Environment and Natural Resources Trust Fund (ENRTF)
M.L. 2018 ENRTF Work Plan (Main Document)

Today's Date: 12/15/2017

Date of Next Status Update Report: 1/31/2019

Date of Work Plan Approval: 06/05/2018

Project Completion Date: 6/30/2020

Does this submission include an amendment request? _No_

PROJECT TITLE: Preserving Minnesota's Native Orchids - Phase 2

Project Manager: David Remucal, Ph.D.

Organization: University of Minnesota Landscape Arboretum

College/Department/Division:

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Location: *Statewide*

Total Project Budget: $259,000

Amount Spent: $0

Balance: $259,000

Legal Citation: M.L. 2018, Chp. 214, Art. 4, Sec. 02, Subd. 08h

Appropriation Language: $259,000 the second year is from the trust fund to the Board of Regents of the University of Minnesota for the Minnesota Landscape Arboretum to expand collection and preservation efforts to enable long-term conservation of at least 25 of the 48 native orchid species in Minnesota and to continue propagation and cultivation research. This appropriation is available until June 30, 2021, by which time the project must be completed and final products delivered.

I. PROJECT STATEMENT:

Expansion of Efforts to Preserve Minnesota Native Orchids

Orchids are a charismatic plant species found in a variety of Minnesota's natural landscapes. Orchids often have many specialized growing requirements, making them more vulnerable to changes in the local environment than most other plant species. Laboratory research on basic orchid biology and observation of introduced populations is essential to comprehending how they are likely to respond to environmental changes. With this understanding it could be possible to develop new ways to detect early declines in Minnesota's ecosystems.

There are roughly 200 species of orchids native to the continental United States and Minnesota has nearly a quarter of those species. While regarded as the plant family with the most number of species, orchids are never dominant members of a plant community. In fact it is generally accepted that potentially all orchids, even common species, are rare or threatened. Ten of Minnesota's 48 native orchid species are listed on Minnesota's List of Endangered, Threatened, and Special Concern Species and even the "common" species are likely to be the first plant species lost when a natural landscape is disturbed. It is imperative to invest in the long-term preservation of this group of plants that can be found in Minnesota's native forest, wetlands, and prairie.

Since 2015 under ENRTF M.L. 2015 funding, Phase 1 of the Minnesota Landscape Arboretum's (MLA) Native Orchid Conservation Program (NOCP) has worked to preserve Minnesota's native orchid diversity by:

1) Collecting and preserving seed and/or live plants of 15 orchid species throughout Minnesota
2) Researching the propagation and cultivation of over half of all of Minnesota's species.
3) Collecting, identifying and banking the fungal symbionts (necessary for many orchids' survival) of Minnesota orchid species, in partnership with the Smithsonian Environmental Research Center (SERC), and with Dr. Jyotsna Sharma at Texas Tech University (TTU).

A long-term goal of the Native Orchid Conservation Program at MLA is to bring all 48 orchid species – either as seeds or live plants – to the Arboretum for conservation and research. To that end, we have collected seeds from populations from 22 counties across Minnesota (Figure 1). It is our vision to do this work for conservation purposes only, not for commercial breeding. While the landscape preservation efforts are the main means to preserve rare plants, as human activity increasingly reaches even the most protected lands there has been a recognized need for ex situ conservation efforts that function as a bank of a genetic material maintained by organizations like zoos or botanic gardens. In the case of plant conservation, ex situ conservation efforts often manifest as seed banks. These seed banks can serve a dual purpose – to act as a source restoration material for the original source populations and to serve as final bulwarks against the catastrophic loss of the species. Botanic gardens curate these seed banks carefully. Seed is tracked and tested to make sure viable genetic material is stored. Orchids grown from seed under the NOCP are not planted outside of Arboretum grounds. The NOCP has the capacity to partner with groups such as the Minnesota DNR and The Nature Conservancy when requested to aid in orchid restoration projects but we would only partner with groups that have the staffing and expertise to work on a scientifically rigorous restoration.

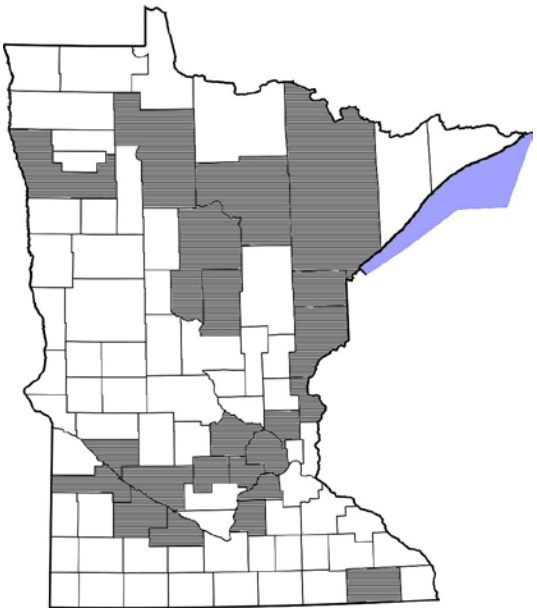

Figure 1. Counties in MN where orchid seeds have been collected/banked for Phase 1 up through the 2017 field season.

These efforts continue under Phase 2 of the NOCP. The Arboretum is in a unique position to continue to advance the knowledge in this field given the strength of its orchid conservation program. Ultimately, this work will be

beneficial not just to the Arboretum but also to all conservation programs around the region and country. Visitors to the Arboretum will also benefit, as they will be able to see and learn about many important plant species native to the state but hard to see in their natural landscapes.

GOALS:

1) Expand collection efforts of 15 Phase 1 species to new locations to diversify banks.
2) Expand banking, propagation and display efforts by an additional 10 species to a total of **at least 25 species**.
3) Complete, as much as possible, fungal symbiont species identification and banking for **38 non-listed orchid species, collecting from listed species when permitted**.

II. OVERALL PROJECT STATUS UPDATES:

First Update January 31, 2019
Second Update June 30, 2019
Third Update January 31, 2020
Final Update August 15, 2020

III. PROJECT ACTIVITIES AND OUTCOMES

ACTIVITY 1: Expand collection/preservation to at least 25 species
Description: The Arboretum will greatly increase the intensity and pace of these efforts with seed collection trips growing from 21 per field season to at least 50. Two new collectors will be employed as well, one contractor is a known regional orchid expert and one a new seasonal field staff with familiarity with farther corners of the state. Both will be able to access land more difficult for staff permanently based at MLA. This expansion will allow for collection in an increased geographic range across the state where there are both new populations of currently banked species and new species to bank. To continue to advance preservation goals, the Arboretum will increase banked species from 15 to 25 and will seek to complete initial acquisition of seed for propagation protocol development for all 48 species. The Arboretum also will complete collection of root samples for as many non-listed orchid species as possible. Root samples are sent to partners at Texas Tech University and the Smithsonian Environmental Research Center to identify, isolate and bank fungal associates.

Each winter locations are vetted for continued banking and subsequent year location determinations will be made during the winter in order to adequately prepare and obtain necessary permits. Permits for collection of listed species will be obtained from the Minnesota Department of Natural Resources. Other permits for non-listed orchids will be properly obtained under Minnesota Statutes 2010, Chapter 18H.18. MLA has worked with the Minnesota DNR and The Nature Conservancy, among other groups, to collect seed from populations on TNC preserves, State Parks, State Scientific and Natural Areas and Wildlife Management Areas across the state. All plants and seed are brought to the Arboretum and tracked and genetics are not mixed between populations. Seed lots are kept separate by the individual maternal sources, stored in the MLA Seed Bank and tracked in the NOCP database. That way, if we are called upon to use our seed banks we can produce the most genetically diverse restoration material possible.

When live plants are collected, either an appropriate garden location at the Arboretum will be used to house them, or they will be grown in appropriately controlled environments. When populations or colonies are established on Arboretum grounds, from seed-grown plants or transplants, regular demographic monitoring will be performed in conjunction with monitoring of environmental factors such as soil moisture and temperature to analyze changes. Some of the current plant populations at the Arboretum come from rescue/salvage operations at construction sites. The Arboretum would be prepared for future opportunities permitted by the Minnesota Department of Natural Resources to rescue native orchid populations. As the program grows and species are brought to the Arboretum, it continues to be vital to engage the public –to educate them on the importance of

native orchid conservation, especially in the context of larger general native and rare plant conservation. Classes on native orchids have been developed and made available at MLA as a result of this work and will continue to be refined.

ENRTF BUDGET: $142,132

Outcome	Completion Date
1. Begin collection for finalized list of 10 Phase 2 orchid species for seed bank.	December 2018
2. Complete collection as much as possible of root samples from 38 non-listed orchid species, with listed species collected when permitted, samples sent to Texas Tech University (fungal identification) and The Smithsonian (propagation and banking).	December 2019
3. Complete seed bank collection goal of 3 populations for each of the 10 Phase 2 species.	December 2019

Activity 2: Continue propagation and cultivation research

Description: Propagation work will increase to include nearly all of Minnesota's native orchid species in MLA's effort to develop an understanding of how to best grow each native orchid species. As the bank itself is only useful if it is understood how to germinate the seed and create propagules, propagation efforts will continue and have a dual purpose: 1) to advance the scientific work of establishing techniques for understanding how to best use the MLA and other seed banks; and 2) to allow MLA to grow specimens to use for display that will assist in broadening public support and educational outreach – both of which are vital to the long-term survival of conservation programs and the species MLA is working to conserve. A germination test, which has been lacking for orchids, will be developed in conjunction with other orchid researchers around the country.

Nearly all orchids grown by people are grown from seed and started in labs. MLA has developed the expertise to do this. Most seed propagation in orchids is done without fungal associates but MLA is working with several partners around the country to collect and identify each orchid species' fungal associates and to develop techniques to utilize them to germinate seeds. For example, Dr. Jyotsna Sharma, a professor at Texas Tech University, who works on orchid mycorrhizal associations, has been partnering with MLA to identify the fungal associations for each species and the Smithsonian Environmental Research Center is assisting MLA with fungal propagation and storage.

Orchids grown for this propagation research from the seed collected under Activity 1 will be planted only for conservation and display purposes and will only be housed at the Arboretum (in appropriate gardens or greenhouse/conservatory locations).

ENRTF BUDGET: $116,868

Outcome	Completion Date
1. Begin construction of display beds at the Arboretum for currently produced native orchid species.	October 2018
2. Increased website presence of orchid conservation program on Arboretum website.	October 2018
3. Evaluation of developed propagation methods for orchid species from Phases 1 and 2. Prepare for publication.	December 2019
4. Produce pamphlet detailing program accomplishments and goals to site visitors and produce scientific publication.	Spring 2020

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IV. DISSEMINATION:

Description:
Live transplanted orchids will continue to be kept in greenhouse or conservatory areas as we determine whether and how an appropriate garden location is available or can be constructed. While orchids are on display in the conservatory, the Arboretum will continue to provide educational information on each species and specific opportunities for the public to engage with this effort. The Arboretum will also use its website (http://www.arboretum.umn.edu/) as a good location for dissemination of general information about the Native Orchid Conservation Program as well as, for example, which species in the collection are currently in bloom. In addition, working through the statewide Master Gardeners network, the Arboretum will continue to disseminate information on a very local level for master gardeners who are more interested in learning about and sharing information about native orchids with local communities. This train-the-trainer work will continue to happen during field work to each of the collection sites throughout the state during the summer months of the program.

Public education will continue to include activities like those held over the Phase 1 portion of the grant:
For National Public Garden Day in May, Dr. David Remucal will again a talk about the Arboretum's Native Orchid Conservation Program and bring examples of the progress of our lab propagated seeds to show people throughout the day. We will also again bring in a few hundred Orchid-gami, which are paper orchid models, that can be given to visitors and constructed over conversations about the program. This is a great opportunity for us to promote the program to the public as well as answer questions people have about our state's native orchids.

We will also pursue publicity opportunities similar to those from Phase 1 to advance outreach efforts and education on orchid conservation: giving talks with diverse regional groups including the U of MN Extension Educators, Native Plant Society, and Garden Clubs; offering interviews to MPR/local press; the U of MN College of Food, Agriculture, and Natural Resource Sciences staff; and responding to speaking requests from regional newspapers, community, garden and interest groups.

We will update and promote the pamphlet previously created about the Native Orchid Conservation Program both at the Arboretum and across the U of MN where appropriate, and we will increase the program's presence on the Arboretum's website and social media platforms (http://www.arboretum.umn.edu/ and https://www.facebook.com/MnArboretum).

First Update January 31, 2019
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V. PROJECT BUDGET SUMMARY:

A. Preliminary ENRTF Budget Overview: See attached budget spreadsheet

Explanation of Capital Expenditures Greater Than $5,000: N/A

Explanation of Use of Classified Staff: N/A

Total Number of Full-time Equivalents (FTE) Directly Funded with this ENRTF Appropriation:

Enter Total Estimated Personnel Hours: 6865.6	Divide by 2,080 = TOTAL FTE: 3.301

Total Number of Full-time Equivalents (FTE) Estimated to Be Funded through Contracts with this ENRTF Appropriation:

Enter Total Estimated Personnel Hours: 80	Divide by 2,080 = TOTAL FTE: .038

B. Other Funds:

SOURCE OF AND USE OF OTHER FUNDS	Amount Proposed	Amount Spent	Status and Timeframe
Other Non-State $ To Be Applied To Project During Project Period:			
Minnesota Landscape Arboretum Foundation	$13,531	$5,396	Arboretum personnel will be provided in-kind including: Director of Operations (0.05 FTE) for supervision of Curator of Endangered Plants ($8,911), Arboretum curator (100 hours) for production and placement of plant labels ($4,630). In addition, the Arboretum is actively fundraising from private philanthropic sources to support this work.
Other State $ To Be Applied To Project During Project Period:			
	$	$	
Past and Current ENRTF Appropriation:			
M.L. 2015, Chp. 76, Sec. 2, Subd. 08c (6/15/15 – 6/30/18)	$ 167,000	$95,260	As of our last submitted report on 8/24/17, 0.57 of the funds appropriated were spent.
Other Funding History:			
Helen Clay Frick Foundation	$25,000	$25,000	

VI. PROJECT PARTNERS:

A. Partners receiving ENRTF funding

Name	Title	Affiliation	Role
NA			

B. Partners NOT receiving ENRTF funding

Name	Title	Affiliation	Role
Minnesota Department of Natural Resources	--	--	The DNR has been vital in providing recommendations for, location information for and access to orchid populations
Dr. Jyotsna Sharma	Associate Professor of Plant Ecology & Conservation	Texas Tech University	Dr. Sharma is working with NOCP to identify MN orchid fungal associates

Jay O'Neill, Dr. Dennis WhIgham	Head Technician, Senior Scientist	Smithsonian Environmental Research Center	Mr. O'Neill and Dr. Whigham are working with NOCP to isolate, propagate and bank fungal associates of MN orchids.
North American Orchid Conservation Center	--	--	MLA is a participating institution in NAOCC and as such has access to the collective knowledge of all other member organizations for assistance in orchid storage and propagation.

VII. LONG-TERM- IMPLEMENTATION AND FUNDING:

The Arboretum's Native Orchid Conservation Program is part of a long-term strategy to establish the Arboretum as a premier center for ex situ (off-site) plant conservation and plant conservation research. This kind of conservation is a vital complement to in situ conservation efforts that protect landscapes where native populations reside.

The Minnesota Landscape Arboretum is uniquely positioned to carry-out this effort. Botanic gardens:

- Keep records (accessions) on their collections;
- Manage accessions (grow and contain);
- Have greenhouse and garden space for display and experiments ;
- Possess in-house horticultural expertise;
- And ultimately have a public mission to connect people to plants.

The Arboretum's first step in this effort was to establish itself as a participating institution with the Center for Plant Conservation (CPC). As an official CPC organization, the Arboretum is now charged with actively managing long-term propagule storage for several endangered species. In 2014-2015 this work will include collecting seeds and/or live plants from the following species, which include one orchid:

- *Besseya bullii* (kittentails)
- *Chrysosplenium iowense* (Iowa golden saxifrage)
- *Erythronium propullans* (dwarf trout lily)
- *Oxytropis campestris* var. *chartacea* (Fassett's locoweed)
- ***Platanthera praeclara* (western prairie fringed orchid)**
- *Polemonium occidentale* ssp. *lacustre* (western Jacob's ladder)
- *Rhodiola integrifolia* ssp. *leedyi* (Leedy's roseroot)

The next step was to become an early member of the North American Orchid Conservation Center, an organization similar in spirit to the CPC but focused exclusively on orchid species, being very forward looking by including all orchid species, not just those currently endangered. As a member of the Midwest Regional group in NAOCC, the young Native Orchid Conservation Program at MLA is already a leading voice and contributing member of NAOCC.

To conduct plant conservation on this level requires a long-term commitment. To successfully conduct seed storage the institution must be committed to the on-going collection of seeds as well as to the regular monitoring of the seeds in storage, as not all seeds can be stored indefinitely. Also in the case where live specimens of species are collected and grown in a controlled environment and then replanted at the Arboretum,

there is an interest in seeing whether or not these plants could then survive in their native habitats over time, which requires continued propagation and monitoring.

While MLA develops the ability to grow more and more of Minnesota's native orchids the NOCP continues to dialog with the MN DNR and TNC, both of which we are already working closely to bank seed, to develop restoration projects. This funding will not cover restoration work like this, and this next step in development of an effective conservation program cannot be done without developing close partnerships. The conservation program at MLA has already partnered with both the Minnesota and Wisconsin DNR for rare plant restoration/translocation projects and the knowledge gained by all parties in these projects will be invaluable for future potential orchid restoration projects.

VIII. REPORTING REQUIREMENTS:

- **The project is for 2 years, will begin on 7/1/18, and end on 06/30/20.**
- **Periodic project status update reports will be submitted 1/31 and 6/30 of each year.**
- **A final report and associated products will be submitted between June 30 and August 15, 2020.**

IX. SEE ADDITIONAL WORK PLAN COMPONENTS:

A. Budget Spreadsheet
B. Visual Component or Map
C. Parcel List Spreadsheet
D. Acquisition, Easements, and Restoration Requirements
E. Research Addendum

Environment and Natural Resources Trust Fund
M.L. 2018 Budget Spreadsheet

Project Title: Preserving Minnesota's Native Orchids - Phase 2
Legal Citation: M.L. 2018, Chp. 214, Art. 4, Sec. 02, Subd. 08h
Project Manager: David Remucal, PhD
Organization: University of Minnesota Landscape Arboretum
College/Department/Division:
M.L. 2018 ENRTF Appropriation: $259,000
Project Length and Completion Date: 2 years, Dec 31, 2020
Date of Report: 02/12/2018

ENVIRONMENT AND NATURAL RESOURCES TRUST FUND BUDGET	TOTAL BUDGET	AMOUNT SPENT	TOTAL BALANCE
BUDGET ITEM			
Personnel (Wages and Benefits) - Overall	$200,549		$200,549
Curator of Endangered Plants David Remucal (MLA Program Manager, 0.5 FTE, Salary 75%, Benefits 25% for FY19 and FY20) (Total estimated amount $82,147)			
Conservation Program Associate (0.5 FTE, Salary 79%, Benefits 21% for FY19 and FY20) (Total estimated amount $61,461)			
Gardener Ricky Garza (Gardener, Orchid Program, 0.14 FTE, Salary 79%, Benefits 21% for FY19 and FY20)(Total estimated amount $16,623)			
Field Technician (seasonal 0.5 FTE, Salary 79%, Benefits 21% for FY19)(Total estimated amount $24,458)			
Student intern (summer season, 10 weeks, Salary 93%, Benefits 7% for FY19 and FY20)(Total estimated amount $12,320)			
Communications Associate, Barb Kastens (0.02 FTE, Salary 79%, Benefits 21% for FY19 and FY20)(Total estimated amount $1,500)			
Professional/Technical/Service Contracts			
Contract, Jason Husveth (seed collection and population surveys in private and commercial lands difficult to gain access by MLA/state staff, 8 days per year @ contractor rate of $1040/day plus travel for 5 trips/year @ 250 roundtrip miles and 0.535/mile reimburesement - FY19	$8,989		$8,989
Equipment/Tools/Supplies - Overall	$11,307		$11,307
Lab supplies: Chemicals, glassware, growth media, greenhouse supplies, sterilization equipment. Includes external soil testing lab work and postage for sending samples to TTU and SERC (Total estimated amount $3,444)			
Greenhouse supplies: Including soil and lumber for garden bed maintenance, common garden construction, and shade structure construction, fertilizers, caging material (Total estimated amount $5,487)			

Water deionization system- Asymbiotic orchid propagation requires very precise control of nutrients and substrates. Distilled water must be used in most steps to ensure that known quantities of chemical compounds are being used. Often in propagation in this manner well or tap water is fatal to plants. Cost is for lease and maintenance of the system (Total estimated amount $2,376)			
Printing			
Printing for brochure: 5 panel, folded, 2-sided, 4-color, 3K quantity	$3,500		$3,500
Travel expenses in Minnesota - Overall	$34,655		$34,655
Food and lodging during seed and/or live plant collection trips in Greater Minnesota more than 200 miles round trip for 2 people - $133/day x 40/days per yr x 2 years. Reimbursed based on University of Minnesota plan. Total estimated amount $21,280)			
Mileage reimbursement for seed and/or live plant collection trips - .535 per mile x 250 miles per trip x 50 round trips per yr x 2 years. Reimbursed based on University of Minnesota plan. Total estimated amount $13,375)			
COLUMN TOTAL	$259,000		$259,000