M.L. 2015 Project Abstract
For the Period Ending June 30, 2018

PROJECT TITLE: Metro Conservation Corridors Phase VIII - Enhancing Restoration Techniques for Improved Climate Resilience and Pollinator Conservation
PROJECT MANAGER: Wiley Buck
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FUNDING SOURCE: Environment and Natural Resources Trust Fund
LEGAL CITATION: M.L. 2015, Chp. 76, Sec. 2, Subd. 08f

APPROPRIATION AMOUNT: $ 400,000
AMOUNT SPENT: $ 377,761
AMOUNT REMAINING: $ 22,239

Overall Project Outcome and Results

Greening and our partners Xerces, Maplewood Nature Center, and U of MN, advanced prairie and oak woodland restoration practices for vegetation and pollinators in multi-faceted fashion. We implemented quality restorations and enhancements, and gathered 12,000 data points, analysis of which is already guiding restoration, pollinator, and engagement practices. Improvements include a successful climate-resilient approach to oak restoration; using conservation haying to benefit prairie plants and pollinators; refining our approach to pollinator refugia, overwintering and nesting needs during restoration; improving student knowledge of native plants and pollinators; implementing citizen science practices for valuable data collection and outdoor citizen engagement; increasing our understanding of native pollinators' macro- and micro- floral resource needs; improving pollinator habitat along trails; and documenting the federally endangered rusty-patched bumble bee. This program further accomplished 32 acres restored, including 6,000 bur oaks, 12,000 pollinator plants, and 45,000 milkweed seeds getting into the ground.

Project Results Use and Dissemination

Dissemination of the results is also multi-faceted and robust, underway and promising to continue beyond the grant period. This includes the publication of a bee monitoring guide for citizen science, and five presentation-ready reports; five social media outreach avenues reaching thousands; eight conference presentations reaching over 400 professionals; partnering with five local government land-owning units; and active engagement of over 1,500 citizens, including 841 K-12 students, 45 Master Naturalists, 200 citizen scientists, and 235 restoration volunteers.

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

Date of Report: November 7, 2018

Final Report

Date of Work Plan Approval: June 11, 2015

Project Completion Date: June 30, 2018

PROJECT TITLE: Metro Conservation Corridors Phase VIII - Enhancing Restoration Techniques for Improved Climate Resilience and Pollinator Conservation

Project Manager: Wiley Buck

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Location: Chisago, Dakota, Ramsey, Washington

Total ENRTF Project Budget:		
	ENRTF Appropriation:	**$400,000**
	Amount Spent:	**$377,761**
	Balance:	**$22,239**

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

Appropriation Language:
$400,000 the first year is from the trust fund to the commissioner of natural resources for an agreement with Great River Greening for the eighth phase of the Metropolitan Conservation Corridors partnership to pilot and evaluate innovative restoration techniques aimed at improving the resilience of bur oak communities to changing climate conditions and enhancing prairie management to benefit pollinators with the help and engagement of citizen volunteers. Expenditures on restoration efforts are limited to the identified project corridor areas as defined in the work plan. A list of proposed restorations must be provided as part of the required work plan. This appropriation is available until June 30, 2018, by which time the project must be completed and final products delivered.

I. PROJECT TITLE: Metro Conservation Corridors Phase VIII - Enhancing Restoration Techniques for Improved Climate Resilience and Pollinator Conservation

II. PROJECT STATEMENT: Refining restoration practices to ensure continued cost-effective success in the face of climate change and the native pollinator crisis, is addressed by studying several restoration activities and sites. This project addresses these urgent real world challenges by: 1) comparing the seedling viability across three ecotypes of bur oak; 2) monitoring the pollinator communities and their relationship to vegetation at two restoration sites; 3) researching the effect of prairie restoration haying, a practice with promising cost-benefit potential in the metro area, on soil nutrients, vegetation, and pollinators; and 4) embedding citizen science programs, student outreach, and volunteer events throughout these activities to experientially inform and engage the public on these important and timely topics.

The project will be implemented on four restoration sites, two of which host multiple activities.

Table 1: Activity by Restoration Site Summary

SITE / ACTIVITY	Central Corridor	Fish Creek Open Space	Bald Eagle-Otter Lakes Regional Park (Ramsey Co.)	Allemansrätt Wilderness Park	Pilot Knob Hill
Planting and Researching Viability of Three Ecotypes of Bur Oak	√	√	√	√	
Pollinator Habitat Restoration and Citizen Monitoring of Pollinators, Vegetation		√			√
Researching Effects of Haying on Vegetation, Soil N, Pollinators	√				

The project will be carried out by a compelling partnership comprised of The University of Minnesota Center for Forest Ecology, Xerces Society for Invertebrate Conservation, City of Maplewood, and Great River Greening. Results will guide oak community plantings and restoration, inform metro area prairie haying practices as it relates to pollinator conservation and vegetation management, provide valuable data to a bumble bee database including rare species searches, and engage 1,250 citizens including 800 K-12 east metro students.

III. OVERALL PROJECT STATUS UPDATES:

Amendment Request (07/02/2015):
Greening respectfully requests to begin spending our 2015 appropriation, retroactive to July 1st, before our 2014 appropriation is fully expended. In general, deliverables and budgets for the respective appropriations are based on the specific project lists for each appropriation, and are substantially different between the appropriations. In addition, projects #4, 5, and 6 in the 2015 restoration list are ready to begin, including July pollinator and bumble bee surveys, and will need the full 3-year grant period to meet the deliverables. The 2014 appropriation is largely allocated to a suite of projects underway, with several projects in advanced development (e.g. enlargement of existing Allemansratt 2014 project) poised to complete the allocations.

Amendment Approved by LCCMR 07/06/2015

Project Status as of February 1, 2016:

The project is underway, on schedule, and on track to meet the deliverables for all Activities. Work conducted includes: procurement of three ecotypes of bur oak acorns; over 150 citizens engaged in various aspects of pollinator monitoring at Fish Creek Open Space and Pilot Knob Hill; documentation of the rare bumble bee *Bombus fervidus* at Pilot Knob Hill; and baseline vegetation and pollinator data and first prescribed haying treatment at Central Corridor.

Two clarifications are made in the workplan, the first being clarification on the interpretive program for the K-12 students in Activity 2, Fish Creek Open Space. The revised, improved text is underlined clarifying the number of activities in which each individual student will be engaged. The second clarification is to specifically include tree and shrub plant material as a part of the pollinator plantings; the revised underlined text reflecting this clarification is included in the budget below as well as in Attachment A.

Project Status as of August 1, 2016:
The project progressed significantly in the past six months with bur oak germination and site selection on track; continued pollinator activities at Fish Creek and Pilot Knob Hill; and conservation haying moving along in its second season

An additional 447 citizens were engaged in pollinator interpretation at Fish Creek Open Space, another 18 at Pilot Knob Hill, and 191 at Central Corridor; documentation of a second and third rare bumble bee species was made at Pilot Knob.

Project Status as of February 1, 2017:
The project progressed significantly in the past six months in all three activities and is on schedule.

Highlights included planting all research oaks; drafting sections of the bur oak write-up; federal endangered listing of a bumble bee present at Pilot Knob; active dissemination; and engaging an additional 249 volunteers, including 69 youth, in these projects.

The restoration list has been updated to reflect the site change between Spring Lake Park and Allemansrätt Park noted in the main document only of the August 1 2016 update.

Activity 1 and the Fish Creek portion of Activity 2 are now shared (pending approval of 2014 amendment request) between this 2015 appropriation and Greening's 2014 appropriation.

Amendment Request (08/16/2017):
Greening respectfully requests to shift $21,000 into Activity 1: Professional/Technical/Service Contracts, subsection "TBD (competitive bid)..." from the same category in Activity 2.

This change is needed to meet the upcoming higher costs of exclosure fencing for the research bur oaks than anticipated. The original fencing estimate did not take into account the added expense due to sloped terrain, limited access, and upgrade to rabbit exclosure fencing above more typical deer exclosure fencing. The reduction in Activity 2 Contracts is allowed because of two items. First, there is no need to contract out a vegetation survey at Pilot Knob Hill. To make the connection between restoration and pollinators, the floral associations are recorded as part of the bumble bee surveys, which will be complemented by vegetation monitoring by Greening staff during non-survey months in fall 2017 and spring 2018. Second, contracted fencing exclosure services for Activity 2 were never needed for installed pollinator plugs and shrubs at the Fish Creek site, because the work was completed by volunteers.

We would like to also shift an additional $878 into Activity 1: Professional/Technical/Service Contracts, subsection "TBD (competitive bid)...", from Activity 1: Other/Out of state travel. We have completed all out of state travel and have $878 remaining as we did not take out any overnight lodging, and a budgeted trip to North Dakota was not needed as the preferred northwestern Minnesota acorns were sourced instead.

For Activity 1: Equipment/Tools/Supplies, we propose to add 'fencing materials' to the list of approved purchases. We anticipate supplementing the contracted fencing work with sustained, localized fencing improvements by staff and/or volunteers, to maximize protection of the research oaks from rabbits.

Amendment Approved by LCCMR 11/28/2017

Project Status as of August 1, 2017:
All projects are underway and all three activities are on schedule. Highlights include completion of baseline data collection, and first year growth data collection underway on the research oaks; successful continuation of the Fish Creek and Pilot Knob citizen science pollinator monitoring and training activities; and completion of professional spring pollinator, soil, and vegetation surveys at Central Corridor.

Amendment Request (02/01/2018):
Greening respectfully requests to shift $2,500 from Activity 3 Personnel (Personnel budget decrease to $9,535) to Activity 2 Personnel (Personnel budget increase to $26,315), for staff time leading an additional pollinator survey/community event, the Bioblitz at Fish Creek Open Space in June 2018.

Amendment Approved by LCCMR 02/15/2018

Project Status as of February 1, 2018:
All three activities progressed on schedule. Fall data collection was completed at all four sites for Bur Oak Acceleration and Migration Research growth data was collected at all fours sites; one citizen science workshop and the final two public bee monitoring events were successfully completed at Fish Creek Open Space; the final three bumble bee surveys were completed at Pilot Knob Open Space; and Central Corridor 2017 vegetation, soil and pollinator surveys and fall conservation haying were completed. Data analysis is underway and two more citizen science workshop events at Fish Creek have been scheduled for 2018.

Overall Project Outcomes and Results:
Greening and our partners Xerces, Maplewood Nature Center, and U of MN, advanced prairie and oak woodland restoration practices for vegetation and pollinators in multi-faceted fashion. We implemented quality restorations and enhancements, and gathered 12,000 data points, analysis of which is already guiding restoration, pollinator, and engagement practices. Improvements include a successful climate-resilient approach to oak restoration; using conservation haying to benefit prairie plants and pollinators; refining our approach to pollinator refugia, overwintering and nesting needs during restoration; improving student knowledge of native plants and pollinators; implementing citizen science practices for valuable data collection and outdoor citizen engagement; increasing our understanding of native pollinators' macro- and micro- floral resource needs; improving pollinator habitat along trails; and documenting the federally endangered rusty-patched bumble bee.

Dissemination of the results is also multi-faceted and robust, underway and promising to continue beyond the grant period. This includes the publication of a bee monitoring guide for citizen science, and five presentation-ready reports; five social media outreach avenues reaching thousands; eight conference presentations reaching over 400 professionals; partnering with five local government land-owning units; and active engagement of over 1,500 citizens, including 841 K-12 students, 45 Master Naturalists, 200 citizen scientists, and 235 restoration volunteers. This program further accomplished 32 acres restored, including 6,000 bur oaks, 12,000 pollinator plants, and 45,000 milkweed seeds getting into the ground.

IV. PROJECT ACTIVITIES AND OUTCOMES:

ACTIVITY 1: Accelerated Migration of Bur Oak Ecotypes for Climate Resilience
Description: Natural colonization by adapted native plants in response to a changing Minnesota climate is hindered by lack of seed source, invasive species, and fragmented habitat. Without careful intervention, weedy invasive species could come to dominate our vegetation. Oak trees, with their low natural rate of migration, extended age to maturity, and importance to Minnesota, are especially in need of human-assisted accelerated

migration. In this study, we will complete early year growth and survival comparison of three ecotypes – local, southern, and northwestern – of bur oak *(Quercus macrocarpa)* at four metro sites to determine which if any ecotype fares better. The local ecotype acorns will originate from the 7-county metro area, the southern ecotype from 200-300 miles south (e.g. Des Moines, IA) and the northwestern ecotype will be from North Dakota / northwestern MN area, with its temperature extremes. Dr. Lee Frelich and his students will design the study, collect growth and survival data on 2000 stems of each ecotype, analyze the results, and write a report. Greening will collect (either directly or through purchase) and germinate acorns from verified sites; plant 6000 stems engaging 150 volunteers; fence (contracted services) and manage the plantings (using a mix of staff and contracted services); and produce informational materials for restoration practitioners based on the results. Verifying acorn collection sites will include driving to the out-of-state collection sites to photograph, take coordinates, and determine authenticity of wild-grown trees.

All data will be statistically analyzed and a report prepared for conference presentation. This report will help refine oak planting to help ensure the continued success of oak community restorations.

Summary Budget Information for Activity 1:

ENRTF Budget: $ 201,118
Amount Spent: $ 195,467
Balance: $ 5,651

Outcome	Completion Date
1. Early year growth and survival by oak ecotype determined; report written and prepared for publication/presentation	5/1/18
2. Informational materials for restoration practitioners prepared for distribution/presentation	6/30/18

Activity Status as of February 1, 2016:
Several bushels each of bur oak (*Quercus macrocarpa*) acorns from Des Moines IA, Minneapolis MN, and Roseau MN were procured, and then sown at the DNR Badoura Nursery. Collection coordinates have been collected and photo-documentation of the source trees scheduled for this winter.

A subcontract to University of Minnesota for the research services of Dr. Lee Frelich has been fully executed.

Activity Status as of August 1, 2016:
In the spring and summer, we completed an extensive review by Greening, landowners, and U of M, of potential planting/study sites for the bur oak ecotype research, and ultimate choice of sites. The updated site selection is summarized in the table above. Sites were chosen to minimize confounding variables between sites and will consist of bur oak planting into grassland sites this fall. Site prep, herbivory protection, and installation are scheduled in time for October plantings.

Documentation of the acorn source trees were completed this winter. DNR Badoura Nursery has confirmed germination of Des Moines and Roseau acorns, but for reasons yet to be determined does not have a planting bed for the Minneapolis acorns. We will use Rice Co. seedlings that Badoura was growing independently but following the same procedure, if these Minneapolis source trees cannot be located.

Activity Status as of February 1, 2017:
The bur oak propagation seedling lots were photo-documented at the DNR Badoura nursery, and the 6000 bur oaks shortly thereafter were received and planted throughout the four (4) planting sites, in fall 2016. Height measurements were started until snow accumulation forced the end of that activity; the remaining measurements are scheduled for March 2017. Advanced drafts of Introduction, Background, Research Design, and Methods sections of the research write-up were completed.

A total of 102 volunteers, including 51 youth, were engaged in the planting.

Activity Status as of August 1, 2017:
Baseline data was collected in the spring and first year growth data collection is underway. Permanent deer and rabbit protection fencing installation has been delayed due to unexpected expense, but is on schedule for installation this fall.

Activity Status as of February 1, 2018:
First year growth/survival data collection was completed by University of MN Dr. Lee Frelich and his student in fall 2017. Permanent deer and rabbit protection fence installation is complete at three sites; the fourth site will not to be fenced due to low deer pressure.

Final Report Summary:
Data from the fall 2017 and fall 2016 growth measurements were tabulated and analyzed, and a summary report for presentation completed (Accelerated Migration of Bur Oak Ecotypes for Climate Resilience. Frelich, L and Toot, R. 2018). This report outlines the study methods and analyzes 10,000 data points in detail, and identifies some significant differences in height between local, southern, and northwestern ecotypes. Beyond the significance found in these first years of early growth/early survival data, this activity and report sets up the baseline data for medium- and long-term research results, capturing the response of three bur oak ecotypes to climate over different time periods. A final report has been written and submitted, and disseminated; data collection by the U of M has continued past the grant period.

Bur oak, with its slow growth and natural rate of migration and habitat importance, is one of the most important tree species in Minnesota to plant and monitor. Beyond the significance of the research, five old fields in four different natural areas have been restored to oak woodland with 6000 bur oak seedlings planted and protected.

A total of 137 volunteers assisted with the planting and surveying of these oaks, receiving information about the project.

ACTIVITY 2: Citizen Engagement for Pollinator Habitat Restoration and Monitoring
Description: Pollinators are keystone species in prairies and woodlands, sustaining wild plant communities that in turn provide food and shelter for a myriad of other wildlife. Despite the recognized importance of pollination services, there is a rapidly growing body of evidence that both wild and managed pollinators are in serious decline, including several bumble bee species in Minnesota that have declined precipitously in recent years.

Vegetation restoration and pollinator management are intricately related. In order to merge the best science from both fields, and also have a broad public impact stemming from today's unprecedented public interest, we will form a working partnership between Greening, Xerces Society for Invertebrate Conservation, and Maplewood Nature Center each with their respective expertise. This collaboration will provide a suite of engagement opportunities for citizens to actively learn about pollinators, restoration, and their relationship, including citizen science monitoring to K-12 school outings with expert interpretation, to restoration volunteer opportunities, ranging from plugging of pollinator-friendly prairie plants to bumble bee surveys at restored sites.

Pollinator monitoring by citizens, students, volunteers and experts will focus on bees. Bees are an amazingly diverse and very important group of insects, yet they remain poorly understood by the general public. When most people hear the word "bee," a single species comes to mind, the European honey bee. However, in Minnesota, there are more than 350 species of native wild bees, including many extremely important pollinators of crops, wildflowers and trees. Most of these 350 species can only be identified by specialists. However, with a little practice and guidance, volunteer citizen scientists can learn to identify the most common bee species and "species-groups" found in Minnesota. Since research has found that the diversity measured by easily identifiable species-groups correlates with the more robust, species-level data collected by bee experts, the approach of measuring diversity of easily identified bees is expected to give an accurate measure of local bee community structure, status, and responses to habitat enhancement.

Citizen science is increasingly recognized as a valuable tool for generating meaningful scientific data and understanding of the distribution and conservation needs of pollinators. In addition, citizen science, like volunteering and interpretation, serves to increase participants' science literacy, environmental stewardship, and connections to nature and place. By developing and implementing pollinator citizen-science programs at restored sites in the metro area, this project will engage and educate participants about Minnesota's diverse pollinators and restored habitats. At the same time, valuable data on both the diversity and abundance of bees that are present on restored habitat, and how the composition of those pollinators change over the course of restoration, will be generated. Potential uses for this data include: quantifying the effectiveness of restoration efforts to promote pollinator populations; understanding the pollinator requirements of wild flowers dependent on insect pollinators; potentially documenting the occurrence and habitat of rare pollinators; and, simply, identifying the types of bees present on a particular site.

Fish Creek Open Space

At Fish Creek Open Space, a robust program with restoration, outreach, and citizen-science initiatives will accelerate the restoration of pollinator habitat in these recently restored prairie habitats; monitor the pollinator community; gather valuable bumble bee data; document relationships between pollinators, floral resources and restoration; and engage K-12 school children and the general public through outreach and citizen science.

Xerces will lead the pollinator and bumble bee monitoring including a 150-person citizen science program, and submit data to web-based Bumble Bee Watch. Maplewood Nature Center will lead and design an interpretation program for 800 distinct K-12 east-metro students and others, engaging each of them in two or more of the following activities: pollinator observation, catch-and-release insect capture, bee photography, and habitat restoration. Greening will conduct focused pollinator habitat restoration, including plugging pollinator-friendly forbs with 50 volunteers. During all citizen engagement activities, the tie-in between restoration practice and pollinator management will be explored, and results and processes shared.

For the 150-person citizen science program, in addition to the activities above, we will:

- Conduct onsite education and outreach to school groups and families about native plant restoration, pollinator conservation, and kid-friendly citizen science projects (Maplewood)
- Conduct four specialized training courses for the more serious participants, on pollinator and native plants, and the relationship between the two. Trainings will cover plant and pollinator symbiosis, biology, identification, conservation, habitat restoration, and introduction to a continental citizen-science monitoring project: Bumble Bee Watch (http://bumblebeewatch.org/) (Great River Greening, Xerces, Maplewood).
- Conduct six public surveys/monitoring for bumble bees and other pollinators in the restored and remnant areas of the site (Xerces, Maplewood)
- Develop a Minnesota Citizen Science Pollinator Monitoring Guide including a photo guide to MN bee groups, monitoring protocols, and sample data sheets. Incorporate this tool in the specialized training courses; school group outreach; and public monitoring (Xerces)

Pilot Knob Hill

At Pilot Knob Hill, Greening will monitor vegetation (using contracted services) including spring forbs and bloom coverage, and soil nitrogen levels (staff will collect while contracted services will analyze), and further restore pollinator habitat by plugging pollinator-friendly plants with 50 volunteers. At the same time, Xerces will implement spring-to-fall bumble bee monitoring including focused searches for the rusty-patch bumble bee and other rare Minnesota species.

Bumble bee surveys will be conducted throughout the study period, with special attention to diversity, abundance, floral preferences, nesting habitat, and the presence/absence of declining species that have a high likelihood of encounter. In an effort to capture the maximum diversity of bumble bees on site, pollinator monitoring will be conducted three times per year for the duration of the three year study, engaging and

training 50 volunteer citizen scientists over this time period. All floral associations will be recorded during the surveys. Since many bumble bees are large and readily identifiable to species in hand from photos, catch-and-release methods will be employed

During all citizen engagement and volunteer activities, the tie-in between restoration practice and pollinator management will be explored, and results and processes shared. Data will be evaluated, and a case study report prepared.

Summary Budget Information for Activity 2:

ENRTF Budget: $ 117,395
Amount Spent: $ 112,533
Balance: $ 4,862

Outcome	Completion Date
1. 1,100 citizens engaged, including 800 K-12 students	6/15/18
2. 3 yr of bumble bee, vegetation, and soil N monitoring and pollinator habitat at Pilot Knob Hill completed, data reported.	6/30/18
3. 3 yr Citizen Science monitoring program, pollinator habitat restoration at Fish Creek completed, data reported	6/30/18

Activity Status as of February 1, 2016:
The Fish Creek K-12 program launched in September 2015 with five classes visiting the site. Each class received two hours of preparation in the classroom; and spent about 3.5 hours at the site surveying and identifying pollinators, hiking, and planting a total of 1100 pollinator plugs. The classes included three fourth grade classes totaling 65 and 10 teachers and chaperones from Harambee Elementary School in Maplewood; and two seventh grade classes totaling 32 students plus 5 adult chaperones from Crosswinds Art and Science School in Woodbury.

The first session of specialized adult training "Bee-come a Bee Monitor" was held on September 12 and 13. The 26 participants learned about bee identification and monitoring in this nine-hour workshop: interest in the specialized training is very strong, and includes a wait list. This training was followed by the pilot monitoring visit the following day during which these trained adults set up five transects and collected data at Fish Creek. An advanced draft of the 'Upper Midwest Citizen Science Monitoring Guide: Native Bees' was developed by Xerces Society and then distributed and field tested at the two-day training.

Bumble bee surveys were conducted at Pilot Knob Hill in July, August, and September engaging over 40 volunteers. During the process, 423 bumble bees were identified and released, representing seven different species including one rare species, *Bombus fervidus*. This species was recently identified by International Union for Conservation of Nature (IUCN) as vulnerable to extinction (http://www.iucnredlist.org/search), based on range and relative abundance declines in recent years. One cuckoo bee species, *Bombus citrinus*, was observed, which may be a signal of ecosystem heath, since cuckoo bees can be highly specific in terms of the bee hosts which they will cleptoparasitize. Over 400 floral associations were documented. All volunteers were engaged in planting prairie smoke (*Geum triflorum*) plugs in the mowed shoulder of a gravel hiking trail, to improve habitat and provide active learning experience about 'bee lawn' habitat in mowed areas.

Activity Status as of August 1, 2016:
In May and June, Maplewood Nature Center led outings for 10 fourth grade classes at the site Each class received two hours of preparation and pollinator education for the fish creek field trip in the classroom; and spent about 1.5 hours at the Fish Creek site, hiking the site, and planting a total of 2000 prairie wildflowers in the seeded prairie restoration. A total of 270 K-12 students were engaged in the process along with 32 adult chaperones. Greening hosted two corporate group events during this period, engaging another 145 volunteers (13 trained Volunteer Supervisors and 132 corporate volunteers) in restoration and management of the site. These volunteers planted 6000 plugs, removed invasive species, and received a roving presentation on pollinators and habitat.

To begin the second year of citizen monitoring at Pilot Knob Hill, a bumble bee survey was conducted engaging 18 volunteers. A total of 104 bumble bees comprising 6 different species were recorded at the site. Two species were detected that had not previously been documented from the site: the American bumble bee (*Bombus pensylvanicus*) and the rusty-patch bumble bee (*Bombus affinis*), both threatened species that have been in serious decline in this region and elsewhere; a third rare species was documented at the site in 2015, yellow bumble bee (*Bombus fervidus*). The presence of these three rare species at Pilot Knob Hill is of great significance to conservationists trying to understand the distribution and needs of these species, and will inform the management of the site going forward. Also as part of the citizen monitoring, over 100 floral associations were documented., and all volunteers planted wild strawberry (*Fragaria virginiana*) plugs in the mowed shoulder of a gravel hiking trail, to improve habitat and provide active learning experience about 'bee lawn' habitat.

Soil nitrogen samples were taken under a different allocation and included a control plot dominated by Canada goldenrod. The soil nitrogen sampling will be expanded during the remainder of the 2016 growing season to include comparisons between mowed and unmoved habitat; forb rich vs forb poor areas; and Canada goldenrod dominated areas vs grass dominated.

Activity Status as of February 1, 2017:
At Fish Creek, Greening conducted focused pollinator habitat restoration, including plugging 288 pollinator-friendly grasses and forbs, and planting 75 early-flowering shrubs with 69 general volunteers including 17 youth, exceeding our general volunteer deliverable.

Maplewood and Xerces completed a specialized pollinator identification training for over 40 attendees, in September 2016, recruiting primarily from Minnesota Naturalists Association, which included a classroom and a field component. Maplewood continued with recruiting school groups for pollinator education days at for Fish Creek for spring 2017. The fourth specialized training, focused on pollinator overwintering habitat/refugia, is being developed for winter 2017-18; a bumble bee survey is being developed to supplement the sustained pollinator transect monitoring.

The second and third 2016 citizen science bumble bee surveys were held at Pilot Knob, one open to the public and one held for experienced Greening volunteer supervisors. These surveys engaged a total of 23 citizen scientists and continued with the innovative non-lethal bumble bee survey protocol developed by Xerces, and included active trail shoulder habitat enhancement with plugging of early blooming, short-stature forbs.

Reported in the August 1, 2016 update, the rusty-patch bumble bee (*Bombus affinis*) was documented in July 2016 at Pilot Knob. Since then, this species has been approved for listing as a federally endangered species. Given this listing and the presence of two additional rare bumble bee species at Pilot Knob, Greening worked with Xerces and Colleen Satyshur, Research Coordinator, Department of Ecology Evolution and Behavior, University of Minnesota (as a follow through activity from the "*2016 LCCMR pollinator projects meeting*") to expand and sharpen bumble bee over-wintering refugia guidelines and specifications; these were implemented when Greening conducted woody encroachment removal at Pilot Knob (2016 appropriation) this past winter.

Activity Status as of August 1, 2017:
A total of 273 K-12 students, from 13 classrooms at 5 schools, and 33 adult chaperones, participated in the Fish Creek pollinator activities during spring 2017. Students participated in classroom preparation, field activities, surveys / monitoring, and restoration activities.

Pilot Knob Hill bumble bee survey was completed in July with an additional species documented; August and September surveys are scheduled.

Activity Status as of February 1, 2018:
Fish Creek Open Space: A total of 112 students and teachers from Carver Elementary participated in Fish Creek pollinator activities with Maplewood Nature Center and Greening on September 26 and September 27. On September 28, 21 Century College students volunteered for a planting event, and on October 19, 48 3M employees and 6 volunteer supervisors planted plugs for pollinators at Fish Creek Open Space. The final 2 of 6 total public monitoring events for bumble bees and other pollinators were completed at Fish Creek this summer and fall. Maplewood, Xerces, and Greening staff are planning the final citizen science workshop for April 2018, which will educate adult learners on winter pollinator habitat, followed by dissemination at a Fish Creek Bioblitz in June 2018.

Pilot Knob Open Space: Greening, Xerces Society, and U of MN Bee Lab held citizen science bumble bee surveys on July 14, August 25, and September 15 at the Pilot Knob Hill site. These public events were attended by 16, 17, and 12 volunteers respectively, and included bee identification (the red-belted bumble bee (*Bombus rufocinctus*) was added to the site list) and training, and active education about 'bee lawn' habitat, which guided the volunteer pollinator forb planting of calico aster (*Symphyotrichum lateriflorum*), ground plum (*Astragalus crassicarpus*), pussytoes (*Antennaria neglecta*), longleaf bluets (*Hedyotis longifolia*), and blue-eyed grass (*Sisyrinchium campestre*). In addition, 11 volunteers (3 adults and 8 youth) from Boy Scout Troop #264 planted 200 forbs/grasses on October 15, 2017. The citizen science bumble bee surveys are now complete and data analysis is underway.

Final Report Summary:

Fish Creek Open Space

Partners co-hosted the sixth and final citizen science workshop in April, 2018 that trained adult learners on creating and managing nesting and overwintering bee habitats; and led 38 volunteers for the Fish Creek Bioblitz in June, 2018. Participants included 28 adults and 5 youth, resulting in observations of 232 different species .

A total of 156 adults received specialized pollinator training, including 45 Master Naturalists; 6 adults sustained their effort to conduct transect surveys on prairie remnant, prairie restorations, and old field all at this one location. This included the development and use of a new guide, Xerces' Upper Midwest Citizen Science Monitoring Guide Native Bees.

A total of 841 K-12 students were reached with both a classroom and field component; through testing these students exhibited statistically significant gain in native pollinator and native plant identification skills. An additional 71 people received interpretive information through the bio-blitz and grand opening. Another 224 adults volunteered for pollinator habitat restoration, and received pollinator/plant interpretation. These adult volunteers, and the K-12 students, planted a combined total of 11,800 pollinator plugs/pots, and 75 pollinator shrubs, and released 45,000 milkweed seeds in our first-ever 'pod cast'.

The Monitoring Guide has been put to use on other projects and will continue into the future. This guide employs a non-lethal method appropriate for surveying sites hosting our native federally endangered rusty-patched bumble bee. Participation in this program for the professionals as well as the citizens has raised pollinator awareness and knowledge on a suite of avenues. The transect survey results indicated that 'old field' may play an important role in pollinator refugia during the restoration process, allowing pollinators to re-colonize a nearby prairie reconstruction after site prep and seeding. The workshop on nesting and overwintering habitats indicate a potential positive effect for stem nesters with conservation haying, mowing, and grazing; as well as the need for woody debris refugia during winter removal, all of which will help increase pollinator habitat value during prairie management.

Pilot Knob Hill

The nine survey, 3-year bumble bee survey data analysis was completed, including floral associations and blooms, and a presentation-ready report made. Soil nitrogen data did not prove to have analytical value.

A total of 122 citizens volunteered for the nine bumble bee surveys over 3 years, collecting over 800 bumble bees, spanning ten species including federally endangered rusty-patched bumble bee and two additional rare species, along with floral associations and surveys; and planted 395 pollinator forbs focused on 'bee lawn' species in the mowed trail shoulder. In addition, 11 Boy Scouts volunteered and planted an additional 200 plugs, for a total of 595 plugs and 133 volunteers. The bee survey, plant identification, and habitat restoration activities proved to be engaging and educational for the volunteers.

These same survey methods are now being employed on additional sites, with the intent of making bumble bee surveys a frequent component part of overall site surveys. Bumble bees have proven to be a readily identified group, are a very important group of pollinators, and are considered indicative of the total pollinator population.

Bloom associations will guide future management of this site, making sure to retain sufficient populations of the visited species. Furthermore, the trailside plantings are being monitored for establishment, to add to the growing body of knowledge on appropriate, successful native bee lawn species, in this case on the mowed shoulder of a recreation trail.

ACTIVITY 3: Prescribed Haying for Pollinators and Prairie

Description: At Central Corridor, a restored prairie site in the metro area, Greening will implement haying as a restoration and management tool, collect data on plant diversity, spring forbs, bloom coverage, and soil nitrogen levels on hayed and un-hayed (control) plots.

Haying will be led by Greening and implement by a local service provider during the first two weeks in August on five plots, the timing of which follows traditional prairie haying practices and nesting bird guidelines, and with the expectation that it will promote cool-season forbs over mesic warm-season grasses. Five plots of four to five acres each will be hayed, with five un-hayed control plots of similar size and composition and moisture gradient. Nitrogen samples will be collected by Greening staff in late April with 20 total soil samples in each unit. Soil samples will be collected by staff across a transect traversing the long center of each individual unit, with analysis by a qualified lab. Vegetation samples will be collected across the same transect by staff, using ten 1-square meter quadrats. Quadrats will be analyzed for presence-absence, cover, and bloom cover, in early June, mid-July, and late September.

Since floral variables alone give an incomplete assessment of the effectiveness of prescribed haying as a prairie management technique, another component of this study, led by Xerces, will examine pollinator abundance, diversity, and floral interactions in hayed and control plots. Haying methods will be designed to minimize direct and indirect negative effects to pollinators, e.g., by mowing as late as possible after peak bloom while still meeting farmer hay-quality objectives, and by haying in a patchy matrix leaving uncut areas that provide food and nesting resources for bees throughout the entire season. Anticipated benefits of haying to pollinators include higher diversity and abundance of forbs during the spring season when nectar and pollen is most limited; lower abundance of nitrophilic forb species; higher forb-to-grass ratio; and reduced thatch/easier access to soil for ground nesting bees.

Pollinator monitoring will be conducted every three to four weeks from May to September, weather permitting, for the duration of the study. Surveys will consist of timed visual transect walks using sweep nets to collect/record all pollinating insects in flight or on vegetation/flowers in designated survey areas of control and test plots. All flower associations will be recorded. Catch-and-release methods will be used when possible for large, readily identifiable insects such as many bumble bees and butterflies. All collected insects will be curated and identified to the lowest practical taxonomic level.

All data will be statistically analyzed and a report prepared for conference presentation. This report will help refine haying as a prairie management tool in Minnesota, for its effects on both plants and pollinators, particularly in the metro area.

Summary Budget Information for Activity 3:

ENRTF Budget: $ 81,487
Amount Spent: $ 69,761
Balance: $ 11,726

Outcome	Completion Date
1. Effect of prairie haying on floristic diversity, soil N, pollinators at Central Corridor determined. Report written, prepared for presentation/publication.	6/30/18
2. Informational materials for restoration practitioners prepared for distribution/presentation	6/30/18

Activity Status as of February 1, 2016:
Baseline data was collected on vegetation, soil Nitrogen and pollinators. A service contract was executed and the first rigorous haying treatment conducted, followed by 3 more sample periods. All baseline data was

collected; spring 2016 is the first season when noticeable differences between hayed and un-hayed plots are anticipated.

Activity Status as of August 1, 2016:
At Central Corridor Conservation Haying project, two pollinator surveys and two vegetation surveys were completed in the last six months. The results of the pollinator surveys by Xerces Society are pending, with data analysis scheduled for the dormant season. Vegetation surveys were conducted by Greening staff. The first survey showed twice as many blooms in hayed versus non-hayed treatments. The second vegetation survey, which is focused on soil nitrogen and its relationship to plant diversity and invasive species, has been completed and data analysis is pending. Summer 2016 haying is expected to begin in August.

Activity Status as of February 1, 2017:
At Central Corridor, haying was conducted for the second year on select research areas. The vegetation was clipped and material removed, creating improved conditions for low-stature, early blooming forbs for spring 2017. The timing was delayed and less than ideal for nitrogen removal, due to high amounts of precipitation and wet soil conditions at the more desirable time period. The sub-contractor list for the 2017 haying RFP has been expanded.

Soil nitrogen surveys were conducted in December and showed no significant difference between hayed and un-hayed plots. Further review of the 2016 vegetation survey data revealed significant gaps in the data collection; Greening has since changed site managers for this activity and has designed a more rigorous survey for 2017.

Xerces compiled the baseline pollinator data from 2015 and reported on it at the "*2016 LCCMR pollinator projects meeting*". Xerces collected 2016 pollinator data over the growing season.

Activity Status as of August 1, 2017:
For the period ending June 30, pollinator soil and vegetation surveys were completed for May and June. Data has been collected, including soil analysis by U of M soil lab, and tabulated. Analysis will occur during the dormant season. Additional surveys are scheduled for July and August.

A haying subcontractor has been chosen and formal agreement expected to be signed in August. Maintenance by Greening crew is ongoing and included mowing of a large patch of non-native invasive Canada thistle and wild parsnip, in one of the hayed units shortly before the July survey. Affected data was noted.

Activity Status as of February 1, 2018:
At Central Corridor, conservation haying was conducted in fall 2017 for the third year on select research areas. The prairie vegetation was clipped and material removed, creating improved conditions for low-stature, early blooming forbs, and possibly affecting soil nitrogen levels.

Vegetation, soil, and the final pollinator surveys were completed in August and September. Xerces Society completed a draft report of monitoring findings at Central Corridor, detailing observed floral associations of pollinators, bumble bee community structure, monarch nectar plant associations, and monitoring implications. These findings suggest that May, June, July, and August should be prioritized for native bee monitoring, due to the highest diversity, abundance, and relative abundance of native bees on flowers at these times. Transect data regarding the impact of conservation haying on floral diversity and bloom coverage was collected and will continue into the spring; analysis of the relation between hayed and un-hayed for pollinator abundance is underway.

Final Report Summary:
Statistical analyses and reports were completed on pollinator, vegetation, and soil nitrogen surveys.

A profile of native pollinator visitation to the site by month was completed, identifying key months for native bee surveys, key monarch nectaring sources, and key floral resources. The profile also revealed a lack of floral resources in June. These findings will guide or restoration of an adjacent prairie, directing us to emphasize June

floral blooms in that restoration, to complement the otherwise robust pollinator forb resources in the prairie that was studies.

The haying study revealed that haying resulted in significantly more forb coverage, and significantly higher forb:grass ratio, than un-hayed units. Additionally, the pollinator study observed an increase in native bee abundance and diversity in hayed units for the month of May. Soil nitrogen analyses did not identify any significant changes as a result of haying. Overall, haying appears to be an appropriate tool for periodic thatch removal and disturbance, to which prairies are adapted, and may promote earlier floral resources for pollinators. Combined, these analyses will guide the management of this prairie for the combined benefits of forbs and pollinators, and expand into guiding management of other sites.

V. DISSEMINATION:
Description:
Greening anticipates periodic reporting on this project through our various electronic media outlets: The Greening monthly e-newsletter (reaches 7,000) (subscribe at www.greatrivergreening.org); Facebook (900 likes) (Like us on Facebook https://www.facebook.com/greatrivergreening); and Twitter (400 followers) (Follow us on Twitter https://twitter.com/greatrivergreen)

Periodic reports may also appear on:

- The U of MN Center for Forest Ecology web page is found at http://cffe.cfans.umn.edu/index.htm
- Maplewood Nature Center website: www.maplewoodnaturecenter.com; newsletter Maplewood Living: Seasons Environmental Insert (http://www.ci.maplewood.mn.us/index.aspx; Type in "Seasons" in the search box); Facebook (https://www.facebook.com/pages/Maplewood-Nature-Center/121697461192602?fref=ts); Maplewood Review : http://www.bulletin-news.com/ramsey-co-maplewood-review
- Xerces Society for Invertebrate Conservation e-newsletter (subscribe at www.xerces.org); Wings magazine (subscribe at www.xerces.org); Facebook (https://www.facebook.com/pages/Xerces-Society/111872242162708?fref=ts) and Twitter (https://twitter.com/xerces_society) and web page (www.xerces.org).

Results will be shared with colleagues including the Metro Conservation Corridors partnership. Some of the data collected will be input into a continental database, in addition to being shared with local pollinator experts. Deliverables include preparing reports and slideshows for eventual publication and/or presentation. Publications and presentations will likely occur after the grant period.

Status as of February 1, 2016:
Greening featured the bumble bee survey at Pilot Knob in our September 2015 e-news (now reaching 7200 subscribers), and then posted the story on our website (http://www.greatrivergreening.org/bee-aware/). Greening also featured the work in three Facebook posts (now at 1200 likes).

Greening, Xerces, and Maplewood Nature Center co-presented at the "Fall 2015 LCCMR Pollinator Projects Update Meeting". Activities and results to date were presented to approximately 20 colleagues, and the draft 'Upper Midwest Citizen Science Monitoring Guide: Native Bees' was distributed for review and comment.

Status as of August 1, 2016:
One public and two private volunteer events were held at Central Corridor during this period. At these events, volunteers received a presentation on the conservation haying activities underway. Greening featured volunteer events at Fish Creek and Pilot Knob in three Facebook posts (now at 1300 likes). The Xerces Society featured the July 2016 bumble bee survey at Pilot Knob in a blog post: http://www.xerces.org/blog/two-rare-species-spotted-during-minn-bumble-bee-survey/.

Status as of February 1, 2017:
On July 18, 2016 Greening ecologist Stephen Thomforde presented on "Biomass Harvest via Haying" employed at Central Corridors, at the North American Prairie Conference, with 380 conference attendees and approximately 60 presentation attendees.

On December 5, 2016, Laura Gould, Greening intern and Macalaster College student, presented a poster highlighting the bur oak accelerated migration project (Activity 1). The presentation was attended by approximately 50 attendees, primarily students, staff, and professors.

During fall 2016, volunteer events at Allemansrätt Park, Pilot Knob, Fish Creek, and Central Corridor were publicized via 9 emails to Greening's e-list (about 8,500 subscribers), Greening's Facebook page (over 1,400 likes), Twitter (nearly 600 followers), a community outreach event (PolliNATION Festival, Sept 11, 2016), and about 280 fliers distributed to community members.

Fall volunteer events involved 141 adult general volunteers, 69 youth volunteers, and 19 trained volunteer supervisors. Volunteers included members of the general public, public and private organizations, school groups, and private institutions. All volunteers received a 'roving presentation' with visual aids on the project, restoration activities, and site in addition to training on the day's restoration activities; volunteer supervisors received this information in written format as well to prepare them to receive and answer questions.

On December 7th, 2016, Greening, Xerces, and Maplewood co-presented and participated in the "*2016 LCCMR pollinator projects meeting*", and continued with follow-up to afternoon break-out sessions.

Status as of August 1, 2017:
During Spring 2017, two press articles disseminated information about the projects (but without Trust Fund recognition despite our written efforts): On May 30, 2017, an article highlighting Greening's related study on accelerated migration of bur and white oaks was published by St. Thomas (http://www.stthomas.edu/news/measuring-future-minnesotas-trees-climate-change/). On March 21, 2017 the Star Tribute published an article highlighting the rusty patched bumble bee identified at Pilot Knob (https://www.greatrivergreening.org/bumblebee-endangered/). Both were shared on Greening's website (approximately 1,500 views per month), Facebook page (over 1,400 likes), Twitter (over 600 followers).

On March 9, 2017 the *Best Practices for Pollinators in the Real World Summit, for Minnesota Counties, Municipalities, Leaders,* with 150 attendees, highlighted work at these projects: 1) A presentation by the Xerces Society noted the rusty-patch bumble bee identification at Pilot Knob, along with only two additional recent records in Minnesota; 2) The non-lethal capture technique used at Pilot Knob Hill was mentioned specifically during a monitoring training session led by Dakota County.

Status as of February 1, 2018:
On November 11, 2017, Maplewood Nature Center naturalists Kayla Wolfe, Oakley Biesanz, and Ann Hutchinson presented at the MN Naturalists Association Annual Conference, sharing the PowerPoint on native bees and reviewing K-12 students' pre-assessment and post-assessment response to measure the efficacy of the three-year pollinator education program at Fish Creek Natural Area. The conference break-out session was delivered to 7 naturalists; presenters recognized the Trust Fund during the presentation. At the conference the previous year, Maplewood Nature Center interpretive naturalist Oakley Biesanz presented "Bumble Bees and Wanna-Bees," sharing bee education activities, geared to 4-6th graders, to 35 attending naturalists; presentation included Trust Fund recognition.

Fall volunteer events at Pilot Knob and Fish Creek Open Space involved 113 adult volunteers/participants, 124 youth, and 6 trained volunteer supervisors; volunteers included members of the general public, public and private organizations, school groups, and private institutions. Events were publicized/volunteers were recruited via 18 emails to Greening's e-list (about 8,500 subscribers), posts to Greening's Facebook page (over 1,400 likes), and 530 volunteer recruitment fliers (with LCCMR ENRTF reference and logo) were distributed at service and volunteer fairs in summer/fall 2017. In addition, 7 emails were sent to Greening's volunteer supervisors (about

350 subscribers) and 6 supervisor packets containing project information were distributed to volunteer event supervisors.

Final Report Summary
Greening, Maplewood Nature Center, and Xerces presented at the March 2018 'LCCMR Pollinator Projects Update Conference' hosted by the Cariveau Bee Lab at the U of M. A total of 47 people attended representing 15 organizations.

Accelerated Migration of Bur Oak Ecotypes for Climate Resilience: Final Report by Frelich, L and Toot, R. will be posted on the U of MN Center for Forest Ecology web page. Greening and our four lgu land-owning partners, have a vested interest in the success of these oak restorations and will remain keenly attuned to the results, thereby guiding future plantings.

The table below summarizes the Dissemination outputs by type:

Description:	Metrics:
Presentations: • Greening, Xerces, and Maplewood Nature Center presented at three annual *LCCMR Pollinator Projects Update Conferences* hosted by the U of M's Cariveau Bee Lab (est. 100 attendees total). • Greening presented on 'Biomass Harvesting via Haying' featuring the Prescribed Haying for Pollinators and Prairie activity, at the *2016 North American Prairie Conference* (60 attendees). • A Greening intern presented a poster highlighting the bur oak accelerated migration project at the December 2016 *Macalaster College student intern poster presentation*. (50 attendees) • Xerces highlighted bumble bee and floral resources monitoring at Pilot Knob, including the Citizen Science Monitoring Guide, at *Best Practices for Pollinators in the Real World Summit, for Minnesota Counties, Municipalities, Leaders* (150 attendees) • Maplewood Nature Center presented at two MN Naturalists Association annual conferences, presenting on the student engagement at Fish Creek Natural Area. (42 attendees), and regularly integrated the findings into programming	Activities and results were presented in-person to over 400 people.
Media : Greening featured the Pilot Knob bumble bee survey in September 2015 monthly e-news; results were posted on website and Facebook page. An article on the related, previously-funded accelerated migration of bur and white oak study was posted by the University of St. Thomas (Measuring the Future of Minnesota's Trees). A Star Tribune article on the rusty patch bumble bee highlighted a photo of the specimen documented at the Pilot Knob site. Star Tribune: Rusty patched bumblebee first of species called endangered. Both articles were subsequently posted to Greening's e-news and website.	

A feature article on the findings at the Pilot Knob Bumble Bee surveys is posted on the Xerces web page: Two Rare Species Spotted During Minnesota Bumble Bee Survey *Accelerated Migration of Bur Oak Ecotypes for Climate Resilience: Final Report* by Frelich, L. and Toot, R. is scheduled to be posted on U of MN Center for Forest Ecology web page	
Active Engagement and Recruitment: A suite of citizen participation, including K-12 field trips, citizen science monitors, professional training, public and private volunteer groups was an integral part of the dissemination of results as well as program deliverables (reported above), , Recruitment for citizen participation, which included brief descriptions of the activities and proper acknowledgement, reached > 30,000 citizens many of them more than once. Greening recruited volunteers for the Pilot Knob bumble bee surveys once per year as part of overall volunteer recruitment, via social and printed media as part of our larger event recruitment, and Maplewood Nature Center recruited participants for the citizen science training several times per year.	Over 1550 citizens, including 841 K-12 students and 712 volunteers participated in this program. Greening social media outreach includes 8,500 e-newsletter subscribers, >680 Twitter followers, and Facebook (>1600 likes). Maplewood Nature Center and Xerces Society conducted outreach via social media, printed material, and networking; >20,000. Greening distributed approximately 750 hard copy flyers recruiting volunteers for the Pilot Knob bumble bee surveys, at an estimated 15 outreach events and other avenues.
Publications and Reports: *Accelerated Migration of Bur Oak Ecotypes for Climate Resilience: Final Report* by Frelich, L. and Toot, R. Xerces' Upper Midwest Citizen Science Monitoring Guide Native Bees pdf. Maplewood Nature Center's Fish Creek Pollinator 4-8 Program ppt Xerces' *Citizen Engagement for Pollinator Monitoring: Bumble Bee Monitoring Final Report 2015-2017 Pilot Knob Hill* Xerces' *Prescribed Haying for Pollinators and Prairie: Pollinator Monitoring Final Report 2015-2017* Greening's *Prescribed Haying for Pollinators and Prairie: Response of vegetation and soil nitrogen to haying in a restored prairie Final Report*	

VI. PROJECT BUDGET SUMMARY:

A. ENRTF Budget Overview:

Budget Category	$ Amount	Overview Explanation
Personnel:	$ 50,960	Staff time for oversight, volunteer events, restoration implementation, procuring services, vegetation monitoring, soil sampling.
Professional/Technical/Service Contracts:	$ 302,046	100K U of M; 101K Xerces; 34K Maplewood; 74K oak fencing, watering, nursery growing, soil analysis, haying.
Equipment/Tools/Supplies:	$ 17,001	Forb and grass plugs, shrubs and trees, with individual herbivory protection; soil amendments/mulch, acorns, herbicide; fencing
Capital Expenditures over $5,000:	$	
Printing:	$ 123	Handouts, poster boards, signs
Travel Expenses in MN:	$ 4,143	
Other: Volunteer Event Expenses	$ 3,366	Approved food and beverage, tent/table/chair /toilet rentals, overnight security, gloves and safety glasses, hand tools.
Other: Out of State travel	$ 122	Travel to Iowa and North Dakota for acorn source verification, procurement
TOTAL ENRTF BUDGET:	**$ 377,761**	

Explanation of Use of Classified Staff:

Explanation of Capital Expenditures Greater Than $5,000:

Number of Full-time Equivalents (FTE) Directly Funded with this ENRTF Appropriation: 1.1

Number of Full-time Equivalents (FTE) Estimated to Be Funded through Contracts with this ENRTF Appropriation: 3.2 (including graduate student)

B. Other Funds:

Source of Funds	$ Amount Proposed	$ Amount Spent	Use of Other Funds
Non-state			
South Washington Watershed District (cash)	$7,800	$7,800	Central Corridor activities
Local Government Units (cash)	$8,000	$8,000	Activities at Fish Creek, Pilot Knob Hill, Allemansratt, Otter Lake
Private Corporations (cash)	$11,200	$11,200	Volunteer Events
Xerces Society (in-kind)	$1,000	$1,000	Printed materials
City of Maplewood (in-kind)	$4,500	$4,500	Staff time, materials, supplies
Ramsey County Parks (in-kind)	$1,500	$1,500	CCM crew time at Otter Lake

NFWF 2016 Monarch Conservation Fund	$12,200	$12,200	Fish Creek, Allemansratt, Pilot Knob, and Central Corridor activities
TOTAL OTHER FUNDS:	**$46,200**	**$46,200**	

VII. PROJECT STRATEGY:

A. Project Partners:

- Dr. Lee Frelich, Director, The University of Minnesota Center for Forest Ecology. Recipient of $100,000 ENRTF for research design, oversight, data collection, analysis, report preparation, for Activity 1, including graduate assistant, and undergraduate assistant(s).
- City of Maplewood Nature Center. Recipient of $34,000 for Nature Center staff, busing to/from Fish Creek for school group pollinator monitoring, interpretation, and restoration; printed materials. Activity 2.
- Xerces Society for Invertebrate Conservation. Recipient of $100,850 ENRTF funds for design and oversight for citizen science monitoring of pollinators; design, identification, curation, data collection, analysis for monitoring of pollinators in hayed vs. unhayed prairie plots; printing of materials. Activities 2 and 3.
- Metro Conservation Corridors Partnership, for planning and coordination.

B. Project Impact and Long-term Strategy:

This project will inform and guide oak restoration throughout the state. The long term strategy is for the most viable oak ecotypes to be used in restorations. Growth and survival data in later years, such as the 5 and 10 year marks, and later, of the oaks will also prove informative and useful. As such, future ENRTF proposals may be submitted for review, in addition to pursuing other funding sources.

This project will inform restoration practitioners on pollinator communities during restoration, and help guide restoration activities to promote pollinators. Collecting the same floral and pollinator data in the future (e.g. 3, 5, 10 years and beyond) will also prove informative and useful. As such, future ENRTF proposals may be submitted for review, in addition to pursuing other funding sources.

Haying is a proven prairie vegetation management tool but is rarely used in the metro area due to lack of agricultural infrastructure. This project will be a metro area demonstration of haying, inform haying practices so they can benefit pollinators, and has the potential to accelerate the development of haying into a cost-saving management and restoration practice in the metro area.

C. Funding History:

Funding Source and Use of Funds	Funding Timeframe	$ Amount
ENRTF M.L. 2009. MeCC V: Restore/Enhance Significant Habitat	7/1/09-6/30/11	$155,000
ENRTF M.L. 2011. MeCC VI: Restoring our Lands and Waters	7/1/11-12/1/14	$400,000
ENRTF M.L. 2013. MeCC VII: (Fish Creek Acquisition by FMR)	7/1/13-6/30/16	$162,000
ENRTF M.L. 2013. MeCC VII: Restoring our Lands and Waters	7/1/13-6/30/16	$208,000
ENRTF M.L. 2014. Upland and Shoreline Habitat Restoration in the Greater Metropolitan Area	7/1/14-6/30/17	$300,000
OHF M.L. 2011, 1st Special Session, Ch 6, Article 1, Sec 2, Subd. 5(d) Metro Big Rivers Habitat - Phase II (Fish Creek portion)	7/1/11-6/30/14	$ 40,000
OHF ML 2012, Regular Session, Ch 264, Article 1, Sec 2, Subd 5(b) Metro Big Rivers Habitat - Phase III (Fish Creek portion)	7/1/12-6/30/15	$176,337

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

A. Parcel List:

See Attached

B. Acquisition/Restoration Information:

1. All restoration activities completed with these fund will occur on land permanently protected by a conservation easement or public ownership.
2. The anticipated restoration outcomes for the oak plantings are that $\geq$ 33% of the planted oaks will survive and exhibit growth by the end of the grant period; that the enhanced pollinator habitat will be established; and that haying will result in a higher diversity of native prairie forbs. Management plans will include the research and monitoring designs such that management will support the research and monitoring goals of the restoration; these plans are kept electronically in project folders.
3. The pollinator habitat improvements will follow the Board of Soil and Water Resources "Native Vegetation Establishment and Enhancement Guidelines". The oak ecotype study, by its nature of comparing local ecotype to southern ecotype and northwestern ecotype, requires a research variance from the BWSR guidelines.
4. Maintenance of the restorations becomes the responsibility of the landowners after the grant period; Greening requires a statement accepting that responsibility to be signed by the landowners.
5. Greening will continue to give consideration to CCM for restoration activities, particularly their summer youth crews.
6. Identifying which techniques worked and which ones did not is a central principle to the entire project; evaluations at the end of the grant period will be completed by the Project Team. The three year evaluations will be led by Great River Greening, with anticipated participation by the research organizations given the inherent value in the 'third year' evaluation data.

IX. VISUAL COMPONENT or MAP(S):

See Attached.

X. RESEARCH ADDENDUM:

XI. REPORTING REQUIREMENTS:

Periodic work plan status update reports will be submitted no later than February 1, 2016, August 1, 2016, February 1, 2017, August 1, 2017 and February 1, 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: Metro Conservation Corridors Phase VIII - Enhancing Restoration Techniques for Improved Climate Resilience and Pollinator Conservation
Legal Citation: M.L. 2015, Chp. 76, Sec. 2, Subd. 08f
Project Manager: Wiley Buck
Organization: Great River Greening
M.L. 2015 ENRTF Appropriation: $400,000
Project Length and Completion Date: 3 Years, June 30, 2018
Date of Report: November 2, 2018

ENVIRONMENT AND NATURAL RESOURCES TRUST FUND BUDGET	Activity 1 Budget	Amount Spent	Activity 1 Balance	Activity 2 Budget	Amount Spent	Activity 2 Balance	Activity 3 Budget	Amount Spent	Activity 3 Balance	TOTAL BUDGET	TOTAL BALANCE
BUDGET ITEM	**Accelerated Migration of Bur Oak Ecotypes for Climate Resilience**			**Citizen Engagement for Pollinator Habitat Restoration and Monitoring**			**Prescribed Haying for Pollinators and Prairie**				
Personnel (Wages and Benefits)	$22,815	$22,075	$740	$26,315	$26,315	$0	$9,535	$2,570	$6,965	$58,665	$7,705
Wiley Buck, Project Manager/Ecologist: $7,924 (78% salary, 22% benefit); 4% FTE for 3 years.											
Candice McElroy, Grants Administrator: $7,000 (80% salary, 20% benefit) 5.6% FTE for 3 years.											
Rebecca Tucker, Ecologist: $8,884 (85% salary, 15% benefits); 4% FTE for 3 years											
Steve Huckett, Director of Conservation: $3,635 (90% salary, 10% benefits); 1.5% FTE for 3 years.											
Eric Ogdahl, Karli Cich; Ecological Assistants: $14,865 (est. 86% salary, 14% benefits); est. 13% FTE for 3 years											
Katie Brom, May Yang; Volunteer Managers: $8,851 (87% salary, 13% benefits); 7% FTE for 3 years.											
David Schmitz,Field Coordinator: $1,428 (86% salary, 14% benefits); 1% FTE for 3 years.											
Alex Wergrzyn, Chance Meyer; Restoration Technicians: $1,935 (93% salary, 7% benefits); 2% FTE for 3 years											
William Smith, Director of Finance: $2,857 (81% salary, 19% benefits); 1% FTE for 3 years.											
Sandy Lewis, Administrative Assistant: $1,286 (86%salary, 14% benefits). 1% FTE for 3 years.											
Professional/Technical/Service Contracts											
U of MN Center for Forest Ecology. Research Design, Oversight, Data Collection, Analysis, Report Preparation.	$100,000	$100,000	$0							$100,000	$0
Xerces Society for Invertebrate Conservation. Design and oversight for citizen science monitoring of pollinators; design, data collection, analysis for monitoring of pollinators; bee expert honorarium; printing of materials.				$38,233	$35,295	$2,938	$62,617	$62,617	$0	$100,850	$2,938
City of Maplewood. Nature Center staff, busing to/from Fish Creek for school group pollinator surveys and restoration, printed materials.				$34,000	$34,000	$0				$34,000	$0
TBD (competitive bid). Site preparation, fencing/tree caging and watering, nursery custom growing, soil N testing, vegetation monitoring, haying services.	$66,719	$65,822	$897				$8,200	$4,312	$3,888	$74,919	$4,785
Equipment/Tools/Supplies											
Acorns, plugs, shrubs/trees, soil amendments, mulch/tree mats, herbicide, fencing.	$5,500	$2,225	$3,275	$14,495	$14,448	$47				$19,995	$3,322
Restoration tools and supplies: chainsaw/brushcutter supplies and repair; flagging; herbicide sprayer; protective equipment.	$337	$147	$190	$368	$181	$187				$705	$377
Printing											
Signs, posters, large maps, volunteer handouts	$500	$50	$450	$664	$71	$593	$336	$2	$334	$1,500	$1,377
Travel expenses in Minnesota											
Mileage to/from sites, meetings, purchases	$2,775	$2,678	$97	$2,220	$1,205	$1,015	$799	$260	$539	$5,794	$1,651
Other											
Out-of-state travel to Iowa to verify acorn source, mileage	$122	$122	$0							$122	$0
Volunteer Event Expenses: 5 events (3 oak planting and 2 forb plugging). 250 volunteers total at $11/volunteer for approved food/beverage, gloves, safety glasses, boot brushes, table/chair/portable toilet rentals, hand tools; 1 tent rental ($450) for larger oak event with overnight security to protect event set up ($250).	$2,350	$2,348	$2	$1,100	$1,018	$82				$3,450	$84
COLUMN TOTAL	**$201,118**	**$195,467**	**$5,651**	**$117,395**	**$112,533**	**$4,862**	**$81,487**	**$69,761**	**$11,726**	**$400,000**	**$22,239**

Environment and Natural Resources Trust Fund

M.L. 2015 Parcel List

Project Title: Metro Conservation Corridors Phase VIII - Enhancing Restoration Techniques for Improved Climate Resilience and Pollinator Conservation
Legal Citation: M.L. 2015, Chp. 76, Sec. 2, Subd. 08f
Project Manager: Wiley Buck
Organization: Great River Greening
M.L. 2015 ENRTF Appropriation: $400,000
Project Length and Completion Date: 3 Years, June 30, 2018
Date of Report: November 7, 2018

#	Acquisition or Restoration Parcel Name	Geographic Coordinates Format: [Deg.]° [Min.]' [Sec.]" [Hemis.] Latitude	Longitude	Actual Cost	County	Site Significance	Activity Description	# of Acres	# of Shoreline Miles	Type of Landowner	Status
1.1	Bur Oak Accelerated Migration: Central Corridor	1) 44° 51' 40.284" 2) 44° 51' 44.964"	1) -92° 54' 32.364" 2) -92° 54' 39.2034"	$22,977	Washington	Prairie and Savanna Habitat	Planting and Researching Three Ecotypes of Bur Oak	2		Watershed District	Complete
1.2	Bur Oak Accelerated Migration: Fish Creek Open Space	44° 53' 49.9194"	-92° 59' 53.1594"	$13,989	Ramsey	Prairie, Savanna, Woodland Habitat	Planting and Researching Three Ecotypes of Bur Oak	0.5		Municipality and County	Complete
1.3	Bur Oak Accelerated Migration: Allemansrätt Wilderness Park	45°23'58.72"N	92°50'42.408"W	$78,646	Chisago	High quality mosaic of forest and wetland	Planting and Researching Three Ecotypes of Bur Oak	3		Municipal	Complete
	Spring Lake Regional Park	44° 42' 34.5234"	-93° 28' 19.8834"	$0	Scott	Wetland, Savanna, Woodland Habitat	Planting and Researching Three Ecotypes of Bur Oak	0		County	Not going forward
1.4	Bur Oak Accelerated Migration: Otter Lake	45° 07' 23.2"	-93° 02' 08.5"	$78,777	Ramsey	High quality mosaic of forest and wetland	Planting and Researching Three Ecotypes of Bur Oak	4		County	Complete
2.1	Fish Creek Open Space	44° 53' 46.7952"	-93° 0' 9.831"	$86,964	Ramsey	Prairie, Savanna, Woodland Habitat	Pollinator-Friendly Plugging and Monitoring Pollinators, Vegetation	0.5		Municipality and County	Complete
2.2	Pilot Knob Hill Open Space	44° 52' 52.2876"	-93° 10' 1.3902"	$21,892	Dakota	Prairie, Savanna Habitat	Pollinator-Friendly Plugging and Monitoring Pollinators, Soil N, Vegetation	0.5		Municipality	Complete
3.1	Central Corridor	44° 51' 53.6364"	-92° 54' 33.4866"	$74,515	Washington	Prairie and Savanna Habitat	Haying and Researching Effects on Vegetation, Soil N, Pollinators	22		Watershed District	Complete

NOTES: As a research, monitoring, and citizen science project, $/acre for restoration activities are not comparable to other restoration projects.