celery	43%

Eurasian Watermilfoil, Water Stargrass, and Wild Celery continue to remain the dominant SAV species at Chautauqua Lake.

Change in Species Occurrence Over Time



Change in Estimated EWM Acreage Over Time

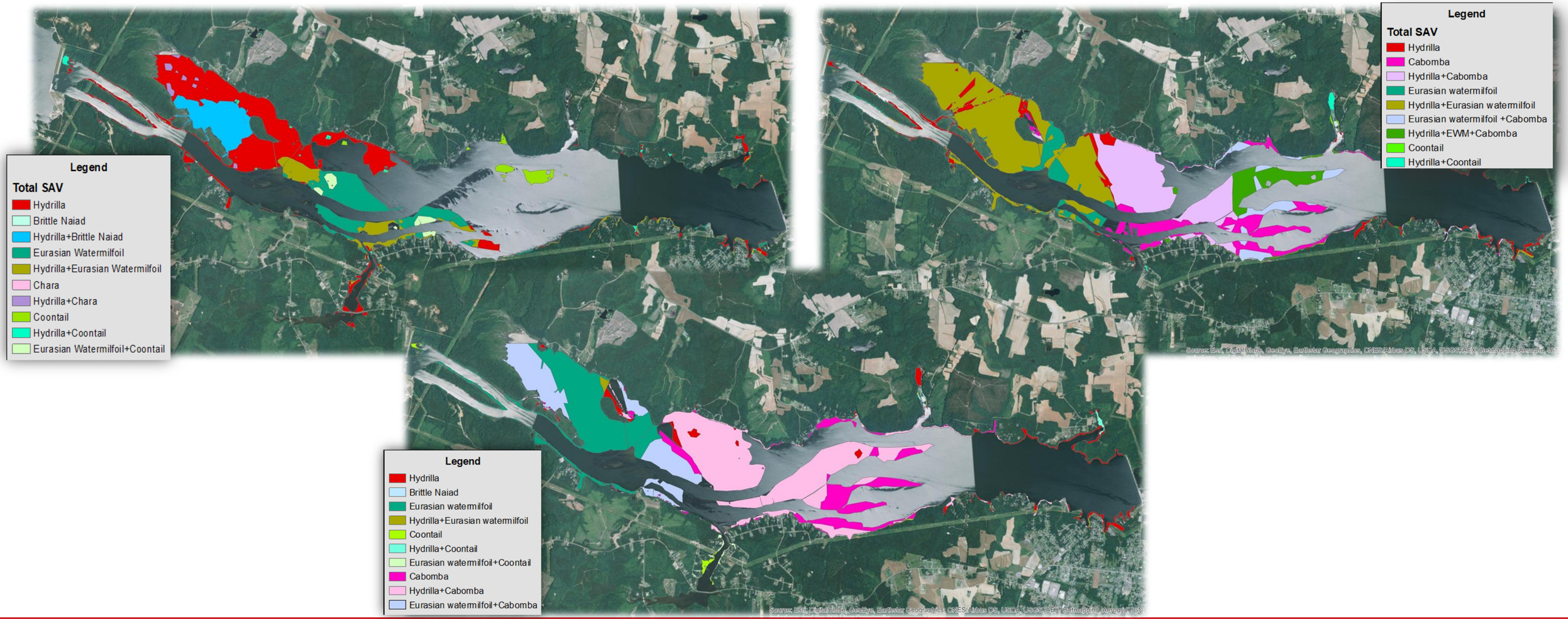


Future efforts could incorporate use of UAS imagery for early-season CLP mapping

Photos by Ready Scout LLC

Survey Conclusions

- Aquatic plant communities will vary over time, even unmanaged systems



Survey Conclusions

- The macrophyte community at Chautauqua Lake continues to be dominated by Eurasian Watermilfoil (Fall) and Curly-leaf Pondweed (Spring)
- Survey timing is critical for documenting SAV seasonal dynamics
- Water quality challenges observed at all survey timepoints (planktonic, filamentous, benthic, colonial algal growth throughout the lake)
- Starry Stonewort presence and distribution is increasing over time at Chautauqua Lake

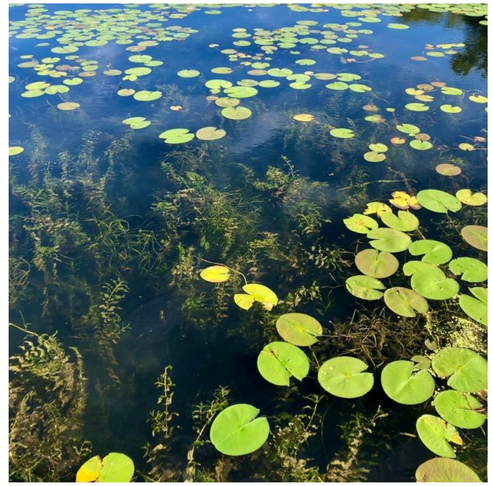




Survey Conclusions

- Despite many years of aquatic plant management-related activities, the SAV community of Chautauqua Lake remains well-established
- Generally, Chautauqua Lake's North Basin supports a more diverse community of SAV when compared to the South Basin during the most recent Fall growing seasons



Pending Research

- PhD student starting in May 2025 likely to focus on Chautauqua related studies
  - MAPMS 2025 Robert L. Johnson Memorial Research Grant; *Curly-leaf Pondweed (Potamogeton crispus L.): Effect of Mechanical Harvesting on Turion Production and Potential Nutrient Release at Senescence*
  - Other research TBD


Questions?