2013 PROJECT ABSTRACT
For the Period Ending June 30, 2016
PROJECT TITLE: Restoration Evaluations
PROJECT MANAGER: Susan M. Galatowitsch
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FUNDING SOURCE: Environment and Natural Resources Trust Fund
LEGAL CITATION: M.L. 2013, Chp. 52, Sec. 2, Subd. 04l
APPROPRIATION AMOUNT: $200,000

Overall Project Outcome and Results

In 2013 LCCMR requested an evaluation of ENRTF restorations, from 1990-2010, to assess ecological outcomes of past projects, to determine factors tied to successful outcomes, and to develop evaluation criteria for proposed and completed projects. Our evaluation was based on information gathered from LCCMR files (450 projects), project manager files (78 projects), project manager interviews (59 projects) and field surveys (59 projects). Project managers were interviewed to gain insight into restoration process and organizational capacity to implement restorations. To quantify the extent of ecological recovery of each site we calculated: 1) proportion of plant species considered part of the potential natural vegetation following DNR Native Plant Community manuals (%PNV) and 2) an index of abundances of invasive species (CISA). These two parameters were used to classify ecological condition as high, medium or low quality. High quality restorations were those with greater than average %PNV and lower than average CISA; low quality restorations have the opposite scores, i.e., lower than average %PNV and higher than average CISA. 32% of projects evaluated were deemed high quality and 27% low quality. Using contingency analysis, we screened a variety of factors related to site history, organizational capacity, and type of ecosystem to determine which have the greatest potential to predict post-restoration ecological condition. This analysis found that starting condition, type of ecosystem, and an organization's internal capacity have the strongest effect on restoration outcome. Restorations of highly altered sites are much riskier than those undertaken on remnant natural areas, and so are less likely to result in high quality outcomes. Restorations of forests are riskier than prairie or wetland restoration. Common problems hindering restoration teams' capacity to keep their ecological restoration projects on track are inadequate staffing and expertise, insufficient funds, incomplete records, and leadership change: Evaluation guidelines, monitoring protocols, planning tool documents are included with the final report.

Project Results Use and Dissemination

The results of this project have been (or will be) disseminated in several ways:

1) A summary report (i.e., Restoration Evaluation Guidelines) that outlines the key findings of the evaluation has been developed. The guidelines will be posted on the Ecological Restoration Practitioners network and website (https://cceevents.umn.edu/restoring-minnesota).

2) Two webinars summarizing key elements of restoration project planning and recordkeeping were hosted in winter 2016. The webinar "Planning to Avoid Pitfalls: The Key to Restoration Success", with guests Dan Shaw from the Board of Water and Soil Resources and Wiley Buck from Great River Greening was hosted on February 23, 2016. The webinar "Learning by Doing: Why Restoration Records Matter" with guests Mark Cleveland from the Department of Natural Resources and Karen Schik from Friends of the Mississippi River was hosted on March 29, 2016. The target audience for the webinars were the project managers as well as other restoration professionals. Each webinar was viewed by approximately 55 professionals. The webinars began with a summary of the results of the restoration evaluation presented as an introduction and context for each topic. The invited expert guests for each webinar presented the perspectives of a state agency and a non-profit engaged in ecological restoration respectively. The webinars are archived on the Ecological Restoration Practitioners website (https://cceevents.umn.edu/restoring-minnesota). In partnership with the DNR, we offered a webinar to agency staff in November 2014.

3) Presentations describing the evaluation process and preliminary findings were made at 3 professional meetings: the Eighth SER Midwest Great Lakes Chapter meeting in Bloomington, IN in April 2016, the Society for Ecological Restoration 6th World Conference on Ecological Restoration in Manchester England in August 2015, and the Seventh SER Midwest Great Lakes Chapter meeting in Glencoe, IL in March 2015.

4) The results of the restoration evaluation will be summarized and submitted for publication in at least two peer-reviewed journals.

5) Content in the Site Assessment and Monitoring courses of the online Ecological Restoration Training Consortium will be reviewed and updated to reflect recommendations and best practices developed as outcomes of the restoration evaluation project.

Environment and Natural Resources Trust Fund (ENRTF)
M.L. 2013 Work Plan Final Report

Date of Status Update Report: **July 1, 2016**
Date of Next Status Update Report: Final Report
Date of Work Plan Approval: June 25, 2013
Project Completion Date: June 30, 2016

PROJECT TITLE: Restoration Evaluations

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Location: Statewide

Total ENRTF Project Budget:		
	ENRTF Appropriation:	**$200,000**
	Amount Spent:	**$196,811**
	Balance:	**$2,188**

Legal Citation: M.L. 2013, Chp. 52, Sec. 2, Subd. 04l

Appropriation Language:
$200,000 From Laws 2008, Chapter 143, section 2, subdivision 8, paragraph (b). Legislative-Citizen Commission on Minnesota Resources, as amended by Laws 2011, First Special Session, chapter 2, article 3, section 2, subdivision 18, paragraph (s), clause (8), is transferred to the Board of Regents of the University of Minnesota for evaluation of lands restored using money from the trust fund. The lands to be evaluated shall be identified and prioritized in consultation with the Legislative-Citizen Commission on Minnesota Resources.

I. PROJECT TITLE: Restoration Evaluation

II. PROJECT STATEMENT:
Monitoring and evaluation of ecological restorations are essential for knowing whether projects are achieving their goals, which, in general, is to aid in the recovery of native ecosystems that have been degraded or lost. Unfortunately, very few projects in Minnesota or elsewhere worldwide are evaluated past the initial implementation phase. Consequently, there is no way to know the extent to which funds spent on restoration are a strategic conservation investment.

While evaluations are important for gauging the value of past projects, the primary reason to monitor restorations is to learn what works, what doesn't, and in doing so, advance restoration practice and increase the likelihood of success of future projects. This project will: 1) develop restoration evaluation procedures specific to different types of ecosystems and project goals, 2) identify the most common causes (environmental and social) of ecological restoration project failure, 3) estimate the levels of success for different types of ENRTF projects based on plans, case histories, and field evaluations.

ENRTF restoration projects funded between 1990-2010 will be categorized into one of 16 groups according to:

- Ecosystem type: 1) prairies & savannas, 2) wetlands, 3) lakeshores & riparian habitats, 4) forests
- Age : 1) 3-10 years, 2) 10+ years
- Continued management: 1) none-sporadic, 2) periodic-frequent

The adequacy of plans will be evaluated for at least five sites from each of these 16 groups. The evaluations of these 80 plans will focus on the adequacy of goals to guide decisions, the extent to which methods conformed to best practices or required standards at the time of project initiation, and the extent to which the plan addressed the most likely risks of failure.

From these, 32-48 restorations will be selected for a more in-depth investigation into the actual outcome of the restoration and factors hindering project success. To determine the most common causes for project failure, detailed case histories will be compiled for each restoration project. These case studies will chronicle the actual implementation of the plan, including changes to the plan, and who implemented the original plan, follow-up actions, and who implemented the follow-up actions. Each restoration will be surveyed in the field to compare the actual vegetation and landform compared to what had been envisioned in the restoration plan. Analysis of evaluation data will explore the likelihood of failure as a function of both ecological factors (e.g., prevalence of invasive species and native species in the surrounding landscape) and social/organizational factors (e.g., continuity of project leadership, size and expertise of staff). This information will be used to suggest protocols for future evaluation of both plans and completed projects.

III. PROJECT STATUS UPDATES:

Project Status as of January 1, 2014:
More than 450 specific ecological restoration projects were identified in a search of LCCMR appropriations from 1990 to 2010. The restoration projects were categorized into 12 groups according to:

- Ecosystem (prairie, forest, and wetland)
- Age (3-10 years or 10+ years)
- Restoration Action (planted or not planted)

Note that lakeshore/riparian habitat was removed from consideration as an Ecosystem class. Restoration Action was added as part of the categorization matrix, while Management will be added to the matrix in the next round of evaluation after the management status of each project has been determined from the manager surveys.
A protocol was developed for selecting up to 20 projects from each of the 12 groups for initial review without creating an undue reporting burden on any one organization. Surveys were sent to the project managers of the

172 ecological restoration projects selected for the first round of evaluation. Survey returns reached 67.4% as of December 31. Contact information for some projects was outdated and updated information has had to be tracked down, delaying returns on some surveys. Additional efforts will be made to increase the number of completed surveys in early January 2014. Responses to the completed surveys have been summarized. For the second step of evaluation, projects will be further categorized into 24 groups according to the level of post restoration management they receive. Management will have 2 classes: none-sporadic or periodic-frequent. A draft of the planning tool has been developed, but review of the planning tool by an expert panel is behind schedule. The planning tool will be sent to reviewers in early January, with feedback due in late January. The monitoring protocols have not been drafted at this time.

Project Status as of July 1, 2014:
Additional efforts were made to increase the number of Manager Surveys including multiple follow-up emails and phone calls. We eventually received more than 89% completed surveys. Projects for which surveys were not returned could not move into the next phase of the evaluation because we could not ascertain the level of management projects received since the end of grant period. The 153 projects with manager survey information were grouped into 24 categories (below); 3 categories did not include projects. A total of 85 projects were randomly chosen to include representative projects from each of the 21 categories with completed restorations. Project categories:

- Ecosystem (prairie, forest, or wetland)
- Age (3-10 years or 10+ years)
- Restoration Action (planted or not planted)
- Management Level (Continuous or Intermittent/Nonexistent)

In February, letters were sent requesting restoration plans for the 85 projects selected for the second phase of the evaluation. As with the manager survey, initial response to our request was very low and required additional requests for information. Restoration plan information was ultimately submitted by all but 4 entities representing 8 projects. The quality and detail of the information provided for the request for restoration plan details varied widely from a few general sentences to highly detailed planning documents. For the most part information being provided was not of sufficient detail to be assessed against the planning tool being developed in consultation with restoration professionals for that purpose. So, a separate, simplified matrix was developed to score the plan information provided in order to determine the likelihood of restoration success or failure prior to selecting projects for field evaluation. Projects were ranked using the planning score matrix prior to selection for the Phase III field evaluation.

Forty-eight projects representing each of the 21 restoration categories and high, medium, and low planning scores were selected for a field evaluation. Additional information necessary to conduct the field evaluation is being solicited from project managers for more than two-thirds of the projects. A field evaluation protocol has been developed that will assess the quality of the restored habitat as determined by the composition of the plant community (vegetation survey) and document site stressors within the restored habitat and land use impacts from the surrounding landscape (land use/cover assessment).

Project Status as of January 10, 2015:
Field evaluations for the 48 ecological restorations selected for detailed evaluation were conducted from June 23 to September 25. Two of the 48 sites could not be visited because the current managers did not have a record of the location of the restoration activities funded by the grant in question. Vegetation surveys were conducted and site stressors and adjacent land uses were assessed for each of the remaining 46 sites. For 9 of the 46 sites visited, managers provided conflicting information regarding either the ecosystem restored (prairie, forest, or wetland) or the restoration action taken (planted or vegetation management only). These 9 projects will be evaluated in categories that match the conditions found on the site during the 2014 visit.

The vegetation survey data has been summarized and is being analyzed to determine the proportion of the plant community comprised of species from the Potential Natural Vegetation, from the planting list (when applicable), and from the invasive species list. Analysis of the vegetation survey data is ongoing as we attempt to determine which relationship best correlates with the observed condition of the restorations. Preliminary analysis suggests that the starting condition of a restoration, whether it was an agricultural field or an old field; a logged forest or a brome field, plays a significant role in whether or not the restoration is a high or low risk venture, what steps should be taken to prepare the site for restoration, and whether or not it requires more or less effort to achieve its goal.

A set of follow-up questions for project managers are being developed that will enable us to gain a better understanding of factors that led to the success or failure of a given project. The planning tool will be used to guide development of the questions. The follow-up questions will be posed to the restoration managers to gain a better understanding of the starting condition of each of the sites, the restoration and management actions taken during various stages of the restoration, and challenges encountered during the restoration process that may have impacted the outcome. The questions will be specific to the habitat type and restoration actions taken at each site.

Project Status as of July 1, 2015:
Project managers for each of the 46 restoration projects for which a site visit was conducted in summer 2014 were contacted by phone and interviewed regarding restoration implementation practices, ongoing management practices, and limitations to implementing the restoration or providing ongoing management. Interview questions related to process were tailored to each plant community type restored. Additional questions in the survey query managers for details regarding organizational changes or limitations that might impact project outcomes. The interviews consisted of 14 -21 questions depending on what habitat was restored. The transcripts from the interviews were analyzed using situational awareness, significant setbacks and keystone vulnerabilities as parameters to assess organizational resilience.

A strategy was adopted for selecting 12 additional projects for a site evaluation in summer 2015. The additional projects selected were those for which preliminary data had already been received and they would each represent one habitat type. Prairie was the most commonly represented plant community restored among the ENRTF funded projects, so it was chosen as the focus for project selection. The projects would also, as much as possible, represent organizations that had not been selected in the original set of projects. Thirteen projects matched the selection criteria and project managers for all 13 projects were solicited for the additional information needed to prepare for the field season. The majority of the projects selected for evaluation in 2015 have provided the requested project documentation.

The planning tool was further refined based on input from the panel of experts who reviewed it. This working version of the planning tool was used to guide development of the follow-up survey and to analyze responses to survey questions related to implementation and post-implementation management practices. The planning tool will be further developed in a format that can be used as an aid in restoration plan development, plan evaluation, and also project evaluation.

Project Status as of January 20, 2016:
Site visits and evaluations of thirteen additional prairie restorations were completed in July and August 2015. Follow up interviews for these projects were conducted in September. Twelve out of thirteen project managers responded to our request for a follow up interview. The follow up surveys were coded for significant setbacks and keystone vulnerabilities as per the protocol used for the 2014 interviews. Field survey data for all projects was processed and compiled after the 2015 field season.

We completed an initial analysis of the information gathered from all 59 restoration projects. To quantify the extent of ecological recovery of each site (i.e, restoration success), we calculated: 1) the portion of all plant

species that are considered part of the potential natural vegetation (following DNR Native Plant Community Reference manuals) and 2) an index based on the abundances of all invasive species. These two parameters (%PNV, CIS) were used to classify ecological condition as high, medium or low quality. We then screened (using contingency analysis) a variety of factors related to site history (i.e., time since restoration, management, starting condition), organizational capacity, and type of ecosystem to determine which have the greatest potential to predict restoration outcome (i.e., post-restoration ecological condition). This preliminary analysis suggests starting condition (restoration vs remnant), type of ecosystem, and an organization's internal capacity (including planning) have the strongest effect on restoration outcome. Further analysis is planned.

A pair of webinars has been scheduled for February and March to share our findings and to highlight best practices from restoration practitioners that we have been working with throughout the restoration evaluation project. The topics for the webinars will be "Restoration Goals as Guidance for Project Planning" and "The Importance of Recordkeeping to Adaptive Management". Expert guests have been invited to participate in a Q and A format with questions from the webinar hosts and the audience. The audiences for the webinars are the managers of the restoration projects who participated in this research project as well as other interested restoration practitioners and managers from around the state.

Overall Project Outcome and Results

In 2013 LCCMR requested an evaluation of ENRTF restorations to assess ecological outcomes of past projects, to determine factors tied to successful outcomes, and to develop evaluation criteria for proposed and completed projects. Our evaluation was based on information gathered from LCCMR files (450 projects), project manager files (78 projects), project manager interviews (59 projects) and field surveys (59 projects). Project managers were interviewed to gain insight into restoration process and organizational capacity to implement restorations. To quantify the extent of ecological recovery of each site we calculated: 1) proportion of plant species considered part of the potential natural vegetation following DNR Native Plant Community manuals (%PNV) and 2) an index of abundances of invasive species (CISA). These two parameters were used to classify ecological condition as high, medium or low quality. High quality restorations were those with greater than average %PNV and lower than average CISA; low quality restorations have the opposite scores, i.e., lower than average %PNV and higher than average CISA. 32% of projects evaluated were deemed high quality and 27% low quality. Using contingency analysis, we screened a variety of factors related to site history, organizational capacity, and type of ecosystem to determine which have the greatest potential to predict post-restoration ecological condition. This analysis found that starting condition, type of ecosystem, and an organization's internal capacity have the strongest effect on restoration outcome. Restorations of highly altered sites are much riskier than those undertaken on remnant natural areas, and so are less likely to result in high quality outcomes. Restorations of forests are riskier than prairie or wetland restoration. Common problems hindering restoration teams' capacity to keep their ecological restoration projects on track are inadequate staffing and expertise, insufficient funds, incomplete records, and leadership change. Documents attached: Evaluation guidelines, monitoring protocols, planning tool.

IV. PROJECT ACTIVITIES AND OUTCOMES:

ACTIVITY 1: Develop tools for evaluating plans and completed projects for ecological restoration and compile basic information on completed projects in order to select sites for evaluation.

Description:

Evaluation procedures are needed for both planned and completed projects, and both need to be specific to the types of ecosystems being restored, level of degradation, and nature of goals. The risks of restoration failure differ greatly among different types of ecosystems. In part this stems from inherent differences in the types of degradation that must be addressed to accomplish restoration, but it also reflects the standards of practice at the time of implementation. Moreover, projects vary in the extent to which they've received ongoing, corrective

actions, which may indicate continued attention to key vulnerabilities and therefore be predictive of the likelihood of project success.

The following are the initial steps of the evaluation process, which will develop the procedures for the evaluation and compile site information needed for site selection (numbers correspond to outcomes listed below):

1. Tools for evaluating restoration plans (planning tool) and completed projects (monitoring tool) will be developed based on the published research literature and professional experience. Tools will be tied to goals articulated in the plans, as well as to the ecology of ecosystems typical for the sites (e.g., DNR Potential Natural Vegetation) and stressors associated with different types of land use (e.g., prevalence of invasive species).

2. A preliminary test of these evaluation tools will be conducted using expert practitioner panels; each panel will be asked to provide feedback on the tools, based on their evaluation of a selection of ENRTF restoration plans. The planning tool will be refined and used as part of project evaluations (see Activity 2). The monitoring tool will be used for the field evaluations described in Activity 3. Both the planning and monitoring tools will be refined based on the analysis of restoration evaluations (see Activity 3).

3. Basic information on all ENRTF restoration projects completed between 1990 and 2010 will be compiled from LCCMR files. Managers of all projects will be surveyed to ascertain the extent to which each site has been managed or monitored following the initial implementation phase (i.e., grant period) and to determine who is currently responsible for the site.

4. Restoration projects will be categorized into one of 16 groups according to:

- Ecosystem type: 1) prairies & savannas, 2) wetlands, 3) lakeshores & riparian habitats, 4) forests,
- Age : 1) 3-10 years, 2) 10+ years
- Continued management: 1) none-sporadic, 2) periodic-frequent.

Five projects will be selected from each group for further evaluation. LCCMR staff will provide input on this selection.

Summary Budget Information for Activity 1:

ENRTF Budget: $ 34,000
Amount Spent: $ 34,000
Balance: $ 0

Activity Completion Date:

Outcome	Completion Date	Budget
1. *Draft planning tool and monitoring protocols for four main types of ecosystems based on published literature and professional experience.*	Nov. 1, 2014	$ 6,000
2. *Complete expert panel review of planning tools. Finalize working version of planning and monitoring tool based on expert panel feedback.*	Jan. 1, 2014	$ 6,000
3. *Compile basic information on all completed projects. Complete surveys of managers of all ENRTF restorations completed from 1990-2010 to determine extent of continued management.*	Jan. 1, 2014	$ 24,100
4. *Categorize projects according to ecosystem, age, and management. Select 80 sites for planning evaluation.*	Feb. 1, 2014	$ 1,000

Activity Status as of January 1, 2014:
Outcome 1: Planning tools were drafted for each of three main ecosystem types: prairies & savannas, wetlands, and forests. A planning tool was not developed for lakeshores and riparian habitats after it was determined that lakeshore and riparian ecosystem restoration projects would not be selected for evaluation due to not meeting the project acreage criteria or being primarily structural restorations. Transition tables were developed for

eleven target habitats within the three main ecosystem types. The target habitats may function primarily for either biological conservation or ecosystem services (utility habitats). For each of the target habitats, multiple restoration start states are presented that represent the vegetative cover of typical disturbed habitats. Restoration steps were outlined that reflect the various restoration strategies to be implemented to get from a particular start state and its associated stressors to a target habitat. The monitoring protocol will be drafted in February, 2014.

Outcome 2: A list of experts has been generated for the panel review of the Planning Tool. Three to four restoration experts will be asked to review the transition tables for each of the 3 ecosystem types. It is anticipated that the draft Planning Tool will be provided to the panel for review by January 6th and that the panel review will be completed by February 1, 2014. The Planning Tool will then be refined based on feedback from the expert panel.

Outcome 3: LCCMR files from 1990 to 2010 were searched for ecosystem restoration projects. More than 450 specific projects were identified from the files. However, fifty-nine appropriations for ecosystem restoration were eliminated from consideration due to lack of enough detail in the work plans or the final reports to readily identify specific project sites. The identified projects were categorized by

- Ecosystem (prairie, forest, and wetland)
- Age (3-10 years or 10+ years)
- Restoration Action (planted or not planted)

The lakeshore/riparian ecosystem subcategory proposed in the original proposal was removed from consideration after reviewing the LCCMR files. Most lakeshore projects were demonstration projects on less than an acre and riparian projects tended to entail modification of channel structure versus vegetative restorations. In addition, “Restoration Action” was added as a grouping category so we can conduct separate evaluations of restorations that had been actively revegetated (i.e., seeding or planting) from those that relied on other actions, such as invasive species control or prescribed burning. Ongoing management used in the next round project selection after more detailed information is obtained from project managers. Random numbers were assigned to all projects in each of the 12 resulting categories and a set of rules were developed to select projects for the first round of evaluation, the manager survey. Up to 20 projects were selected for the first round of evaluation from each group. No more than 12 projects were selected from any one entity/ organization, and no more than 4 projects were selected from any one category per entity/organization.

Project managers were asked to complete a brief survey which solicited information regarding project location, restoration records, level of continued management, and monitoring status. Surveys were sent to 39 different entities/organizations requesting information on 172 restoration projects. More than 67% of surveys have been completed and returned. The survey results are being collated and will be used to further categorize the projects based on the level of continued management. A set of not more than 96 projects will be selected for the second tier of evaluation, a detailed restoration plan review.

Outcome 4: Work has not begun on this outcome.

Activity Status as of July 1, 2014:

Outcome 1: The monitoring protocol was developed using two established methods as models. For Part 1 of the survey, the site and adjacent buffering lands will be assessed for land uses and stressors that may be impacting the restored site. Methods for this aspect of the evaluation are modified from work done to understand the impacts of surrounding land use in wetlands reported in Galatowitsch et al. 1998 (a LCCMR project product). Part 2 of the evaluation, the vegetation survey, will use a timed meander sampling survey based on methods developed and used by the Minnesota Pollution Control Agency. The methods outlined in their protocol will be modified to take into account the diverse habitats being evaluated as well as the varied size (from 3 to 785 acres) of the projects being assessed for this grant. The number of timed meanders will vary dependent on the

size of the site. Only dominant species will be recorded. Species checklists were developed from 4 sources to allow site specific species checklists:

- Indicator species lists for each Native Plant Community Type
- Common and easier to identify wetland species from the PCA RAM list
- Species list for a site that was seeded or planted will be used as a checklist.
- Invasive species (Developed from DNR and MDA lists)

Outcome 2: Reviewers were identified and commissioned to review the draft Planning Tool. Reviewers were drawn from state and federal agencies, as well as private consulting firms. Four reviewers were asked to review the Prairie/Savanna Planning Tool transition tables, 4 reviewers reviewed the Wetland tables, and 3 reviewed the Forest/Savanna tables. The process of collating the feedback from the reviewers began in February. To date, the feedback on the Prairie tables has been collated and collation of the forest tables has begun. Collation of the wetland tables has not yet begun. Based on feedback on the Prairie/Savanna transition tables, there was much consensus on the methods outlined in the planning tool however, there were a couple of areas where the experts diverged in their recommended practices. As the document is further developed, these differences will be explored further.

It has been determined that the Planning Tool will not be a useful tool for evaluating the likelihood of success or failure for the projects in this assessment because the majority of projects provided too little detail to compare to the Planning Tool, However, it is clear that the need for such a tool during the planning stages of restoration would benefit many project managers. Other agencies are working on similar tools for specific habitats, so the value of such a tool has been recognized by other agencies as well. Further development of the Planning Tool will continue after the field season.

Outcome 3: As of January 17th, manager surveys for 89.5% of projects were returned. Projects for which surveys were not returned, by default could not move into the next phase of the evaluation because they could not be further categorized by their level of management and because projects could not be further evaluated without the cooperation of project managers. The returned surveys were summarized, with particular attention at this stage being given to the level of management provided to each project after restoration implementation. On the survey, managers were able to select from one of three management levels:

- Continuous and regular (Intensive management occurs at least every other year)
- Intermittent or irregular (Intensive management occurs only every few years)
- Nonexistent (Management of this site has not occurred for at least 5 years)

Continuous and regular management was reported for only 42% of projects.

Outcome 4: We decided to use only 2 levels of management for further analysis of the projects, so projects were further categorized into 24 groups according to level of management and the three parameters already implemented:

- Ecosystem (prairie, forest, and wetland)
- Age (3-10 years or 10+ years)
- Restoration Action (planted or not planted)
- Management Level (Continuous or Intermittent/Nonexistent)

From the 153 projects reported on via the manager survey, up to 96 (4 per category) could be selected for Phase II, the Plan Evaluation. However, there were not enough projects in some categories to select the full complement. In total, 87 projects representing 21 of the restoration categories were selected for a plan evaluation.

Activity Status as of January 10, 2015:

Outcome 1: The monitoring protocol was modified prior to the field season. All species encountered during a meander were documented in order to develop a list of species that represented the richness of each site. The list of species developed during a survey was compared to the Species Frequency and Cover Tables (indicator

species lists) for each Native Plant Community Class in the Field Guides to the Native Plant Communities of Minnesota to develop a list of species representative of the ecosystem that were present in the restored plant community.

Outcome 2: No additional progress on this outcome.

Outcome 3: No additional progress on this outcome.

Outcome 4: No additional progress on this outcome.

Activity Status as of July 1, 2015:

Outcome 1: No additional progress on this outcome.

Outcome 2: The planning tool was edited and refined based on feedback from the expert panel. For each start state/end state combination, appropriate restoration actions for each of the 5 broad restoration steps were identified and prioritized by the experts. Where the experts disagreed on the importance or appropriateness of a particular restoration action, further discussion may be needed to identify when the particular action should be implemented and when not. Additional restoration practices recommended by the expert panel were incorporated into the planning tool. The planning tool was utilized to develop the questions in the follow-up manager survey as well as to guide assessment of responses to questions related to restoration process. This tool will be further developed to increase its usability for practitioners and evaluators.

Outcome 3: No additional progress on this outcome.

Outcome 4: No additional progress on this outcome.

Activity Status as of January 20, 2016:

Outcome 1: No additional progress on this outcome.

Outcome 2: The planning tool was further refined and formatted to increase its usability for practitioners during the planning and implementation phases of restoration. Given disparate initial conditions (start states) and possible outcomes (end states) for typical prairie, forest, savanna, and wetland restorations in Minnesota, the planning tool provides a summary of the management actions that should be considered for each step of the restoration to achieve the desired outcome. The planning tool also provides a framework for evaluating restoration progress and outcomes.

Outcome 3: No additional progress on this outcome.

Outcome 4: No additional progress on this outcome.

Final Report Summary:

Two products, a planning tool and a monitoring tool, were developed with the intent to be used during the course of evaluating restorations for this review. Each product is also intended to be used by practitioners during the planning stage and for monitoring restorations.

The planning tool incorporates three main ecosystem types: prairies & savannas, wetlands, and forests. Transition tables built into the planning tool were developed for eleven target habitats within the three main

ecosystem types. For each of the target habitats, multiple restoration start states are presented that represent the vegetative cover of typical disturbed habitats. Restoration steps were outlined that reflect the various restoration strategies to be implemented to get from a particular start state to a target habitat. A panel of expert reviewers from state and federal agencies, as well as private consulting firms provided input on the planning tool steps. Additional restoration practices recommended by the expert panel were incorporated into the planning tool. The planning tool is designed to be a useful tool for practitioners writing a restoration plan and during the implementation phase of restoration to monitor progress. The planning tool provides a summary of the management actions that should be considered for each step of the restoration to achieve the desired outcome for multiple combinations of initial conditions (start states) and possible outcomes (end states) for typical prairie, forest, savanna, and wetland restorations in Minnesota. The planning tool also provides a framework for evaluating restoration progress and outcomes. The planning tool did not prove to be of value for measuring the quality of restoration plans for this evaluation when the plans provided by a majority of project managers turned out to be wholly inadequate or lacking entirely.

The monitoring tool is a straight-forward, easy to implement process that can be used to evaluate restoration outcomes. It consists of two parts. Part 1 assesses the site and adjacent buffering lands for land uses and stressors that may be impacting the restoration. Part 2 of the evaluation, the vegetation survey, is a timed meander sampling survey based on methods developed and used by the Minnesota Pollution Control Agency. Two metrics are tallied. The portion of all plant species considered part of the potential natural vegetation is calculated and a metric that summarizes invasive species cover is calculated. The two values are used to determine the quality of the restoration relative to the restorations observed for this evaluation. A plant community with a high value for potential natural vegetation and a low value for invasive species cover indicates a restoration of high quality.

To begin the restoration evaluation, more than 450 restoration projects implemented from 1990 to 2010 were identified from the LCCMR files. Projects with enough detailed information to work with were categorized based upon the following criteria

- Ecosystem (prairie, forest, and wetland)
- Age (3-10 years or 10+ years)
- Restoration Action (planted or not planted)

Project managers were asked to complete a brief survey for the first round of evaluation. The survey solicited information regarding project location, restoration records, level of continued management, and monitoring status. Surveys were sent to 39 different entities/organizations requesting information on 172 restoration projects. Surveys were returned for 153 or 89.5% of the projects. Continuous/regular management was reported for only 42% of projects. Using 2 levels of management for further analysis of the projects, projects were then categorized into 24 groups according to level of management and the three parameters previously used.

- Management Level (Continuous or Intermittent/Nonexistent)

Eighty-seven projects representing 21 of the restoration categories were selected for a plan evaluation. There were not enough projects in some categories to select a full complement (96 projects) for the plan evaluation.

ACTIVITY 2: Evaluate restoration plans and select sites for detailed evaluations.

Description:
1. The adequacy of plans will be evaluated for at least five sites from each of the 16 groups. The evaluations of these 80 plans will focus on the adequacy of goals to guide decisions, the extent to which methods conformed to best practices or required standards at the time of project initiation, and the extent to which the plan

addressed the most likely risks of failure. The plans will be categorized as likely to have achieved goals or unlikely to have achieved goals.

2. Two-three sites will be selected for in-depth review from each of the 16 groups. Of these, at least one will be chosen from each planning category (i.e., likely or unlikely to achieve goals). LCCMR staff input will be part of the selection process.

Summary Budget Information for Activity 2:

ENRTF Budget: $ 13,832
Amount Spent: $ 13,832
Balance: $ 0

Activity Completion Date: **July 1, 2014**

Outcome	Completion Date	Budget
1. *Complete planning evaluation of 5 sites for each of 16 groups based on ecosystem type, project age, extent of follow-up management.*	April 1, 2014	$ 9,000
2. *Select 32-48 sites for detailed evaluations of project outcomes, with LCCMR staff input.*	May 1, 2014	$ 1,832

Activity Status as of January 1, 2014:
No progress on this activity

Activity Status as of July 1, 2014:
Outcome 1: Letters were sent to project managers and partners requesting documentation of the restoration process in the form of project records or restoration plans that detailed the following:

- Project goals
- Project participants and partners
- Restoration methods used to implement the project
- Time-frame of the project implementation process
- Species that were installed (when applicable)

A total of 90% of projects reported back for the Plan Evaluation. Four managers representing 8 projects did not report on their projects. The quality and detail of the information provided for the request for restoration plan details varied widely from information regarding unrelated infrastructure management to highly detailed planning documents, including stewardship plans. For the most part it was determined that the information being provided was not of sufficient detail to be assessed against the planning tool being developed in consultation with restoration professionals for that purpose. A separate, simplified matrix was developed to score the plan information provided, in order to determine the likelihood of restoration success or failure prior to selecting projects for a field evaluation.

Projects were ranked using the planning score matrix prior to selection for the Phase III field evaluation. Forty-eight projects representing each of the 21 restoration categories and high, medium, and low planning scores were selected for field evaluation.

The following scoring scheme was used:

Restoration Goal	Score
Minimal ("restoring prairie")	1
Moderate (restore for what purpose?)	2
Detailed SMART goal	3
No restoration goal articulated	0
Species List	

Species list only	1
Seed mix number	1
Qty of seed/plants	2
Species list Not Applicable	0
No species list provided	0
Species Inventory	
Assessment of plant community type	1
Other assessment of pre-rest site conditions	1
Detailed inventory of existing veg	2
Pre-restor site condition not noted	0
Implementation Methods	
Generic methods	1
Detailed methods - timing, chemicals etc	2
Methods listed are inadequate	0
No methods listed	0
Post-implementation Management Plan	
Generic plan	1
Detailed plan with actions, timeframe	2
Management plan is inadequate	0
No management plan provided	0
Managed	
Managed	1
Not Managed	0
Maps/Aerial Photos	
Large-scale overview map	1
Map of specific project area	1
No maps provided	0

Projects were scored after a review of the submitted documents. Rankings ranged from 0 – 12 with a possible high score of 14.

The scores were organized into 3 Plan Review scoring groups:

- 0-5 Unlikely to succeed or unable to determine
- 6-9 Likely to succeed
- 10-14 Highly likely to succeed

Typically projects for which no information was received scored zero. Several projects which had conducted pre-restoration site assessments and developed formal management plans scored high. It is assumed that many projects have more detail than they provided. Various reasons may explain why more information was not provided to us:

- Managers do not feel our evaluation project is important enough to take time to find the files
- Hardcopy files may be archived in hard to access locations
- Electronic files may be non-retrievable on old digital storage media
- Files are not organized and searchable
- Records were not kept

- Records were disposed of
- Staff changes resulted in lack of continuity and displacement of records
- We may still be contacting the wrong manager to address our request fully

Outcome 2: No projects were dropped from the plan evaluation phase going into the field evaluation phase. A protocol for selection of sites for field evaluation was developed. Selection of projects for the field evaluation took into account the 24 categories already established and the plan evaluation scores, with random numbers assigned within categories established using both parameters. When applying the selection process, the need to include both metro and outstate projects was considered. In addition, a limit of 3 projects per organization/management unit was established to limit the reporting burden on any one manager and to ensure that the projects represented as many organizations as possible. Projects were selected and project managers were contacted on May 21 to notify them of the sites selected for field evaluation. Additional information was requested for approximately 70% of projects in order to plan for the field season, in particular to obtain specific project location or species information

Activity Status as of January 10, 2015:
No additional action on this activity.

Activity Status as of July 1, 2015:
Outcome 1: No additional progress on this outcome.

Outcome 2: Additional projects were selected for detailed evaluation of project outcomes. Upon reviewing all projects for which the initial manager survey had been completed and which had not previously been selected for a field site evaluation, it was determined that the addition of prairie restoration projects completed by organizations that had not yet been evaluated would add the most value to this evaluation process. Restoration plans were solicited for 13 prairie projects. One extra project was selected as a backup in case project information is not forthcoming from one of the other 12 projects. The projects are evenly balanced between metro and outstate locations and more than 10 years old or less than 10 years old. The project planning documentation received for the new projects was scored to determine the likelihood of success of each new project.

Activity Status as of January 20, 2016:
We contacted project managers to fill minor gaps in information in the data we had compiled on project histories.

Final Report Summary:
It was our intent to evaluate the adequacy of restoration plans for at least five sites from each of the representative groups. We expected that the restoration plans would articulate goals for the project and the methods used for the project. With that information, we intended to assess the adequacy of goals to guide decisions, the extent to which methods conformed to best practices or required standards at the time of project initiation, and the extent to which the plan addressed the most likely risks of failure. The restorations were to be categorized as likely to have achieve their goals or unlikely to achieve their goals. Although 90% of projects reported back regarding planning documents, our request to project managers soliciting restoration plans resulted in very few actual restoration plan documents. Typically we were provided with a few separate documents that collectively represented a record of the restoration. The quality and detail of the information provided for the request for restoration plan details varied widely from information regarding unrelated infrastructure management to highly detailed planning documents, including stewardship plans. The information being provided was seldom of sufficient detail and completeness to allow for a formal evaluation. A separate, simplified matrix was developed to score the plan information provided in order to determine the likelihood of restoration success or failure prior to selecting projects for a field evaluation. Based on the plan

components provided, 18.6% of projects were categorized as highly likely to succeed, while 40.7% of projects were categorized as unlikely to succeed.

We intended that projects would be chosen based on their likelihood of success/failure for a further detailed evaluation. However, it became clear that this would not be a valid method for choosing projects for further review. Projects were instead chosen to be representative of geographic area (metro vs. outstate) and of organizations. Forty-eight projects representing wetland, forest, and prairie/savanna restorations were chosen for in-depth evaluation in 2014. Another 13 prairie restorations were selected for in-depth evaluation in 2015.

ACTIVITY 3: In-depth monitoring and investigation of factors affecting project success.

Description:
Evaluations of restoration projects need to be based on ecosystem responses to actions as observed during field monitoring. Because many restorations are not implemented exactly as planned and projects vary in their investment in ongoing or corrective actions, it is crucial to have detailed information on implementation to interpret monitoring results. Projects will be evaluated based on the extent to which they achieved stated goals and the extent to which methods used achieved the desired results.

The following activities will be undertaken to achieve the outcomes listed below (with corresponding numbers):

1. Detailed case histories will be developed for the 32-48 selected projects (see Activity 2). These cases will compile information on details of implementation since project initiation, changes in staffing and project management, and monitoring results. Information will be obtained from ENRTF files, files of project managers, reports distributed by project managers, and interviews with project managers and staff.

2. Field surveys will be conducted for each of the 32-48 selected projects, using the monitoring and evaluation tool (See Activity 1). Monitoring will focus on changes to landform and vegetation, since these are the most common direct targets of restoration actions. The field evaluation will determine the extent to which desired conditions outlined in the plan have been achieved and the extent to which the ecosystem is typical of natural vegetation expected for the locale.

3. Analysis of evaluation data will explore the likelihood of failure as a function of the general factors used to group sites: ecosystem type, age, ongoing management, adequacy of planning, in addition to other specific, ecological factors (e.g., prevalence of invasive species in the surrounding landscape) and social/organizational factors (e.g., continuity of project leadership). Evaluation data will also be analyzed to ascertain the relative importance of the adequacy of initial planning, implementation, and unforeseeable circumstances to restoration outcomes.

4. The results of the detailed evaluations will be compared to the *a priori* predictions using the planning tool (Activity 2) to determine the reliability of this tool, and to refine it, as necessary. The results of the detailed evaluation will also be used to provide guidance for practitioners preparing restoration plans and for program managers ranking prospective projects for funding and evaluating outcomes of implemented projects.

Summary Budget Information for Activity 3:

ENRTF Budget: $ 152,068
Amount Spent: $ 149,879
Balance: $ 2,189

Activity Completion Date:

Outcome	Completion Date	Budget
1. *Complete case histories of 32-48 sites, including changes to planned implementation, changes to staffing, restoration work completed after*	July 1, 2014	$ 50,000

grant period.		
2. *Complete field-based monitoring of the same 32-48 sites, focusing on the extent to which desired changes to vegetation and landform outlined in the plan have been achieved and the extent to which the ecosystem is typical of natural vegetation expected for the locale.*	Oct. 1, 2014	$ 77,068
3. *Complete analysis of restoration evaluation data to ascertain the factors that commonly limit restoration success.*	March 1, 2015	$ 20,000
4. *Use conclusions from analysis to refine evaluation tools for planning and completed projects and to provide recommendations for the standards for future restoration projects.*	July 1, 2015	$ 5,000

Activity Status as of January 1, 2014:
No progress on this activity. However, a pair of chest-waders were purchased that will be used during the field evaluations.

Activity Status as of July 1, 2014:
Outcome 1: Some of the information for this case history has been gathered via the manager survey, the plan evaluation request, and communications with project managers. However, more detail will be needed to complete this outcome.

Outcome 2: Preparations are under way for the field season, including development of project files for each of the 48 sites to be visited. Project files will include maps, species lists, and other information that will facilitate the field evaluation.

Outcome 3: Work has not begun on this outcome.

Outcome 4: Work has not begun on this outcome.

Activity Status as of January 10, 2015:
Outcome 1: To gather additional information on restoration histories from project managers, we developed a second survey that we will conduct via phone interviews. During the field surveys, we identified information gaps for many projects related to conditions at the initiation of restoration and the restoration actions. We used the planning tool developed under Activity 1 to more comprehensively compile information on restoration actions. This additional information will improve our ability to identify the most important determinants of restoration success for different types of ecosystems. The project managers of the 46 sites visited in 2014 will be contacted by phone in January-February, 2015.

Outcome 2: Field evaluations for the 48 ecological restorations selected for detailed evaluation were conducted from June 23 to September 25, 2014. Upland sites in southern Minnesota were visited earlier in the growing season than sites in northern Minnesota and wetland sites in order to maximize the number of plant species that were at an identifiable stage. Two of the 48 sites could not be visited because the current managers did not have a record of the location of the restoration activities funded by the grant in question. For 9 of the 46 sites visited, managers provided information regarding the type of restoration that occurred (e.g., prairie vs wetland or planted/seeded vs vegetation management only) inconsistent with our field observations. Vegetation surveys were conducted at each site as per the protocol. Additional observations about site stressors and adjacent land use practices were recorded and a summary statement was written for each site.

Outcome 3: The vegetation survey data has been compiled and is being analyzed to determine for each project: 1) the proportion of the plant community comprised of species from the Potential Natural Vegetation lists (DNR), 2) the proportion of the plant community represented by species from the planting list (when applicable),

and 3) the proportion of the plant community comprised of invasive species. We are currently evaluating whether these three metrics will be capable of discriminating differences in restoration outcomes. We are also beginning to evaluate the importance of various explanatory variables on these outcomes. For example, it appears (based on one initial analysis) that the starting condition of a restoration, whether it was an agricultural field or old pasture restored to prairie or a logged forest or brome field restored to forest, plays a major role in whether or not the restoration is a high or low risk venture and whether or not it requires more or less effort to achieve its goal. Restoration efforts seldom overcome the legacies of high levels of degradation (e.g., densely invaded sites).

Outcome 4: Work has not begun on this outcome.

Activity Status as of July 1, 2015:
Outcome 1: Follow-up manager surveys were conducted in January and February for the 46 restoration projects that were visited in 2014. The relationship between the project managers (the individuals who acquired the grant) and the land manager often complicated the process of gathering information. For several projects both were interviewed to enable a greater understanding of the site history and the restoration process, as well as current management practices. Many interviewees were very forthcoming, providing much useful information, while others were not as detailed in their responses.

Information for the case histories for the new projects has been gathered via the manager survey, the plan evaluation request, and communications with the project managers. More detail will be gathered via the follow-up survey after the site visits for each project.

Outcome 2: Field evaluations for the 13 new projects will begin in July when vegetation is well developed for identification. Project files are being finalized for each of the new projects in preparation for the site visits. Maps have yet to be obtained for 2 of the projects.

Outcome 3: The analysis of the data from the field surveys and follow-up manager surveys is ongoing. We have analyzed and coded the follow-up survey transcripts using methodology from research on organizational resilience and are currently attempting to determine where factors related to situational awareness, keystone vulnerabilities or significant setbacks may have had either positive or negative impacts on project outcomes. Resilience comes from having a framework, process, and culture that allow an organization to respond to unforeseen events such as often arise when implementing ecological restorations. Our preliminary analysis does not find a strong correlation between project outcomes and the situational awareness demonstrated by the organization via the follow-up survey.

Outcome 4: Work has not begun on this outcome.

Activity Status as of January 20, 2016:

Outcome 1: The project managers of the 13 sites visited in 2015 were contacted by phone in September, 2015 for a follow up interview to gather additional project information regarding start state, restoration implementation, ongoing management, staff changes, and other details that could affect project outcomes. Project managers were very responsive to our follow up questions, with the exception of one manager who did not return our calls.

Outcome 2: Field evaluations for the 13 additional prairie restorations selected for detailed evaluation were conducted from July 13 to August 11, 2015. Vegetation surveys were conducted at each site as per the protocol. Observations about site stressors and adjacent land use practices were recorded and a summary statement was written for each site. The additional sites visited provide a more robust data set for analysis of the relationship between ecological and organizational factors and project success.

Outcome 3: The twelve follow up interviews conducted in September were transcribed and then analyzed and coded for Setbacks and Keystone Vulnerabilities. The interviews were not coded for Situational Awareness, as it was determined from analysis of the 2014 interviews that coding for Situational Awareness was inconsistent between different coders and would not be a reliable means of evaluating restoration outcomes. Coding for Setbacks and Keystone Vulnerabilities was more consistent between coders and our early analysis shows some interesting relationships with these parameters and project outcomes.

We completed an initial analysis of the information gathered from all 59 restoration projects. Of several parameters developed from the field surveys, we determined that two, % Potential Natural Vegetation (PNV) and Composite Invasive Species Abundance (CISA), best expressed the ecological outcomes of the restoration project. So, to quantify the extent of ecological recovery of each site (i.e, restoration outcome), we calculated: 1) the portion of all plant species that are considered part of the potential natural vegetation (following DNR Native Plant Community Reference manuals) and 2) an index based on the abundances of all invasive species. These two parameters were used to classify ecological condition of each project as high, medium or low quality. Projects with above average PNV and below average CISA are classified as "high quality) and those with the reverse, "low quality". We then screened (using contingency analysis) a variety of factors related to site history (i.e., time since restoration, management, starting condition), organizational capacity, and type of ecosystem to determine which have the greatest potential to predict restoration outcome (i.e., post-restoration ecological condition). This preliminary analysis suggests starting condition (restoration vs remnant), type of ecosystem, and an organization's internal capacity (including planning) have the strongest effect on restoration outcome. Further analysis is planned as we continue to study the relationship between restoration outcomes and the factors that lead to success or failure.

Outcome 4: Work has not begun on this outcome.

Activity Status –April 18, 2016:
Outcome 4: We held two webinars to share findings from the project and to share preliminary guidelines. Each webinar was attended by approximately 60 restoration managers. They were recorded and are available online (www.restoringminnesota.umn.edu). We request permission to move $2900 budgeted for webinars from the "other" budget category to "Personnel". We had intended to rely on the University of Minnesota's College of Continuing Education's technical support for the webinars. However, they required $6000 for 2 webinars, which did not seem reasonable. So, we have arranged support by hiring a staff member (Justin Meissen) internally to perform this work.

Activity Status—July 22, 2016:
We request permission to move $1009 from travel to salaries for this activity. The shift accounts for minor discrepancies between previous reporting and actual accounting in the final closeout of the appropriation. Mike Banker was contacted about this budget issue. Amendment approved: 08/11/2016.

Final Report Summary:

Case histories for each project were developed from the manager survey, the plan evaluation request, and communications with the project managers. During the field surveys we identified information gaps for many projects related to conditions at the initiation of restoration, restoration actions, and organizational capacity. Consequently, project manager phone interviews were used to obtain additional information on the restoration histories for the 59 sites visited in 2014 and 2015. The planning tool, developed under Activity 1, was used to focus the request for information related to restoration actions. The relationship between the project managers (the individuals who acquired the grant) and the land manager often complicated the process of gathering information. For several projects both were interviewed to enable a greater understanding of the site history and the restoration process, as well as current management practices. Many interviewees were very

forthcoming, providing detailed information, while others were not as detailed in their responses. The information gathered via the interviews improved our ability to identify the most important determinants of restoration success for different types of ecosystems. The additional project information regarding start state, restoration implementation processes, ongoing management, staff changes, recordkeeping, and etc. were analyzed to shed light on factors that could affect project outcomes.

Field evaluations for the 59 ecological restorations selected for detailed evaluation were conducted between June and mid-September in 2014 and 2015. Two sites could not be visited because the current managers did not have a record of the location of the restoration activities funded by the grant. For 9 of the sites visited, the type of restoration or restoration action that was observed during our field evaluation (e.g., prairie vs wetland or planted/seeded vs vegetation management only) was inconsistent with the information provided by the manager. These inconsistencies in records points to a general problem of insufficient record keeping by many project teams.

Vegetation surveys were conducted at each site; observations about site stressors and adjacent land use practices were recorded, and a summary statement was written per the monitoring protocol. The vegetation survey data for each project was analyzed. Two metrics, 1) the proportion of the plant community comprised of species from the Potential Natural Vegetation lists (DNR), and 2) the proportion of the plant community comprised of invasive species were determined to be the most capable of discriminating differences in restoration outcomes. We were able to evaluate the importance of various explanatory variables on these outcomes. For example, the starting condition of a restoration, whether it was an agricultural field or old pasture restored to prairie or a logged forest or brome field restored to forest, plays a major role in whether or not the restoration is a high or low risk venture and whether or not it requires more or less effort to achieve its goal. Restoration efforts seldom overcome the legacies of high levels of degradation (e.g., densely invaded sites).

The follow-up phone interview transcripts were analyzed and coded using methodology from research on organizational resilience. We attempted to determine where factors related to situational awareness, keystone vulnerabilities or significant setbacks had either positive or negative impacts on project outcomes. Resilience comes from having a framework, process, and culture that allow an organization to respond to unforeseen events such as often arise when implementing ecological restorations. Our analysis did not find a strong correlation between project outcomes and the situational awareness demonstrated by the organizations. However, keystone vulnerabilities and the ability to respond to setbacks do appear to have an impact on outcomes. According to project managers of Minnesota restorations, 25% have experienced serious setbacks, yet many managers reported limitations to their capacity to respond to these setbacks. Limitations, or vulnerabilities, included insufficient funds (41%), inadequate staffing (60%), incomplete records (45%), and change in leadership (24%).

As a result of the restoration evaluations, the planning tool, monitoring tool, two webinars and a guidance document were developed to provide guidance during project planning and ongoing management and monitoring. These documents are attached with this final report.

Recommendations for planning and prioritizing future restoration projects:

- Organizations requesting funding should have demonstrated organizational capacity to successfully implement the proposed restoration project.
- The capacity to implement a restoration should be reflected in a detailed restoration plan submitted with the project proposal.
- The restoration plan should include measurable goals that will help guide the restoration process and provide benchmarks for assessing progress toward achieving biodiversity or ecosystem services outcomes.

- The restoration plan should include a timeline commensurate with the complexity of the proposed restoration project to allow time for adequate site preparation prior to seeding when appropriate.
- The project proposal should include a management plan that demonstrates a commitment to ongoing management with an emphasis on the first 5 years post-implementation.

V. DISSEMINATION:

Description:
The results of this project will be disseminated in five ways : 1) posting summary reports (i.e., fact sheets) on the Ecological Restoration Practitioners network and website (www.restoringminnesota.umn.edu), 2) presenting webinars, 3) updating content in the monitoring course of the online Ecological Restoration Training course, 3) making presentations at professional meetings, and 4) publishing peer-reviewed scientific papers. We expect that this project will yield at least 4 peer-reviewed publications**.**

Status as of *(January 1, 2014)*: No outcome to report.

Status as of (*July 1, 2014)***:** No outcome to report

Status as of *(January 10, 2015)***:** In partnership with DNR, we offered a webinar to agency staff.

Status as of *(July 1, 2015)*: Presented a summary of the LCCMR Restoration Evaluation project at the SER Midwest Great Lakes Chapter meeting in March.

Status as of *(January 20, 2016)***:** Preliminary findings from the LCCMR Restoration Evaluation project were featured in a presentation about restoration outcomes at the Society for Ecological Restoration 6th World Conference on Ecological Restoration in Manchester England in August. Note: Attendance at this conference was funded by other sources.

A pair of webinars has been scheduled for February and March to share our findings and to highlight goal setting, planning, and recordkeeping best practices from restoration practitioners that we have been working with throughout the restoration evaluation project. The topic for the February webinar will be "Restoration Goals as Guidance for Project Planning" with guests Wylie Buck, Restoration Ecologist, Great River Greening and Dan Shaw, Native Vegetation Specialist, Board of Water and Soil Resources. The topic for the April webinar will be "The Importance of Recordkeeping to Adaptive Management" with guests Karen Schik, Senior Ecologist, Friends of the Mississippi River and Mark Cleveland, Natural Resource Program Coordinator, MN DNR. The webinars will be recorded to be archived for future viewing. Expert guests have been invited to participate in a Q and A format with questions from the webinar hosts and the audience. The audiences for the webinars are the managers of the restoration projects who participated in this research project as well as other interested restoration practitioners and managers from around the state.

Final Report Summary (July 1, 2016):
The results of this project have been (or will be) disseminated in several ways:

1) A summary report (i.e., Restoration Evaluation Guidelines) that outlines the key findings of the evaluation has been developed and is attached with this report. The guidelines will be posted on the Ecological Restoration Practitioners network and website (www.restoringminnesota.umn.edu).

2) Two webinars summarizing key elements of restoration project planning and recordkeeping were hosted in winter 2016. The webinar "Planning to Avoid Pitfalls: The Key to Restoration Success", with guests Wiley Buck from Great River Greening and Dan Shaw from the Board of Water and Soil Resources was hosted on February 23, 2016. The webinar "Learning by Doing: Why Restoration Records Matter" with guests Karen Schik from

Friends of the Mississippi River and Mark Cleveland from the Department of Natural Resources was hosted on March 29, 2016. The target audiences for the webinars were the project managers as well as other restoration professionals. Each webinar was viewed by approximately 55 professionals. The webinars began with a summary of the results of the restoration evaluation presented as an introduction and context for each topic. The invited expert guests for each webinar presented the perspectives of a state agency and a non-profit engaged in ecological restoration. The webinars are archived on the Ecological Restoration Practitioners website (www.restoringminnesota.umn.edu). In partnership with the DNR, we offered a webinar to agency staff in November 2014.

3) Presentations describing the evaluation process and/or preliminary findings were made at 3 professional meetings:
The Eighth SER Midwest Great Lakes Chapter meeting in Bloomington, IN in April 2016, "Selecting restoration projects for public funding In Minnesota".

The Society for Ecological Restoration 6th World Conference on Ecological Restoration in Manchester England in August 2015, "Ecological restoration at meaningful time scales".

The Seventh SER Midwest Great Lakes Chapter meeting in Glencoe, IL in March 2015, "Evaluation of publicly funded restorations in Minnesota".

4) The results of the restoration evaluation will be summarized and submitted for publication in at least two peer-reviewed scientific journals. These are in preparation.

5) Content in the Site Assessment and Monitoring courses of the online Ecological Restoration Training Consortium will be reviewed and updated to reflect recommendations and best practices developed as outcomes of the restoration evaluation project.

VI. PROJECT BUDGET SUMMARY:

A. ENRTF Budget:

Budget Category	$ Amount	Explanation
Personnel:	$ 162,500	1 research fellow to complete most tasks of this project; 1 research fellow to add capacity needed for field monitoring
Professional/Technical/Service Contracts:	$ 3,600	Honoraria for expert panelists
Equipment/Tools/Supplies:	$ 3,000	For panel review meeting and field supplies for monitoring
Travel Expenses in MN:	$ 28,000	Transportation, food and lodging for field monitoring
Other: IT costs for 2 webinars	$ 2,900	2 webinars to communicate guidance –1 for planning, 1 for completed projects
TOTAL ENRTF BUDGET:	**$ 200,000**	

Explanation of Use of Classified Staff: N/A

Explanation of Capital Expenditures Greater Than $3,500: N/A

Number of Full-time Equivalent (FTE) funded with this ENRTF appropriation: 1.25

Number of Full-time Equivalent (FTE) estimated to be funded through contracts with this ENRTF appropriation:

B. Other Funds:

Source of Funds	$ Amount Proposed	$ Amount Spent	Use of Other Funds
University of Minnesota			
5% salary and fringe (Galatowitsch)	$20,640	$20,640	Project manager's time for administration of project, and participation in all other aspects of project, especially statistical analysis.
Unallowable fringe (52%)	104,000	$104,000	
TOTAL OTHER FUNDS:	**$124,640**	**$124,640**	

VII. PROJECT STRATEGY:

A. Project Partners: None

B. Project Impact and Long-term Strategy:

Over the past twenty years, the scale and complexity of ecological restoration projects have increased as practice has advanced. Despite these advances, projects vary in their outcomes, with many failing to achieve their intended goals. Because few restorations are adequately monitored, we do not know the rate of restoration failure or the most common causes of failure. The intent of this LCCMR project is to develop a demonstration monitoring program for LCCMR restoration projects, whereby planned and completed projects can be evaluated to determine critical corrections needed to achieve goals. This demonstration project will look for deficiencies (and strengths) in 80 project plans and about 40 completed projects to provide a 'first look' at the effectiveness of LCCMR restorations. This project will develop tools and procedures that can be efficiently used on a group of selected restoration projects each year, so LCCMR can estimate the overall effectiveness of restoration efforts for different types of goals and ecosystems, and identify specific projects that are deficient.

C. Spending History: N/A

Funding Source	M.L. 2007 or FY08	M.L. 2008 or FY09	M.L. 2009 or FY10	M.L. 2010 or FY11	M.L. 2011 or FY12-13

VIII. ACQUISITION/RESTORATION LIST: N/A

IX. MAP(S):N/A

X. RESEARCH ADDENDUM: N/A

XI. REPORTING REQUIREMENTS:

Periodic work plan status update reports will be submitted not later than January 1, 2014, July 1, 2014, and January 1, 2015. A final report and associated products will be submitted between June 30 and August 15, 2015 as requested by the LCCMR.

Attachment A: Budget Detail for M.L. 2013 Environment and Natural Resources Trust Fund Projects

Project Title: *Restoration Evaluations*
Legal Citation: *M.L. 2013, Chp. 52, Sec. 2, Subd. 04l*
Project Manager: *Susan Galatowitsch*
M.L. 2013 ENRTF Appropriation: $ *200,000*
Project Length and Completion Date: 36 months, July 1, 2016
Date of Update: August 29, 2016

ENVIRONMENT AND NATURAL RESOURCES TRUST FUND BUDGET	Activity 1 Budget	Amount Spent	Balance	Activity 2 Budget	Amount Spent	Balance	Activity 3 Budget	Amount Spent	Balance	TOTAL BUDGET	TOTAL BALANCE
BUDGET ITEM	***Develop tools & compile basic project information***			***Evaluate restoration plans***			***In-depth monitoring***				
Personnel (Wages and Benefits)											
Research Fellow-(100%, 2 yrs, 75.6% salary, 25.1% fringe)	32,500	32,500	0	13,832	13,832	0	143,809	143,809	0	190,141	0
Teaching Specialist-($2169-salary, $731 fringe)							2,900	2,900	0	2,900	0
Professional/Technical/Service Contracts Honorarium-expert panel reviewers-12 x $300	1,500	1,500	0				0	0	0	1,500	0
Travel expenses in Minnesota: (2 people, 9 weeks, 1000 mi/week pp@.56/mi, $100 day/pp lodging, $50 day/pp food)							3,659	2,689	970	3,659	970
Other - Supplies and other costs associated with expert panel review, planning guidebook	0	0	0				1,000	0	1,000	1,000	1,000
Field supplies including waterproof boots, plant collection materials, field guides, waterproof camera.							800	582	218	800	218
2 webinars to communicate guidance for planning and evaluation-IT and facilities rental costs ($1450 each)							0	0	0	0	0
COLUMN TOTAL	**$34,000**	**$34,000**	**$0**	**$13,832**	**$13,832**	**$0**	**$152,168**	**$149,980**	2,188	200,000	2,188