Aquatic Macrophyte Survey
of
Lower White River Flowage
Waushara County, Wisconsin

Amphibious smartweed (*Polygonum amphibium*), a common species in Lower White River Flowage
Photo: Paul Skawinski

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Acknowledgements
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INTRODUCTION

A point-intercept survey of aquatic plants was conducted on Lower White River Flowage during August 15, 2013. The information in the survey was obtained to evaluate the aquatic plant community and can be used as baseline information for the development of an aquatic plant management plan. Lower White River Flowage is a 133-acre, hard-water impoundment. The maximum depth of rooted vegetation we recorded during our survey was 21 feet.

Aquatic plants play an important role in a lake's ecosystem. They provide habitat for the fishery and other aquatic organisms, stabilize the sediment, reduce shoreline erosion, buffer temperature changes and waves, and infuse oxygen into the water. Rapid and dominant growth of aquatic invasive plants, such as Eurasian watermilfoil, can outcompete and cause a decline in native vegetation, which degrades habitat diversity and recreational value. In Wisconsin, aquatic invasive species (AIS) have spread quickly via transport on boats, trailers, and equipment. Two AIS were found in our survey: Eurasian watermilfoil (EWM) and curly-leaf pondweed (CLP).

METHODS

The aquatic plant survey in Lower White River Flowage was conducted by Golden Sands RC&D Council, Inc. on August 15, 2013. The survey was accomplished using the Wisconsin Department of Natural Resources (WDNR) point-intercept sampling protocol. The GPS coordinates for the grid, which consisted of 249 sample sites, was provided by WDNR (Figure 1). The grid was laid out with equal spacing between all points to ensure future replicability and thorough coverage of the lake. The shape of the lake and the size of the littoral zone are the two factors used to determine the number of points and their spacing. The GPS points were first overlaid onto an aerial photograph that was used in the field. A handheld GPS unit was also used to navigate to sampling sites while in the field.

For aquatic plant sampling, a pole-mounted rake was used to sample aquatic plants at each accessible site by dropping the rake straight down, turning it 360°, then pulling it straight back up. The rake had a double rake head with fourteen teeth on each side with a width of 13.8 inches. The pole rake method was usable up to a depth of 13.5 feet. At depths greater than this, a rake on a rope was used by towing the rake 0.75 meters along the lake bottom before pulling it straight back up. The rope was marked in 1-foot increments. After the rake was retrieved, each species present was assigned a rake fullness rating to quantify relative abundance. Ratings ranged from 0 (plants not present) to 3 (plants overflowing the rake tines). If an aquatic plant was seen at a site but not pulled up on the rake, it was noted with a "V" on the data sheets and included in the plant list on Table 1 of this report.

At each site, depth and dominant sediment type were also recorded. Depth was measured by 1-foot increments on the rake pole or rope. Sediment was measured by visual observation or by tapping the rake on the bottom to determine the substrate type.

A motorboat with a crew of three was used during this survey. One person drove the boat, while another recorded data and the third sampled and identified aquatic plants.

There were a number of points that were inaccessible by boat. If the water was too shallow or the surface was a tangle of vegetation, the points were deemed “non-navigable”.

RESULTS & DISCUSSION

The survey was based on 249 sample sites that were assigned using the WDNR’s point-intercept protocol; 201 of these points were accessible to sample during this survey. Some points were inaccessible due to dense, matted vegetation or because points were placed on shore. In addition, some points were too deep and had no plants or were blocked by temporary obstacles. 179 (89%) of the 201 sampled sites had vegetation present.

The greatest depth at which aquatic plant growth was found was 16 feet. 91% of the sites sampled had vegetation growing shallower than the maximum plant depth. This is reflected in the total rake fullness (Figure 2). The flowage had an aquatic plant species richness of 21 (24 including visuals). In addition, we also found freshwater sponges, which are actually animals, but they were recorded because they are good water quality indicators. Filamentous algae were noted as well. Figure 3 displays the species richness of individual sampling points. This indicates how diverse each site is.

Two invasive plants species currently exist in the Lower White River Flowage. EWM and CLP were both found (Figure 8,9). EWM is present in low abundance at the center of the flowage. CLP is currently at its highest abundance near the White River inlet. The majority of CLP was found in the western half of the flowage. This could be due to an accumulation of soft sediments at the upstream end, which is ideal for CLP.

Frequency of Occurrence

The frequency of occurrence (FO) value is a measure of the frequency at which a species occurs in the lake. The FO for total vegetation occurring at shallower than the maximum plant depth for Lower White River Flowage was 91.8%. The most frequently occurring aquatic plant species found in the Lower White River Flowage was common waterweed (*Elodea canadensis*). Common waterweed occurred at 64.8% of areas with vegetation (Figure 4). The second most frequently occurring aquatic plant species was coontail (*Ceratophyllum demersum*) which occurred at 52.5% of the vegetated areas (Figure 5) followed by water stargrass (*Heteranthera dubia*), occurring in 26.3% of vegetated areas (Figure 6).

Although northern watermilfoil, (*Myriophyllum sibiricum*) (NWM), had the ninth highest frequency of occurrence (Figure 7), it is one of the more important species to know in the lake. NWM can look very similar to its invasive counterpart, EWM; however, it tends to be less abundant. There were a number of points in the lake which had NWM present, but the plants were low in abundance. This native milfoil can easily be misidentified as EWM, which may prompt unnecessary action.

Simpson Diversity Index

The Simpson Diversity Index (SDI) quantifies biodiversity based on a formula that uses the number of species surveyed and the number of individuals per site. The SDI uses a decimal scale; values closer to one represent higher amounts of biodiversity. The SDI of the flowage for the 2013 survey was 0.89. This is 0.02 higher than the value given to West Branch Millpond, an upstream flowage which was also surveyed in August 2013.

Floristic Quality Index

The Floristic Quality Index (FQI) evaluates the similarity of a plant community to undisturbed conditions. Each plant is assigned a coefficient of conservatism value ("C-value") that reflects its sensitivity to disturbance and these numbers are used to calculate the FQI. C-values range from 0 to 10—the higher the number, the more intolerant of disturbance. A zero C-value is assigned to non-native species. The FQI for the Lower White River Flowage was 26.2. The FQI and average C-value for Lower White River Flowage are above the statewide averages for flowages. Figure 10 displays the maximum C-value of each site.

In Lower White River Flowage, the C-value ranged from 0 to 8 (Table 2). Two invasive species were sampled, CLP and EWM, both of which have a C-value of 0. 5 of the 24 species found in Lower White River Flowage (Wild rice, white water crowfoot, white-stem pondweed, Fries' pondweed, and southern naiad) had a C-value of 8 or greater, indicating good health in the aquatic plant community. Within vegetated areas, wild rice occurred at 0.6% of the sample sites, white water crowfoot was found at 4% of the sites, white-stem pondweed occurred at 2% of sites, and Fries' pondweed and southern naiad both occurred at 13% of sites. The species with the highest frequency of occurrence within vegetated areas was common waterweed; it has a C-value of 3.

Aquatic Invasive Species

Two invasive plant species were found in the flowage. EWM was first identified in the flowage in 2002. CLP was first reported in the flowage in 2013. Steps to control them were taken by the management district. On May 8, 2013, the management district contracted with Stantec to treat 4 acres of EWM. The herbicide Navigate (a form of 2,4-D) was used at a rate of 200 lbs/acre. Curly-leaf pondweed was also identified, and 4 acres were treated with the chemical ClearCast 2.7G, which was applied at 100 lbs/acre. Our August survey showed populations of both CLP and EWM (Figures 8,9).

Because our survey took place in August, results for CLP may not be representative of the population, due to the unique life cycle of the plant. CLP typically dies off in late June, releasing phosphorus from its plant tissues into the water. The timing of the die off can be problematic by fueling filamentous algae blooms. The CLP turions, or winter buds, establish themselves in a suitable substrate shortly after the plants die back. When conditions are right in autumn, the turions will sprout and exist in a dormant state under the ice. The plants then resume growth shortly after ice out; this unique life cycle gives it a head start and a competitive advantage over other aquatic plants. CLP was sampled during our August survey, as depicted in Figure 9.

CONCLUSIONS

Lower White River Flowage has a moderately diverse aquatic plant community. The flowage is designated "no-wake", which allows for more stable conditions for aquatic plants, and in some cases, may increase the possibility for the presence of rare species that may be less tolerant of disturbance.

Aquatic plant growth is abundant in the flowage due to the shallow depth of water and rich sediments delivered from the White River watershed. Several areas in the flowage have an abundance of the native northern milfoil (*Myriophyllum sibiricum*).

In August, CLP can be found mainly around the mouth of the White River, but stretches south halfway down the flowage. This plant can become invasive and may contribute to nuisance algae blooms throughout the summer. CLP should be monitored annually in early June, and if the beds continue to expand, management should be considered.

EWM accounts for a small portion of the plant biomass in the Lower White River Flowage. Most of the populations exist in the center of the flowage, but plants were also seen at the southern end. There were many dead stems throughout the flowage in June after the treatment. Although the EWM looked scattered, it was present in most parts of the flowage. EWM can create dense beds which can stall or burn up boat motors, make areas non-navigable, and prevent activities like swimming and fishing. This plant can produce viable seed; however, its primary mode of spread is fragmentation. A one-inch stem fragment is enough to start a new plant.

Boats and trailers that have visited other lakes can be a primary vector for the transport of AIS. Volunteer boat inspectors at the boat landing, trained through the Clean Boats, Clean Waters (CBCW) program, can help prevent new AIS introductions. The lack of intensive high-speed recreational boating helps to preserve the integrity of Lower White River Flowage by reducing disturbance to the lakebed. Disturbed conditions often encourage the colonization of AIS. Monitoring for AIS should be conducted routinely throughout the flowage by either trained citizen volunteers or paid personnel. Free training for volunteers for CBCW and AIS monitoring is available through the Regional AIS Program at Golden Sands RC&D Council, Inc. Contact Golden Sands RC&D at 715-343-6215 or www.goldensandsrcd.org.

Aquatic plants play a critical role in the aquatic ecosystem by providing quality habitat and food for fish, invertebrates, birds, and mammals. The plants tie up nutrients which would otherwise be available to algae. Any management activities should be planned to minimize disturbance of the native species in the water and on shore, and maintain the balance between aquatic plants and algae. In addition, care should be taken to minimize the amount of disturbed lake bed from raking or pulling of plants, since these open spaces are simply “open real estate” for aquatic invasive plants to establish.

Sedimentation and excessive nutrient inputs accelerate algae and aquatic plant growth in the flowage. Some erosion and sedimentation occurs naturally in the watershed, but it is commonly increased by shoreline disturbance and fertilizer applications. Protecting lakefront and riverfront habitat throughout the watershed will help to reduce the amounts of sediment and nutrients delivered to the lake. A minimum 35-foot vegetative buffer is recommended to provide sufficient filtering of runoff. Healthy, vegetated shoreline buffers are comprised of native, unmown grasses, forbs, shrubs, and trees. Riparian property owners looking to add native plants to their shorelines can find several local sources, including:

- Prairie Nursery of Westfield, WI
- J&J Aquatic Nursery of Wild Rose, WI
- Marshland Transplant of Berlin, WI

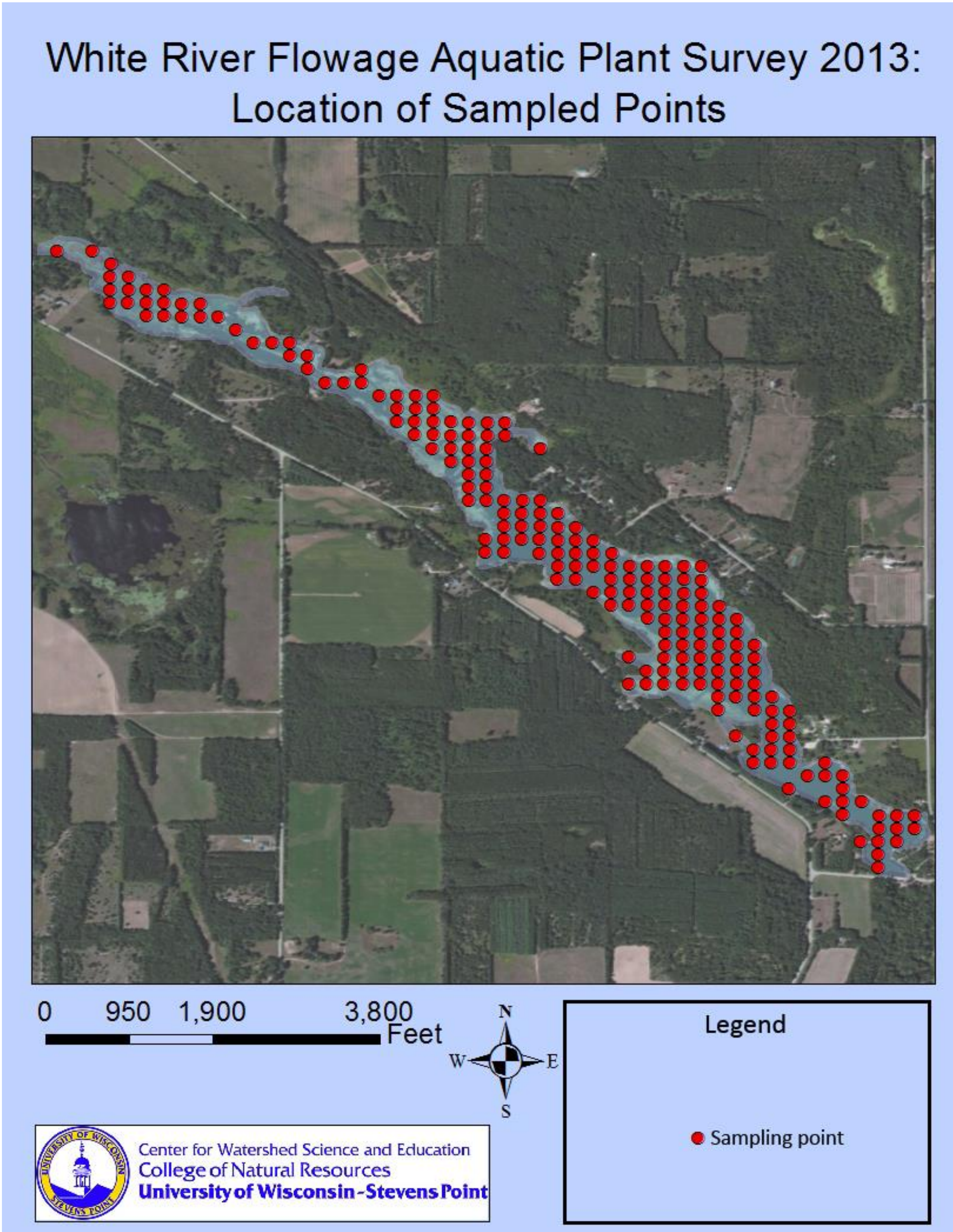

Figure 1. Sampling points for aquatic macrophyte survey using the Wisconsin DNR point-intercept method.

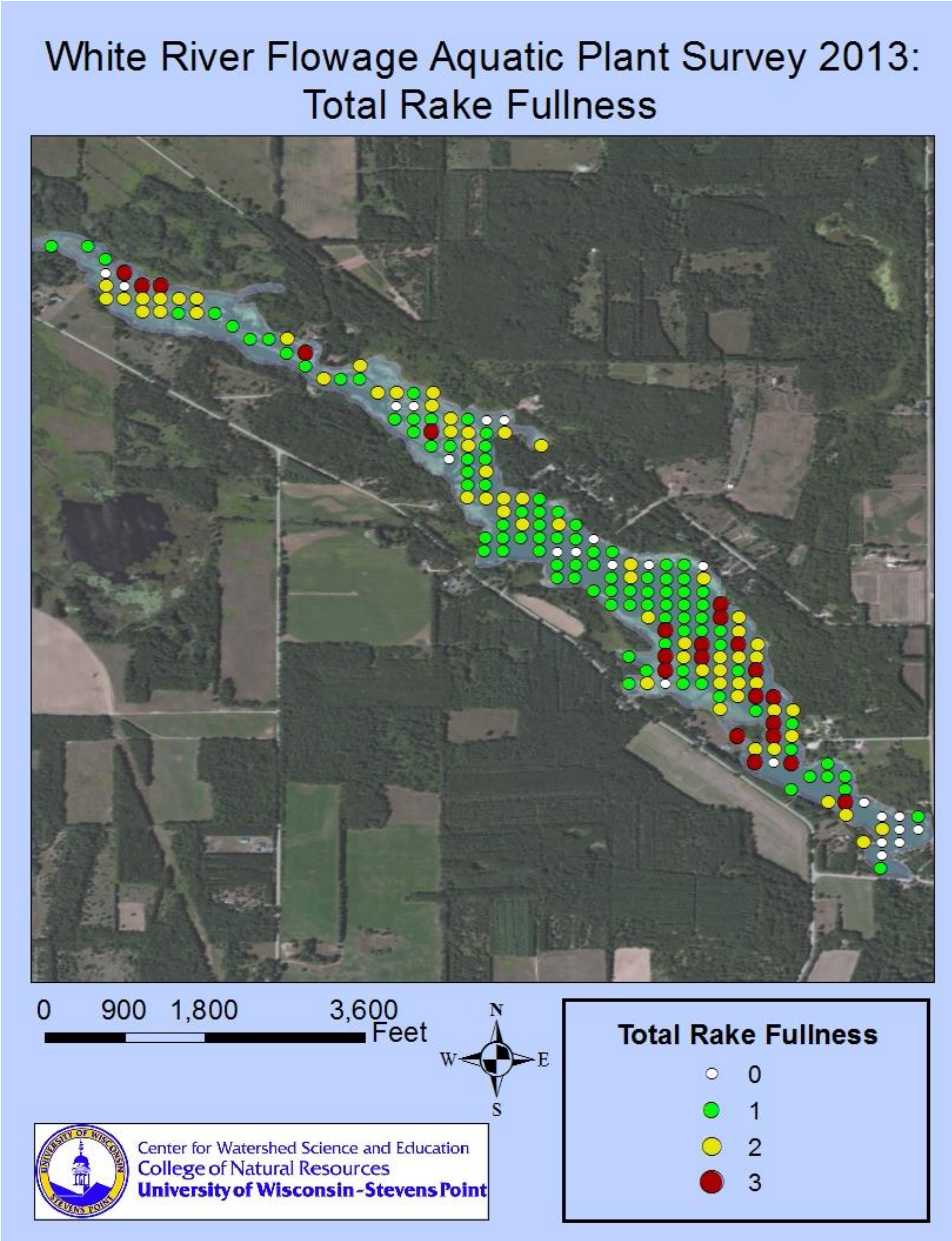

Figure 2. Total rake fullness of aquatic macrophytes in the Lower White River Flowage, August 15, 2013.

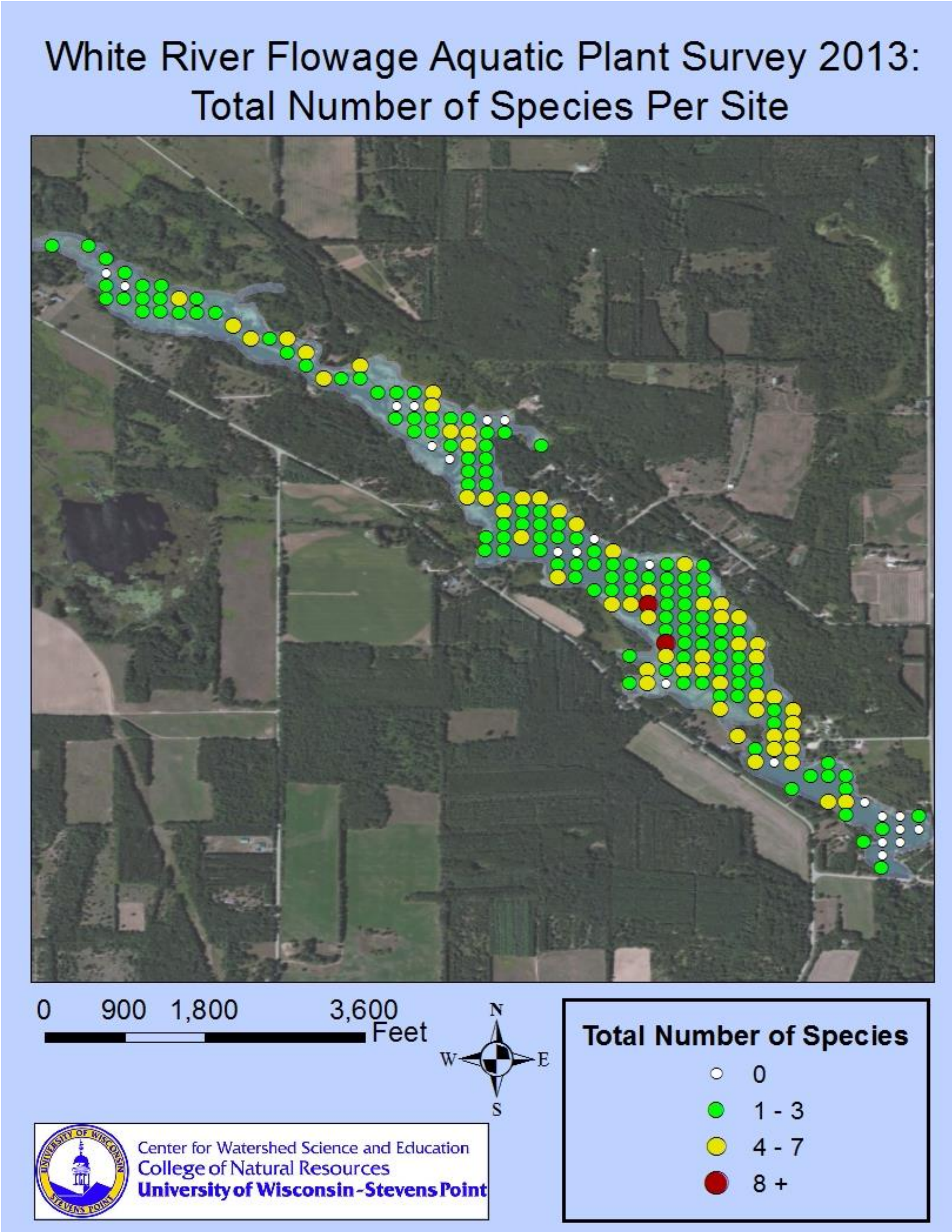

Figure 3. Total number of species at each sample site in the Lower White River Flowage, August 15, 2013.

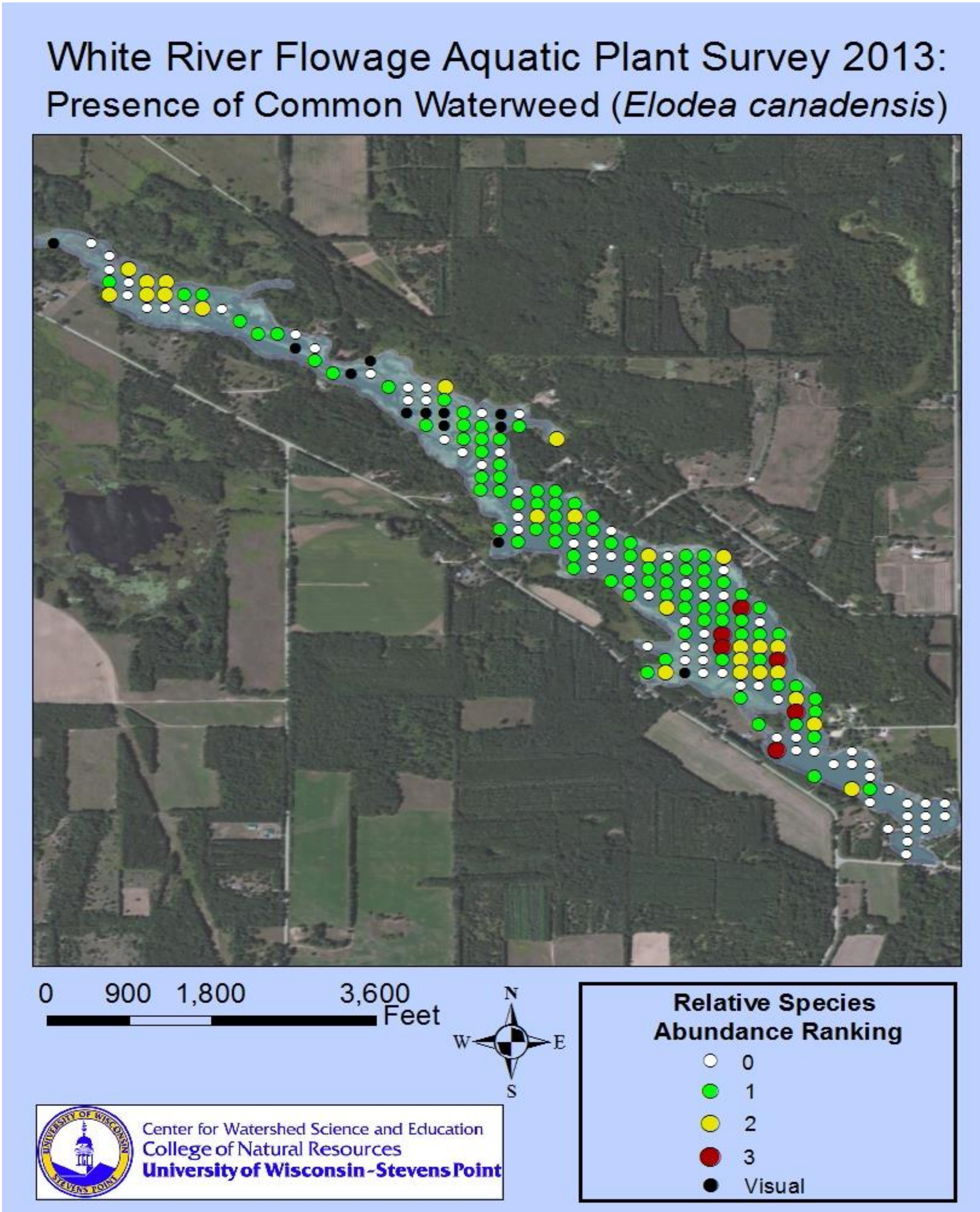

Figure 4. Location and relative abundance of common waterweed in the Lower White River Flowage, August 15, 2013.

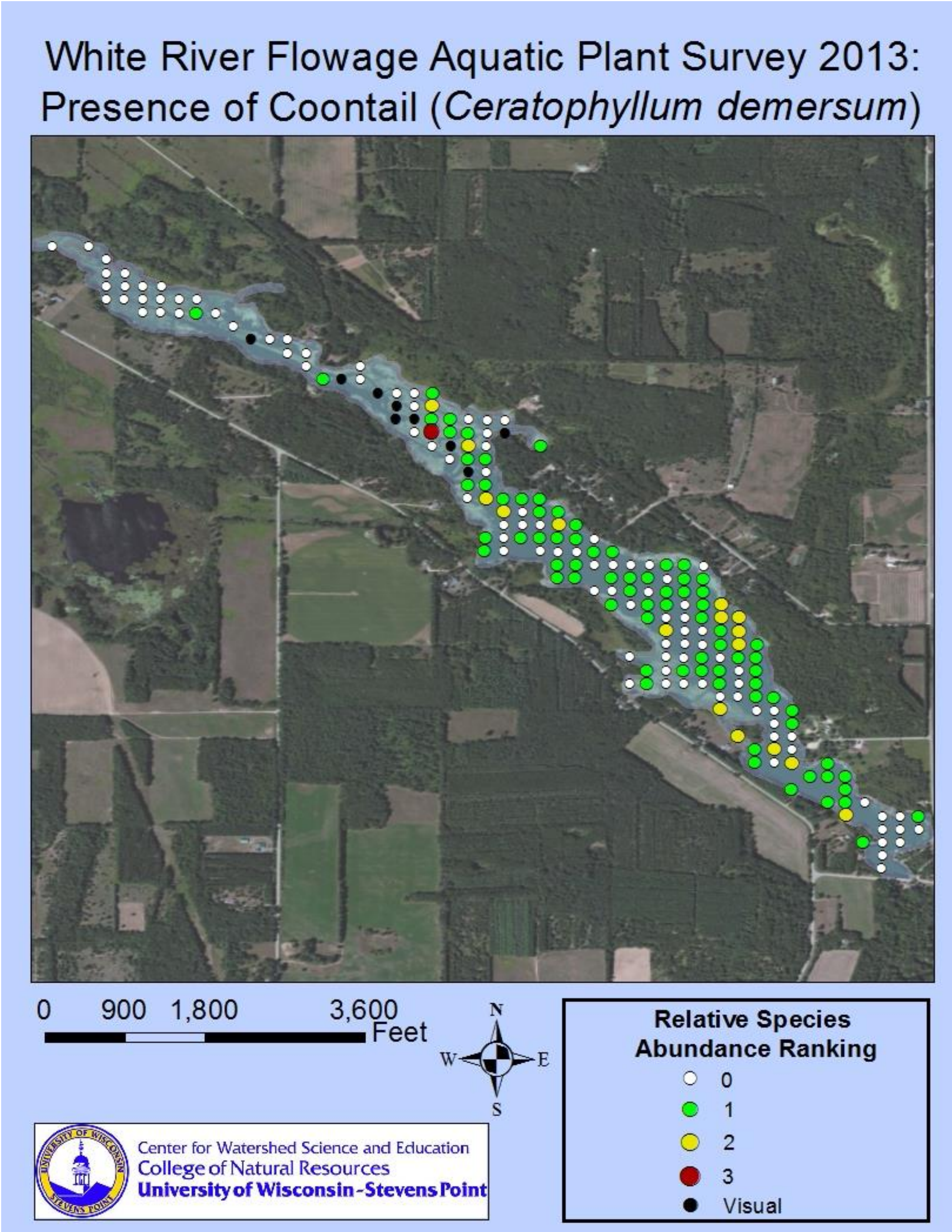

Figure 5. Location and relative abundance of coontail in the Lower White River Flowage, August 15, 2013.

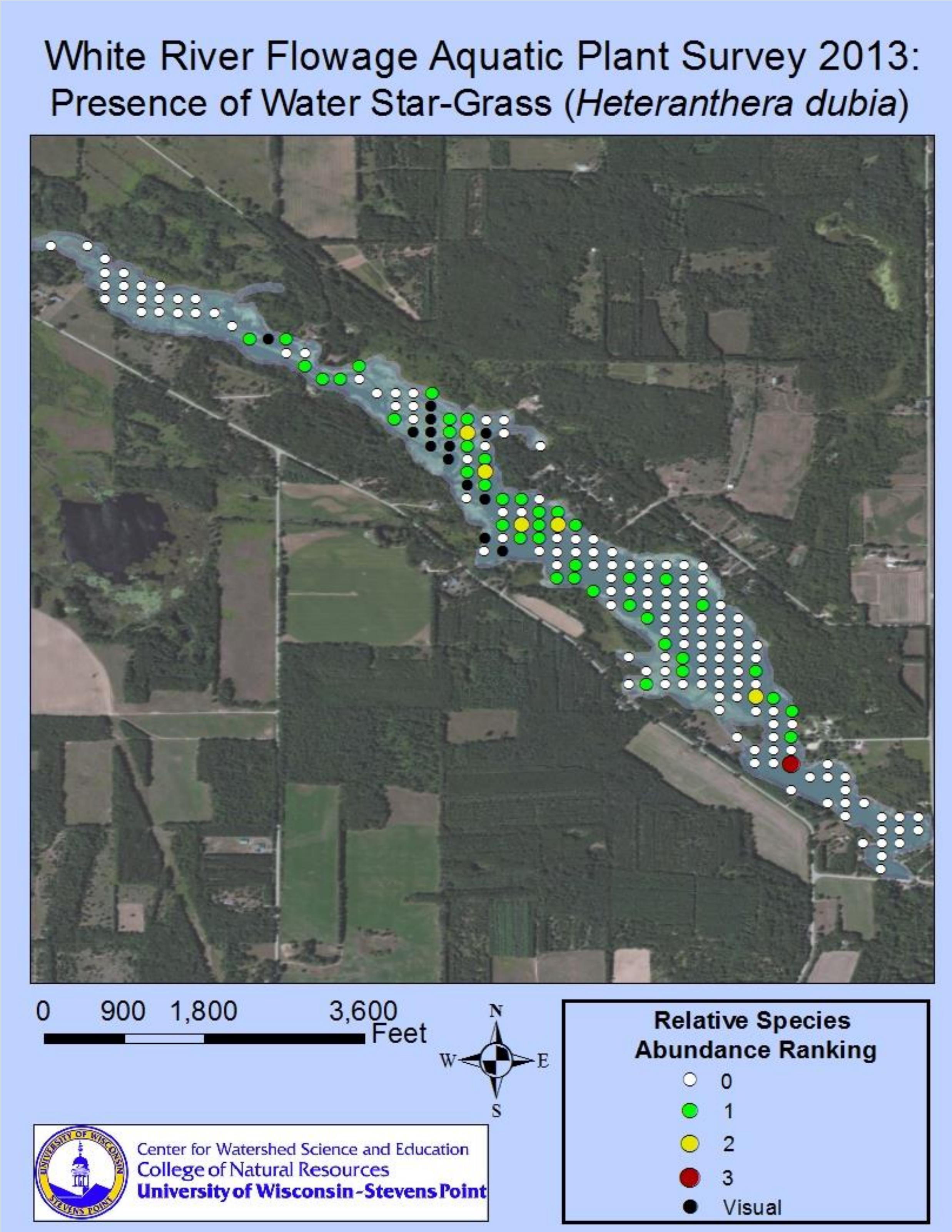

Figure 6. Location and relative abundance of water stargrass in the Lower White River Flowage, August 15, 2013.

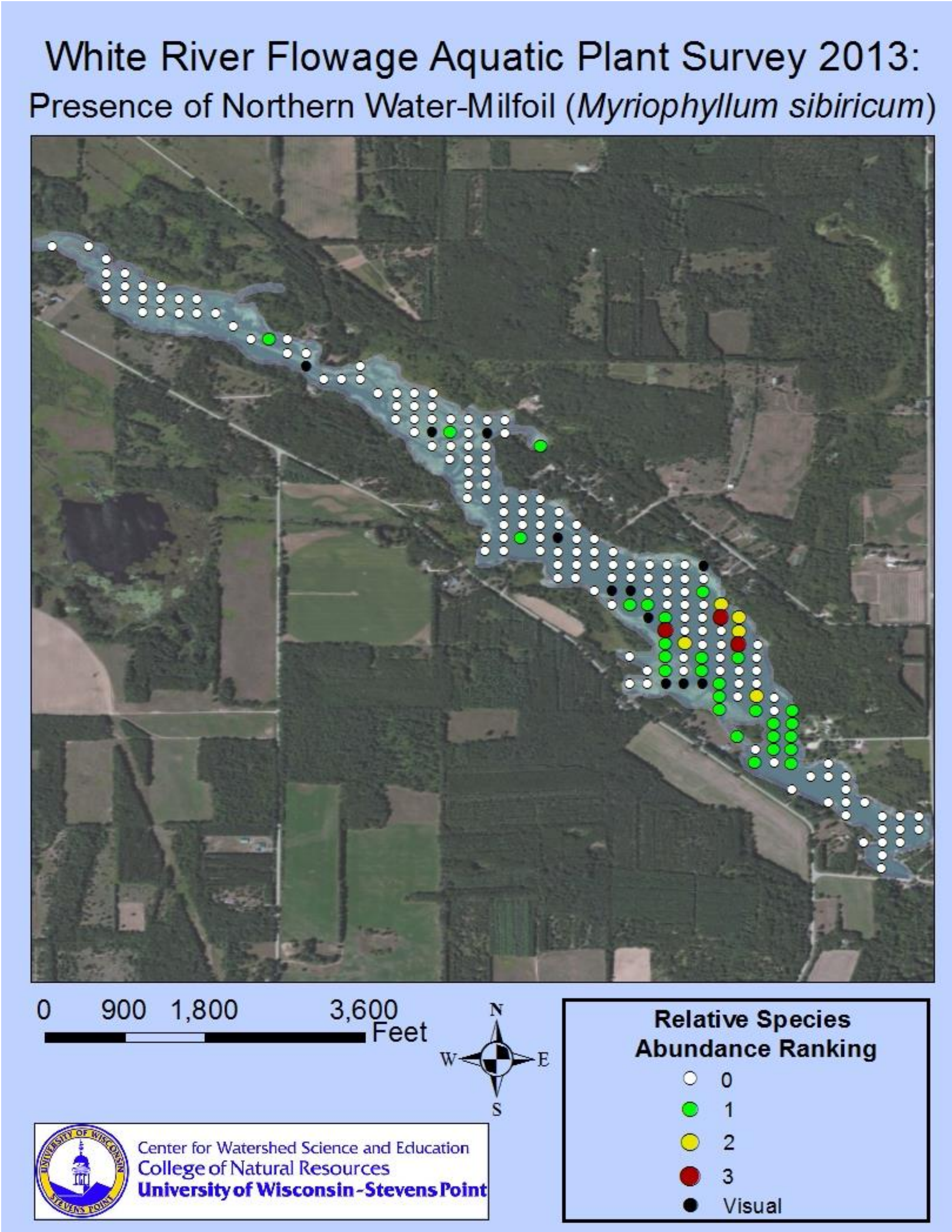

Figure 7. Location and relative abundance of northern watermilfoil in the Lower White River Flowage, August 15, 2013.

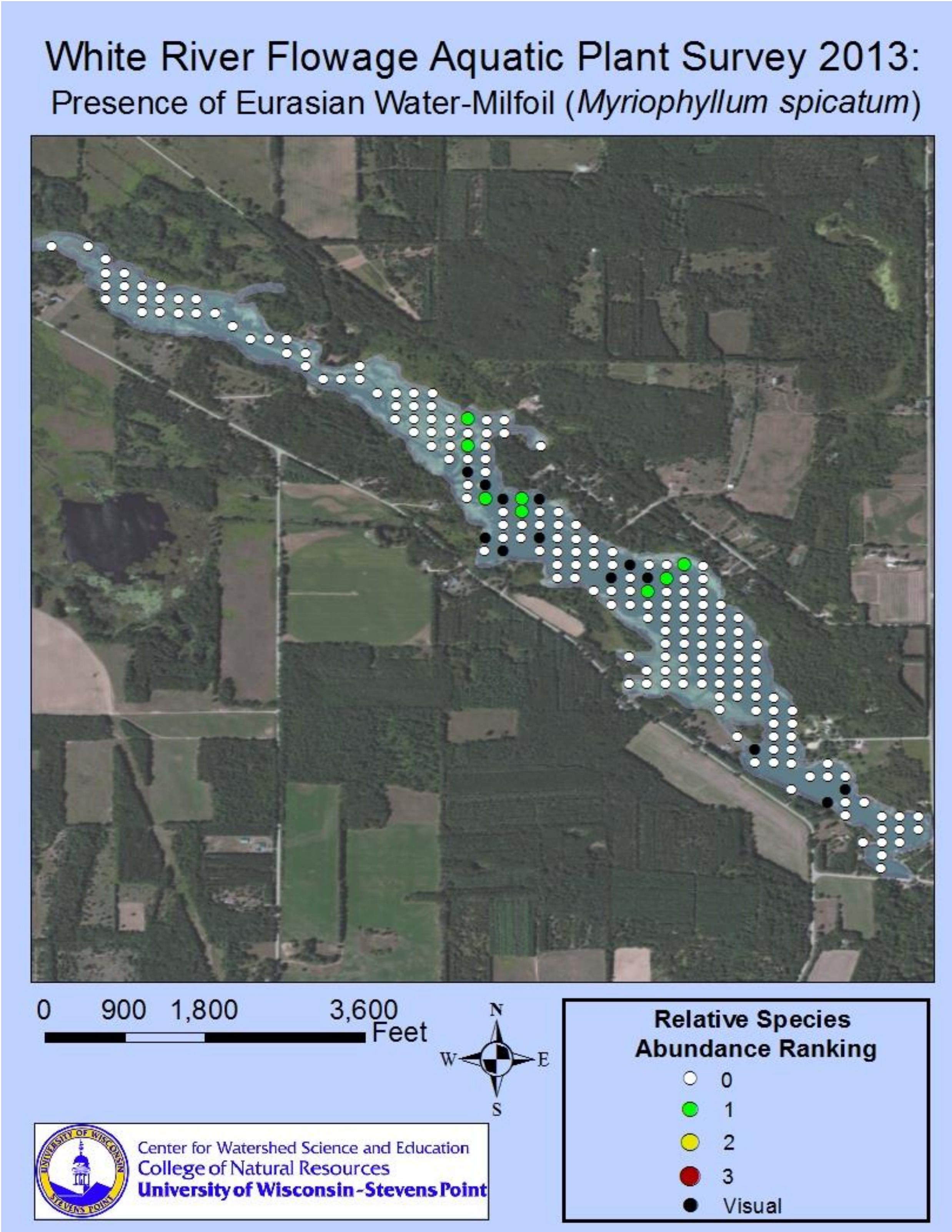

Figure 8. Location and relative abundance of Eurasian watermilfoil in the Lower White River Flowage, August 15, 2013.

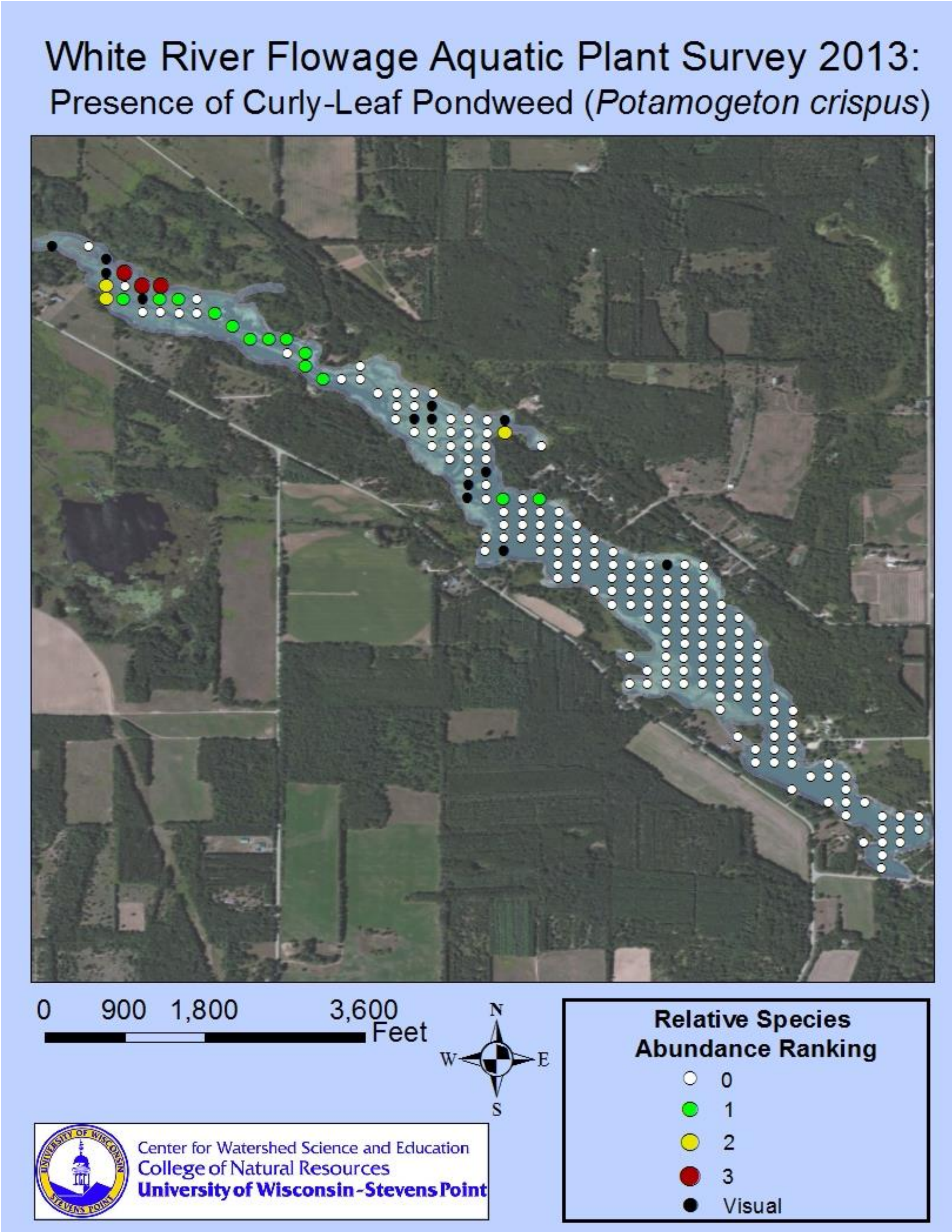

Figure 9. Location and relative abundance of curly-leaf pondweed in the Lower White River Flowage, August 15, 2013.

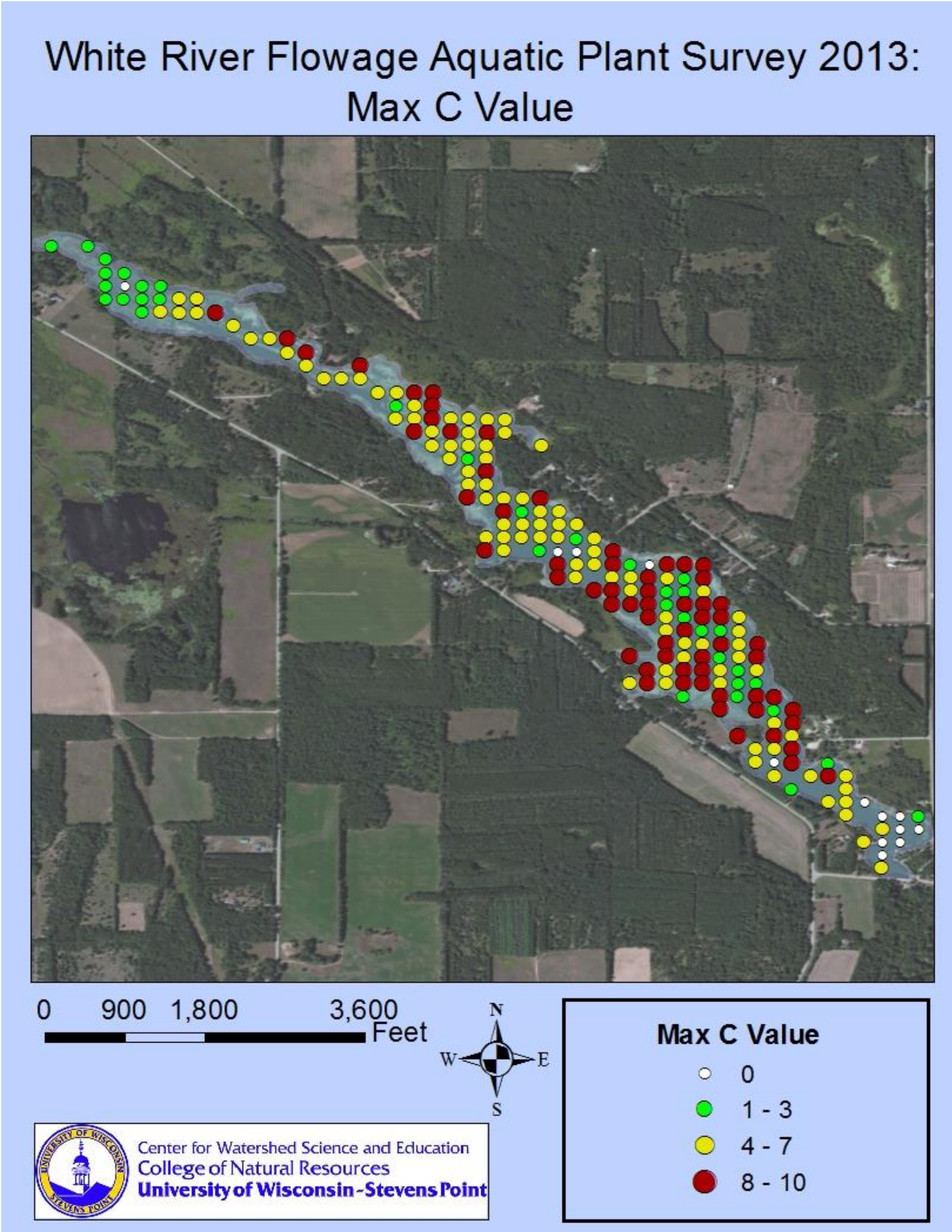

Figure 10. Maximum Coefficient of Conservatism value found at each sample site in the Lower White River Flowage, August 15, 2013.

Table 1. Aquatic plant species identified in survey of the Lower White River Flowage, August 15, 2013.

Scientific name	**Common name**	**Sampled**	**Visuals**
Bolboschoenus fluviatilis	River bulrush		x
Ceratophyllum demersum	Coontail	x	x
Chara spp.	Muskgrasses	x	x
Elodea canadensis	Common waterweed	x	x
Heteranthera dubia	Water stargrass	x	x
Lemna trisulca	Forked duckweed	x	
Myriophyllum sibiricum	Northern watermilfoil	x	x
Myriophyllum spicatum	Eurasian watermilfoil	x	x
Najas guadalupensis	Southern naiad	x	x
Nymphaea odorata	White water lily	x	x
Polygonum amphibium	Amphibious smartweed	x	x
Potamogeton crispus	Curly-leaf pondweed	x	x
Potamogeton friesii	Fries' pondweed	x	x
Potamogeton natans	Floating-leaf pondweed	x	x
Potamogeton nodosus	Long-leaf pondweed	x	
Potamogeton praelongus	White-stem pondweed	x	x
Potamogeton pusillus	Small pondweed	x	
Potamogeton zosteriformis	Flat stem pondweed	x	x
Ranunculus aquatilis	White water crowfoot	x	x
Sparganium spp.	Bur-reeds		x
Stuckenia pectinata	Sago pondweed	x	x
Vallisneria americana	Water celery	x	x
Zizania spp.	Wild rice	x	x
	Freshwater sponges	x	x
	Filamentous algae	x	

Table 2. Coefficient of Conservatism values for species present during the survey of Lower White River Flowage, August 15, 2013.

Scientific name	Common name	C-value
Bolboschoenus fluviatilis	River bulrush	6
Ceratophyllum demersum	Coontail	3
Chara spp.	Muskgrasses	7
Elodea canadensis	Common waterweed	3
Heteranthera dubia	Water stargrass	6
Lemna trisulca	Forked duckweed	6
Myriophyllum sibiricum	Northern watermilfoil	6
Myriophyllum spicatum	Eurasian watermilfoil	0
Najas guadalupensis	Southern naiad	8
Nymphaea odorata	White water lily	6
Polygonum amphibium	Amphibious smartweed	5
Potamogeton crispus	Curly-leaf pondweed	0
Potamogeton friesii	Fries' pondweed	8
Potamogeton natans	Floating-leaf pondweed	5
Potamogeton nodosus	Long-leaf pondweed	7
Potamogeton praelongus	White-stem pondweed	8
Potamogeton pusillus	Small pondweed	7
Potamogeton zosteriformis	Flat stem pondweed	6
Ranunculus aquatilis	White water crowfoot	8
Sparganium spp.	Bur-reeds	5
Stuckenia pectinata	Sago pondweed	3
Vallisneria americana	Water celery	6
Zizania spp.	Wild rice	8
	Freshwater sponges	-
	Filamentous algae	-