Environment and Natural Resources Trust Fund (ENRTF)
M.L. 2015 Work Plan

Date of Report: 10/15/2014

Date of Next Status Update Report: 1/15/2016

Date of Work Plan Approval:

Project Completion Date: 6/30/2018

Does this submission include an amendment request? No

PROJECT TITLE: Preserving and Protecting Minnesota Native Orchid Species

Project Manager: David Remucal, Ph.D.

Organization: University of Minnesota Landscape Arboretum

Mailing Address: 3675 Arboretum Dr

City/State/Zip Code: Chaska/ MN/ 55318

Telephone Number: (612)301-1838

Email Address: remu0005@umn.edu

Web Address: www.arboretum.umn.edu

Location:

Statewide

Total ENRTF Project Budget:		
	ENRTF Appropriation:	**$167,000**
	Amount Spent:	**$0**
	Balance:	**$167,000**

Legal Citation: M.L. 2015, Chp. 76, Sec. 2, Subd. 08c

Appropriation Language:
$167,000 the first year is from the trust fund to the Board of Regents of the University of Minnesota for the Minnesota Landscape Arboretum for propagation and cultivation research to enable long-term conservation of at least 15 selected species of the 48 native orchid species in Minnesota. This appropriation is available until June 30, 2018, by which time the project must be completed and final products delivered.

I. PROJECT TITLE: Preserving and Protecting Minnesota's Native Orchid Species

II. PROJECT STATEMENT:
The initial phase of this new program will involve two main activities: 1) collect and preserve seed and/or live plants from 15 native Minnesota orchid species and 2) research the propagation and cultivation of each species. There is a total of 48 species in Minnesota and our eventual goal with this program is to bring all 48 orchid species to the Arboretum for conservation and research, however this proposal is to fund this initial, 15 species, stage. Traditional conservation efforts, *in-situ* conservation that focuses on maintaining the species in its current habitat, are important but because of increasing habitat degradation and loss they can't be the only conservation method in use. A Native Orchid Conservation Program like this may or may not be able to directly prevent the loss of populations of orchids, but what it will do is act in a very necessary and important complimentary role to these traditional conservation efforts. Through collection and research, we will be able to build a seed bank from which populations could be reconstituted in the event that wild populations are lost. This is a vital activity as there is unfortunately an increasingly likely possibility that the habitats of many wild populations will change substantially over the next 30 years and will no longer support these populations in the wild. This seedbank approach will make it possible for the Arboretum to act as a bulwark against irreversible species loss as well as insurance in case individual populations are lost.

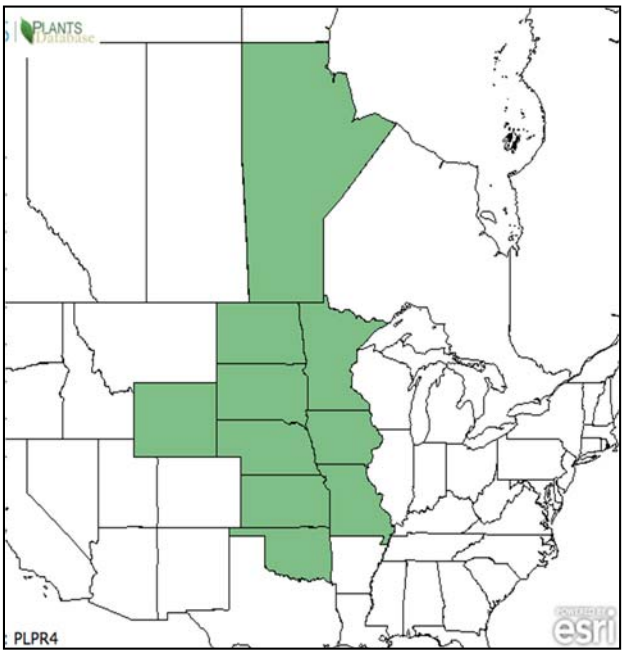
Orchids often have many specialized growing requirements, making them more vulnerable to changes in the local environment than most other plant species. Laboratory research on basic orchid biology and observation of introduced populations is essential to comprehending how they are likely to respond to 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.

MINNESOTA – 48	Texas – 50	Iowa – 32
Florida – >87	Georgia – 50	California – 31
North Carolina – 69	Washington – 41	Alaska – 31
New York – ~60	Pennsylvania – ~40	Colorado – ~25
South Carolina – 55	Wisconsin – 40	Hawaii - 3

With ten of Minnesota's 48 native orchid species already listed on Minnesota's List of Endangered, Threatened, and Special Concern Species, it is imperative to invest in the long-term preservation of this group of plants that can be found in every ecosystem type in the state. Orchids can be found throughout in Minnesota in native forest, wetlands, and prairie.

The Western Prairie Fringed Orchid is found on mesic prairie in western MN (*habitat seen in map on right with photo below*). Because native prairie habitat in Minnesota has been decimated and fractured, this species, while widespread, is endangered. It is imperative that a program like this is developed prior to either to loss of any endangered orchid species from our state or to the critical attrition from unlisted species to the point that they too become endangered. **The goal of this program is to preserve Minnesota's native orchid diversity.** The Arboretum is deeply committed to preserving and protecting Minnesota's threatened and endangered plants and it currently houses a



Provincial range of
Western Prairie Fringed Orchid

collection of eight native orchid species, some of which have been acquired through rescue efforts throughout the state. **The long-term goal of this work is to bring all 48 orchid species – either as seeds or live plants – to the Arboretum for conservation and research. It is our vision to do this work for conservation purposes only, not for commercial breeding.**

We will also be able to increase the visibility and appreciation of our native orchids by sharing our research with the public through installations in Arboretum grounds as well as in its conservatory. This native orchid conservation program at the Arboretum will introduce over 325,000 visitors to these elusive plants and their important role in forewarning threats to Minnesota's ecosystems. The Arboretum is committed to making its information and resources accessible to all Minnesotans, and it is in that spirit that the Arboretum waives its entrance fees for visitors during the month of January – an ideal time to view native orchids in the Arboretum's conservatory. In addition, admission is free on Thursdays from November – March and then from April – October admission is free the third Thursdays of the month after 4:30.

Western Prairie Fringed Orchid

III. OVERALL PROJECT STATUS UPDATES:

Project Status as of *[1/15/2016]***:**

Project Status as of *[6/15/2016]***:**

Project Status as of *[1/15/2017]***:**

Project Status as of *[6/15/2017]***:**

Project Status as of *[1/15/2018]***:**

Project Status as of *[6/15/2018]***:**

Overall Project Outcomes and Results:

IV. PROJECT ACTIVITIES AND OUTCOMES:

ACTIVITY 1: Collect and preserve seed and/or live plants from orchids throughout MN
Description: The first phase of this new initiative will involve collecting seeds and/or live plants from a total of fifteen native orchid species, representing nearly a third of the 48 known species in Minnesota. Samples will be collected from as many individual specimens as possible to obtain a representation of several populations that span a large area of each species' range. A tentative list of initial target species will be assembled at the beginning of the first summer with finalization of the initial list by the end of 2015.

Roughly one collection trip for each of the four regions of the state (NW, SW, NE, SE) anticipated to be visited the first year will be undertaken at the beginning of the summer to collect live plants and again in mid to late summer for seed collection, with a similar schedule anticipated for each year of the program, depending on specific species and locations. In subsequent years species lists and 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.

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 regular demographic monitoring will be performed in conjunction with monitoring of environmental factors such as soil moisture and temperature to analyze changes. As the program grows and species are brought to the Arboretum, it will be vital to engage the public –to educate them on the importance of native orchid conservation. Education efforts will happen in collaboration with the statewide Master Gardeners Program, which is now located at the Arboretum. 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.

Summary Budget Information for Activity 1:

ENRTF Budget: $ 70,659
Amount Spent: $ 0
Balance: $ 70,659

Outcome	Completion Date
1. *Finalized list of phase one species, with collection begun from as many of these species as possible.*	12/31/2015
2. *Collection of samples from 7 species, with a goal of three populations per species*	12/31/2016
3. *Establish demographic database to manage data collected for populations within the Arboretum.*	12/31/2016
4. *Public will have access to labeled species and a printed and online version of a "Visitors Guide to Minnesota Orchids" on display at various locations on Arboretum grounds.*	6/1/2017
5. *Collection of remaining 8 species and populations to meet proposed goal of 15 species.*	6/30/2018

Activity Status as of *[1/15/2016]***:**

Activity Status as of *[6/15/2016]***:**

Activity Status as of *[1/15/2017]***:**

Activity Status as of *[6/15/2017]***:**

Activity Status as of *[1/15/2018]***:**

Activity Status as of *[6/15/2018]***:**

Final Report Summary:

ACTIVITY 2: Propagation and cultivation research
Description: Develop an understanding of how to best grow each native orchid species. There are methods of growing orchids from seed that can be done in soils or laboratory environments that either include fungal associates or do not. It will be important to assess which methods produce the best, most reproducible results and which environmental factors are vital for seedlings and adults. The first year most germination methods will be asymbiotic techniques as these methods are more established for a wider variety of orchid species and will give us good baselines for comparing to symbiotic propagation methods.

There is research already underway for some of these native orchid species and building collaborations with other researchers to promote effective sharing of our results and to avoid duplication of effort. For example, Dr.

Jyotsna Sharma, a professor at Texas Tech University, who works on orchid mycorrhizal associations will be able to help us identify the fungal associations for each species as well as assist us with their propagation and storage.

Summary Budget Information for Activity 2:

ENRTF Budget: $ 96,341
Amount Spent: $ 0
Balance: $ 96,341

Outcome	Completion Date
1. *Evaluation of varied methods of orchid seed germination and cultivation for each species. These evaluations to include both laboratory and soil methods.*	12/31/2017
2. *Arboretum convenes meeting of researchers and other interested groups such as the Orchid Society of Minnesota in field to share emerging results and best practices*	Spring 2018

Activity Status as of *[1/15/2016]***:**

Activity Status as of *[6/15/2016]***:**

Activity Status as of *[1/15/2017]***:**

Activity Status as of *[6/15/2017]***:**

Activity Status as of *[1/15/2018]***:**

Activity Status as of *[6/15/2018]***:**

Final Report Summary:

V. DISSEMINATION:
Description: Initially, live transplanted orchids will be kept in greenhouse or conservatory areas while 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 provide educational information on each species as well as specific opportunities for the public to engage with this effort. The Arboretum will also use its website (http://www.arboretum.umn.edu/) is a good location for dissemination n 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 be able to disseminate information on a very local level for master gardeners that are more interested in learning about and sharing information about native orchids with the local communities. This train-the-trainer work could happen during field work to each of the collection sites throughout the state during the summer months of the program.

Activity Status as of *[1/15/2016]***:**

Activity Status as of *[6/15/2016]***:**

Activity Status as of *[1/15/2017]***:**

Activity Status as of *[6/15/2017]***:**

Activity Status as of *[1/15/2018]***:**

Activity Status as of *[6/15/2018]***:**

Final Report Summary:

VI. PROJECT BUDGET SUMMARY:

A. ENRTF Budget Overview:

Budget Category	$ Amount	Overview Explanation
Personnel:	$128,763	Salary for .40 FTE Curator for Endangered Plants. Salary for .14 FTE Seasonal Horticulture staff member specializing in work with endangered plants and propagation. One student intern for 400 hours over 10 weeks of summer.
Equipment/Tools/Supplies:	$3,797	lab supplies Chemicals, glassware, growth media, greenhouse supplies, sterilization equipment
Capital Expenditures over $5,000:	$7,000	Lab glassware washer. Needed to thoroughly cleanse and sanitize lab equipment
Capital Expenditures over $5,000:	$9,000	Water Distillation/deionization system. Needed to ensure control of nutrients and substrates in all steps of process.
Travel Expenses in MN:	$18,440	Collection trips throughout state over three years.
TOTAL ENRTF BUDGET:	**$167,000**	

Explanation of Use of Classified Staff:

Explanation of Capital Expenditures Greater Than $5,000:

1) Lab glassware dishwasher – to be used exclusively by this project to ensure that equipment is sanitized. Other like equipment in the lab is shared with the wine-making operation, which washes glassware used for human consumption.
2) Water distillation/deionization system – to be used in the orchid propagation process. Distilled water must be used in most steps of the process to ensure that known quantities of chemical compounds are being used.

Number of Full-time Equivalents (FTE) Directly Funded with this ENRTF Appropriation: 2.19 FTE

Number of Full-time Equivalents (FTE) Estimated to Be Funded through Contracts with this ENRTF Appropriation: 0

B. Other Funds:

Source of Funds	$ Amount Proposed	$ Amount Spent	Use of Other Funds
Non-state			
Minnesota Landscape Arboretum Foundation Helen Clay Frick Foundation	$13,531 $25,000		Arboretum personnel will be provided in-kind including: Director of Operations (.05 FTE) for supervision of Curator of Endangered Plants ($8,911), Arboretum Curator (100 hours) for production and placement of plant labels ($4,620). In addition the Arboretum is actively

			fundraising from private philanthropic sources to support this work.
State			
	$	$	
TOTAL OTHER FUNDS:	**$38,531**	**$**	

VII. PROJECT STRATEGY:

A. Project Partners:

The Arboretum does not have organizational partners that will be receiving ENTRF funds. However, in order to accomplish this effort the Arboretum will work with the following organizations and individuals:

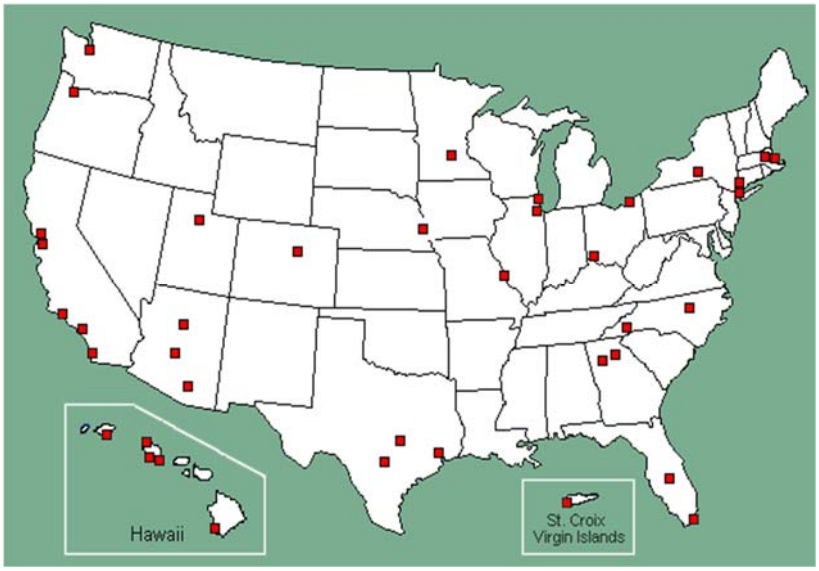
Minnesota Department of Natural Resources - The Arboretum's most key partner in this work is the Minnesota Department of Natural Resources. Dr. Remucal has already begun to conduct field work with DNR staff collecting seeds from Western Jacob's Ladder, as you can see in the photo at right.

Center for Plant Conservation - The Arboretum is participating organization of the Center for Plant Conservation and plays a major leadership role in monitoring and protecting endangered plants in Minnesota, Wisconsin, Iowa, North Dakota and South Dakota.

National Researchers - Dr. Remucal has already discussed this project with Dr. Jyotsna Sharma Assistant Professor of Plant Ecology & Conservation at Texas Tech University, and she is interested in sharing information and building this field of practice.

Smithsonian - Dr. Remucal will work to build ties and potentially collaborate with the North American Orchid Conservation Center at the Smithsonian.

B. Project Impact and Long-term Strategy:



The Arboretum's Native Orchid Conservation Program is part of a long-term strategy to establish the Arboretum as a premier center for plant conservation and plant conservation research.

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) – see map at right for locations of CPC participating institution locations. 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)

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.

C. Funding History:

Funding Source and Use of Funds	Funding Timeframe	$ Amount
Helen Clay Frick Foundation - general plant conservation	2014 – 2015	$15,000
Helen Clay Frick Foundation – general plant conservation	2013 – 2014	$20,000
Helen Clay Frick Foundation – seed bank / plant conservation	2011 – 2012	$7,000

VIII. FEE TITLE ACQUISITION/CONSERVATION EASEMENT/RESTORATION REQUIREMENTS:

N.A.

IX. VISUAL COMPONENT or MAP(S): See attached.

X. RESEARCH ADDENDUM:

N.A.

XI. REPORTING REQUIREMENTS:
Periodic work plan status update reports will be submitted no later than 1/15/2016, 6/15/2016, 1/15/2017, 6/15/2017, 1/15/2018 and 6/15/2018. A final report and associated products will be submitted between June 30 and August 15, 2018.

Environment and Natural Resources Trust Fund

M.L. 2015 Project Budget

Project Title: Preserving and Protecting Minnesota Native Orchid Species

Legal Citation: *Fill in your project's legal citation from the appropriation language - this will occur after the 2015 legislative session.*

Project Manager: David Remucal, Ph.D.

Organization: University of Minnesota Landscape Arboretum

M.L. 2015 ENRTF Appropriation: $ *167,000*

Project Length and Completion Date: *3 Years, December 31, 2018*

Date of Report: 10/15/2014

ENVIRONMENT AND NATURAL RESOURCES TRUST FUND BUDGET	Activity 1 Budget	Amount Spent	Activity 1 Balance	Activity 2 Budget	Amount Spent	Activity 2 Balance	TOTAL BUDGET	TOTAL BALANCE
BUDGET ITEM	Collect and preserve seed and/or live plants from native orchids throughout MN			Propagation and cultivation research of native orchid species				
Personnel (Wages and Benefits)	$52,276	$0	$52,276	$76,487	$0	$76,487	$128,763	$128,763
David Remucal, Ph.D., Project Manager: $90,995 (.40 FTE @ 36% benefits for 3 years)								
Ricky Garza, Seasonal Horticulture staff member: $24,211 (.14 FTE @ 26.4% benefits for 3 years)								
One student intern: $13,560 (40 hrs a week for 10 weeks of summer @ $10/hr @ 12% taxes/benefit for 3 years)								
Equipment/Tools/Supplies								
Lab supplies: Chemicals, glassware, growth media, greenhouse supplies, sterilization equipment				$3,797	$0	$3,797	$3,797	$3,797
Capital Expenditures Over $5,000								
Lab glassware dishwasher - to be used exclusively by this project to ensure that equipment is properly sanitized.				$7,000	$0	$7,000	$7,000	$7,000
Water distillation/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				$9,000	$0	$9,000	$9,000	$9,000
Travel expenses in Minnesota								
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 15/days per yr x 3 years. Reimbursed based on University of Minnesota plan. $11,970	$11,970	$0	$11,970				$11,970	$11,970
Mileage reimbursement for seed and/or live plant collection trip .575 per mile x 15/round trips per yr x 3 years. Reimbursed based on University of Minnesota plan. $6,413	$6,470	$0	$6,470				$6,470	$6,470
COLUMN TOTAL	**$70,716**	**$0**	**$70,716**	**$96,284**	**$0**	**$96,284**	**$167,000**	**$167,000**

Preserving and Protecting Minnesota's Native Orchid Species

Wetlands

Amerochis rotundifolia (round-leaved orchid)
Arethusa bulbosa (dragon's-mouth)
Calopogon tuberosus var. *tuberosus* (tuberous grass-pink)
Calypso bulbosa var. *americana* (fairy-slipper)
Corallorhiza trifida (early coral-root)
Cypripedium acaule (stemless lady's-slipper) Arb
Cypripedium arietinum (ram's-head lady's-slipper) * *Arb*
Cypripedium parviflorum var. *makasin* (northern small yellow lady's-slipper) Arb
Cypripedium reginae (showy lady's-slipper) Arb

Goodyera repens (lesser rattlesnake-plantain)
Liparis loeselii (Loesel's twayblade)
Listera convallarioides (broad-leaved twayblade) *
Listera cordata (heart-leaved twayblade)
Malaxis monophyllos var. *brachypoda* (white adder's-mouth) *
Malaxis paludosa (bog adder's-mouth) *
Malaxis unifolia (green adder's-mouth)
Platanthera aquilonis (northern green bog-orchid)
Platanthera clavellata (small green bog-orchid) *
Platanthera dilatata var. *dilatata* (tall white bog-orchid)
Platanthera huronensis (tall green bog-orchid)
Platanthera lacera (ragged fringed orchid)
Platanthera obtusata ssp. *obtusata* (bluntleaved rein-orchid)
Platanthera orbiculata (lesser roundleaved orchid)
Platanthera psycodes (small purple fringed orchid) Arb
Pogonia ophioglossoides (rose pogonia)
Spiranthes cernua (nodding ladies'-tresses)
Spiranthes romanzoffiana (hooded ladies'-tresses)

Wetland species: *Cypripedium arietinum* (ram's-head lady's-slipper) * Arb. Image: Christopher Noll, Friends of the Eloise Butler Wildflower Garden

Upland woodland

Aplectrum hyemale (putty-root) Arb
Coeloglossum viride (long-bracted orchid)
Corallorhiza maculata var *maculata* (spotted coral-root)
Corallorhiza maculata var. *occidentalis* (western spotted coral-root)
Corallorhiza odontorhiza var *odontorhiza* (autumn coral-root) Arb
Corallorhiza striata var. *striata* (striped coral-root)
Cypripedium parviflorum var. *pubescens* (large yellow lady's-slipper) Arb
Galearis spectabilis (showy orchis)
Goodyera pubescens (downy rattlesnake-plantain)
Goodyera tesselata (tesselated rattlesnake-plantain)
Liparis liliifolia (lily-leaved twayblade) Arb
Listera auriculata (auricled twayblade) *
Platanthera hookeri (Hooker's orchid)
Spiranthes casei var. *casei* (Case's ladies'-tresses) *
Spiranthes lacera var. *lacera* (northern slender ladies'-tresses)

Upland Woodland species: *Cypripedium parviflorum var. pubescens* (large yellow lady's-slipper) Arb. Image: Thomas G. Barnes @ USDA-NRCS PLANTS Database

Prairie

Calopogon oklahomensis (Oklahoma grass-pink)
Cypripedium candidum (small white lady's-slipper) *
Platanthera flava var. *herbiola* (tubercled rein-orchid) *
Platanthera praeclara (western prairie fringed orchid) * Arb
Spiranthes magnicamporum (Great Plains ladies'-tresses)
Spiranthes lacera var. *gracilis* (southern slender ladies'-tresses)

Prairie species: *Cypripedium candidum (small white lady's-slipper) *. Thomas G. Barnes @ USDA-NRCS PLANTS Database*

Notes: * refers to "a state-listed species"; Arb refers to "can be found at Minnesota Landscape Arboretum"