

Drones as a tool for monitoring ribbonweed (*Vallisneria australis*), a recently detected non-native submersed aquatic plant in the Sacramento-San Joaquin Delta

Anthony Elias-Linarez

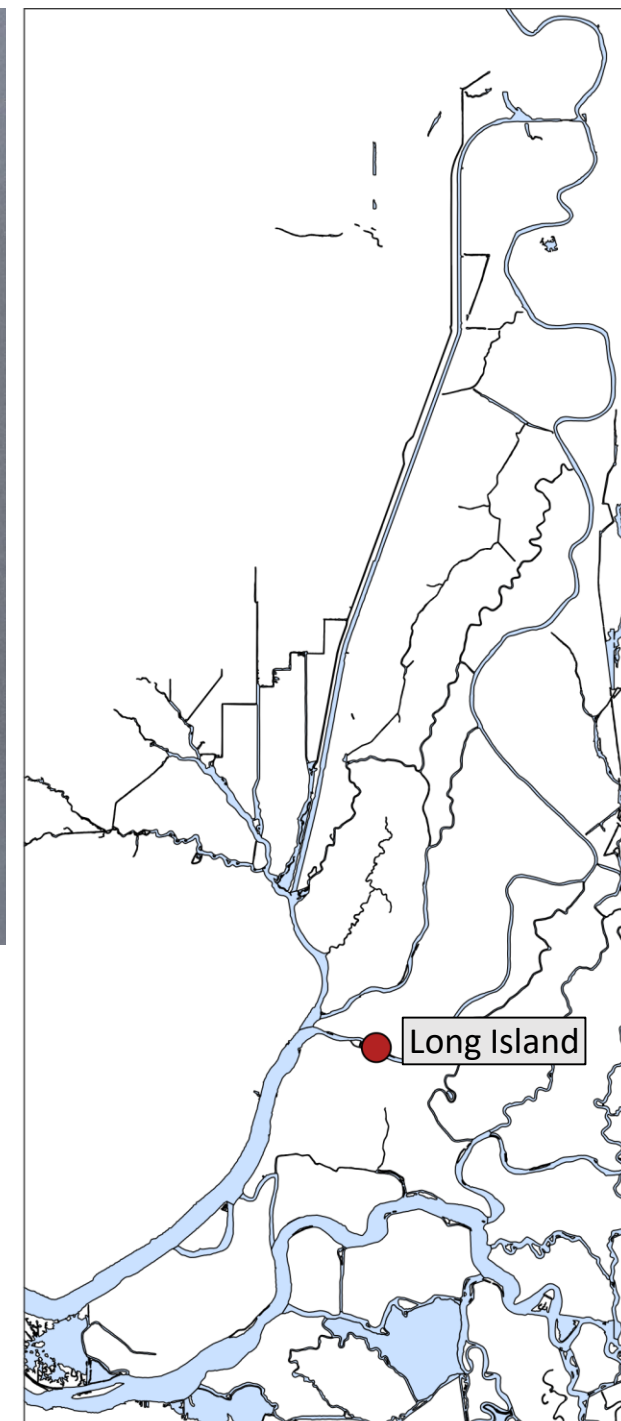
California Department of Water Resources



UCDAVIS

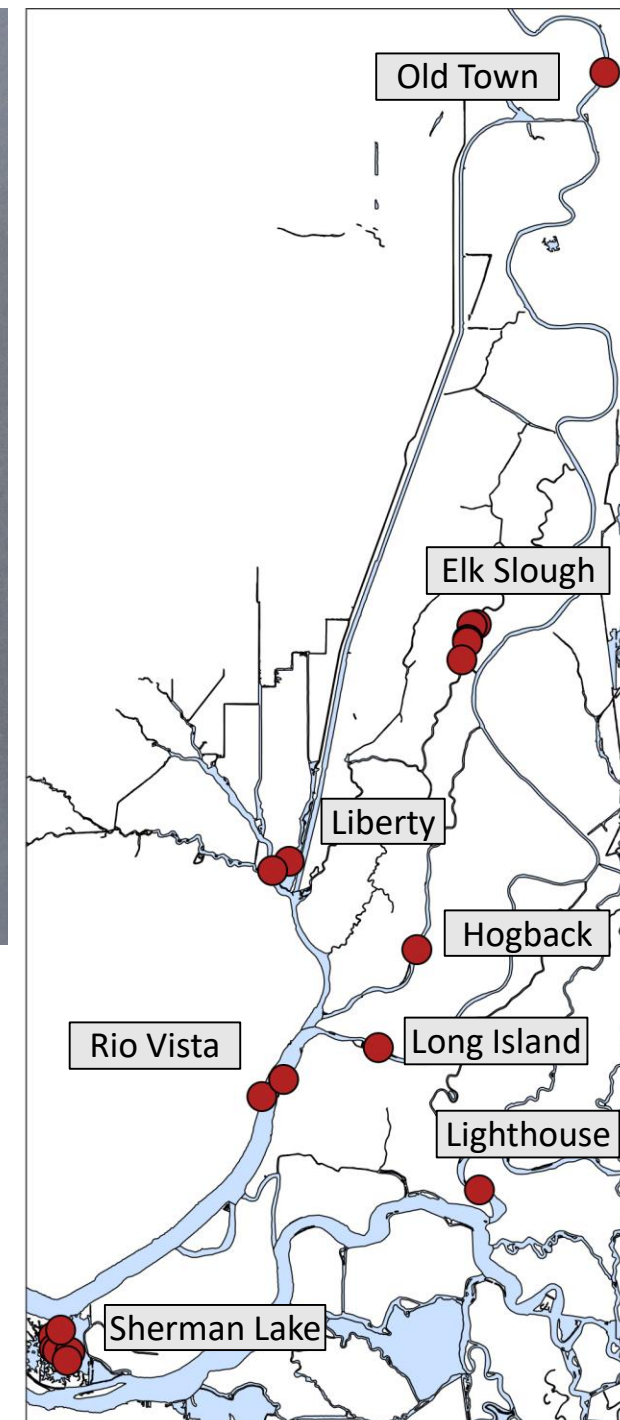
Detection

- In 2017, Trish Gilbert from DBW found an unknown plant at Long Island
- In following years, more patches observed by DBW and others



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Identification

- July 2021: DBW sent samples to CDFA Plant Pest Diagnostics Center
- Patrick Woods and Lainey Phan used DNA sequencing to ID
- All samples were *Vallisneria australis* (ribbonweed)
- Native to Australia and introduced in New Zealand, Japan, Hungary, Belgium, and Germany
- This is first documented introduction in North America





Tolerates low light, growing at depths to 27 ft



No flowers or fruits observed in Delta



Rounded leaf tips



Straplike leaves up to 10 ft long



Forms dense monocultures



Tolerates salinity to 11 ppt

Perennial spreading by stolons and rhizomes

Submersed species rooted in sediment

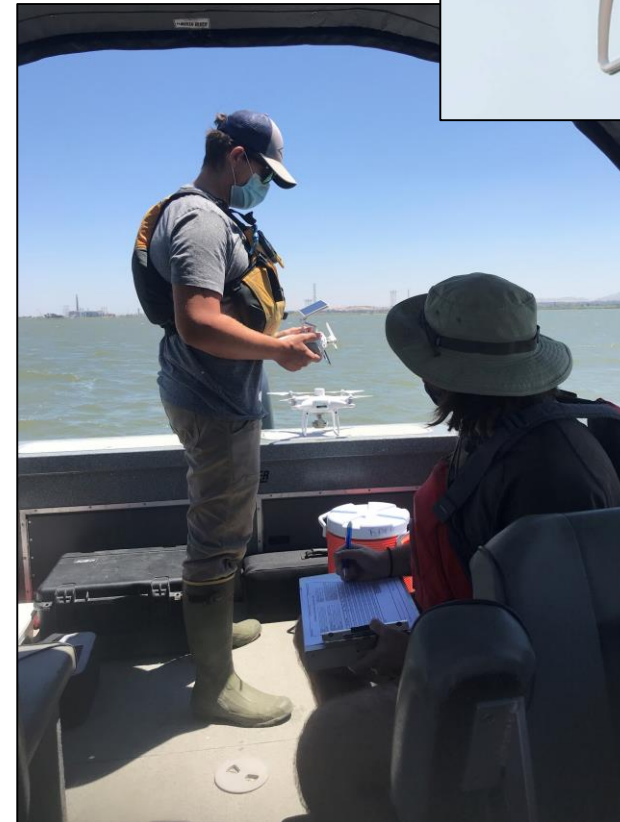
- In 2021, UC-Davis CStars found large patch in Sherman Lake
- Visible in satellite imagery as early as 2013
- Locals noted presence in Elk Slough as early as 2007
- Possibly started with dumped aquarium at Courtland Rd. bridge



Quantifying the infestation

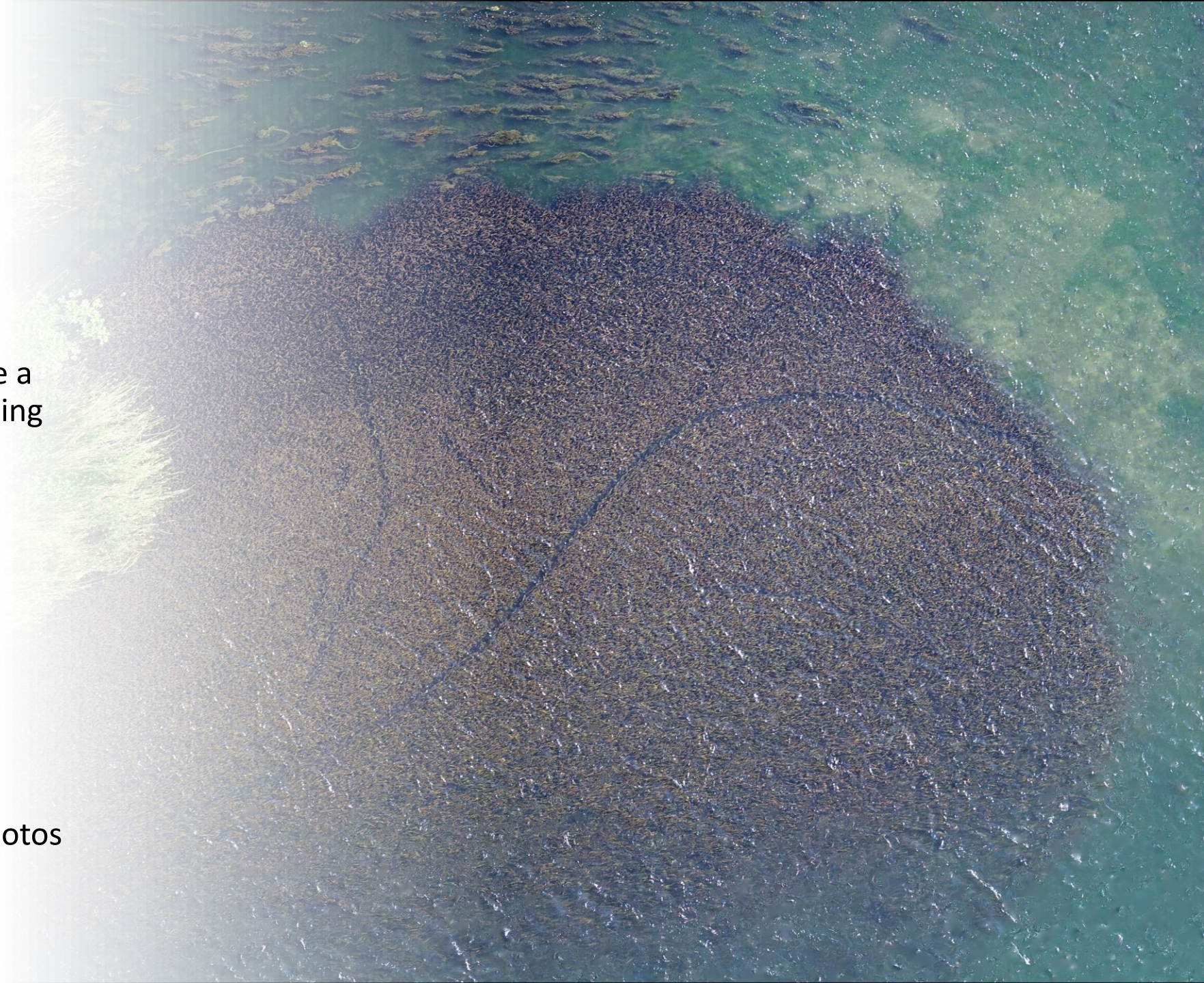
- During June 2022 to Feb 2023, DWR tested UAVs as tool for monitoring
- Work done by DWR's Ribbonweed Team
 - Project PI: Nick Rasmussen
 - Drone Pilots:
 - JT Casby
 - Anthony Elias-Linarez
 - Brian Armstrong
- Imaged all known ribbonweed patches
- Measured area of patches from imagery

DJI Phantom 4 Pro RTK

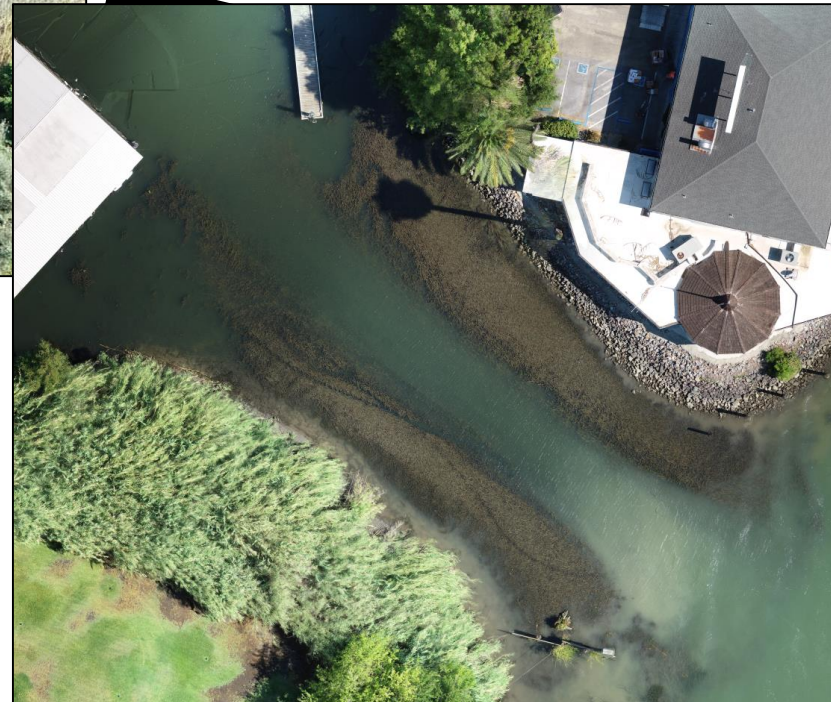


Imaging Ribbonweed

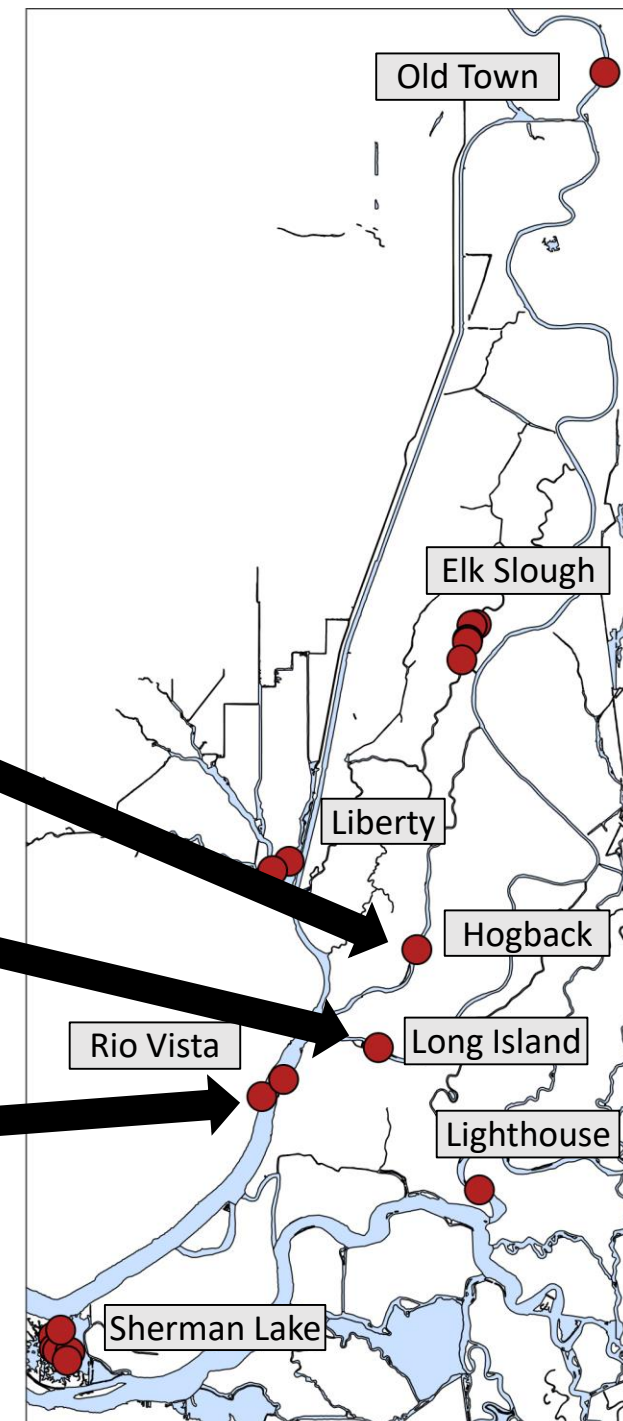
- Dense monocultures create a structure easily detectable using aerial imagery
- Caveats include:
 - Tides
 - Turbidity
 - Shadows
 - Glare
 - Tree canopy
 - Stitching of open water photos



Boat traffic areas

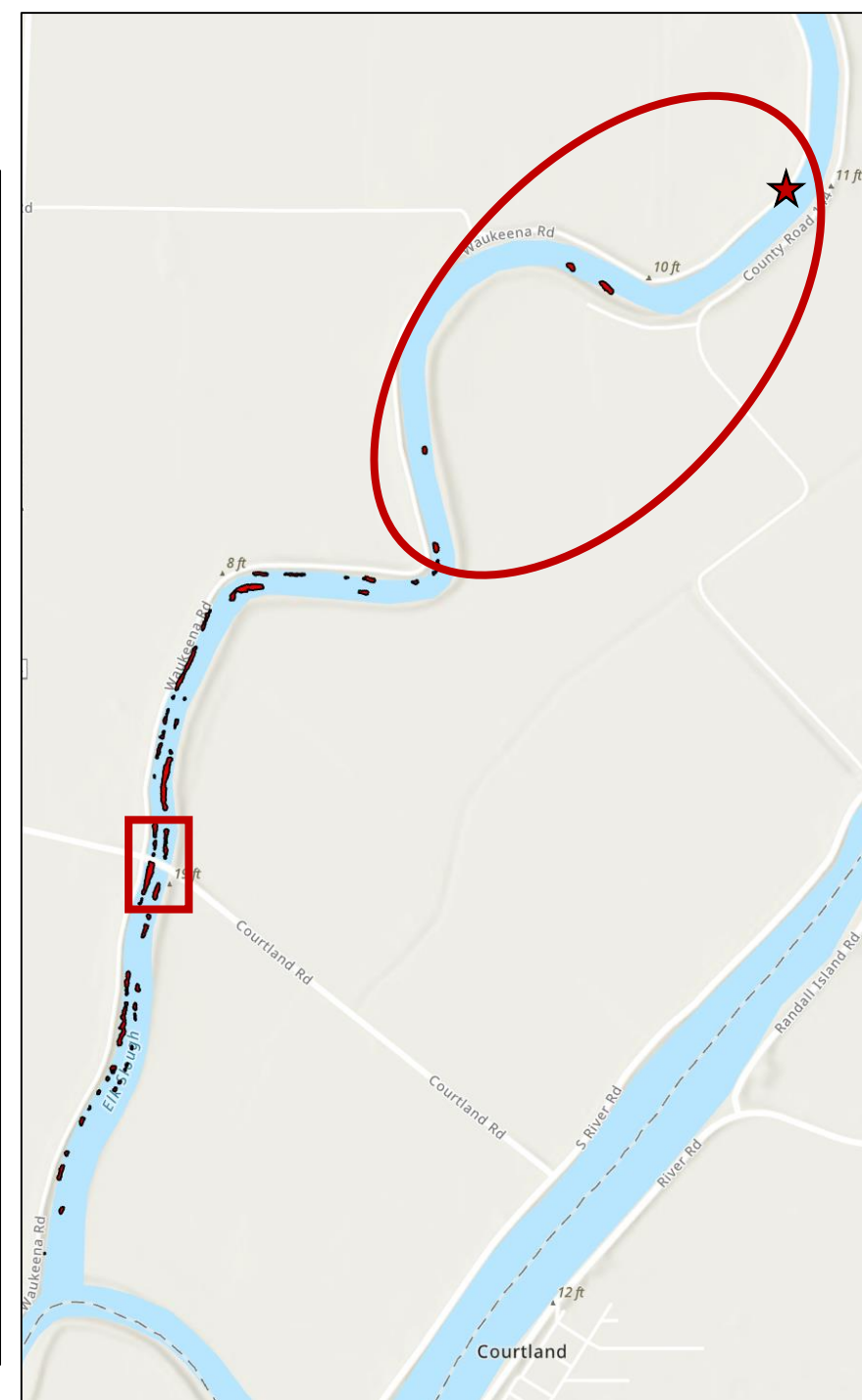


Constant disturbance creates high risk of spread by fragments

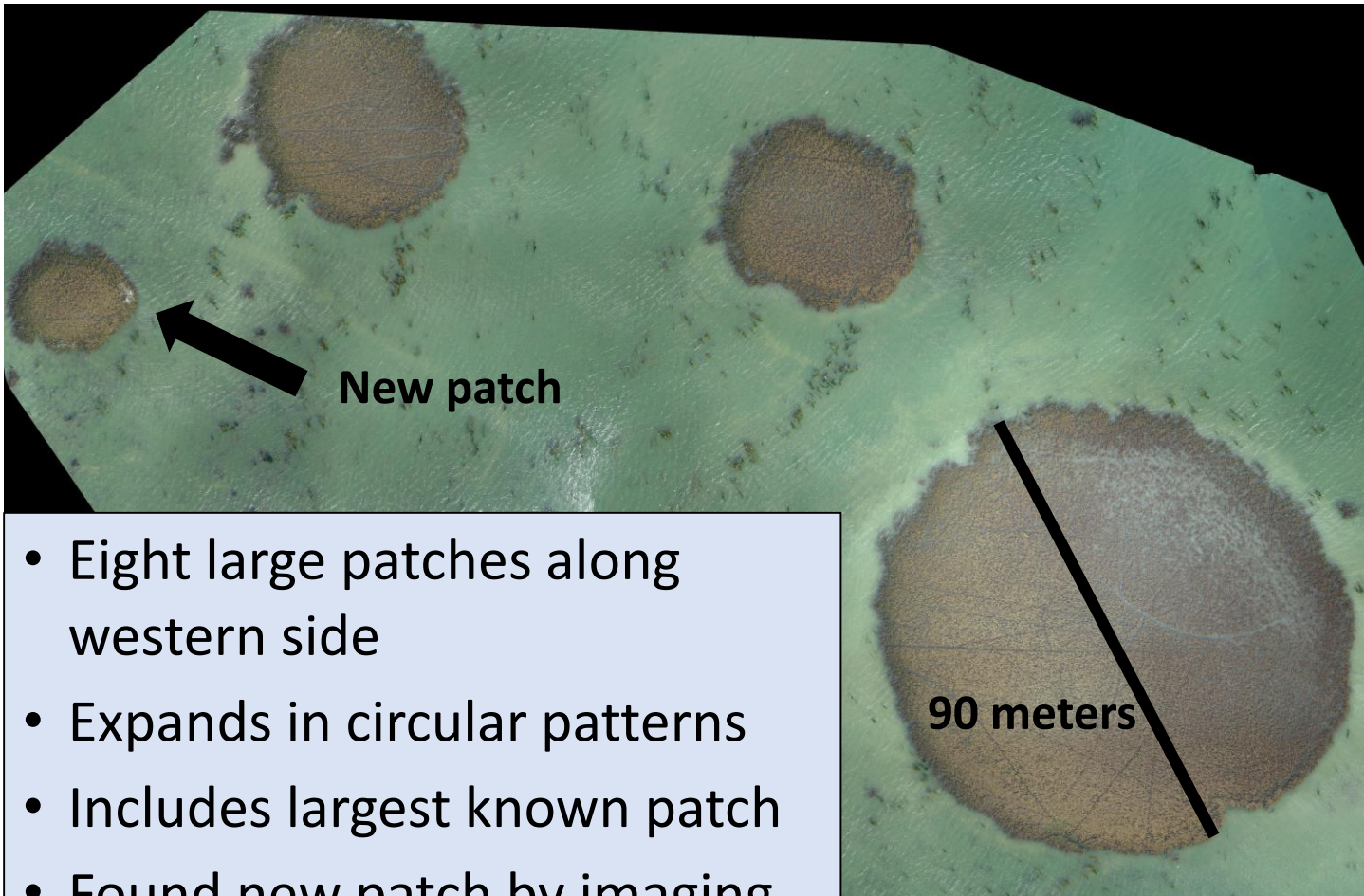


Elk Slough

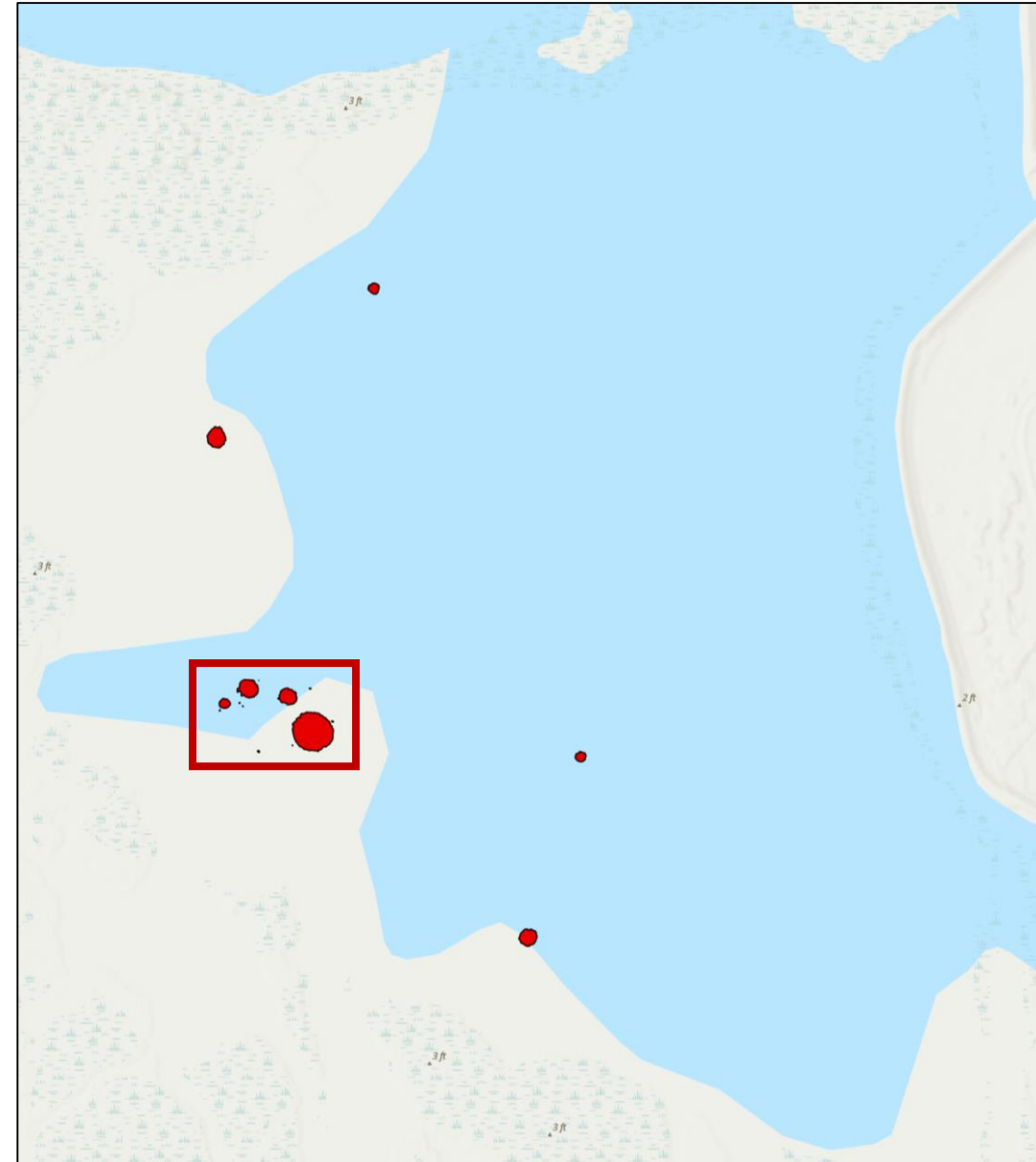
- Margins densely covered by patches
- Densest by bridge
- Found several new patches
- Estimated northern extent



Sherman Lake

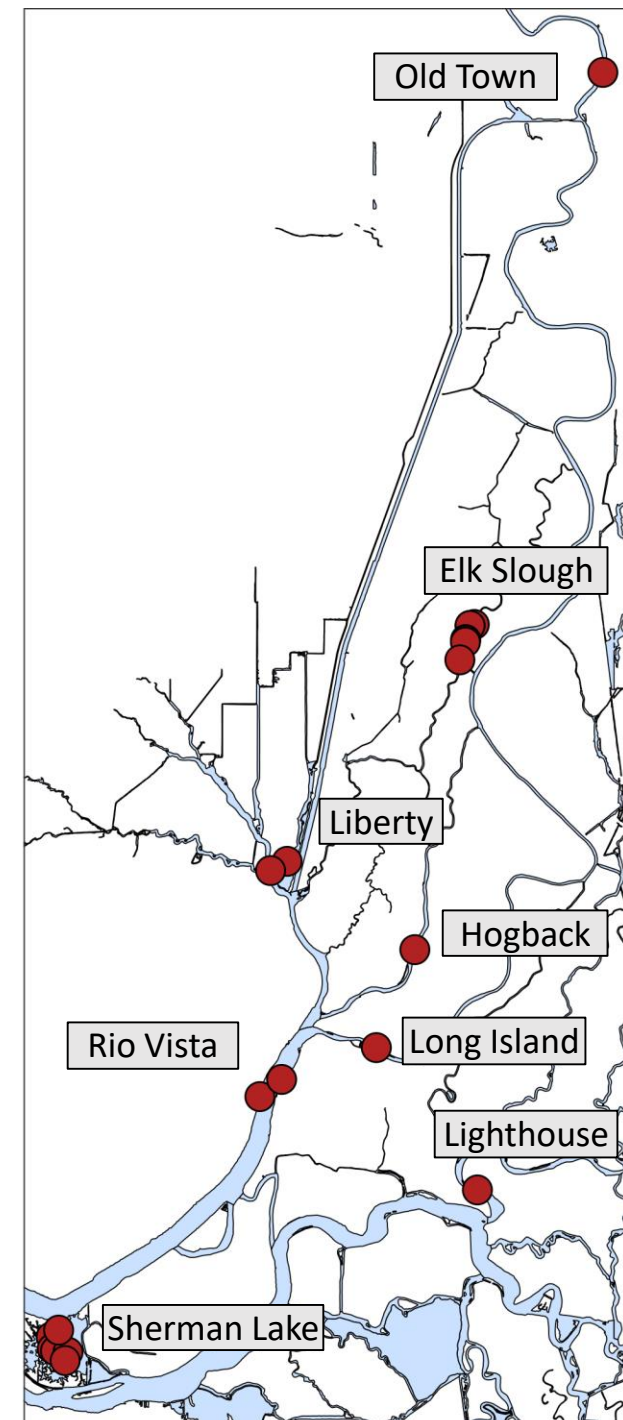
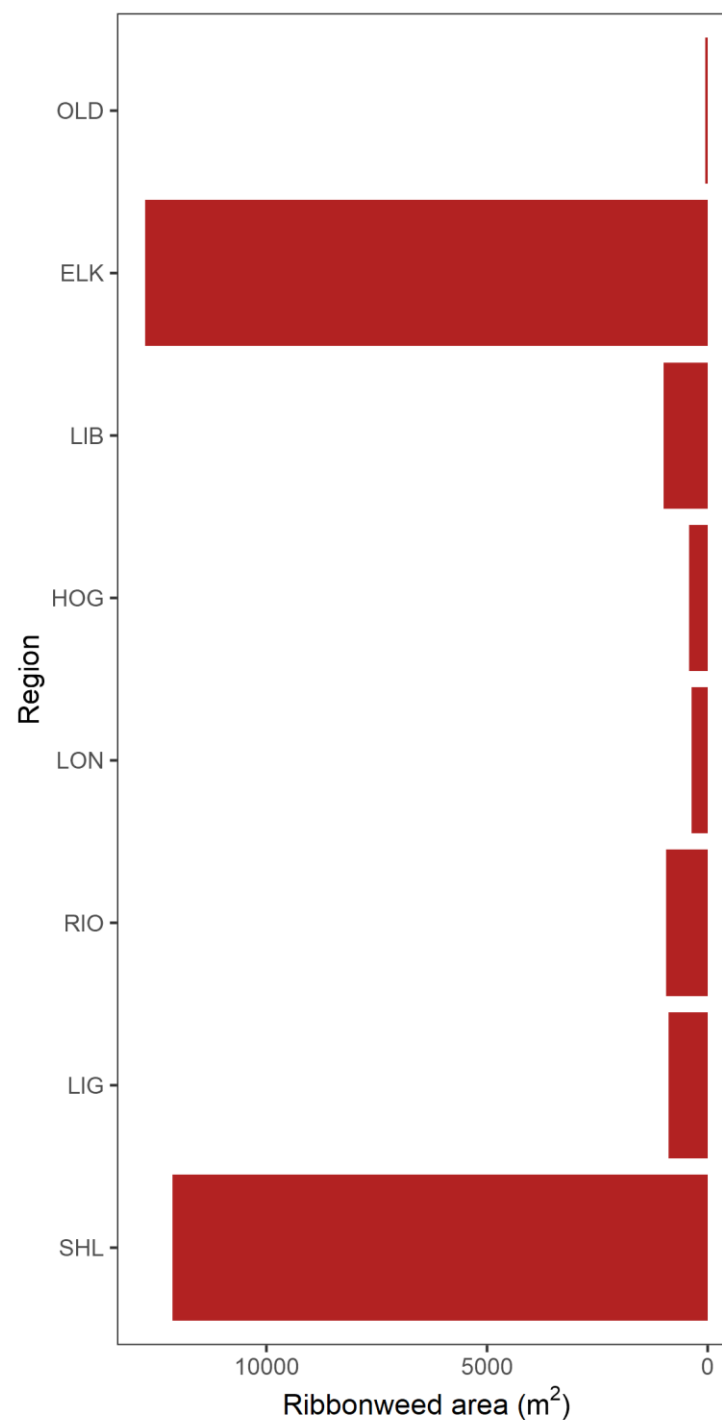


- Eight large patches along western side
- Expands in circular patterns
- Includes largest known patch
- Found new patch by imaging

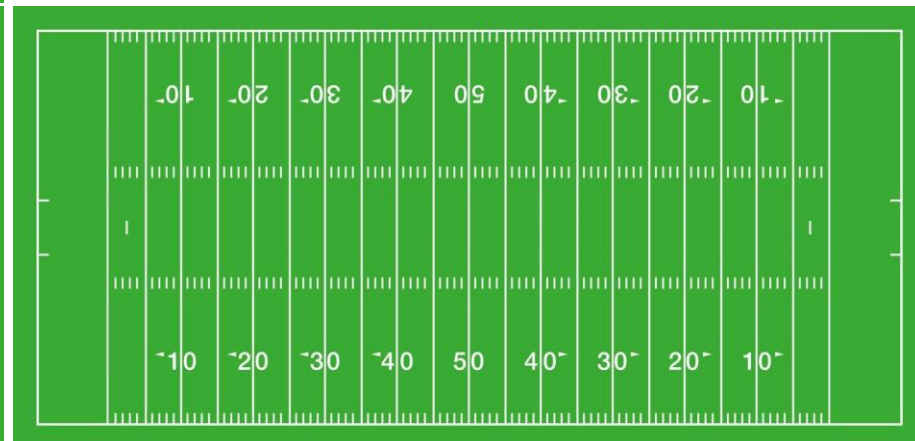
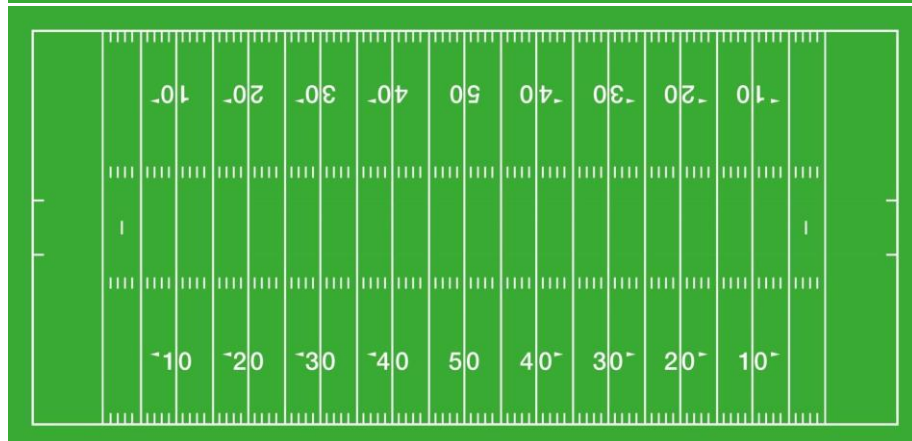
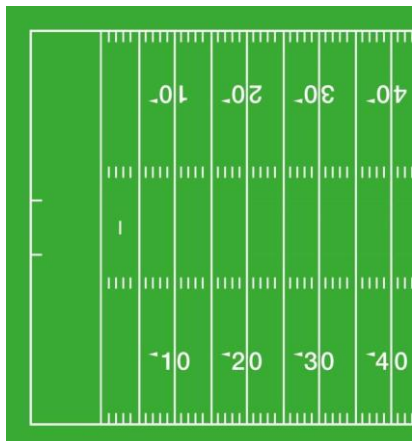
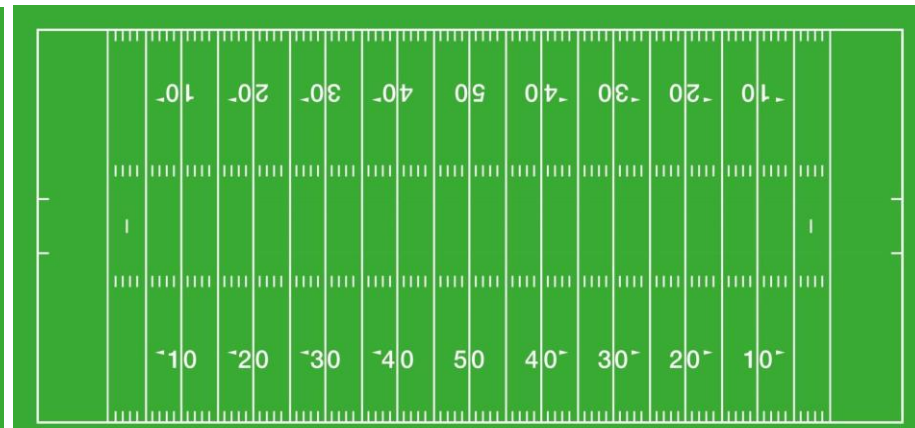
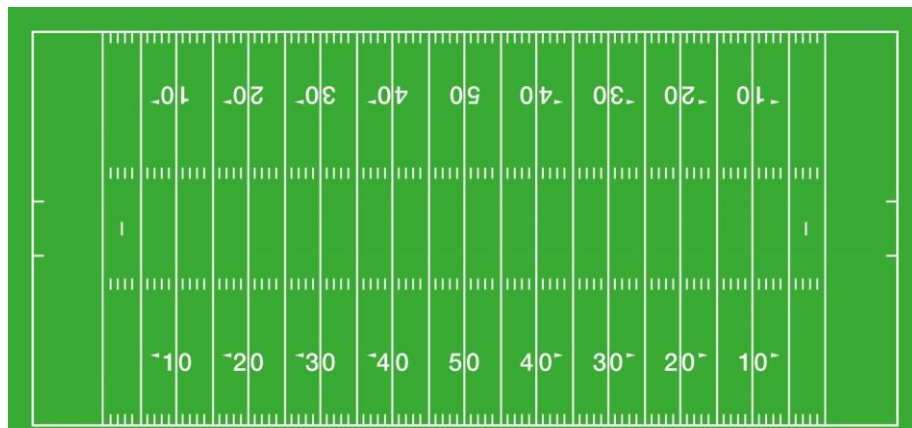
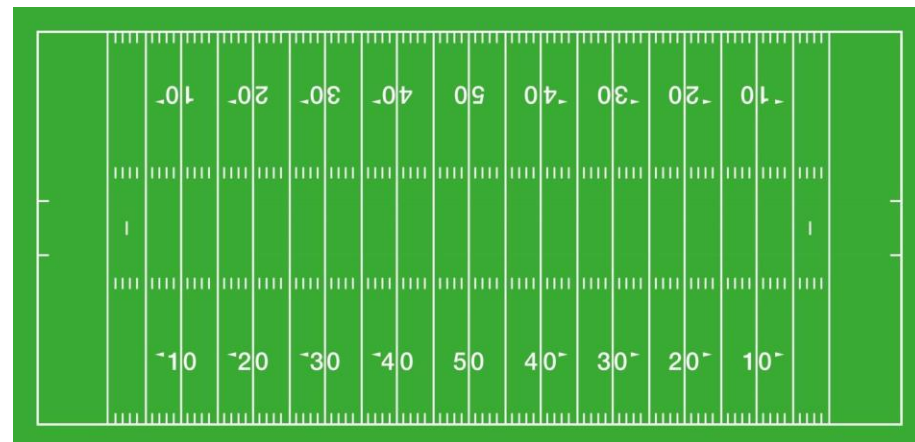


Infestation by region

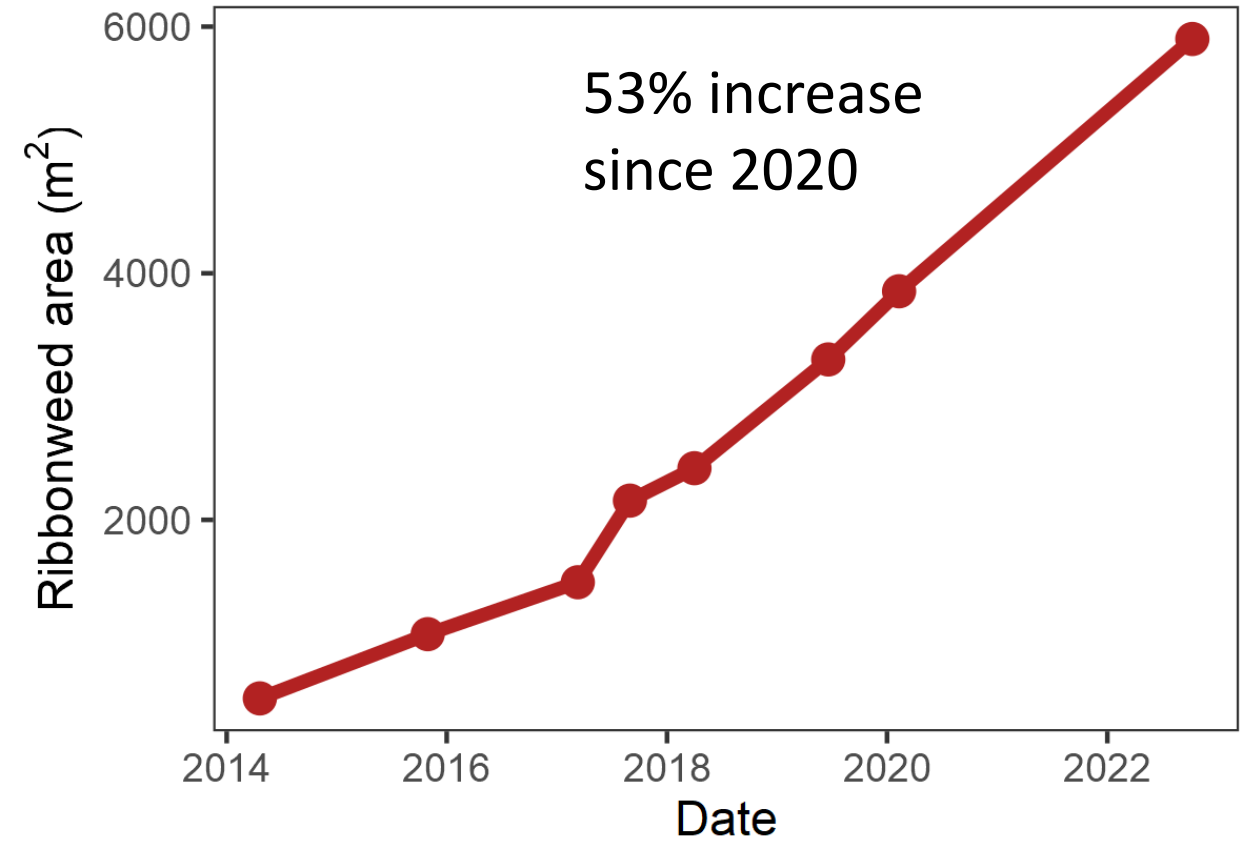
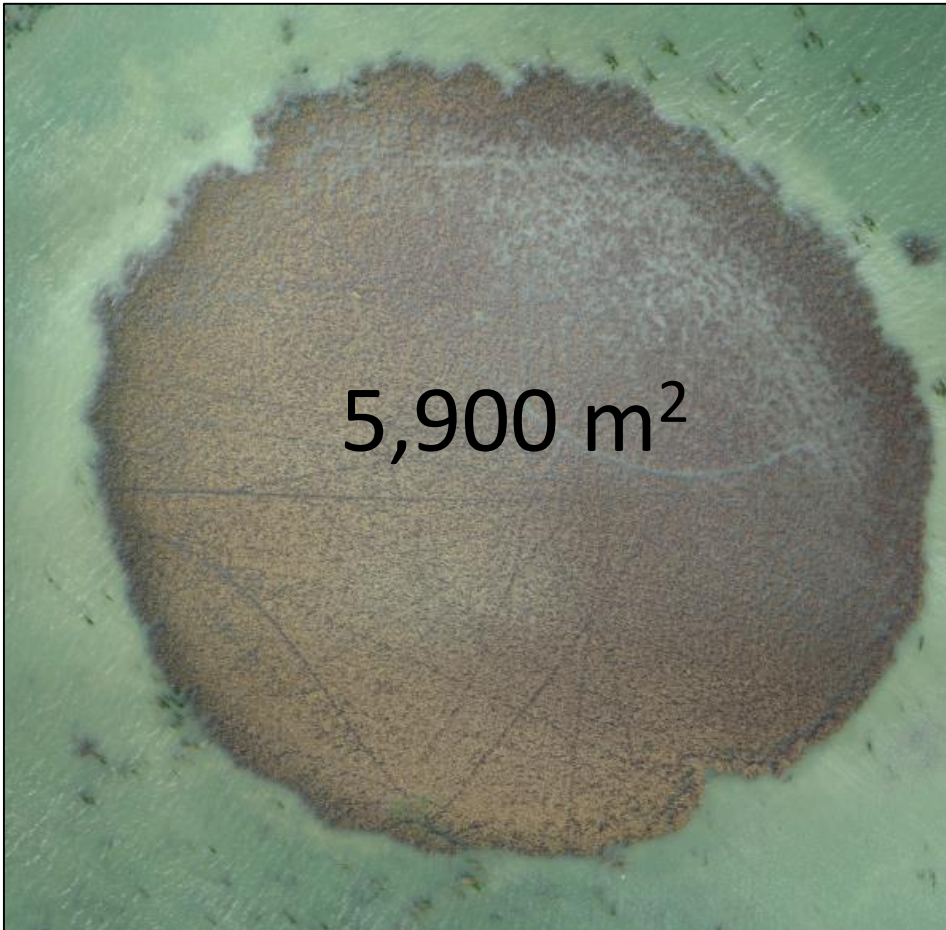
- Size varies widely
- Old Town: 57 m²
- Elk Slough: 12,748 m²
- Sherman Lake: 12,135 m²



Grand Total
28,564 m² or 2.85 hectare



Patch growth: Sherman Lake



Summary

- Tolerates a broad range of conditions
- Known patches cover 2.85 ha in dense monocultures systemwide
- Multiple patches in high boat traffic areas, creating increased risk of spread
- Considered likely to cause economic and environmental harm
- Control options will be explored in the near future
- Report potential sightings in the field to CDFA:
 - <https://www.cdfa.ca.gov/plant/reportapest/>