

Final Abstract

Final Report Approved on August 15, 2024

M.L. 2021 Project Abstract

For the Period Ending June 30, 2024

Project Title: Preserving Minnesota's Only Ball Cactus Population

Project Manager: David Remucal

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Funding Source:

Fiscal Year:

Legal Citation: M.L. 2021, First Special Session, Chp. 6, Art. 6, Sec. 2, Subd. 08d

Appropriation Amount: \$103,000

Amount Spent: \$100,922

Amount Remaining: \$2,078

Sound bite of Project Outcomes and Results

This first phase of work protecting the only population of ball cactus in Minnesota has been a resounding success, with almost 500 plants in three new locations planted over 2022 and 2023 and nearly 80% first-year survival for individuals planted in 2022. This success will continue to be reinforced.

Overall Project Outcome and Results

There is a single population of ball cactus (*Escobaria vivipara*) in the state of Minnesota near Ortonville, and the plant lives on granite rock surfaces, a substrate highly desirous for mining. The largest parts of this population are under threat of development, and our hope was to move plants off quarry lands to protected landscapes. Permitting issues between the quarries and the DNR delayed access to moving adult plants beyond the window of this grant, but we were able to collect seed from quarry plants. We propagated and planted nearly 500 individuals from these parent plants to three locations in the area, all of which are protected lands, including an expansion of the existing subpopulation at the Big Stone National Wildlife Refuge. Two of the plantings are in new locations where the cactus was currently not found: another nearby federally-protected preserve and The Nature Conservancy preserve Plover Prairie. This kind of rescue is difficult with cactus, but we had unexpected success after the first year planting, with nearly 80% survival. Rare plant

introduction success is often hard won, so the we expect to follow and bolster this population as necessary for several years. The goal will be to have these new populations establish on their own and sustain themselves after time. The parameters established and data collected from this work will be useful for future projects, whether this or other species. We anticipate this will inspire more work seeking to proactively preserve imperiled populations of rare plant species as well as inform groups seeking to preserve or reintroduce populations lost or destroyed on their original landscapes. Direct intervention to save rare plants has been itself rare in Minnesota but this project shows that this avenue has the great potential to be a useful tool to preserve some of Minnesota's rare

Project Results Use and Dissemination

Signs at the National Wildlife Refuge are in the process of being constructed and these will acknowledge ENRTF funding. The StarTribune produced two front page articles on the project (attached). Staff at the University of Minnesota Landscape Arboretum gave several public and staff talks highlighting this project. In general, this project has garnered much excitement and interest. Much like with previous work with orchids through LCCMR funding, our work with the cactus brought to attention a plant that many most Minnesotans had no idea was even in the state.



Environment and Natural Resources Trust Fund

M.L. 2021 Approved Final Report

General Information

Date: November 8, 2024

ID Number: 2021-062

Staff Lead: Tom Dietrich

Project Title: Preserving Minnesota's Only Ball Cactus Population

Project Budget: \$103,000

Project Manager Information

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Project Reporting

Final Report Approved: August 15, 2024

Reporting Status: Project Completed

Date of Last Action: August 15, 2024

Project Completion: October 31, 2023

Legal Information

Legal Citation: M.L. 2021, First Special Session, Chp. 6, Art. 6, Sec. 2, Subd. 08d

Appropriation Language: \$103,000 the first year is from the trust fund to the Board of Regents of the University of Minnesota for the Minnesota Landscape Arboretum to move the only known remaining ball cactus population in the state from private to protected land and to propagate and bank ball cactus seeds for education and preservation.

Appropriation End Date: June 30, 2024

Narrative

Project Summary: Minnesota's only population of ball cactus is threatened as a significant proportion of the population is on private, unprotected lands. Moving plants to protected land will better protect this species.

Describe the opportunity or problem your proposal seeks to address. Include any relevant background information.

The ball cactus (*Escobaria vivipara*) is a small cactus whose native range in the US reaches the western edge of Minnesota where it occurs as a single population in Big Stone and Lac qui Parle counties. It lives on thin soils on and around exposed granite outcrops on two larger privately-owned properties and the Big Stone National Wildlife Refuge (NWR). A major concern to both the Minnesota DNR and the US Fish and Wildlife Service that manages the NWR system is that these private properties hold the majority of the genetic variability for this species in the state. The plants in private locations are unprotected as long as they remain on private properties. The NWR subpopulation is on permanently protected public land. The nearby Plover Prairie property, owned by The Nature Conservancy (TNC), has granite outcrops that should also be suitable for the cacti.

What is your proposed solution to the problem or opportunity discussed above? Introduce us to the work you are seeking funding to do. You will be asked to expand on this proposed solution in Activities & Milestones.

Propagation by seed of this species is slow, therefore collection of seed will occur prior to the granting period with all necessary permits in place. Funding from this grant will be used to address the following issues:

- 1) Translocation of adult plants to the Big Stone NWR and Plover Prairie.
- 2) Translocation of a subset of plants to the University of MN Landscape Arboretum (UMLA) for quarantine (to help remove weeds) and to create a reserve population in the event immediate translocations to Big Stone NWR/Plover Prairie fail.
- 3) Propagation and curation of two separate living genetic banks of material held at UMLA and University of MN College of Biological Science (CBS) Conservatory. These will serve as a failsafe (in addition to the seed bank) to ensure protection of the genetic material should translocations fail as well as a source of plants for augmentation at NWR. This augmentation will help protect against increasing poaching pressures at that site.

While official landowner permits won't be sought until final approval by the MN DNR Rare Species Coordinator, informal cooperation from all parties (including DNR) has been obtained, and the USFWS and TNC are supporting partners on this proposal signalling their approval.

What are the specific project outcomes as they relate to the public purpose of protection, conservation, preservation, and enhancement of the state's natural resources?

This project will increase protection for ball cactus from current threats and ensure continued presence of the only population in the state. The project will also ensure preservation of the unique genetics represented in this edge-of-range population. Moreover, moving plants to off-site protected locations like UMLA and the CBS Conservatory will help buffer the species against future climate change effects by creating populations effectively protected from climate effects. In a larger sense, partnerships between multiple levels of government units and conservation programs are becoming increasingly important ways of conserving individual species, especially when buying and protecting land is not feasible.

Project Location

What is the best scale for describing where your work will take place?

Region(s): SW

What is the best scale to describe the area impacted by your work?

Region(s): SW

When will the work impact occur?

During the Project and In the Future

Activities and Milestones

Activity 1: Propagation of seed material to replace plants that do not survive the transplant process.

Activity Budget: \$37,000

Activity Description:

From seed collected at the quarry sites, plants will be grown as backup material. Because cacti are very slow-growing plants, small amounts of banked seed will be grown in anticipation of attrition of translocated plants. Plants will only be outplanted at NWR and/or Plover Prairie or held at UMLA or CBS Conservatory.

Activity Milestones:

Description	Approximate Completion Date
Generate from seed enough plants to replace roughly 25% of the number of translocated plants	February 28, 2022

Activity 2: Transplantation of plants from private sites to the NWR and TNC sites and backup at UMLA

Activity Budget: \$66,000

Activity Description:

Plants will be moved from the threatened quarry sites to the NWR and to Plover Prairie. Both locations are permanently protected and have appropriate exposed granite outcrop landscapes within 10 miles of the population. A subset of plants will also be brought to UMLA. UMLA plants will be divided and curated at UMLA and the CBS Conservatory. Plants at UMLA and CBS will be moved to NWR/Prairie Plover to augment the population if plants are lost after the first translocations. If permitting from the DNR by the quarry management does not happen during the appropriate window of this project, then seedlings will be prepared for substitution in planting approximately a year later. Adult plants will be moved whenever permitting occurs, regardless of the end date of this proposal.

Activity Milestones:

Description	Approximate Completion Date
Move remaining plants to UMLA, to be split between UMLA and CBS Conservatory.	November 30, 2021
Move majority of plants to Big Stone NWR and Plover Prairie, recording locations of individuals	November 30, 2021
UMLA with NWR and TNC staff, monitor translocations annually. Augment subpopulations with reserves if necessary.	July 31, 2022
Begin planting seedlings from local seed in protected areas if adults haven't been transplanted yet.	November 30, 2022
UMLA with NWR and TNC staff, monitor translocations annually. Augment subpopulations with reserves if necessary.	June 30, 2023

Project Partners and Collaborators

Name	Organization	Role	Receiving Funds
Joe Blastick	The Nature Conservancy	Plover Prairie, a TNC property will accept cactus subpopulation and manage land	No
Scott Simmons	US Fish and Wildlife Service	Big Stone National Wildlife Refuge will accept cactus subpopulation and manage land	No

Dissemination

Describe your plans for dissemination, presentation, documentation, or sharing of data, results, samples, physical collections, and other products and how they will follow ENRTF Acknowledgement Requirements and Guidelines.

We will display plants at the Arboretum, where we can share the story of the individual project as well as the general importance of Minnesota native plant conservation through educational flyers, displays, and interpretive signage. We will also provide project updates and additional information on the Arboretum and Plant Conservation Program websites, <https://arb.umn.edu/> and <https://arbconservation.cfans.umn.edu/>. Education, information, and outreach are important aspects of the Arboretum's conservation work. Additionally, we will give presentations at several local or national conferences or meetings each year, which are additional opportunities to share this project and our conservation work. Our collaborators in this project, The Nature Conservancy and US Fish and Wildlife, will also have the opportunity to inform their stakeholders about this work through their separate networks.

Finally, because this work will be done under several different permits, we will be making official reports of this project to the DNR.

The Minnesota Environment and Natural Resources Trust Fund (ENRTF) will be acknowledged through use of the trust fund logo or attribution language on project print and electronic media, publications, signage, and other communications per the ENRTF Acknowledgement Guidelines.

Long-Term Implementation and Funding

Describe how the results will be implemented and how any ongoing effort will be funded. If not already addressed as part of the project, how will findings, results, and products developed be implemented after project completion? If additional work is needed, how will this work be funded?

After the initial two years of transplanting and monitoring additional work will hopefully be minimal, with population supplementation done as necessary and monitoring for at least 5-10 years. This work will be funded similar to other UMLA programs – through a combination of fundraising, earned income, and endowment support. External funding sources (grants, individual giving, corporate support) will continue to be pursued to extend population supplementation and necessary monitoring.

Other ENRTF Appropriations Awarded in the Last Six Years

Name	Appropriation	Amount Awarded
Preserving and Protecting Minnesota Native Orchid Species	M.L. 2015, Chp. 76, Sec. 2, Subd. 08c	\$167,000
Preserving Minnesota's Native Orchids - Phase 2	M.L. 2018, Chp. 214, Art. 4, Sec. 2, Subd. 08h	\$259,000

Budget Summary

Category / Name	Subcategory or Type	Description	Purpose	Gen. Ineligible	% Benefits	# FTE	Classified Staff?	\$ Amount	\$ Amount Spent	\$ Amount Remaining
Personnel										
UM CBS Conservatory Student worker		Field and greenhouse assistance			0%	0.46		\$11,000	-	-
UM CBS Conservatory Horticulturalist		Conservatory plant management and field work			23%	0.4		\$28,000	-	-
Curator of Endangered Plants		Principal Investigator and project coordinator			26.7%	0.2		\$19,000	-	-
UMLA Greenhouse Technician		Propagation and Greenhouse specialist at UMLA			24.1%	0.2		\$9,000	-	-
UMLA Field Botanist		Field coordinator and main botanist			24.1%	0.4		\$26,000	-	-
							Sub Total	\$93,000	\$93,000	-
Contracts and Services										
							Sub Total	-	-	-
Equipment, Tools, and Supplies										
	Tools and Supplies	Greenhouse and planting supplies: Including soil, digging and potting material	These tools and supplies will be needed for both the translocation of living plant material to various destinations and for propagation and maintenance of plant material at greenhouses at MLA and the CBS Conservatory.					\$4,000	\$3,980	\$20
							Sub Total	\$4,000	\$3,980	\$20

Capital Expenditures										
							Sub Total	-	-	-
Acquisitions and Stewardship										
							Sub Total	-	-	-
Travel In Minnesota										
	Miles/ Meals/ Lodging	Food and lodging during seed and/or live plant collection trips in Greater Minnesota more than 200 miles round trip for 4 people - \$133/day x 4 overnight trips per yr x 2 years. Reimbursed based on University of Minnesota plan.	Lodging and per diem for UM staff to survey, plan and execute translocation and planting of cacti.					\$4,500	\$2,442	\$2,058
	Miles/ Meals/ Lodging	Mileage reimbursement for seed and/or live plant collection trips - 300 miles round trip - .575 per mile x 4 round trips per yr x 2 years. Reimbursed based on University of Minnesota plan 2020 rate.	Travel mileage for UM staff to survey, plan and execute translocation and planting of cacti.					\$1,500	\$1,500	-
							Sub Total	\$6,000	\$3,942	\$2,058
Travel Outside Minnesota										
							Sub Total	-	-	-
Printing and Publication										
							Sub Total	-	-	-
Other Expenses										
							Sub Total	-	-	-
							Grand Total	\$103,000	\$100,922	\$2,078

Classified Staff or Generally Ineligible Expenses

Category/Name	Subcategory or Type	Description	Justification Ineligible Expense or Classified Staff Request
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Non ENRTF Funds

Category	Specific Source	Use	Status	\$ Amount	\$ Amount Spent	\$ Amount Remaining
State						
			State Sub Total	-	-	-
Non-State						
			Non State Sub Total	-	-	-
			Funds Total	-	-	-

Attachments

Required Attachments

Visual Component

File: [8756ae9a-374.pdf](#)

Alternate Text for Visual Component

Visual representation of activities for proposal, moving unprotected plants to two protected locations as well as backed up at University of Minnesota locations. Previously banked seed at the UMLA long-term seedbank will be used to help replace plants that do not survive the move....

Supplemental Attachments

Capital Project Questionnaire, Budget Supplements, Support Letter, Photos, Media, Other

Title	File
USFWS Letter of Support	9cf4e9c5-87d.pdf
Background Check Form	10f8a998-4cb.pdf

Media Links

Title	Link
Rare and threatened Minnesota cactus species could be saved with relocation effort	https://www.startribune.com/rare-and-threatened-minnesota-cactus-species-could-be-saved-with-relocation-effort/600052863/
In a rocky corner of Minnesota, botanists race to save imperiled cactus	https://www.startribune.com/minnesota-endangered-species-ball-cactus-arboretum-big-stone-refuge-wildlife/600306961/?utm_source=newsletter&utm_medium=email&utm_campaign=best_of

Difference between Proposal and Work Plan

Describe changes from Proposal to Work Plan Stage

Added dissemination information, but otherwise unchanged. [10-10-2020] Added requested expanded information about dissemination and permit process. [Late 2020] Changed project completion date to October 2023, as per requested in staff email. Also added additional information about our contingency if permitting process with private landowner permits doesn't complete in the window this project timeline would require. Added text in activity 2 and an additional milestone addressing that. Uploaded background check form. [7-14-2021]

Additional Acknowledgements and Conditions:

The following are acknowledgements and conditions beyond those already included in the above workplan:

Do you understand and acknowledge the ENRTF repayment requirements if the use of capital equipment changes?

N/A

Do you agree travel expenses must follow the "Commissioner's Plan" promulgated by the Commissioner of Management of Budget or, for University of Minnesota projects, the University of Minnesota plan?

Yes, I understand the UMN Policy on travel applies.

Does your project have potential for royalties, copyrights, patents, sale of products and assets, or revenue generation?

No

Do you understand and acknowledge IP and revenue-return and sharing requirements in 116P.10?

N/A

Do you wish to request reinvestment of any revenues into your project instead of returning revenue to the ENRTF?

N/A

Does your project include original, hypothesis-driven research?

No

Does the organization have a fiscal agent for this project?

Yes, Sponsored Projects Administration

Work Plan Amendments

No Amendments Entered

Status Update Reporting

Final Status Update December 15, 2023

Date Submitted: January 16, 2024

Date Approved: January 16, 2024

Overall Update

While the private landowner permits were not finalized during the grant project window, we remain engaged in this process and committed to assisting with the eventual translocation of parent material. With the work done so far on this project, we have a greater understanding on how to work with this species and have a plan we feel will maximize the survivorship of moved plants. We also were able to plan ahead and create a large cohort of seedlings that we used instead of the unavailable adult plants, both augmenting the NWR protected population and establishing two new populations at nearby TNC and a second federally-protected site. Initial survivorship of these new populations is incredibly encouraging and with continued funding from LCCMR we anticipate being able to keep monitoring and augmenting these sites for several years to come. We also created a more publicly accessible subpopulation at Big Stone NWR, to encourage safer viewing of this species as well as present an opportunity to teach the public about this project and the importance of conservation work in the state. In total, nearly 500 individuals were planted, in three separate protected locations, all from seed from one of the private, unprotected sites.

Activity 1

This activity was previously marked complete.

(This activity marked as complete as of this status update)

Activity 2

A second phase of plants (from the same cohort of seedlings previously planted at two protected locations) were planted in the fall of 2023. About 120 plants were added to the new subpopulation at Big Stone NWR and a new population was established with another 120 plants at a separate, nearby federally-protected site. Finally, a small subpopulation was established from 30 plants at an interpretive trail at Big Stone NWR. These plants were placed as a way of allowing visitors to see this species in a much more accessible location, the goal being to encourage visitors to find the cactus in this well-traveled area instead of walking out onto the more fragile natural outcrops where the cactus is typically found in the area. Surveys of the previously planted cacti from the fall of 2022 reported an astonishing 75-80% survival rate, with most plants either becoming larger in the year since planting or adding stems. This is incredibly encouraging, and we hope to build on this success. Hopefully this initial success is a good indicator that we can successfully manage this species and keep it around for Minnesotans to enjoy.

(This activity marked as complete as of this status update)

Dissemination

Overall, the StarTribune published two front-page articles about this project, attributing this valuable project to ENRTF funding, most recent article attached. This project was also the highlight of several talks and presentations given by UMLA conservation program staff. We are also working with US Fish and Wildlife Service partners at Big Stone National Wildlife Refuge to put up information about this project at the interpretive site population planted this fall. This signage will be temporary as we assess the placement, feasibility and scope of a more permanent installation. Both the temporary and permanent signs will address the scope of the project and highlight the partnerships that came together to accomplish the work, including the support of the ENRTF. Finally, we are including increasing information about the project at our website - ArbConservation.umn.edu. Overall reaction from the public has been very supportive with, it appears, increasing understanding and support of proactive work like this to preserve endangered species in the state.

Status Update Reporting

Status Update June 1, 2023

Date Submitted: June 15, 2023

Date Approved: June 15, 2023

Overall Update

As this project enters the final season for the granting period, the previously planted seedlings were partially evaluated this spring and were largely intact and thriving. As a first season from planting, this was unexpected (typically a large percentage of plants is expected to die), but highly encouraging. True success for a natural landscape planting does not happen until that new population starts producing new plants on its own, but having a high degree of establishment from planted plants is a fantastic start to achieving this goal. To maintain this success, we hope to continue to augment these populations steadily over time as well as monitor and watch for natural recruitment. Overall, a better outcome could not have been hoped for at this early stage, but as all projects like this go, this is just the beginning of the work.

Activity 1

This activity was previously marked complete.

(This activity marked as complete as of this status update)

Activity 2

Permitting for the private sites continues to be delayed so no adult plants will be able to be moved by the end of the granting period. However, we continue to bring seedlings along at both UMLA and the CBS Conservatory, with over a thousand plants potentially ready to be outplanted in the fall of 2023. We have evaluated the fall 2022 plantings at the NWR site and have found 90% survival. This is a very high survival rate for a rare plant outplanting, and we contribute the success to the continual snowpack present in that part of Minnesota throughout the 2022-2023. This snowpack prevented the likely typical dessication and wind-scouring that might happen during the winters on those exposed granite outcrops, as well as gave the cactus a good spring water source. While this result is unexpected, we are hoping to learn from it. We will not plant out all of the remaining plants in 2023, we will instead plan on planting out smaller lots over a few years. This will allow us to collect data to compare establishment rates to winter weather conditions and to increase our chances of catching another favorable winter.

Dissemination

We continue to give presentations to UMLA visitors and in front of other interested third party groups, which include reference these cacti and the process we are going about to establish a successful, self-sustaining cactus population in both the established and the nearby TNC site. We also have had articles in the Arboretum's magazine, referencing both the research and outplantings, and the possibility of a followup article with the StarTribune. We also have had the project appear on the Prairie Yard and Garden show on Pioneer PBS. As we talk about our program, we continue to credit LCCMR and hopefully this spreads the word on the importance of the funding program for Minnesota's environment.

Status Update Reporting

Status Update December 1, 2022

Date Submitted: December 1, 2022

Date Approved: December 20, 2022

Overall Update

As mentioned previously, the permitting process for the private landowners will not resolve in time for this granting process. We will continue to work with both the DNR and the main quarry site so that when the process resolves we will be ready and equipped to move plants with additional external funding. We were still able to plant 222 plants across two protected sites, and both locations will be monitored going forward. Our continued work with germination for the species continues to find increasing success with germination rates increasingly higher than is typical for other groups' work with this cactus. We anticipate having roughly 1500 seedlings available next fall for a second round of planting, using survival rates and data from this fall's planting to improve techniques for the second planting. We also have identified a third protected site very close to the first two, that should allow for support of the amount of plants we would want to plant next fall.

Activity 1

This activity was previously marked complete.

(This activity marked as complete as of this status update)

Activity 2

The DNR and quarry sites were not able to come to an agreement allowing us access to the adult plants we would like to translocate off the site so we continued to move forward with our backup plan of planting out curated seedlings across two protected sites, the Big Stone National Wildlife Refuge and TNC's Plover Prairie. We planted 114 individuals at the the NWR and 108 at Plover Prairie in the fall of 2022 and will follow up with these individuals in the spring of 2023 to collect data on success or failure of different planting techniques and locations. We will use this data to inform a second round of planting planned for the fall of 2023 with a much larger cohort of approximately 1500 plants representing the offspring of about 100 plants from the quarry site. Our germination efforts have continued to outpace previous efforts by both us and other groups working with this species so this is actually more plants than the two sites will be able to handle. A third site, federally protected, was identified in 2022 where plants could be placed as well, so we will move plants to this site as well.

Dissemination

We continue to speak to multiple groups, giving updates on this project. We also will be updating our digital outreach with results from the outplanting this fall and have published information about the project in the Arboretum's news sources.

Status Update Reporting

Status Update June 1, 2022

Date Submitted: June 1, 2022

Date Approved: July 1, 2022

Overall Update

While the DNR and private-landowner negotiations continue, perhaps not resolving during the time of the granting period, we have successfully brought in thousands of seed from most of the known subpopulations of this cactus. Notably, we have banked over 85,000 seed in the Arboretum's long-term rare plant seed bank from one private property site, capturing the genetics of over 200 individuals. With seedlings growing at two locations at the University of Minnesota, we will have roughly 800 seedlings to plant out at our two protected sites near the private sites this year, and another roughly 800 seedlings expected to be ready for a second planting in the future after observing the results of the first planting. This plan was developed as a contingency in case the DNR permitting process for the private properties happened as is happening now. This allows us to preserve the genetics of that site even if the cactus on site are eventually taken outside of the granting period. As a result of this project, we have also documented two unreported subpopulations of the species, increasing both the current size of the known population as well as the material banked in the seedbank.

Activity 1

There are enough seedlings both in production and in preparation for production to more than replace the estimated populations of the two target private properties, far exceeding our target production. This larger than expected production has come from both greater success in propagation than is typically reported for this species and from the very large seedbank established from these sites.

(This activity marked as complete as of this status update)

Activity 2

Outplanting of seedlings will happen in the fall of 2022. In preparation for this, we experimented with techniques for establishing plants on these difficult sites - exposed granite outcrops with little to no soil for new seedlings to put their roots into. With a couple of good techniques established, and seedlings growing at both the Arboretum and the UMN Conservatory, we are prepared for planting.

Dissemination

There has already been one story about this project in the Minneapolis StarTribune. We have also presented the project to Arboretum members and visitors in print and on the web and have presented to interest groups about the project multiple times. A very charismatic project, we believe this dissemination has brought lots of positive press to both the Arboretum and the ENRTF.