

To whom it may concern,

The Kansas Department of Wildlife and Parks is submitting a grant application through Friends of Reservoirs and the Reservoir Fish Habitat Partnership to construct a greenhouse structure at Perry Reservoir for the propagation, rearing, and eventual transplant of native aquatic vegetation at Banner Creek Reservoir. The aquatic plants that this greenhouse produces will provide benefits to those who enjoy our area lakes on a variety of levels:

- The sediment stability brought on by increased desirable aquatic vegetation will ensure the longevity of our Kansas impoundments by slowing lakeshore and shallow area erosion.
- The uptake of nutrients by aquatic plants will limit the unsightly, difficult to fish, and potentially hazardous algal blooms (both filamentous green algae and blue-green cyanobacteria).
- Establishment of native aquatic vegetation prevents the spread and colonization of less desirable, non-native plants.
- Most native aquatic plants are more easily fishable than the dense pockets of non-native plants.
- The increased vegetation brought on by this project will provide a plethora of nursery habitat for larval and juvenile fish to utilize during early growth stages.
- This habitat will also be beneficial for aquatic insects which in turn will provide prey to early and adult life stages of fish.
- Once established, native aquatic vegetation will provide food and shelter to a variety of terrestrial organisms.

These benefits counteract many of the reservoir impairments identified by the 2013 Reservoir Fish Habitat Partnership's nationwide assessment. Excessive nutrients, siltation/turbidity, and limited littoral structure would all be addressed by the establishment of native aquatic vegetation.

In submitting the grant application that is below this text and also submitted in the online fields, The Kansas Department of Wildlife and Parks is expressing the support of the fisheries biologist that oversees Banner Creek Reservoir as well as the rest of the Agency.

I appreciate your consideration of this project and welcome any feedback should we not be fortunate enough to receive your support.

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Project Leader:

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Friends of Reservoir group:

Banner Creek Reservoir Chapter

Title:

Establishment of aquatic vegetation at Banner Creek Reservoir

Location:

Banner Creek Reservoir, Holton, Kansas

U.S. Congressional District

1st Congressional District of Kansas. Future projects, outside the timeframe of this project, utilizing the greenhouse's production capabilities may occur in the 2nd Congressional District of Kansas.

Target Species (in order of importance)

Largemouth Bass, Bluegill, Smallmouth Bass, Redear Sunfish, Walleye, Sauger, White Crappie, Black Crappie, and Channel Catfish

Region

Temperate Plains

Project Objectives

The objective of this project is to establish native aquatic vegetation along three miles of shoreline at Banner Creek Reservoir using a greenhouse structure to produce two production cycles of propagated plants each year from 2024 through 2026.

Estimated start and end dates:

- Background work for the project will begin during the summer of 2023. This includes identifying native aquatic plant colonies from which we can collect propagation material, familiarizing staff with propagation and rearing techniques, and compiling images of aquatic plants found in Kansas impoundments for outreach materials. If successful in our application of this grant, any state-required bid processes will be initiated to begin purchasing items once funds become available. Additionally, between application date and project completion, we will continue to reach out to potential local and regional partners to either solicit their support or to provide updates to those who have already pledged to support the project.
- Most work for the grant will occur from April through June of 2024 as funds will likely not be available until then.

- Native aquatic vegetation will be raised in the greenhouse structure once it is constructed through, and beyond, the project end date of June 30, 2026.

List of partners:

While preparing this grant application, we solicited numerous groups for their support of this proposal. Those that we heard from were overwhelmingly supportive however most simply mentioned, noted, or inferred that they would be willing to help by donating either labor, materials, or equipment without offering any specific quantities that we could list in a budget table as partners.

List of supporters:

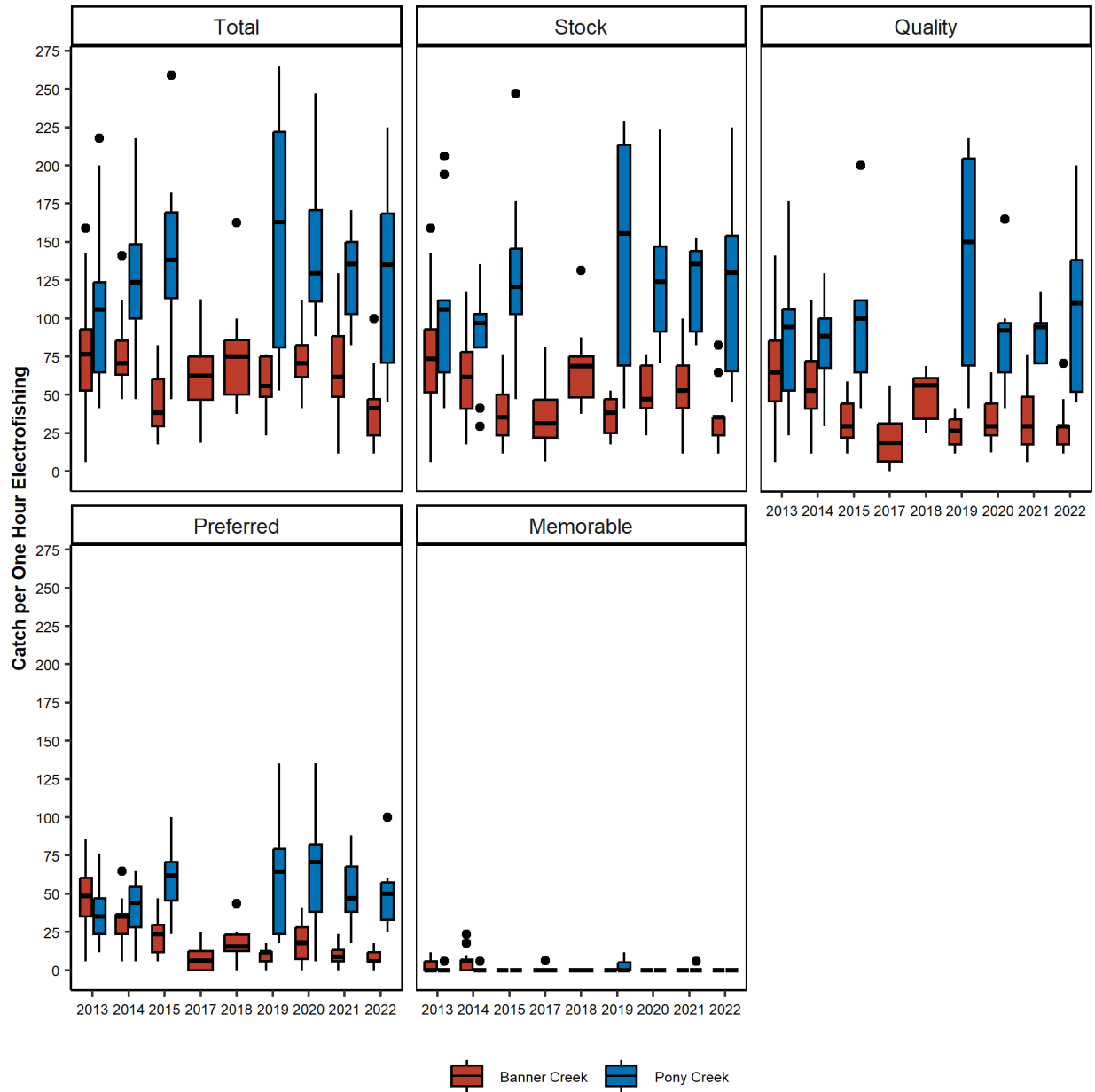
Banner Creek Reservoir and Banner Creek Reservoir FOR Chapter
Great Blue Heron, Inc
Kansas Bass Nation
Ned and Pat Kehde
Jim Farrow
Holton HS and Holton FFA
Tgranger1@cox.net
Paul Finn
Kansas Native Plant Society
Kansas Chapter of Backcountry Hunters and Anglers

Project Description

This project involves construction of a greenhouse structure for the purpose of double cropping propagated native aquatic vegetation for transplantation in Banner Creek Reservoir.

Native aquatic vegetation provides numerous benefits for impoundments, fish, wildlife, and the recreationalists that enjoy it all. These benefits also counteract many of the reservoir impairments identified by the 2013 Reservoir Fish Habitat Partnership's nationwide assessment. Native aquatic plants uptake nutrients, limiting those available to unsightly, difficult to fish, and potentially hazardous algal blooms (both filamentous green-algae and blue-green cyanobacteria). Aquatic vegetation limits the impacts of wind and waves on shoreline and shallow lake area erosion. James and Barko (1994) found that the amount of wind required to resuspend sediments was 3-6 miles per higher in vegetated impoundments compared to non-vegetated impoundments. That difference resulted in non-vegetated impoundments having sediment resuspended, thus increasing turbidity, 25% more often than when vegetated. While solidifying the shallow sediments, aquatic vegetation also provides littoral structure for fish species such as Largemouth Bass and Bluegill. This littoral structure provides refuge for young fish, a source of food for grazing zooplankton and aquatic insects which, in turn, are prey items for littoral fish species. Additionally, aquatic vegetation can provide food and nesting structure for aquatic reptiles, amphibians, mammals, and waterfowl.

Currently, Banner Creek Reservoir's nearly eight miles of shoreline are mostly devoid of aquatic vegetation with the exception of sparse pockets of water willow and patches of American lotus in the shallow areas of western third of the reservoir. As such, much of the lake's shorelines are left exposed to erosion caused by wind and waves. The absence of aquatic vegetation may also be a reason for lower-than-desired population metrics for Largemouth Bass.



The above figure illustrates a comparison of the catch rates of various Largemouth Bass length categories between Banner Creek Reservoir with limited aquatic vegetation and Pony Creek Lake (Sabetha, Kansas) which has abundant aquatic vegetation. As observed, Pony Creek consistently has higher catch rates of Largemouth Bass for all sizes other than Memorable size (20-25 in.).

The establishment of aquatic vegetation at Banner Creek Reservoir would likely improve the impoundment and fishery by securing shorelines and shallow areas, limiting nutrient availability to harmful algal blooms, and providing refuge and foraging grounds for popular sport fish species. This project aims to establish aquatic plants by transplanting plants that have been propagated from materials from other nearby impoundments and reared in a greenhouse structure that will allow for plant propagation to occur at an earlier date resulting in an earlier transplant date and a longer period to become established before winter dormancy. An earlier propagation and transplant date also allows for the greenhouse to be used to produce a second crop of aquatic vegetation, doubling the number of

plants that would be transplanted in the reservoir allowing for more of the reservoir to be colonized in a shorter time frame. The greenhouse will be constructed at Perry State Park (Ozawkie, Kansas), the closest office of a Kansas Department of Wildlife and Parks Fisheries Biologist to Banner Creek Reservoir. This location will also allow for the greenhouse to produce plants for other impoundments throughout Northeast Kansas using KDWP funds at the conclusion of the original grant project.

Aquatic plant stems, roots, rhizomes, or tubers will be collected from local, established populations and propagated in the controlled setting of a greenhouse. A list of possible native aquatic plants can be seen in Appendix A. Within the greenhouse there will be seven tanks of differing depths to accommodate a variety of plant species. Two 4'x8'x8" trays will be set up for rearing emergent aquatic plants, and three 3'x8'x2' tanks and two 3'x18'x3' raceways will hold submerged and floating leaf aquatic plants. Altogether, this combination can produce up to 1484 total plants each production cycle or nearly 3000 plants per year.

Plants will be transplanted into Banner Creek Reservoir during June and August of each year through the duration of the project. Plants will be planted in shallow (<3') areas of the impoundment. Due to the quantity of plants produced, not all will be transplanted into herbivore exclosures however, it is assumed that the number of plants transplanted will be more than will be preyed upon. If survivability of plants is drastically different between exclosures and those planted outside, additional exclosures will be constructed for the remaining plantings. Exclosures will be constructed from PVC vinyl coated welded wire fencing and set in tandems of two 10'x10' squares and one 6' diameter circle. Total area of exclosure tandems is 231.7 ft². The project budget includes funds to purchase materials to construct ten exclosure tandems. All remaining plants will be planted in 5'x100' swaths at suitable depths. These plantings would begin in 2024 and continue through 2025 and 2026. Due to a delayed start in 2024, only one cycle of plants will be produced resulting in 960 ft of shoreline and 5,817 ft² of lake bottom vegetated. In both 2025 and 2026, those numbers will be 2,400 ft of shoreline or 12,000 ft² of lake bottom vegetated. At the conclusion of the project (September 2026) we will have planted aquatic plants along 5,760 ft of shorelines and covered 29,817 ft² of lake bottom. Vegetation establishment projects in other states have observed vegetation spread anywhere from 2x-750x of the initial planted area after about five years. It is hoped to observe a threefold expansion of vegetation at Banner Creek in a similar timeframe. This would equate to 89,451 ft² of vegetated area or 17,280 ft of shoreline with submerged or emergent plant presence equaling over a third of the impoundment's shoreline vegetated.

Monitoring and evaluation of project

Goals and intended outcomes of this project are to produce 2,484 aquatic plants and 2,260 ft of vegetated shoreline each year resulting in 6,780 feet of shoreline vegetated by the end of the project. While at the mercy of nature, we are hoping to observe a threefold expansion of aquatic vegetation after a period of five years which would equate to half of Banner Creek Reservoir's shoreline. Any benefits or population increases would likely occur over a longer period.

Monitoring of these goals will begin in 2023 with a thorough assessment of aquatic vegetation in the impoundment by conducting a visual inspection of the water surface, shoreline, and observable lake bottom while operating a boat along the shoreline of the impoundment. If water clarity limits observation of the lake bottom, a two-sided rake will be dragged along the bottom from the shoreline ten yards toward the center of the impoundment every 300' along the shoreline. When vegetation is observed, location will be recorded along with species composition and current area. This will form a basis for evaluating spread of future plantings while also providing a chance to scout for areas that can be used for transplant establishment.

While transplanting aquatic plants each year, GPS coordinates of the transplant areas will be taken to record the initial planted area. Species planted in each area will also be recorded. In September

of each year, each site will be revisited, and snorkel surveys will be conducted to assess species survival and determine the edges of aquatic vegetation which will again be marked with GPS coordinates and later uploaded into QGIS to evaluate growth or shrinkage of established plant colonies. Any species that have poor survivability will not be produced or planted in subsequent transplants. This monitoring will continue until 2031 (five years after last planting) to quantify spread of plant colonies.

Fish communities have been monitored annually using statewide or nationwide standard methods since at least 2010. These methods will continue to be used to evaluate if fish populations exhibit any differences with the establishment of aquatic vegetation.

Outreach and Education

In preparation of this grant proposal, numerous outdoor clubs, angler groups, and student organizations were contacted to solicit support. Those that replied were enthusiastic about the opportunity to help and were eager to volunteer. This project offers numerous opportunities for public involvement in the project:

- Construction of greenhouse (Spring 2024)
 - Dirtwork/preparation of the site
 - Trenching water line from main to site
 - Trenching of electrical line to building site
 - Pouring of concrete pad
 - Erection of greenhouse
 - Installation of electrical service
- Identification and collection of source plants (2023 and beyond)
 - Identify sources of parent plant materials
 - Aide in field collection of parent plant material
- Propagation (2024 and beyond)
 - Mixing and preparation of soil mixture
 - Planting of parent cuttings, rooted plants, rhizomes, or tubers in prepared nursery pots
- Preparation (2024)
 - Cutting welded wire fencing and rebar to construct enclosures
 - Transportation of enclosure materials to impoundment
 - Construction of plant enclosures at transplant sites
- Transplantation (2024 and beyond)
 - Loading of transplants on trailers for transport
 - Assistance with transporting plants to impoundment
 - Planting of transplants

Those areas for public involvement will not only make the project possible but also instill a sense of ownership in each of the participants. However, there are more users of Banner Creek Reservoir than we have volunteer opportunities for so education and outreach activities will also be conducted. These will include submitting articles to the local newspaper, interviews on local radio, speaking with high school classes at the three nearby schools, and speaking at meetings of local organizations and clubs. In all these outreach venues much of the same information that has been provided in this proposal will be included but weighing more heavily on the roles and benefits of native aquatic vegetation in an impoundment. Additionally, photographs of aquatic plant species will be collected and a digital guide to aquatic plant management in Kansas will be developed and published on the agency's website (www.ksoutdoors.com). Once established, educational signage will be developed and posted in an area where an established plant colony can be seen from the shore.

This project will also provide the opportunity to refine plant propagation, rearing, and transplant techniques specific to Kansas. Using the knowledge gained from these refinements, presentations and informational material could be made for KDWP staff and partner agencies such as USDA NRCS, Kansas State University Extension, and Ducks Unlimited as well as local high schools wishing to utilize school greenhouses for similar projects. Along those lines, this project offers research opportunities to evaluate survival of different plant species when transplanted, survival between those planted within and outside of enclosures, benefits to fish populations, and improvements in water quality. These findings could then be included in programs and materials and presented at regional and national conferences and published in scientific literature.

Project Deliverables

As noted in other sections, this project will be capable of producing 1484 native aquatic plants each production cycle or nearly 3000 plants per year. These plants would begin being transplanted in 2024 and continue through 2025 and 2026. Due to a delayed start in 2024, only one cycle of plants will be produced resulting in 960 ft of shoreline and 5,817 ft² of lake bottom vegetated. In both 2025 and 2026, those numbers will be 2,400 ft of shoreline or 12,000 ft² of lake bottom vegetated. At the conclusion of the project (September 2026) we will have planted aquatic plants along 5,760 ft of shorelines and covered 29,817 ft² of lake bottom. Vegetation establishment projects in other states have observed vegetation spread anywhere from 2x-750x of the initial planted area after about five years. It is hoped to observe a threefold expansion of vegetation at Banner Creek in a similar timeframe. This would equate to 89,451 ft² of vegetated area or 17,280 ft of shoreline with submerged or emergent plant presence equaling over a third of the impoundment's shoreline vegetated.

List of Required Permits

This project will not be propagating or rearing any aquatic nuisance species so no ANS Possession Permit will be required from KDWP.

This project does not require any permits from the Kansas Department of Agriculture.

The greenhouse structure will be built on federal land under the control of the United States Army Corps of Engineers (USACE) and leased to the Kansas Department of Wildlife and Park. The engineered plans will need to be approved by the Kansas City District Office of the USACE prior to construction.

Project Timeline

Summer 2023: Initial survey of aquatic vegetation at Banner Creek Reservoir and identification of transplant sites

Winter 2023-2024: solicitation of bids and initiation of state purchasing procedures to be ready for purchasing required materials when funds become available

January – February 2024: Speak about the project in local high school classrooms.

April 1, 2024: Official project start date

April 2024: purchase greenhouse kit and initiate preparation of site and erection of greenhouse. During construction, identify local parent plant populations from which to gather propagation material. Submit articles in local newspapers and make radio appearances explaining project and intended outcomes and solicit volunteers for eventual transplantation.

June 2024: Propagate native aquatic plants and place in greenhouse tanks

August 2024: Transport and transplant plants in Banner Creek Reservoir and propagate winter holdovers. Invite local media outlets to transplant day(s) to observe and document activities.

September 2024: Survey transplant locations to evaluate growth and expansion of colonies

Winter 2024: Prepare and publish updated Aquatic plant management guide for Kansans.

January – February 2025: Speak about the project at local, regional scientific conferences and in local high school classrooms.

April 2025: propagate first crop of plants from winter holdovers

June 2025: Transport and transplant first crop to Banner Creek Reservoir and propagate second crop

August 2025: Transport and transplant second crop to Banner Creek Reservoir and propagate winter holdovers. Invite local media outlets to transplant day(s) to observe and document activities.

September 2025: Survey transplant locations to evaluate growth and expansion of colonies

January – February 2026: Speak about the project at local, regional scientific conferences and in local high school classrooms.

April 2026: propagate first crop of plants from winter holdovers

June 2026: Transport and transplant first crop to Banner Creek Reservoir and propagate second crop

August 2026: Transport and transplant second crop to Banner Creek Reservoir and propagate winter holdovers

September 2026: Survey transplant locations to evaluate growth and expansion of colonies

September 30, 2026: Project completion.

Following the completion of the project, the greenhouse will still be operational, and all plants produced in the structure will be used to establish native aquatic vegetation in other impoundments throughout Northeast Kansas. Once grant funds are matched, the building, activities, and maintenance will be paid for by the Kansas Department of Wildlife and Parks and assisted by in-kind donations.

Appendix A: Proposed Native Aquatic Plants

		Shoreline Stabilization	Waterfowl Food	Bird Shelter	Mammal Food	Mammal Shelter	Fish Shelter	Fish Food	Insect Shelter
EMERGENT NARROW LEAFED									
River Bulrush	<i>Bolboschoenus fluviatilis</i>	X	X		X				
Creeping Spikerush	<i>Eleocharis plaustris</i>	X	X		X				
Common Rush	<i>Juncus effusus</i>		X	X			X		
Rice cut-grass	<i>Leersia oryzoides</i>		X		X				
Hardstem Bulrush	<i>Schoenoplectus acutus</i>		X	X	X	X	X		X
Common Three-square	<i>Schoenoplectus pungens</i>		X	X	X	X			
Softstem Bulrush	<i>Schoenoplectus tabernaemontani</i>		X	X	X	X	X		X
Common Bur-reed	<i>Sparganium eurycarpum</i>	X	X	X	X				
Eastern Bur-reed	<i>Sparganium Americanum</i>	X	X	X	X				
Broad-leaved Cattail	<i>Typha latifolia</i>		X	X	X	X	X		X
Northern Wildrice	<i>Zizania palustris</i>		X		X	X			
EMERGENT BROAD LEAFED									
Southern Water Plantain	<i>Alisma subcordatum</i>		X	X	X		X		
Northern Water Plantain	<i>Alisma triviale</i>		X	X	X		X		
American Water Willow	<i>Justicia americana</i>	X							
Water Purslane	<i>Ludwigia palustris</i>		X		X				
Pickeralweed	<i>Pontederia cordata</i>	X	X		X		X		X
Grass-leaved Arrowhead	<i>Sagittaria graminea</i>		X		X		X		
Common Arrowhead	<i>Sagittaria latifolia</i>		X		X		X		
Arum-leaved Arrowhead	<i>Sagittaria cuneata</i>		X		X		X		
Midwestern Arrowhead	<i>Sagittaria brevirostra</i>		X		X		X		
FREE FLOATING									
Small Duckweed	<i>Lemna minor</i>		X		X		X	X	X
Forked Duckweed	<i>Lemna trisulca</i>		X				X		X
Great Duckweed	<i>Spirodela polyrrhiza</i>		X		X		X	X	X
Common Watermeal	<i>Wolffia columbiana</i>		X		X			X	
FLOATING LEAF PLANTS									
Watershield	<i>Brasenia schreberi</i>		X				X		X
American Lotus	<i>Nelumbo lutea</i>		X	X	X		X		X
Yellow Pond Lily	<i>Nuphar advena</i>		X		X		X		X
Spatterdock	<i>Nuphar variegata</i>		X		X		X		X
White Water Lily	<i>Nymphaea odorata</i>		X		X		X		
Water Smartweed	<i>Persicaria amphibia</i>		X		X		X		X
SUBMERGED PLANTS									
Large Water Starwort	<i>Callitriche heterophylla</i>		X				X	X	X

