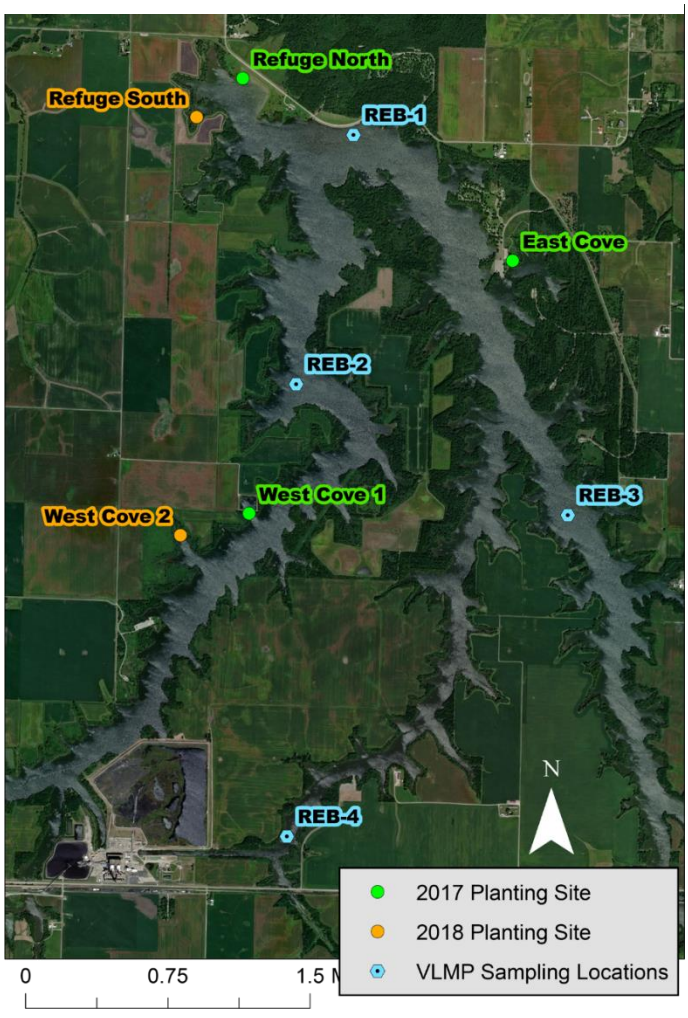
Sangchris Lake Aquatic Vegetation Restoration Project – 2018 Progress Report

In 2017, IDNR's Contaminant Assessment Section began an aquatic vegetation restoration project at Sangchris Lake in Christian County, IL. The goal of this project is to reestablish a diverse assemblage of aquatic plants and ultimately improve lake conditions by reducing shoreline erosion, increasing sedimentation, reducing nutrient loads through plant uptake, and providing habitat and food sources for a variety of aquatic and terrestrial organisms. The initial phase of the project focused on establishing restoration procedures, determining transplanting methods, identifying target species, and selecting of restoration locations. In 2017, four aquatic plant species, spatterdock (*Nuphar advena*), white water lily (*Nymphaea odorata*), American pondweed (*Potamogeton nodosus*), and water stargrass (*Heteranthera dubia*), were transplanted from nearby sources into the lake at three locations (Figure 1). These planting sites are intended to act as founder colonies that will provide a source for future plants through vegetative and sexual reproduction. As part of an experimental approach, some plants were placed within protective exclosures, and others were left unprotected. This was done to determine the effects of herbivores and/or foraging by fish on growth and survival of each species. The results of this experimental phase were used to improve restoration design and efficiency the following year.

Figure 1. Planting Locations



During the 2017 experimental phase, it quickly became obvious that protection from herbivory and foraging was necessary for macrophyte survival. Nearly all unprotected plants were absent within the first month, while nearly all protected plants survived. Spatterdock, a large rooted, hearty species, showed some resilience and resistance to herbivory, but growth and survival were still severely impaired. When protected, spatterdock, white water lily, and American Pondweed thrived in most locations; however, growth and survival of water stargrass was limited. As all four species were abundantly available and showed survival and growth under certain conditions, all were considered viable options for further translocation.

Some issues were identified with the planting locations selected in the initial phase. The location on the west arm, called West Cove 1, was heavily infested with brittle naiad (*Najas minor*). This submersed invasive species may influence the growth and survival of the desired macrophytes, particularly water stargrass, which is also a submersed species. The crappie nursery pond adjacent to this site

may also be problematic. Aquatic herbicides are used to control excessive plant growth within the pond. The outflow pipe for both excess water and crappie release empties into the planting area and may contain residual herbicides following treatment. The site known as Refuge North was noted to have issues with wind and wave action. Spatterdock and American pondweed performed well at this site and survived the winter; however, no additional plants were placed at this location in 2018. The East Cove planting site was highly successful, and no issues were observed.

The aquatic plants used in 2018 were gathered from the same locations as in 2017. Spatterdock was collected from Paradise Lake in Coles County, IL, white water lily was collected from Lake Mingo at Kennekuk County Park in Vermillion County, and American pondweed was collected from a pond adjacent to Sangchris Lake in Christian County. Water stargrass was collected from Clear Pond at Kickapoo State Park in Vermillion County in 2017; however, due to an abundance of Eurasian watermilfoil, a highly invasive aquatic plant, no water stargrass was collected in 2018. If another source of water stargrass can be found, it may be utilized in future efforts.

Phase II

As stated in the restoration plan and recommended by the Army Corp of Engineers (Dick et al., 2013), the second phase in the project included expansion of the first-year planting sites by increasing the size of the protective exclosures. This gives the plants more room to grow and spread, while also keeping them safe from herbivores. The existing exclosure fences, each 20 feet in length, were dismantled and linked together to form larger exclosures (Figures 2 and 3). These large exclosures were placed around the surviving plants in May of 2018. Wherever possible, plots with no visible growth were included within the new larger exclosure in anticipation of regrowth later in the growing season. Exclosure fences were secured with rebar hooks at the base and wooden stakes were attached for structural support.

Figure 2. Small Single Species Exclosure

Figure 3. Large Multi-Species Exclosure

At West Cove 1, two large exclosures were created. The first exclosure, approximately 40 feet in circumference, contained white water lily, which survived throughout the growing season. The second exclosure, approximately 80 feet in circumference, contained American pondweed. Although growth was widespread early in the season, these plants died off in August. A large infestation of brittle naiad at this location may have interfered with growth. The larger exclosure may have also been more susceptible to failure, which would allow carp, turtles, or other animals to uproot or eat the plants.

At the Refuge North site, three large exclosures were created. One exclosure, approximately 80 feet in circumference contained two separate plots of spatterdock. The other two exclosures, each 40 feet in circumference, contained American pondweed. One also contained volunteer American lotus, not planted by IDNR. All plants present at the beginning of the season survived throughout 2018 and appeared to be healthy.

The East Cove planting site had the most surviving plants of the three locations. Two exclosures, each 80 feet in circumference were created, each containing spatterdock, white water lily, and American pondweed, as well as American lotus. The plants in these exclosures spread rapidly to fill the larger exclosures and survived throughout the growing season. Two small exclosures at this site contained water stargrass that survived until the end of the 2017 growing season. Although these plants could not be observed in May of 2018, the exclosures were left in place and were not incorporated into the larger exclosures. Water stargrass was present in one of these exclosures in late July but was apparently short-lived. Brittle naiad was also present within several exclosures at this site, however, it seemed to grow only in patches where gaps occurred between the leaves of the translocated species.

In addition to expanding exclosures at the existing planting locations, two new planting locations were selected for 2018 (Figure 1). The first was in another cove in the west arm of the lake, called West Cove 2 (Figure 4). This cove is large, shallow, and well protected from wind and wave action. A total of nine plots were established at this site, each with a 20-foot circumference exclosure. Approximately four plants of each species were planted at three plots each. All plots exhibited good growth and had surviving plants throughout the growing season. As in West Cove 1, brittle naiad was abundant at this site. Before planting, the brittle naiad was cleared from each exclosure. It grew back in many plots but appeared to be less dense inside the exclosures than in the surrounding area. It did not seem to effect growth and survival of the target plants.

Figure 4. West Cove 2 on 8/28/18

Figure 5. Refuge South on 9/13/18

The second new planting location created in 2018 is in the southern portion of the wildlife refuge area and is called Refuge South (Figure 5). This site is in a well-protected cove with limited fetch and should therefore not have the wind and wave action problems observed at the Refuge North site. A total of 12 plots were established at this location, each with a 20-foot circumference protective exclosure. This allowed for four plots for each species, with approximately four plants placed

in each plot. The plants at this location were also very successful, with excellent growth and survival in all plots. No brittle naiad was observed at this location.

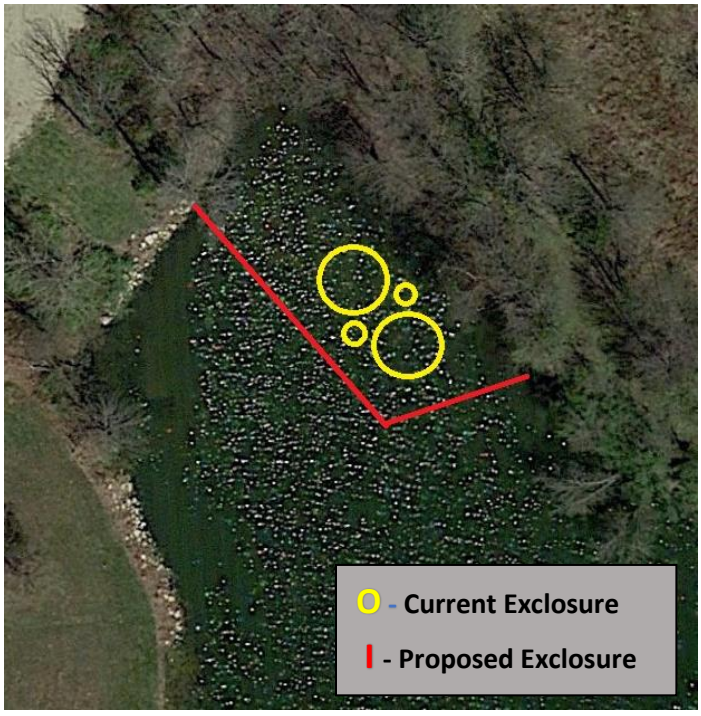
Conclusions and Recommendations

The experimental approach taken in 2017 was a very useful exercise and learning experience that led to a successful second phase in 2018. Although the West Cove 1 and Refuge North sites were not as productive in 2018, some plants did survive and should continue to grow and spread. The East Cove site continued to be very productive in 2018 and spread rapidly to fill the expanded exclosures. The transplants at the two new sites in 2018 were very successful, which indicates that these sites have suitable growing conditions and should continue to be successful in the future.

In the spring of 2019, West Cove 1 and Refuge North should be surveyed for surviving aquatic plants. In plots where plants continue to grow, exclosures should be repaired and left in place. This will ensure that the plants remain protected, allowing them more time to become established. Additional spatterdock could be planted at the Refuge North site to bolster the existing colony and increase the potential for pollination. Since growth appeared to be limited at these sites, further expansion of the exclosures is not recommended at this time.

The East Cove site showed excellent growth in 2018 and appears to have the potential to expand beyond the current limits of the exclosures. Rather than creating larger round exclosures, a portion of the cove should be protected using the fencing material already on site. This fence would extend to two different points on the shoreline, using the land as a barrier. Figure 6 shows the existing exclosures in yellow and the proposed barrier fence in red. The new fence would be approximately 200 feet in length. This will expand the protected area from approximately 1000 ft^2 to 9000 ft^2. Longer and sturdier stakes such as 6 ft plastic coated steel garden stakes or 6 ft lengths of ½ inch pvc pipe should be used to ensure that the fencing stays upright. Additional transplants of all species should be placed within the expanded areas.

Figure 6. Proposed exclosure at East Cove



At the 2018 planting locations, the existing exclosures can be combined to form larger exclosures, as was done at the 2017 planting sites. The size and extent of these exclosures will depend on apparent survival but will likely consist of two or three exclosures at each site, 40 to 60 feet in circumference. If any fencing is removed from West Cove 1 or the Refuge North site, these can be used to supplement expansion at these sites. These larger exclosures should also be reinforced with 6 ft

gardening stakes or pvc pipe. Any brittle naiad growing within the exclosures should be cleared and removed from the area. Additional transplants of all species should be placed within the expanded exclosures.

As recommended above, additional plants should be collected and transplanted into existing planting sites wherever possible. These plants can be obtained from the locations which were used in previous years; however, if new sources become available these could also be utilized to increase genetic diversity. Increasing genetic diversity by obtaining plants from different sources can prevent inbreeding depression and founder effects, which limit the sustainability and viability of isolated genetically similar populations (Hufford and Mazer, 2003). Increasing plant abundance will also provide more opportunities for colonization through sexual and vegetative reproduction.

American Lotus

American lotus (*Nelumbo* lutea), a large, floating-leaved aquatic plant, has been observed growing in exclosures at almost all planting sites during the first two years of this project. This plant was once abundant in Sangchris Lake, but its return seems to be hindered by herbivory and uprooting by carp. Transplanting American lotus has not been successful in other restoration projects in Illinois and was therefore not selected as a target species for this effort. Instead, seed collecting and distribution within the lake has been proposed as an alternative strategy for restoration of this species.

In the fall of 2018, lotus seed was collected from a stormwater retention pond west of Springfield in Sangamon County. These seeds were sorted and cleaned, then stored in paper sack and kept in a cool, dry location. In the spring, these seeds can be scarified using sandpaper or a file. Scarification wears down the thick outer shell of the seeds and increases the likelihood of germination. These seeds can then be distributed within exclosures throughout the lake to increase the abundance and diversity of this species.

Invasive Aquatic Plant Control

As discussed above, the invasive aquatic plant brittle naiad (*Najas minor*) can be found at nuisance levels in many of the coves in the western arm of the lake. Physically removing these plants within exclosures appears to be effective in the short-term; however, removing the large mats of naiad in the surrounding area would be a difficult and labor-intensive task. The use of chemical herbicides may be an effective solution for reducing the abundance of this plant, thereby reducing its ability to compete with native species and slowing its spread to other parts of the lake. As this plant appears to be restricted to several shallow coves in only one branch of the lake, localized treatment could be an effective strategy for control. The granular formulation of Aquathol K (dipotassium salt of endothall) may be especially effective for spot treating these separate coves. The granular form allows for more control over the treatment area compared to the liquid form, which is generally used to treat large areas. Unlike the liquid, the granules stay in place and slowly dissolve, killing nearby plants on contact. This will lessen the impacts on non-target plants and prevent large die-offs that could potentially deplete dissolved oxygen. Aquathol K also poses no significant short-term exposure risks to fish or aquatic invertebrates (WDNR, 2012).

References

Dick, G. O., Smart, R. M., & Dodd, L. L. (2013). *Propagation and establishment of native plants for vegetative restoration of aquatic ecosystems* (No. ERDC/EL-TR-13-9). Lewisville, TX: U.S. Army Corp of Engineers, Engineer Research and Development Center.

Hufford, K. M., & Mazer, S. J. (2003). Plant ecotypes: genetic differentiation in the age of ecological restoration. *Trends in Ecology & Evolution*, *18*(3), 147-155.

Wisconsin Department of Natural Resources (WIDNR) (2012). *Endothall Chemical Fact Sheet* (DNR PUB-WT-970). Madison, WI: Wisconsin Department of Natural Resources