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

Date of Report: December 18, 2014

Date of Next Status Update Report: October 30, 2015

Date of Work Plan Approval:

Project Completion Date: April 15, 2018

Does this submission include an amendment request? No

PROJECT TITLE: Habitat Mitigation for Goblin Fern Conservation

Project Manager: Bobby Henderson

Organization: Leech Lake Band of Ojibwe

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Location: Beltrami, Cass, Itasca (Leech Lake Reservation/Chippewa National Forest)

Total ENRTF Project Budget:		
	ENRTF Appropriation:	**$61,000**
	Amount Spent:	**$0**
	Balance:	**$61,000**

Legal Citation: M.L. 2015, Chp. 76, Sec. 2, Subd. 03s

Appropriation Language:
$61,000 the first year is from the trust fund to the commissioner of natural resources for an agreement with the Leech Lake Band of Ojibwe to examine goblin fern populations, a threatened species in Minnesota, in relation to habitat degradation and to develop long term habitat mitigation and species conservation strategies. This appropriation is available until June 30, 2018, by which time the project must be completed and final products delivered.

I. PROJECT TITLE: Habitat Mitigation for Goblin Fern Conservation

II. PROJECT STATEMENT:

In 2013 Minnesota made updates to the Endangered and Threatened Species list, Statement of Need and Reasonableness (SONAR). As a result the status for Goblin fern (*Botrychium mormo*) was raised from a species of Special Concern to a Threatened species in Minnesota. This rare fern commonly referred to as a moonwort or Goblin fern, is a small discreet fern endemic to the rich Northern Hardwood forests of Minnesota, Wisconsin, Michigan, with a single historic record from Ontario, Canada. Currently this species is threatened in Minnesota (total records unknown), threatened in Michigan (13 records), endangered in Wisconsin (89 records), and receives a Global rank of G3 (vulnerable). Within this restricted range it occurs only within specific habitats defined by forest community type and soils. These communities in Minnesota are often dominated by *Acer saccharum, Tilia americana, Fraxinus nigra, Betula alleghaniensis,* with occasional upland *Thuja occidentalis* and *Ulmus spp*... The soils tend to be sandy loams – loam, with an intact thick organic layer (O and A soil horizons) Outside Minnesota the habitats and canopy composition slightly differ, but *Acer* and *Tilia* continue to be a dominant associate species.

Since 1975 there have been over 600 Goblin fern observations on Leech Lake Reservation/Chippewa NF; which makes this area the heart of Goblin fern distribution. But it is highly suspected many of the populations prior to 2000 have been extirpated as a result of severe habitat degradation. The scourge most responsible for Goblin fern extirpation throughout its range has been the introduction of non-native earthworms. All earthworms found in Minnesota are non-native; with the majority being European species of the family *Lumbricidae.* The initial arrival of earthworms came with European settlers around the mid 1800s, but since that time their spread has been expedited through human activities such as the dumping of unused fishing bait, forest management activities, recreation, development, and potentially anything that moves soil from a contaminated area to areas unaffected by earthworms. As a result the continual rapid loss of habitat is extirpating Goblin fern populations at an alarming rate.

This is a multifaceted project with multiple goals. The **overall goal** is to review historic record locations to examine populations in order to quantify Goblin fern abundance, decline, and possible extirpations at the local scale. These crucial steps in the project will be accomplished through surveying and monitoring a random sampling of sample units (EO records).

The **second goal** is to collect earthworm data utilizing the Invasive Earthworm Rapid Assessment Tool (IERAT) and assign each specific location a ranking as defined by IERAT. This exercise will also give us the opportunity to assess and document the adverse effects earthworms cause to Goblin fern habitat. Ultimately the earthworm data will be submitted to a much larger earthworm study being conducted by Great Lakes Worm Watch and UMD NRRI.

My **third goal** is to analyze the data with the assistance of Forest Service botanist Kirk Larson in order to determine:

1) Is Goblin fern abundance and distribution diminishing on the Leech Lake Reservation/Chippewa National Forest?

2) Identify the factors responsible for diminishing population abundance and/or extirpations at the local scale.

3) Identify conservation strategies/plans which will need to be addressed and/or developed in order to minimize further negative affects to Goblin fern habitat and populations.

III. OVERALL PROJECT STATUS UPDATES:

Project Status as of October 30, 2015:

Project Status as of April 15, 2016:

Project Status as of October 30, 2016:

Project Status as of April 15, 2017:

Project Status as of October 30, 2017:

Project Status as of April 15, 2018:

Overall Project Outcomes and Results:

IV. PROJECT ACTIVITIES AND OUTCOMES:

ACTIVITY 1: Identify Experimental Units, Finalize Project Design, Survey and Assess Locations.
CNF botanist Kirk Larson and I will examine the CNF Goblin fern records to identify four sub-sets of experimental units. The sub-sets will be based on five year increments from 1992 – 2011 giving us a sample period of 20 years. It is important to note that CNF Forest Service lands are divided into districts, compartments, and timber stands, so each experimental unit has a unique identifier (District - Compartment/Stand number). For each five year period we will randomly identify our 20 experimental units for a total of 80 unique experimental units.

Sample units will be based on the element of occurrence (Goblin fern record) within the experimental unit. Each experimental unit will contain a sample unit identified by a unique corporate number for the EO (example: BOMO3001) There will be a total of 80 sample units to coincide with the 80 experimental units. For timber stands containing more than one Goblin fern EO, a sample unit will be randomly selected for survey and monitoring.

Sub-set 1: 1992-1996 – 20 experimental units – 20 sample units
Sub-set 2: 1997-2001 – 20 experimental units – 20 sample units
Sub-set 3: 2002-2006 – 20 experimental units – 20 sample units
Sub-set 4: 2007-2011 – 20 experimental units – 20 sample units

Once the experimental and sample units are identified, CNF botanist Kirk Larson and I will design the survey and data collection protocol for the three year project. Much of the information we wish to obtain is related to habitat quality and population viability (*goblin fern presence/persistence, canopy closure, soil moisture, associated species, soil organic layer, earthworm presence and effects*). This simple base data will be important for decisions regarding future Forest Plan updates.

The first year of surveys will be most labor intensive as the location coordinates from early observations tend to be highly inaccurate. If ground truthing the original EO proves to be difficult, then the experimental unit (timber stand) will be fully surveyed to help establish the probable EO coordinates. If the original location goes without detection, the original field notes will be utilized to identify the best habitat within proximity of the given EO coordinates. Once the probable habitat is identified it will be designated as the sample unit.

For sample plots where Goblin fern continues to persist, there will be pin flags placed in the ground to identify a meter square sample unit at the site. At EO locations where Goblin fern is absent, there will be a single pin flag placed in the vicinity of the coordinates or habitat to identify the location as a sample unit. If at a later date Goblin fern is observed in the vicinity, then there will be a meter square sample unit placed around the EO to identify it as the probable location.

By mid August most Goblin fern have senesced, so intensive field work is required as there is approximately a six week time window from late June – early August for conducting quality Goblin fern surveys. Kirk Larson and I are highly experienced in *Botrychium* surveys and identification so this accounts for the decision to utilize only two surveyors for the project. Data consistency and thoroughness are crucial to reduce inaccuracy which also contributes to the decision for only two surveyors.

Summary Budget Information for Activity 1:

ENRTF Budget: $ 37,400
Amount Spent: $ 0
Balance: $ 37,400

Outcome	Completion Date
1. Establish project and survey protocol and identify experimental and sample units	July 2015
2. Survey experimental and sample units late June-mid August 2015, 2016, 2017	August 2017
3. Compile and analyze data from survey and monitoring efforts	December 2017

Project Status as of October 30, 2015:

Project Status as of April 15, 2016:

Project Status as of October 30, 2016:

Project Status as of April 15, 2017:

Project Status as of October 30, 2017:

Project Status as of April 15, 2018:

Final Report Summary:

ACTIVITY 2: Data Analysis, Submit Results to CNF, Assist in Development of Mitigation Plan for Updated CNF Forest Plan

For each sample unit, we will monitor and collect data for three consecutive seasons in order to document population health for our random selection of sample units. The data collection protocol will focus on target species presence, population viability, probable extirpations, current habitat conditions and earthworm activity. From this project we can potentially conduct long term monitoring of the locations which continue to contain viable Goblin fern populations.

Specific data we wish to collect includes:
1) Target species presence
2) Conduct plant count at sample units
3) Population viability (based on plant count, habitat conditions, earthworm activity)
4) Canopy composition
5) Canopy density
6) Associate vegetation species
7) Habitat conditions
8) Soil moisture
9) Evaluate Earthworm activity with the assistance of IERAT

Within the data analysis we will search for correlations between population abundance, habitat conditions and earthworm activity. Through repeated field observations I've observed what appear to be Goblin fern extirpations in the wake of earthworm invasions, but there has been very little work on the CNF to document or prove these events.

The major goal of this project is to extract enough information from data to support proposal for the development of improved Goblin fern habitat mitigation strategies and species conservation plans.

The intensive three year survey and monitor project will help in identifying the most detrimental issues surrounding Goblin fern habitat and populations. From this data, Leech Lake Band of Ojibwe will be able to develop appropriate Goblin fern habitat mitigation strategies and species conservation plans to insure appropriate protection for Goblin fern and Goblin fern habitat on tribally owned and managed lands.

As a co-managing agency, Leech Lake Band of Ojibwe must collaborate with Chippewa National Forest to insure habitat mitigation strategies and species conservation plans are developed at the forest wide level. This will help insure the species and habitat on Forest Service managed lands within the Leech Lake Reservation boundaries are adequately protected.

The Chippewa National Forest, Forest Management Plan is scheduled for review and revision on a 10 year cycle, but has not been revised since 2004. This indicates the Forest Plan is up for review and revision this year. As a result, the current forest plan is probably inadequate for the long term conservation of Goblin fern and the required habitat for this species. As a co-management agency, Leech Lake Reservation will request review of the current CNF Forest Plan with the intentions of co-developing a current and appropriate species conservation plan for Goblin fern and all struggling moonwort species residing on Leech Lake Reservation/Chippewa National Forest.

Summary Budget Information for Activity 2:

ENRTF Budget: $ 23,600
Amount Spent: $ 0
Balance: $ 23,600

Outcome	Completion Date
1. Predict probable extirpations within our experimental and sample units	October 2017
2. Updating CNF records to account for extirpations	October 2017
3. Submit data to support a larger earthworm project	December 2017
4. Coordinate with CNF to develop and implement new habitat mitigation and species conservation plans	April 2018
5. Develop and implement new habitat mitigation plans for Leech Lake Tribal Lands	April 2018
6. Disseminate results to interested management agencies	April 2018

Project Status as of October 30, 2015:

Project Status as of April 15, 2016:

Project Status as of October 30, 2016:

Project Status as of April 15, 2017:

Project Status as of October 30, 2017:

Project Status as of April 15, 2018:

Final Report Summary:

V. DISSEMINATION:
Description:
Once we compile all relevant data, the results will be shared with interested agencies and organizations who express similar interest in the conservation of Goblin fern. All relevant earthworm data will be shared with NRRI, University of Minnesota, Duluth to help with their ongoing research. This information will include

coordinates, and severity of infestation. Since this Goblin fern is considered a Threatened, Endangered, Sensitive species by Leech Lake Band of Ojibwe and the Chippewa National Forest, data and results will be shared at the discretion of the two co-management agencies.

Project Status as of October 30, 2015:

Project Status as of April 15, 2016:

Project Status as of October 30, 2016:

Project Status as of April 15, 2017:

Project Status as of October 30, 2017:

Project Status as of April 15, 2018:

Final Report Summary:

VI. PROJECT BUDGET SUMMARY:
A. ENRTF Budget Overview:

Budget Category	$ Amount	Overview Explanation
Personnel:	$52,200	Bobby Henderson, project manager, botanist, data analysis (80% salary, 20% benefits) 35% FTE for 3 years
Equipment/Tools/Supplies:	$2050	High precision GPS for establishing sites, Densiometers, Field supplies: collection bags, batteries, flagging,
Travel Expenses in MN:	$6750	Travel to, between, and from survey and data collection sites. Mileage:
TOTAL ENRTF BUDGET:	**$61,000**	

Explanation of Use of Classified Staff: N/A

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

Number of Full-time Equivalents (FTE) Directly Funded with this ENRTF Appropriation: 1.05

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

B. Other Funds:

Source of Funds	$ Amount Proposed	$ Amount Spent	Use of Other Funds
Non-state	$0	$0	
State	$0	$0	
In-kind Services To Be Applied			
USDA Forest Service: Botanist Kirk Larson.	$11,100	$0	Survey and data collection support.
Leech Lake Division of Resource Management.	$40,000	$0	IDC, Administrative support, office space, computers, GIS programs, vehicles and maintenance.
TOTAL OTHER FUNDS:	**$51,000**	**$0**	

VII. PROJECT STRATEGY:

A. Project Team/Partners

Funded:

Bobby Henderson, Leech Lake Band of Ojibwe Botanist, sole recipient of funds

Non-funded/in-kind partners:

- Kirk Larson (Chippewa National Forest, Botanist/rare plants specialist, assist in survey and data collection).
- Dr. Don Farrar professor emeritus (Iowa State University, leading moonwort expert), support for Botrychium species.
- Dr. Cindy Johnson-Groh (Gustavus Adolphus College, Professor of Biology and Environmental Studies, moonwort expert) support for project design and protocol.

B. Project Impact and Long-term Strategy:

1. Provide data to support the degree of imperilment Goblin fern may be currently facing in Minnesota.
2. Facilitate the development of long term mitigation strategies and conservation plans to protect remaining Goblin fern habitat and populations.
3. Facilitate revisions to the current CNF Forest Plan.
4. Invoke more conscious decisions for updating and implementing BMPs in northern hardwood forests.
5. Provide data to support updating records in the CNF corporate database.
6. Provide Earthworm data to a much larger earthworm study being conducted by Great Lakes Worm Watch and UMD NRRI.
7. Neighboring state agencies continue to express interest in the results of this project as Goblin fern faces extinction within neighboring states.

C. Funding History:

Funding Source and Use of Funds	Funding Timeframe	$ Amount
N/A		

IX. VISUAL COMPONENT or MAP(S):

See attached photos and maps.

X. RESEARCH ADDENDUM: N/A

XI. REPORTING REQUIREMENTS:

Project Status as of October 30, 2015:

Project Status as of April 15, 2016:

Project Status as of October 30, 2016:

Project Status as of April 15, 2017:

Project Status as of October 30, 2017:

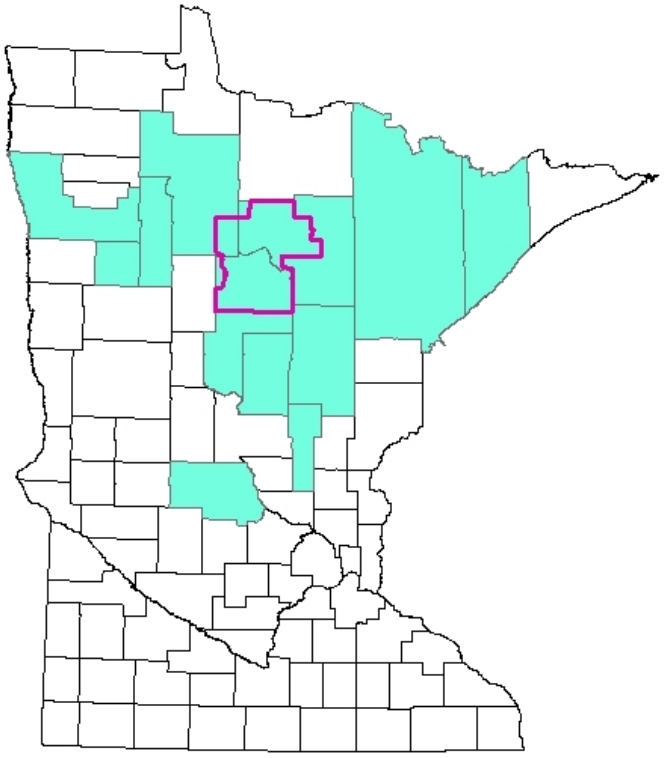
Project Status as of April 15, 2018:

A final report and associated products will be submitted April 15, 2018

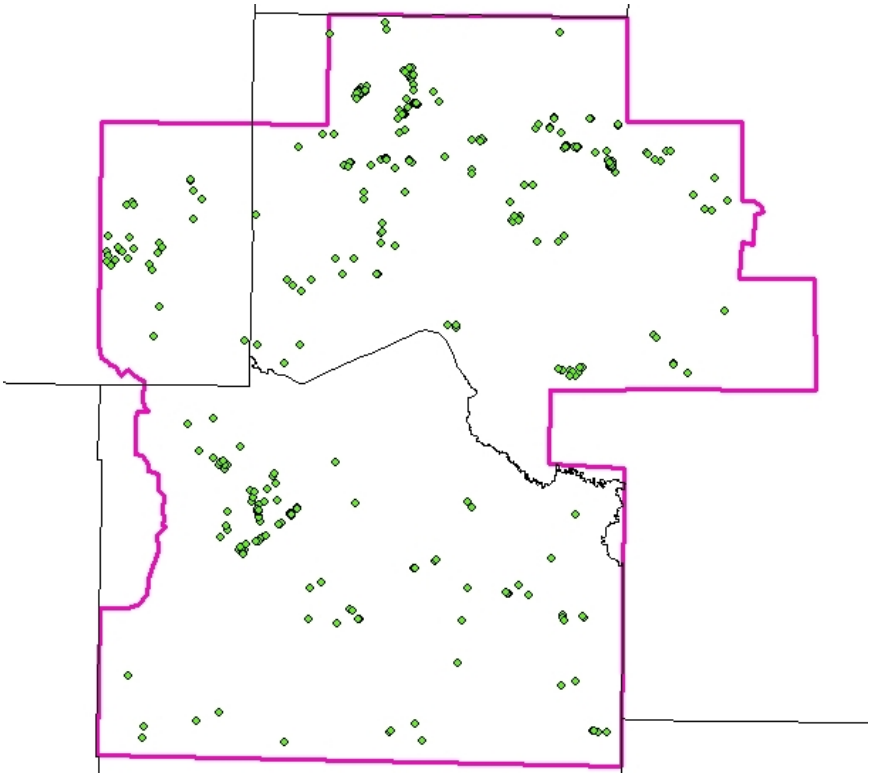
Environment and Natural Resources Trust Fund
M.L. 2015 Project Budget

Project Title: Habitat Mitigation for Goblin Fern Conservation
Legal Citation: M.L. 2015, Chp. 76, Sec. 2, Subd. 03s
Project Manager: Bobby Henderson
Organization: Leech Lake Band of Ojibwe
M.L. 2015 ENRTF Appropriation: $61,000
Project Length and Completion Date: 3 years, January 31, 2018
Date of Report: December 18, 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	**Identify, Project Design, Survey, and Assess Locations**			**Data Analysis, Submit Results to CNF, Assist in Development of Mitigation Plan for Updated CNF Forest Plan**				
Personnel (Wages and Benefits)	$28,600	$0	$28,600	$23,600	$0	$23,600	$52,200	$52,200
Bobby Henderson, project manager, botanist, data analysis (80% salary, 20% benefits) 35% FTE for 3 years								
Equipment/Tools/Supplies	$2,050	$0	$2,050				$2,050	$2,050
2 High precision GPS for relocating sites ($1300)								
2 Densiometers ($220)								
Field supplies: collection bags, batteries, flagging, ($530)								
Travel expenses in Minnesota								
Travel to, between, and from survey and data collection sites. Mileage: $6750	$6,750	$0	$6,750				$6,750	$6,750
COLUMN TOTAL	**$37,400**	**$0**	**$37,400**	**$23,600**	**$0**	**$23,600**	**$61,000**	**$61,000**



Historic Goblin fern Distribution in Minnesota with project area outlined: Leech Lake Reservation/Chippewa NF.



Goblin fern record locations within the project area.
Location UTM represented as dots on map.