2010 Project Abstract
For the Period Ending June 30, 2013

PROJECT TITLE: Ecological Restoration Training Cooperative
PROJECT MANAGER: Susan M. Galatowitsch
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FUNDING SOURCE: Environment and Natural Resources Trust Fund
LEGAL CITATION: M.L. 2010, Chp. 362, Sec. 2, Subd. 4(a).

APPROPRIATION AMOUNT: $ 550,000

Overall Project Outcome and Results

Ecological restoration is increasingly relied on as a conservation strategy in Minnesota even though project failure rates remain high. To improve ecological restoration success in Minnesota, this project developed training opportunities for practicing restoration professionals. We established the Ecological Restoration Training Cooperative (ERTC), which is based at the University of Minnesota, and coordinated as a partnership between state agencies and the University. A program of web-based, instructor-guided learning, combined with field sessions offered at multiple locations, are the first of its kind in the US for restoration. As part of this project, the training cooperative developed and offered five application-oriented online courses accessible statewide. These courses covering site assessment, seeding, planting, vegetation management and monitoring, were taken by 113 people during the “pilot phase”. Each course will be offered at least twice a year through the UM College of Continuing Education. In conjunction with the online courses, field training sessions were developed for the seeding and vegetation management courses. These sessions focus on hands-on restoration skills introduced in the online courses. A four-year agreement with DNR Parks and Trails will allow each of the two field sessions to be taught by DNR natural resource specialists at four out-state locations each year in order to facilitate access to the training opportunities by individuals from around the state.

In addition to the five training courses, the ERTC developed several other ways for restoration practitioners to learn skills and stay current. A webinar series, an annual workshop, social network, and website were all launched as part of ERTIC programming. During this grant period, five webinars were held, which were attended by over 1000 people. These presentations were recorded and are available on the practitioner’s network, which has 187 members to date. The first annual conference, focused on restoration monitoring, was held in May 2013. Information on all upcoming events, including online courses can be found on the ERTC website, www.restoringminnesota.umn.edu. Details about the content of online courses, field sessions, webinars, and the workshop are presented in a supplemental report.

Project Results Use and Dissemination

Information from this project has been made available in the following ways:

1. Information on training opportunities is made available through the ERTC website, which was accessed over 2600 times in the past 18 months.
2. Recorded webinar presentations are available through the ERTC practitioner’s network, which is also linked to the website.

3. Course and workshop information has been (and will continue to be) disseminated to over 6000 people, which is part of an active marketing effort led by the College of Continuing Education.
4. The innovative approaches taken to the online courses have been communicated by press-releases connected to the R1Edu national university network.
5. The innovative suite of training opportunities will be communicated with restoration researchers and practitioners at a talk to presented to the Society for Ecological Restoration International Congress to be held in October 2013.
6. Of the 140 people that completed the course as beta-testers or in the pilot phase, many were middle-level managers responsible for contracting and program coordination. These individuals have first-hand experience with the course and are in a position to recommend it to colleagues that need/want to advance their skills.

Environment and Natural Resources Trust Fund (ENRTF)
2010 Work Program Final Report

Date of Report: September 9 2013
Date of Next Progress Report: Final Report
Date of Work Program Approval: June 9, 2010
Project Completion Date: June 30, 2013

I. PROJECT TITLE: Ecological Restoration Training Cooperative

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Locations: Ramsey, Dodge, Redwood, Otter Tail, Pine, St. Louis Counties

Total ENRTF Project Budget:	**ENRTF Appropriation**	**$ 550,000**
	Minus Amount Spent:	**$ 491,699**
	Equal Balance:	**$ 58,301**

Legal Citation: M.L. 2010, Chp. 362, Sec. 2, Subd. 4(a).

Appropriation Language:
$550,000 is from the trust fund to the Board of Regents of the University of Minnesota for improving ecological restoration success in Minnesota by developing and offering training programs for habitat restoration professionals. This appropriation is available until June 30, 2013, by which time the project must be completed and final products delivered.

II. FINAL PROJECT SUMMARY AND RESULTS:
Ecological restoration is increasingly relied on as a conservation strategy in Minnesota even though project failure rates remain high. To improve ecological restoration success in Minnesota, this project developed training opportunities for practicing restoration professionals. We established the Ecological Restoration Training Cooperative (ERTC), which is based at the University of Minnesota, and coordinated as a partnership between state agencies and the University. A program of web-based, instructor-guided learning, combined with field sessions offered at multiple locations, are the first of its kind in the US for restoration. As part of this project, the training cooperative developed and offered five application-oriented online courses accessible statewide. These courses covering site assessment, seeding, planting, vegetation management and monitoring, were taken by 113 people during the “pilot phase”. Each course will be offered at least twice a year through the UM College of Continuing Education. In conjunction with the online courses, field training sessions were developed for the seeding and vegetation management courses. These sessions focus on hands-on restoration skills introduced in the online courses. A four-year agreement with DNR Parks and Trails will allow

each of the two field sessions to be taught by DNR natural resource specialists at four out-state locations each year in order to facilitate access to the training opportunities by individuals from around the state.

In addition to the five training courses, the ERTC developed several other ways for restoration practitioners to learn skills and stay current. A webinar series, an annual workshop, social network, and website were all launched as part of ERTIC programming. During this grant period, five webinars were held, which were attended by over 1000 people. These presentations were recorded and are available on the practitioner's network, which has 187 members to date. The first annual conference, focused on restoration monitoring, was held in May 2013. Information on all upcoming events, including online courses can be found on the ERTC website, www.restoringminnesota.umn.edu.

III. PROGRESS SUMMARY AS OF APRIL 24, 2013:

Progress Summary as of April 24, 2013
The five online courses are currently being offered as pilot courses. The curricula for the field courses have been developed in collaboration with resource specialists of MN DNR-State Parks.

Amendment approved April 24, 2013
During the process of curriculum planning for the field training sessions, many needs for additional, essential supplies and non-capital equipment were identified. We request permission to increase these budget lines a total of $27,812 to acquire these supplies and equipment, which will be dispersed to the state parks serving as field training sites. Those that aren't expendable will also be used for restoration work conducted by state parks. To cover these additional expenses, $25812 less will be used for the research fellow salary and $2000 less for a DNR contract.

We also request permission to use $5000 designated for professionals featured in videos for additional work by the instructional designer. With this contract we will prepare a version of the online courses suitable for undergraduates. Offering this as a regular university course will provide an opportunity to enhance the training of university students who intend to become restoration professionals. We expect this course would be offered for the first time in Spring 2014.

We also request a minor accounting change to add $300 to the Result 2 budget and remove $300 from the Result 3 budget for the CCE Program Director's salary. This reflects the change in effort needed by the director to handle arrangements for offering courses for the first time.

Progress Summary as of January 26, 2013
The development of the five on-line courses is complete: all have been alpha-tested, beta-tested, and revised based on comments received. The virtual sites (see below) with interactive maps have also been extensively evaluated. Feedback on all five courses was very positive. One major change made in response to the beta-testing is that we decided that assignments needed to be graded by instructors, rather than relying on self-evaluation. This will add a significant amount of instructional time to these course offerings, but the number of students who did not complete assignments appeared to be very high. Since the assignments are critical for building essential skills, we decided this change was necessary. The courses will be offered for the first time between January and May as pilot courses (i.e., registration costs covered by this appropriation). If the courses fill (which is very likely), 100 students will take the site assessment course (a pre-requisite for the other courses), and 80 students will take one of the other four courses (Seeding, Planting, Monitoring, Vegetation Management).

A financial plan has been drafted by the College of Continuing Education (CCE), the unit responsible for administration of the courses on an ongoing basis. CCE staff members are working with the College of Food, Agriculture and Natural Resource Science, the instructional unit, to finalize this plan. Under this draft three-year plan, each course would be offered twice a year; the cost to each student would be $375/course, which is lower than undergraduate tuition rates. Assuming 100 students take the courses/year, 41% of revenues generated will be used by CCE to update the curriculum, handle registration, market the courses, manage student records, administer expenses and contracts associated with instructional design, and provide technical support for students in the course and for the practitioner's network (see below). The remaining 59% of the revenue will be used for instructional costs, including providing feedback on student assignments, responding to student inquiries, and revising course content.

Three webinars have been offered thus far, and another two are planned for spring 2013. The most recent webinar focused on selecting seed sources to future-proof restoration projects. Over 300 people registered for the webinars, which greatly exceeded expectation. We are investigating options for handling the high level of interest in these webinars. The webinars are recorded and archived on the Practitioner's Network, which now has 160 members.

Amendment approved January 26, 2013
Development of the field training curriculum and establishment of the satellite field training centers will occur January-April 2013, with the first field sessions being offer in May-June 2013. We have determined that the optimal field training centers would be Minnesota State Parks; Parks and Trail staff have a high level of expertise related to restoration and there are ongoing restoration projects in the state park system statewide. Therefore, for Deliverable #5 under Result 1 we plan to align training with the four DNR regions of the state and rely on DNR Parks and Trail staff to offer the training for the next 4 years. To accomplish this, we request permission take $30,000 of the funding in non-capital equipment and tools and include it in a professional services contract to MN DNR. The funds would be spent in the same manner and for the same purpose (to support training), but purchases would be made by the parks responsible for the training. This contract would also include $20,000 of the field trainer funds designated under Results 1 and 2. Because these funds would be expended as part of offering training, rather than developing training, we have moved the budget items that would be part of the DNR-Parks and Trails contract to Result 2.

We are also requesting a few changes to the budget related to personnel that we relied on to develop online courses. For instructional design, we have will use $8000 more in consulting professional services but $8000 less for the CCE Online Distance Learning Team because we opted to use an external contractor rather than internal staff.

To develop content, instead of a junior scientist ($21,000), we hired a graduate research assistant ($33,117), because of their expertise and availability. In addition, online course development required more research fellow time than anticipated (an additional $17,000). We opted to increase the number of beta testers used during course development to ensure obtained adequate feedback, which increased costs of Result 1 by $5000. We can cover the additional expenses for this result ($34,000) because we anticipate needing less research fellow time for offering courses ($5800), for webinars and conferences ($8400), for travel ($7000) and for field trainers ($5000) and training equipment/tools ($8000). We need less money for field trainers and equipment/tools because we will hold them in four locales, rather than five, to align with logical state park locations.

Progress Summary as of July 20, 2012:
By the end this second year, we have completed development of three of the five on-line courses, Site Assessment, Designing and Using Native Seed Mixes, Designing, Installing and Managing Native Plantings. Each of these three courses consists of four components: 1) on-screen teaching modules (120-140 screens/per course) with audio narration, 2) a virtual site that provides data sources and images necessary for site assignments, 3) 7-9 site assignments, 4) tests (7-8 quizzes and an end-of-course exam). The online screens present concepts so there practical relevance is clear and using active learning devices to engage the students. Video clips feature 'expert' Minnesota practitioners.The virtual sites include multiple interactive maps that link to data and maps; these allow students to experience many aspects of working on actual sites. The two remaining courses, Monitoring Ecological Restorations and Managing Ecological Restorations, are currently in development.

The courses are "alpha" tested by agency project partners who reviewed the content, two University of Minnesota students who took the entire course, and a College of Continuing Education staff member who tested links and navigation. Based on detailed feedback from alpha-testers, courses are revised and offered to beta testers, i.e., early career restoration professionals, i.e., similar to the intended audience for the courses. Beta testers provide their feedback in the form of a detailed written survey. The courses are revised based on beta-testing comments before they are available as a regular offering (beginning January 2013). Course 1 (Site Assessment) has been alpha and beta-tested, Course 2 (Seed Mixes) has been alpha-tested and is currently in beta testing. Course 3 is ready for alpha-testing. Course development and testing is scheduled to be completed by November 1, 2012. Feedback from 28 beta-testers on Course 1 was very positive; while few students had previous experienced with on-line courses, nearly all reported they learned a lot and would take other courses.

Two webinars have been offered thus far; the second one on shoreland and stormwater plantings was held in March 2012. Over 250 people registered and participated in this webinar. The restoration practitioners network has 116 members who have joined to participate in forums (including Q and A from webinar sessions), receive notices about events (e.g., training workshops and conferences), and read about featured restoration practices.

Amendment approved July 20, 2012:
During the past 6 months, we moved into the full-production phase of on-line course development, a process that will be complete within the next 5 months. It is now possible to confidently know where budget adjustments are needed to finish this work.

For Result 1: We would like permission to reduce the funding allocated to the CCE online distance learning team by $41,500 and the CCE new media group by $10,000. Most of these funds ($30,000) would be shifted to other CCE that are providing more support for online course development than originally anticipated ($15,000 for CCE program planning team, $15,000 for CCE marketing team). We also need an additional $1000 for temporary technicians who are recording audio and testing site assignments.The marketing team, for example, includes the staff members that are handling audio and video production for the online courses.

We also need $14,000 less for video simulations because our contractors have been efficient and affordable. We also need $6000 less in travel; for course development, the CCE staff have not needed to travel. We will use $2500 for supplies to support all three results. Our consulting professional services for instructional design and web programming for essential course components requires an additional $50,000. So, in addition to the funds available from rebudgetnig other Result 1 items, we would like to reallocated $14,000 from webinar support (Result 3). Technical support for webinars has been more affordable than anticipated; this change will not reduce the number or quality of webinars we will offer.

For Result 2: We need to allocate an additional $2000 for CCE program planning team time to cover work needed to offer courses for the first time.

Amendment approved on February 20, 2012

1. Since the beginning of this project in July 2010, we've made some changes in the titles and scope of courses, based on what we've learned about online learning as well as restoration training needs in Minnesota. We believe we now have an optimal scheme. We originally proposed "Five application-oriented courses (12-16 hrs each) will be developed that fill an immediate need of multiple agencies: (1) Designing and using native seed mixes, (2) Vegetation management for restored ecosystems, (3) Monitoring restoration success, (4) Revegetating drastically altered lands, (5) Restoration for biodiversity conservation". We request permission to amend these five courses to be: (1) Site Assessment, goal-setting and planning, (2) Designing and using native seed mixes, 3) Native planting design and implementation, 4) Monitoring restoration success and 5) Vegetation management for restored ecosystems. Course 1 (site assessment) will be a gateway (i.e., pre-requisite) for the others. We are covering many of the basic topics and skills proposed for the originally proposed courses on drastically altered lands and restoration of biodiversity in other courses. The more advanced topics are likely best addressed in in-person training sessions.
2. We would like to move $30,000 in funds from the CCE Online Distance Learning Team to Consulting Professional Services. We are finding it efficient and productive to work with outside consultants on course design and editing.
3. We would like to move $5000 from Webinar Technical Support to Personnel CCE Program Planning Team- Program Associate. The staff member who has been organizing the webinars is from the Program Planning office of CCE which has reduced the support needed from external contractors.

Progress Summary as of January 1, 2012:

The first course, Site Assessment, has been transformed from a collection of content and media elements into a self-paced, interactive learning experience. A distinct component that allows the user to explore conditions and analyze data to make restoration decisions for a virtual site is in development now. This component, the Site Portfolio, will be the basis of applied learning activities within each of the online courses; it is being designed to be easily updated with new data sets so each course can provide a customized virtual site analysis experience relevant to the course topic. A style guide, governing the look and feel both within and across each course was developed with input from a graphic designer, who also designed graphic elements for the courses. A second course Seed mixes) is currently in-progress and is scheduled to be completed in February. Specific course content for two other courses (Site Planting Design, Monitoring and Management) had been developed previously; these courses should be completed by May. For these courses we have screen-by-screen written drafts of content that will be transformed into the audiovisual content the students will see on-line when they participate in a course. To support online course development, we created a large photo library by visiting project sites and working with professionals around the state. The course content drafts were reviewed by project partners in DNR, BWSR, and DOT who made recommendations to ensure the courses would meet their agencies' needs. Project partners have also reviewed the completed Site Assessment course. We also held open forums in those agencies to introduce staff to the training program opportunities we are developing, solicit their cooperation, and ask for suggestions.

The ERTC program website went "live" in June (www.restoringminnesota.umn.edu). It includes a professional networking site ('i.e. community of practice), resource library, and information on courses, Webinars, and conferences (in development). The professional network site already has 73 members. We hosted the first Webinar November 15, 2011, Building Better Seed Mixes.

This webinar, which focused on use of Mn/DOT's new seed mix tool, was attended by 132 people from 88 cities in Minnesota, Iowa, Indiana, Michigan, South Dakota and Wisconsin (177 people were pre-registered, and received resource information prior to the Webinar). The audience included many engineers, and project managers, planners, city and county employees, environmental specialists, landscape architects, master gardeners, biologists, and US Army Corps of Engineers. Another Webinar is planned for early 2012, likely on the topic of urban retrofit stormwater gardens.

Progress Summary as of July 1, 2011:
We developed specific course content for four courses (Site Assessment, Seed Mixes, Planting Design, Monitoring and Management). For these courses we have screen-by-screen written drafts of content that will be transformed into the audiovisual content the students will see on-line when they participate in a course. We need a large number of specific photographs to illustrate course concepts and methods, and so have been systematically visiting project sites and working with professionals around the state in order to build a photo library. The production of the online course content will be accomplished with guidance and assistance from an instructional designer who we hired on July 1. The course content drafts were reviewed by project partners in DNR, BWSR, and DOT who made recommendations to ensure the courses would meet their agencies' needs. We also held open forums in those agencies to introduce staff to the training program opportunities we are develop, solicit their cooperation, and ask for suggestions.

The ERTC program website went "live" in June (www.restoringminnesota.umn.edu). It includes a professional networking site ('i.e. community of practice), resource library, and information on courses, webinars, and conferences (in development). We plan to market the web site in the fall, using our first webinar as a key event to generate interest.

Amendment Approved on May 4, 2011:
1. We need more staff capacity during the field season (May-Sept) to ensure we collect all needed images for our online courses. This is going to be a much larger job than we anticipated -- we need over 600 images. We would like to hire a temporary assistant (student or recent graduate) to acquire and organize the photo collection. This will cost $6000.
2. We neglected to include any supply budget for the university-based work (it is all dedicated to our field training sites). We need to purchase some software and pay for miscellaneous expenses (e.g., web storage of photos). We would like to allot $2000 for this purpose.
3. Our budget allots $25000 for video simulations for on-line courses. The course plans we have devised rely much less on simulations than we had expected. So, we propose redistributing $8000 that we need for salary and supplies, reducing the amount available for simulations to $17000.
4. We also need more staff capacity at a lower level throughout the year to do basic tasks, so we want to use some funds for a B.S. level junior scientist ($21,000) rather than a PhD level scientist.

Amendment Approved on March 17, 2011: (1) We need to move $28,800 in University of Minnesota instructional design salaries to instructional design consultants. Course development requires expertise not currently available at the University. (2) We need to move $5700 in marketing from Result 1 (course development) to Result 3 (website and conference). This was an error in the original proposal; there's minimal need for marketing during course development.

Progress Summary as of January 1, 2011:
In the first six months, we developed detailed course plans for five courses and a site assessment module that will be used in the five courses. We have expanded the scope of the

course content by incorporating vegetation management information into Courses 1, 3, 4, 5 (see titles below), allowing us to create another course, "Designing , installing and managing native plants in restoration". We realized early in course development that this information could not be covered in the other courses, although it is important for programs such as those involving lakeshore restoration and raingardens. We also began developing course content for the first course on designing seed mixes. The basic organization and design elements of the website were created during the past 6 months. In addition, various options for supporting the "community-of-practice" network elements of the website were evaluated for their suitability.

IV. OUTLINE OF PROJECT RESULTS*:*

RESULT 1: Develop ecological restoration training courses.

Description: Web-based instructional technology has greatly advanced in recent years; people in remote locations can now effectively learn from instructor-guided multimedia lectures, collaborative projects and discussions. We will rely on web-based instruction for delivering much of the content of the courses. Some topics, though, require field-based instruction which will be offered at multiple statewide locations. Five application-oriented courses (12-15 hrs each) will be developed that fill an immediate need of multiple agencies: (1) Site Assessment, goal-setting and planning, (2) Designing and using native seed mixes, 3) Native planting design and implementation, 4) Monitoring restoration success and 5) Vegetation management for restored ecosystems. The University of Minnesota will develop course content collaboratively with state agency staff. Course content will also be reviewed and tested by experienced practitioners. We will review other environmental training programs as precedents. We will also collaborate with agency and private-sector restoration professionals to identify key additional training needs, to determine how to apply training completion as a professional credential for contracts, and to plan for long-term program sustainability.

Summary Budget Information for Result 1: **ENRTF Budget: $ 326,688**
Amount Spent: $ 300,381
Balance: $ 26,307

Deliverable	Completion Date	Budget
1. Detailed outlines for all courses (field & online components)	March 1, 2011	$ 19,475
2. Detailed instructor plans for field sessions of all courses	July 1, 2011	$ 38,950
3. Financial plan for program sustainability	July 1, 2011	$ 3,895
4. Pilot versions of all courses -online components	January 1, 2012	$ 125,938
5, Set up satellite training centers & complete training of field instructors	January 1, 2012	$ 93,480
6. Tested and refined versions of all courses (online and field components)	July 1, 2012	$ 38,950

Result Status as of January 1, 2011: Outlines were created for the following six course components: (1) Site assessment module, (2) Designing and using native seed mixes, (3) Designing, Installing, and Managing Native Plantings, (4) Monitoring and Management of Ecological Restorations, (5) Revegetating Drastically Altered Ecosystems, and (6) Restoring Biodiversity. These outlines were reviewed by agency representatives of MN DOT, MN DNR,

and BWSR. We began developing course content for the site assessment module and seed mix courses.

Result Status as of July 1, 2011:

We developed specific course content for four courses (Site Assessment, Seed Mixes, Planting Design, Monitoring and Management). For these courses we have screen-by-screen written drafts of content that will be transformed into the audiovisual content the students will see on-line when they participate in a course. We need a large number of specific photographs to illustrate course concepts and methods, and so have been systematically visiting project sites and working with professionals around the state in order to build a photo library. The production of the online course content will be accomplished with guidance and assistance from an instructional designer who we hired on July 1. The course content drafts were reviewed by project partners in DNR, BWSR, and DOT who made recommendations to ensure the courses would meet their agencies' needs. We also held open forums in those agencies to introduce staff to the training program opportunities we are develop, solicit their cooperation, and ask for suggestions.

Result Status as of January 22, 2012:

We have completed the pilot version of the first online course (Site Assessment). The course is estimated to take 10 hours to complete and includes over 100 "screens" of narrated content, links to external resources, self-evaluated quizzes, and practical exercises to apply learned skills. The practical application section relies on a virtual field site we constructed from detailed vegetation and soils data collected during a summer field campaign, climate and land use information and over 80 annotated maps and images. A second course (Seed Mixes), estimated to take 15 hours to complete, is currently in-progress and is scheduled to be completed in February. Specific course content for two other courses (Site Planting Design, Monitoring and Management) had been developed previously; these courses should be completed by May. For these courses we have screen-by-screen written drafts of content that will be transformed into the audiovisual and interactive content the students will see on-line when they participate in a course. To support online course development, we created a large photo library by visiting project sites and working with professionals around the state. The course content drafts were reviewed by project partners in DNR, BWSR, and DOT who made recommendations to ensure the courses would meet their agencies' needs. Project partners have also reviewed the completed Site Assessment course. We also held open forums in those agencies to introduce staff to the training program opportunities we are developing, solicit their cooperation, and ask for suggestions.

We realize that we are significantly behind schedule in completing online courses. There was a significant 'learning curve' for both content staff and instructional designers. In addition, the team we initially assembled for the project did not have all of the skills necessary for the project. Since October, we have had the capacity necessary to make significant progress and completed one full course. We now have the staff we need and an efficient development process, so anticipate we progress much faster.

Result Status as of July 20, 2012:

Course development is completed for three of the five on-line courses, Site Assessment, Designing and Using Native Seed Mixes, Designing, Installing and Managing Native Plantings. Each of these three courses consists of four components: 1) on-screen teaching modules (120-140 screens/per course) with audio narration, 2) a virtual site that provides data sources and images necessary for site assignments, 3) 7-9 site assignments, 4) tests (7-8 quizzes and an end-of-course exam). The two remaining courses, Monitoring Ecological Restorations and Managing Ecological Restorations, are currently in development. Course 1 (Site Assessment)

has been alpha and beta-tested, Course 2 (Seed Mixes) has been alpha-tested and is currently in beta testing; Course 3 is ready for alpha-testing. Course development and testing is scheduled to be completed by November 1, 2012.

Result Status as of January 26, 2013:

The development of the five on-line courses is complete: all have been alpha-tested, beta-tested, and revised based on comments received. The detailed feedback provided by the students was used to identify gaps in content, add clarity to parts of the course students found confusing, and revise exam questions and details of assignments. The virtual sites (see below) with interactive maps have also been extensively evaluated. Feedback received on all five courses was very positive.

The site assignments are important for building critical skills in each course. One major change made in response to the beta-testing is that we decided that assignments should be graded by instructors, rather than relying on self-evaluation. This will add a significant amount of instructional time to these course offerings, but the number of students who did not complete assignments appeared to be very high. We developed a process whereby students upload their responses to assignment questions, which are typically a few sentences of text or a table, to the electronic course system, and instructors provide written feedback and determine if the response was correct. Students will have two opportunities to attempt each of the assignment questions and need to pass 70% of them (as well as 70% of the exam questions) to successfully complete the course.

A financial plan has been drafted by the College of Continuing Education (CCE), the unit responsible for administration of the courses on an ongoing basis. CCE staff members are working with the College of Food, Agriculture and Natural Resource Science, the instructional unit, to finalize this plan. Under this draft three-year plan, each course would be offered twice a year; the cost to each student would be $375/course, which is lower than undergraduate tuition rates. Assuming 100 students take the courses/year, 41% of revenues generated will be used by CCE to update the curriculum, handle registration, market the courses, manage student records, administer expenses and contracts associated with instructional design, and provide technical support for students in the course and for the practitioner's network (see below). The remaining 59% of the revenue will be used for instructional costs, including providing feedback on student assignments, responding to student inquiries, and revising course content. If the enrollment drops below 50 students/per year, all of the revenue will be used by CCE for the fixed costs associated with the courses, i.e., marketing, administration, and registration. In the event of low enrollments, instructional costs will be covered as part of part of the regular teaching responsibilities of the project manager (Galatowitsch).

Result Status as of April 24, 2013:

No additional information to report—the courses have been developed and are being offered.

Final Report Summary: July 1, 2013:

Five application-oriented courses (15-25 hrs each) were developed to fill immediate need of multiple agencies: (1) Site Assessment and goal-setting, (2) Designing and using native seed mixes, 3) Native planting design and implementation, 4) Monitoring restoration success and 5) Vegetation management for restored ecosystems. Each of these three courses consists of four components: 1) on-screen teaching modules (120-140 screens/per course) with audio narration, 2) a virtual site that provides data sources and images necessary for site assignments, 3) 7-9

site assignments, 4) tests (7-8 quizzes and an end-of-course exam). A demonstration of these course elements can be found on the ERTC website at www.restoringminnesota.umn.edu.

Learning objectives for each course and outlines of each module were reviewed by agency partners prior to content development to ensure all essential information needed by their restoration practitioners was included. Each on-screen module includes presentation of the foundational scientific concepts, examples of practical applications of these concepts, and interactive slides that allow students to practice what they've learned. The modules are graphics-rich with illustrations and photos taken during Minnesota restorations. Each course includes one-two videos featuring restoration practitioners. Upon completing a module, students visit a 'virtual site' and complete assignments that reinforce practical skills and their ability to apply concepts to actual field situations. Three virtual sites were developed to support on on-line courses: 1) agricultural land adjacent to a highway, wetlands, and oak savanna, 2) residential lakeshore, and 3) wetland and prairie restored in an urbanizing landscape. Each of these is based on details of actual sites, which are presented as websites within the courses. These websites include many interactive maps, descriptions of site conditions and land use history, and data files on features such as vegetation. The virtual sites and associated assignments are intended to mimic many aspects of gathering and using information from sites to make restoration decisions. Students submit their answers to assignments and receive feedback from instructors. They are allowed two attempts to complete assignments.

The first working versions of the courses were tested by two university technicians (1 focusing on content, 1 focusing on navigation) and the three agency partners. The courses were revised and then 'beta-tested' by a minimum of 6 people who had been recruited by an open-call for participants. Upon completion of the course, beta testers provided detailed feedback, which was used to revise the course and produce the "pilot version" of each course. The learning objectives and syllabus for the courses are provided in the supplemental report.

In conjunction with the online courses, field training sessions were developed for the Seeding and Vegetation Management courses. Each session will be offered at four Minnesota State Parks, taught by natural resource specialists with extensive restoration experience. The learning objectives for these sessions focus on skills that require 'hands-on' opportunities. For example, calibrating equipment, such as seed drills or tank sprayers, requires students perform the tasks to know if they have mastered the skill. Detailed field session outlines were developed by the team of park trainers and the university course instructors. The curriculum outlines for these field sessions are provided in the supplemental report. The trainers will follow this common curriculum. Each park hosting ERTC field training sessions received supplies and equipment from this grant so they have equivalent capacity to deliver the training.

A financial plan that allows for courses offerings to be sustained after the end of this grant was developed by the College of Continuing Education (CCE), the unit responsible for administration of the courses on an ongoing basis. CCE staff members worked with the College of Food, Agriculture and Natural Resource Science, the instructional unit, to finalize this plan. Under this three-year plan, each course would be offered twice a year; the cost to each student would be $375/course, which is lower than undergraduate tuition rates. Assuming 100 students take the courses/year, 41% of revenues generated will be used by CCE to update the curriculum, handle registration, market the courses, manage student records, administer expenses and contracts associated with instructional design, and provide technical support for students in the course and for the practitioner's network (see below). The remaining 59% of the revenue will be used for instructional costs, including providing feedback on student assignments, responding to student inquiries, and revising course content. If the enrollment drops below 50 students/per year, all of the revenue will be used by CCE for the fixed costs associated with the courses, i.e., marketing, administration, and registration. In the event of low enrollments, instructional costs

will be covered as part of part of the regular teaching responsibilities of the project manager (Galatowitsch).
We have a surplus for this result because some of the work we expected to be performed by personnel hired by this project was performed by the project manager and not billed to the project.

RESULT 2: Offer ecological restoration training courses.

Description Each course will be offered at least once/yr beginning in 2013. University faculty (Galatowitsch) will be the main instructor responsible for overseeing course quality and participant performance and will teach web-based parts of all courses. Field sessions will be taught by a group of trainers from state agencies, UM outreach centers, and the private sector. All trainers will have extensive prior experience and receive formal training from the project team. Courses will be marketed by the University of Minnesota- Continuing Education Professional Education Program.

Summary Budget Information for Result 1:	**ENRTF Budget:**	**$ 129,712**
	Amount Spent:	**$ 119,634**
	Balance:	**$ 10,078**

Deliverable	Completion Date	Budget
1. Market and offer five courses	July 1, 2013	$ 129,712

Result Completion Date: July 1, 2013

Result Status as of January 1, 2011: No progress on this result because courses are still in development.

Result Status as of July 1, 2011: No progress on this result because courses are still in development.

Result Status as of January 1, 2012: No progress on this result because courses are still in development.

Result Status as of July 20, 2012: No progress on this result because courses are still in development.

Result Status as of January 26, 2013:
The courses will be offered for the first time between January and May as pilot courses (i.e., registration costs covered by this appropriation). Registration is currently open for the courses, and they are nearly full. We anticipate that, 100 students will take the site assessment course (a pre-requisite for the other courses), and 80 students will take one of the other four courses (Seeding, Planting, Monitoring, Vegetation Management).

Result Status as of April 24, 2013
The field course training plans have been developed and the first year of classes has been scheduled. Supplies and equipment necessary for the training are in the process of being purchased and distributed**.**

Final Report Summary: July 1, 2013

Between January and May, 2013, the site assessment course was offered twice and the other four courses were offered once. Eighty-eight students enrolled in the site assessment course without cost, which was covered by this grant. Sixty eight students started the course, of these, 80% successfully completed the course. Sixty-six students enrolled in the other four courses; 45 students started work on them, of which 84% passed. A table providing detail on each course is provided in the supplemental report. Student feedback from the courses was very positive, often noting that the scope of the information presented and the level of detail was valuable. Comments from students are included in the supplemental report.

In 2013, field sessions for the seeding course are being held at Rice Lake State Park (June 19, September 12), Glendalough State Park (September 11), and Camden State Park (September 12). Vegetation management sessions are offered at St. Croix State Park (June 19), Glendalough State Park (June 20), Fort Snelling State Park (June 20), and Jay Cooke State Park (September 25). Participants must have completed the associated online course to attend these all-day sessions. The June sessions went very well, although very few of the eligible students opted to attend (1-2 per location). Announcements for future course offerings can be found on the ERTC website: www.restoringminnesota.umn.edu.

In recognition of the innovation and excellence of the ERTC courses, Susan Galatowitsch (project manager) received the national R1edu Award for Distinguished Faculty Contributions to Online Learning.

We have a small surplus for this result: we completed all work under budget.

RESULT 3: Establish opportunities for continued restoration training.

Description For recent advances in restoration practice and science, a webinar series and an annual conference will be offered. Some examples of webinar topics include: effects of seed source location, wave breaks for lakeshore restoration, direct seeding and forest regeneration. These will be 1-2 hr on-line presentations by experts with Q & A sessions. Information on webinars, conferences, and courses will be available on a training coop website. This stand-alone University of Minnesota-hosted website will also provide links to new restoration ecology publications, plant identification resources, and to the "Community of Practice" online discussion forums, where practitioners can exchange ideas on finding solutions to restoration problems.

Summary Budget Information for Result 1:	**ENRTF Budget:**	**$ 93,600**
	Amount Spent:	**$ 71,684**
	Balance:	**$ 21,916**

Deliverable	Completion Date	Budget
1. Launch website	March 1, 2011	$ 21,920
2. Establish web-hosted online forums	July 1, 2011	$ 10,960
3. Offer first annual ecological restoration training conference	March 1, 2013	$ 22,360
4. Offer 5 webinars	July 1,2013	$ 38,360

Result Completion Date: July 1, 2013

Result Status as of January 1, 2011: The basic website was organized and constructed, including obtaining the URL and all necessary permissions required for University of Minnesota

hosting. The logo to be used on the site and all program material was also designed. Software applications to support the Community-of-practice component of the website were evaluated.

Result Status as of July 1, 2011: The professional network site already has 73 active members. We hosted the first webinar November 15, 2011, Building Better Seed Mixes. This webinar, which focused on use of Mn/DOT's new seed mix tool, was attended by 132 people from 88 cities in Minnesota, Iowa, Indiana, Michigan, South Dakota and Wisconsin (177 people were pre-registered, and received resource information prior to the Webinar). The audience included many engineers, and project managers, planners, city and county employees, environmental specialists, landscape architects, master gardeners, biologists, and US Army Corps of Engineers. Another webinar is planned for early 2012, likely on the topic of urban retrofit stormwater gardens.

Result Status as of January 1, 2012: The ERTC program website went "live" in June (www.restoringminnesota.umn.edu). It includes a professional networking site ('i.e. community of practice), resource library, and information on courses, Webinars, and conferences (in development). The professional network site already has 73 members. We hosted the first Webinar November 15, 2011, Building Better Seed Mixes. This webinar, which focused on use of Mn/DOT's new seed mix tool, was attended by 132 people from 88 cities in Minnesota, Iowa, Indiana, Michigan, South Dakota and Wisconsin (177 people were pre-registered, and received resource information prior to the Webinar). The audience included many engineers, and project managers, planners, city and county employees, environmental specialists, landscape architects, master gardeners, biologists, and US Army Corps of Engineers. Another Webinar is planned for early 2012, likely on the topic of urban retrofit stormwater gardens.

Result Status as of July 20, 2012: Two webinars have been offered thus far; the second one on shoreland and stormwater plantings was held in March 2012. Over 250 people registered and participated in this webinar. The restoration practitioners network has 116 members who have joined to participate in forums (including Q and A from webinar sessions), receive notices about events (e.g., training workshops and conferences), and read about featured restoration practices.

Result Status as of January 26, 2013: Three webinars have been offered thus far, and another two are planned for spring 2013. The most recent webinar focused on selecting seed sources to future-proof restoration projects. Over 300 people registered for the course, which exceeded the capacity of the university's tele-conference system. We are investigating options for handling the high level of interest in these webinars. The webinars are recorded and archived on the Practitioner's Network, which now has 160 members.

Result Status as of April 24, 2013:
A conference on the topic of monitoring ecological restorations is scheduled for May 20, 2013 at the Minnesota Landscape Arboretum; planning is underway.

Final Report Summary: July 1, 2013
Five webinars were presented by the Ecological Restoration Training Cooperative over the past three years: 1) Building better seed mixes, 2) Ten things to know about planting wet areas, 3) Selecting seed sources to "future proof" restorations, 4) Interseeding prairies to enhance biodiversity, 5) Biocontrol for ecological restoration: looking back and looking forward. Each webinar featured two 15 minute talks and a 30-minute moderated discussion responding to questions submitted by attendees. Speakers included practitioners from agencies and private organizations and university scientists. The number of webinar attendees ranged from 140-300, although this is based on the number of computers logged-in and many informally reported that

multiple people participated via a single connection. The presentations were recorded and are available for viewing on the ERTC practitioner's network (www.restoringminnesota.ning.com). Information on speakers and attendees for each webinar is presented in the supplemental report.

The webinars continued to be popular, despite many technical difficulties associated with services and facilities available through the University of Minnesota. We have reported these problems and hope they will be resolved. Otherwise, webinars proved to be a mode of information delivery that was attractive to restoration practitioners statewide.

The Restoring Minnesota website and Practitioner's Network were created to share information and facilitate discussion among restoration practitioners. The ERTC practitioner's network, a social network site, had 187 members as of July 1, 2013. The practitioner's network is used by members to post upcoming events, post job announcements, and discuss topics of interest to restoration practitioners. The ERTC website is used to promote online courses, webinars, workshops, as well as providing resources for restoration practitioners. From September 2012 to June 2013, the website was visited over 2600 times. Both the practitioner's network and website will be maintained by the University following the end of the grant.

The ERTC held a restoration training workshop in May 2013 on the topic of monitoring. Based on feedback we received from the training courses, we felt that the need for additional training opportunities was greatest for the topic of monitoring. Many people reported having little experience or even motivation to monitor their restoration projects. This one-day session, attended by 45 people, featured practical sessions on weed mapping, detecting vegetation change, monitoring establishment of prairies, and using free statistical analysis software. The workshop was capped at 45 to allow for a high-level of participation by attendees. Detailed information on the workshop (including a list of session leaders) is provided in the supplemental report. Student feedback was very positive, with many commenting on the practical relevance and field-based emphasis of the workshop. The workshop was free, which appealed to participants, as well. It is uncertain if workshops can be offered annually, as originally proposed, without charging a significant fee to cover facilities, registration, and coordination of the event.

We over-budgeted for the activities in this result: we were able to fully complete all work for less money than budgeted.

V. TOTAL ENRTF PROJECT BUDGET:

Personnel: $ $297388

1.Postdoctoral Associate (50%, 3.0 yrs, 75.6% salary, 24.3% fringe) Responsible for working with project manager to develop course content, gather input from stakeholders, arrange webinar speakers, conduct analysis of comparable training programs, train trainers, offer field sessions of courses, facilitate instruction of on-line portion of courses.

2. Technician ($15/hr x 400 hrs). Responsible for organizing image collection and for acquiring images and other graphics for online courses.

3. CCE* Program Director-Online Distance Learning (3%, 2.9 yrs, 75.6% salary, 24.3% fringe). Responsible for entire online course development process-including tech support & production.

4. CCE Program Director - Professional Education (10%, 2.9 yrs, 75.6% salary, 24.3% fringe). Responsible for planning, development, marketing & promotion.

5. CCE Online Distance Learning Team: Instructional designer @12%, course developer @10%, Editor @10%, 2.7 yrs, 73% salary, 27% fringe. The instructional designer will develop learning experiences for each course so they are effective for online instruction. The course developer / editor is responsible for building the Web-delivered course site so it provides an optimal online experience for the learner.

6. CCE New Media Group: Multi-media programmers @10%, Audio Visual Specialist @10%, Web Developer @10% each for 1 yr, 73% salary, 27% fringe. The multimedia programmer will design and implement interactive elements (flash cards, simulations). Audio visual specialists will produce the media elements needed for the course (onsite videos, recorded presentations) and the Webinar and conference programs. The Web developer designs and implements the functionality of the program Web site.

7. CCE Program Planning Team: Program associate @10% and program secretary@10% for 2.6 yrs, 73% salary, 27% fringe. This staff will provide on-going assistance in making arrangements for satellite training locations and trainers. Collecting information for website updates and communicating with University and state agency personnel on timelines and needed contracts are also their responsibility.

8. CCE Marketing Team: Graphic designers@5% and Marketing manager@10% for 1.2 yrs, 73% salary, 27% fringe. Responsible for setting up the "Ecological Restoration Training Cooperative" website including the design, communicating tools, webinar hosting, as well as the overall look and feel of what will be included in later marketing of the courses.

Contracts: ~~$~~ $179,300

Field trainers - $2500 pp x 10 trainers -- to complete training curriculum and co-teach field sessions of a course 4 times (for non-agency, non-UM personnel only)

Instructional and curriculum designer/editor @$75-100/hr.

~~I~~nstructional design to modify online courses for a university course (5 @$1000)

Restoration professionals (private sector) serving as beta-testers for 5 training courses ($500 pp x 5 classes x 5 per class)

Video simulations (5-10, $17K total) - for online courses - Digital media specialist – development video simulations of natural processes to illustrate course concepts

Graphic designer – ($1000) Creation of the design and/or branding image to be used by the training cooperative for all promotion and website identification.

Webinar technical and speaker support ($4000 x 5 webinars). Web conference coordination including software set up, arranging speaker participation, audio visuals, and interaction with participants during webinars.

Conference services - for annual conference ($10000) Facility rental, audio visual support, registration, conference materials.

Equipment/Tools/Supplies: $ $46,500

Tools, implements and supplies for field training centers ($10,000 x 5 locations), e.g., seed drills, field guides, backpack sprayers, soil & seed testing reagents

Office and computer supplies—paper, computer software and miscellaneous expenses such as web storage fees for photos. $2000.

Acquisition (Fee Title or Permanent Easements): $ 0

Travel: $ -$1000
Travel to field training centers to develop & offer training, production of training materials (e.g., videos): CCE: 8 trips x 500 x .50/mi, 8 nites food and lodging (2 people). Hort: 16 trips x 500 x .50.mi, 16 nites food and lodging (2 people).

Additional Budget Items: $ 0

TOTAL ENRTF PROJECT BUDGET: $ 550,000

Explanation of Capital Expenditures Greater Than $3,500: $3620. We purchased a mower for the field session parks that is needed to deliver the curriculum.

VI. PROJECT STRATEGY:

A. Project Partners:

University of Minnesota – Horticultural Science – Susan Galatowitsch - $ 270,100
Continuing Education – Lori Graven, Mary Davis - $ 279,900
Minnesota Department of Natural Resources – Jason Garms - $ 0
Minnesota Board of Water and Soil Resources – Dan Shaw - $ 0
Minnesota Department of Transportation – Ken Graeve - $ 0

B. Project Impact and Long-term Strategy:

Initiatives to restore prairies, wetlands, streams, lakeshores, and forests have been supported anticipating improved environmental quality. Despite an expanded knowledge base, restoration project failure rates remain high. For example, poor plant selection and installation results in a substantial loss of expensive native seed in both prairie and lakeshore restoration. By adopting best-practices, high-quality restorations more frequently can be economically feasible. Although Minnesota has many competent restorationists, the quality of work varies across the profession and lack of expertise contributes to project failures. A variety of workshop-based programs educates the public about restoring ecosystems, but these must focus on a limited range of practices feasible for individual landowners. Some colleges offer a restoration ecology course; these are typically global in scope and focus more on concepts than techniques. Currently, professional restoration training is limited to what is gained on-the-job, often through trial-and-error.

Our aim is to improve ecological restoration success in Minnesota by developing training opportunities for practicing restoration professionals. High-quality training opportunities need to reach a large number of professionals statewide. Our solution is to establish the Ecological Restoration Training Cooperative, to be based at the University of Minnesota, and coordinated as a partnership between state agencies and the University. Web-based, instructor-guided learning, combined with field sessions offered at multiple locations will be the first of its kind in the US for restoration. At least 700 Minnesota restoration professionals actively involved in planning, plant or seed production, installation, maintenance and monitoring, could benefit. Increased professional competency should improve restoration outcomes not only for state programs, but also local government and private sector initiatives.

By the end of the three project period, the training opportunities will be routinely available to the practicing restoration professionals of Minnesota and able to be relied by

agencies as one form of a professional credential. The first year of the project will focus on planning and curriculum development and launching website. During the second year, the training program will be tested and refined; web forums will be established. Full implementation year will occur in the third year; courses will be available to the public for enrollment In the third year, agencies can pilot use of credential in contracting.

Beginning in 2013, training courses will be offered at least once/year. Professionals will be able to stay current through webinars,the online "community of practice" online forum, and annual conference. The training cooperative will be financially sustainable over the long-term, relying on tuition revenues and recurrent instructional and technology contributions from the University of Minnesota, and minimal staff contributions from state agencies.

C. Other Funds Proposed to be Spent during the Project Period:

In kind:

UM Galatowitsch Salary ($50,600) – 65% Result 1, 20% Result 2, 15% Result 3

DOT – Graeve Salary ($10,650) - -- 80% Result 1, 10% Result 2, 10% Result 3

BWSR – Shaw Salary ($12,000) – 80% Result 1, 10% Result 2, 10% Result 3

Other Funds: Participation fees from courses, webinars, conferences - $36,000

Result 1 – 0, Result 2 – 16,000, Result 3 – 20,000

D. Spending HIstory:

VII. DISSEMINATION: The website that will be developed for the training program (Result 3) will provide information on webinars, conferences, and courses. We will make practitioners aware of the new opportunities by providing information directly to professional groups (e.g., native seed producers), natural resource agency offices (e.g., watershed districts and extension offices), and through an email distribution list developed to market the program.

VIII. REPORTING REQUIREMENTS: Periodic work program progress reports will be submitted not later than January and July of each year. A final work program report and associated products will be submitted between June 30 and August 1, 2013 as requested by the LCCMR.

IX. RESEARCH PROJECTS: N/A

Final Attachment A: Budget Detail for 2010 Projects - Summary and a Budget page for each partner (if applicable)

Project Title: *Ecological Restoration Training Cooperative*
Project Manager Name: *Susan Galatowitsch*
Trust Fund Appropriation: $ *550,000*

2010 Trust Fund Budget	**Revised Result 1 Budget (Apr 2013)**	**Result 1 Amount Spent** *(June 30 2013)*	**Result 1 Balance** *(June 30 2013)*	**Revised Result 2 Budget (June 30 2013)**	**Result 2 Amount Spent** *(June 30 2013)*	**Result 2 Balance** *(June 30 2013)*	**Revised budget (June 30 2013)**	**Result 3 Amount Spent** *(June 30 2013)*	**Result 3 Balance** *(June 30 2013)*	**TOTAL BUDGET**	**TOTAL BALANCE - June 30 2013**
	Develop Ecological Restoration Training Courses			*Offer Ecological Restoration Training Courses*			*Establish opportunities for continued restoration training*				
BUDGET ITEM											
PERSONNEL: wages and benefits											
Research Fellow(100%, 2.5 yrs, 75.6% salary, 24.3% fringe)	88,171	88,171	0	19,000	18,112	888	16,000	16,000	0	123,171	888
Research Assistant (50%, 1 year 79.2% salary, 20.7% fringe	33,117	32,528	589	0	0	0	0	0	0	33,117	589
Junior Scientist (25%, 2 years, 72% salary, 28% fringe) (May 3, 2011)	0	0	0	0	0	0	0	0	0	0	0
Temporary casual technician ($15/hr x 400 hrs) (May 3, 2011)	7,000	6,252	748	0		0	0	0	0	7,000	748
CCE* Program Director-Online Distance Learning (3%, 2.9 yrs, 75.6% salary, 24.3% fringe).	3,600	3,000	600	2,800	0	2,800	2,000	1,180	820	8,400	4,220
CCE Program Director - Professional Education (10%, 2.9 yrs, 75.6% salary, 24.3% fringe).	8,000	8,000	0	4,100	4,100	0	19,600	19,600	0	31,700	0
CCE Online Distance Learning Team: Instructional designer @12%, course developer @10%, Editor @10%, 2.7 yrs, 73% salary, 27% fringe.	12,000	4,697	7,303	0	0	0	0	0	0	12,000	7,303
CCE New Media Group: Multi-media programmers @10%, Audio Visual Specialist @10%, Web Developer @10% each for 1 yr, 73% salary, 27% fringe.	5,000	5,000	0	0	0	0	5,000	2,284	2,716	10,000	2,716
CCE Program Planning Team: Program associate @10% and program secretary@10% for 2.6 yrs, 73% salary, 27% fringe.	16,000	16,000	0	2,000	0	2,000	24,300	12,646	11,654	42,300	13,654
CCE Marketing Team: Graphic designers@5% and Marketing manager@10% for 1.2 yrs, 73% salary, 27% fringe	15,000	11,192	3,808	5,000	5,000	0	9,700	6,583	3,117	29,700	6,925
Contracts			0			0			0		
Professional/technical			0			0			0	0	
Consulting Prof Services Instructional and curriculum designer / editor / course developer @ $75 - 100 / hr	108,800	102,162	6,638	8,000	3,001	4,999	0	0	0	116,800	11,637
~~Restoration professionals featured in teaching videos (non-UM, non-agency) (5 @$1000)~~ Instructional design contract for modifications to existing courses	5,000	5,000	0	0	0	0	0	0	0	5,000	0
Restoration professionals (private sector) serving as beta-testers for 5 training courses ($500 pp x 5 classes x 7 per class)	17,500	14,750	2,750	0	0	0	0	0	0	17,500	2,750
Video simulations (5-10) - for online courses	3,000	0	3,000	0	0	0	0	0	0	3,000	3,000
Graphic designer -Creation of the design and/or branding image to be used by the training cooperative for all promotion and website identification.	1,000	0	1,000	0	0	0	0	0	0	1,000	1,000
Webinar technical support Web conference coordinationl inc. software, speakers, audio visuals, and interaction with participants during webinars.	0	0	0	0	0	0	6,000	5,935	65	6,000	65
Conference services - for annual conference	0	0	0	0	0	0	10,000	6,496	3,504	10,000	3,504
DNR Contract: Field trainers - $2500 pp x 8 trainers -- to complete training curriculum and co-teach field sessions of a course 4 times (for non-agency, non-UM personnel only)	0	0	0	20,000	20,000	0	0	0	0	20,000	0
DNR Contract-Tools, implements, supplies for field training $7500 for each of four training locations	0	0	0	28,000	28,000	0	0	0	0	28,000	0
Non-capital Equipment / Tools: Tools, implements, and supplies for training centers ($10,000 x 5 locations), e.g, seed drills, field guides, backpack sprayers, soil& seed testing reagents	0	0	0	37,812	38,515	-703	0	0	0	37,812	-703
Supplies - paper, computer software, and miscellaneous expenses such as web storage fees for photos. (May 3, 2011)	2,500	2,476	24	3,000	2,906	94	1,000	960	40	6,500	158
Travel expenses in Minnesota: Travel to field training centers to develop and offer training, production of training materials. CCE: 8 trips x 500 x.50/mi, 8 nites food & lodging for 2 p. Hort: 16 trips x 500 x .50 mi, 16 nites food & lodging for 2 p.	1,000	1,153	-153	0	0	0	0	0	0	1,000	-153
COLUMN TOTAL	**$326,688**	**$300,381**	26,307	**$129,712**	**$119,634**	10,078	**$93,600**	**$71,684**	21,916	550,000	**$58,301**

RESTORING MINNESOTA

ECOLOGICAL RESTORATION TRAINING COOPERATIVE

Supplemental Report

FINAL PROJECT SUMMARY

ERTC TRAINING OPPORTUNITIES

Part I: Monitoring Workshop, Website, & Webinars

Practitioner's Network Website

Webinar Series

Vegetation Monitoring Workshop

Vegetation Monitoring Photo Gallery

Part II: Online Courses

Online Course Marketing Flyer

Online Course Pilot Offering Summary

Online Course Learning Objectives

Sample Online Course Syllabus

Comments From Beta Testers and Pilot Course Students

Part III: Field Sessions

Field Session Schedule and Registration Information

Field Session Photo Gallery

Seeding Field Session Outline

Seeding Field Session Teaching Notes

Vegetation Management Field Session Outline

Vegetation Management Field Session Teaching Notes

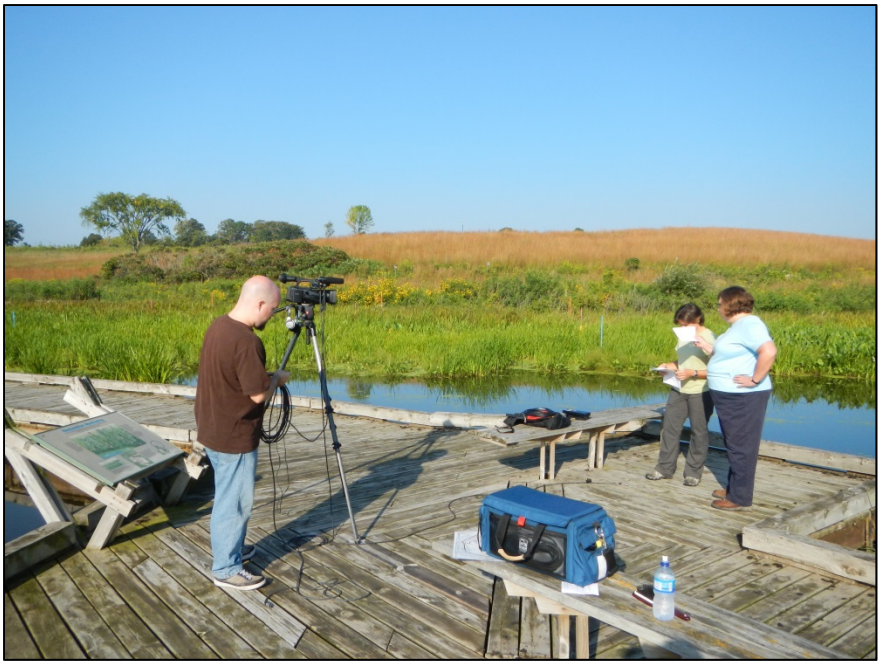
Final Project Summary

Abstract: Ecological restoration is increasingly relied on as a conservation strategy in Minnesota even though project failure rates remain high. To improve ecological restoration success in Minnesota, this project developed training opportunities for practicing restoration professionals. We established the Ecological Restoration Training Cooperative (ERTC), which is based at the University of Minnesota, and coordinated as a partnership between state agencies and the University. A program of web-based, instructor-guided learning, combined with field sessions offered at multiple locations, are the first of its kind in the US for restoration. As part of this project, the training cooperative developed and offered five application-oriented online courses which are accessible statewide. These courses, covering site assessment, seeding, planting, vegetation management and monitoring, were taken by 113 people during the "pilot phase". Each course will be offered at least twice a year through the University of Minnesota College of Continuing Education. In conjunction with the online courses, field training sessions were developed for the seeding and vegetation management courses. These sessions focus on providing hands-on experience for restoration skills introduced in the online courses. A four-year agreement with DNR Parks and Trails will allow each of the two field sessions to be taught by DNR natural resource specialists at four out-state locations each year in order to facilitate access to the training opportunities by individuals from around the state.

In addition to the five training courses, the ERTC developed several other ways for restoration practitioners to learn skills and stay current. A webinar series, an annual workshop, a social network, and a website were all launched as part of ERTC programming. During this grant period, five webinars were held, which were attended by over 1000 people. These presentations were recorded and are available on the practitioner's network, which has 187 members to date. The first annual conference, focused on restoration monitoring, was held in May 2013. Information on all upcoming events, including online courses can be found on the ERTC website, www.restoringminnesota.umn.edu

Course development summary: Five application-oriented courses (15-25 hours each) were developed to fill the immediate needs of multiple agencies: 1) Site assessment and setting restoration goals, 2) Designing and using native seed mixes, 3) Designing, installing, and managing native plantings, 4) Monitoring ecological restorations and 5) Vegetation management for restored ecosystems. Each of these five courses consists of four components: 1) on-screen teaching modules (120-140 screens/per course) with audio narration, 2) 7-9 site assignments, 3) a virtual site that provides the background, a data source, and images for a restoration site upon which the site assignments are built, and 4) tests (7-8 quizzes and an end-of-course exam). A demonstration of these course elements can be found on the ERTC website at www.restoringminnesota.umn.edu.

Learning objectives for each course and outlines of each module were reviewed by the agency partners prior to content development to ensure all essential information needed by their restoration practitioners was included. Each on-screen module includes presentation of the foundational scientific concepts, examples of practical applications of these concepts, and interactive slides that allow students to practice what they've learned. The modules are graphics-rich with illustrations and photos taken during Minnesota restorations. Each course includes one or two videos featuring Minnesota restoration practitioners.



Making a video at Spring Peeper Meadow

Upon completing a module, students visit a 'virtual site' and complete assignments that reinforce practical skills and their ability to apply concepts to actual field situations. Three virtual sites were developed to support the on-line courses including: 1) Elk River Farm - agricultural land adjacent to a highway, wetlands, and oak savanna, 2) Turtle Lake - residential lakeshore, and 3) Spring Peeper Meadow - wetland and prairie restored in an urbanizing landscape. Each of the virtual sites is based on details from actual sites. The virtual sites are presented as websites within the courses. These websites include many interactive maps, descriptions of site conditions and land use history, and data files on features such as vegetation. The virtual sites and associated assignments are intended to mimic the many aspects of gathering and using information from sites to make restoration decisions. Students submit their answers to the assignments and receive feedback from instructors. They are allowed two attempts to complete each assignment.

The first working versions of the courses were tested by two university technicians (one focused on content and the other focused on course navigation) and the three agency partners. The courses were revised and then 'beta-tested' by a minimum of 6 people who had been recruited by an open-call for participants. Upon completion of the course, beta testers provided detailed feedback, which was used to revise the course and produce the "pilot version" of each course. The learning objectives and syllabus for the courses are provided in the supplemental report. This short video of the Designing and Using Native Seed Mixes Course provides a sample of the variety of ways information is presented in the online course and demonstrates how to navigate within the online course environment: http://youtu.be/zw4Ix77wlAY.

In conjunction with the online courses, field training sessions were developed for the Seeding and Vegetation Management courses. Each session will be offered at four Minnesota State Parks, taught by natural resource specialists with extensive restoration experience. The learning objectives for these sessions focus on skills that require 'hands-on' opportunities. For example, calibrating equipment, such as seed drills or tank sprayers, requires students perform the tasks to know if they have mastered the

skill. Detailed field session outlines were developed by the team of park trainers and the university course instructors. The curriculum outlines for these field sessions are provided in the supplemental report. The trainers will follow this common curriculum. Each park hosting ERTC field training sessions received supplies and equipment from this grant so they have equivalent capacity to deliver the training.

Participants learn to calibrate a broadcast seeder

A financial plan that allows for course offerings to be sustained after the end of this grant was developed by the College of Continuing Education (CCE), the unit responsible for administration of the courses on an ongoing basis. CCE staff members worked with the College of Food, Agriculture and Natural Resource Science, the instructional unit, to finalize this plan. Under this three-year plan, each course would be offered twice a year; the cost to each student would be $375/course, which is lower than undergraduate tuition rates. Assuming 100 students take the courses/year, 41% of revenues generated will be used by CCE to update the curriculum, handle registration, market the courses, manage student records, administer expenses and contracts associated with instructional design, and provide technical support for students in the course and for the practitioner's network (see below). The remaining 59% of the revenue will be used for instructional costs, including providing feedback on student assignments, responding to student inquiries, and revising course content. If the enrollment drops below 50 students/per year, all of the revenue will be used by CCE for the fixed costs associated with the courses, i.e., marketing, administration, and registration. In the event of low enrollments, instructional costs will be covered as part of part of the regular teaching responsibilities of the project manager (Galatowitsch).

Course completion summary: Between January and May, 2013, the site assessment course was offered twice and each of the other four courses was offered once. Eighty-eight students enrolled in the site assessment course without cost, which was covered by this grant. Sixty eight students started the course, of these, 80% successfully completed the course. Sixty-six students enrolled in the other four courses; 45 students started work on them, of which 84% passed. A table providing detail on each course is provided in the supplemental report. Student feedback from the courses was very positive,

often noting that the scope of the information presented and the level of detail was valuable. Comments from students are included in the supplemental report.

In 2013, field sessions for the Seeding course are being held at Rice Lake State Park (June 19, September 12), Glendalough State Park (September 11), and Camden State Park (September 12). Vegetation management sessions are offered at St. Croix State Park (June 19), Glendalough State Park (June 20), Fort Snelling State Park (June 20), and Jay Cooke State Park (September 25). Participants must have completed the associated online course to attend these all-day sessions. The June sessions went very well, although very few of the eligible students opted to attend (1-2 per location). Announcements for future course offerings can be found on the ERTC website: www.restoringminnesota.umn.edu.

In recognition of the innovation and excellence of the ERTC courses, Susan Galatowitsch (project manager) received the national R1edu Award for Distinguished Faculty Contributions to Online Learning.

Summary of other restoration training opportunities: Five webinars were presented by the Ecological Restoration Training Cooperative over the past three years: 1) Building better seed mixes, 2) Ten things to know about planting wet areas, 3) Selecting seed sources to "future proof" restorations, 4) Interseeding prairies to enhance biodiversity, 5) Biocontrol for ecological restoration: looking back and looking forward. Each webinar featured two 15 minute talks and a 30-minute moderated discussion responding to questions submitted by attendees. Speakers included practitioners from agencies and private organizations and university scientists. The number of webinar attendees ranged from 140-300, although this is based on the number of computers logged-in and many informally reported that multiple people participated via a single connection. The presentations were recorded and are available for viewing on the ERTC practitioner's network (www.restoringminnesota.ning.com). Information on speakers and attendees for each webinar is presented in the supplemental report.

The webinars continued to be popular, despite many technical difficulties associated with services and facilities available through the University of Minnesota. We have reported these problems and hope they will be resolved. Otherwise, webinars proved to be a mode of information delivery that was attractive to restoration practitioners statewide.

The Restoring Minnesota website and Practitioner's Network were created to share information and facilitate discussion among restoration practitioners. The ERTC practitioner's network, a social network site, had 187 members as of July 1, 2013. The practitioner's network is used by members to post upcoming events, post job announcements, and discuss topics of interest to restoration practitioners. The ERTC website is used to promote online courses, webinars, workshops, as well as providing resources for restoration practitioners. From September 2012 to June 2013, the website was visited over 2600 times. Both the practitioner's network and website will be maintained by the University following the end of the grant.

The ERTC held a restoration training workshop in May 2013 on the topic of vegetation monitoring. Based on feedback we received from the training courses, we felt that the need for additional training opportunities was greatest for the topic of monitoring. Many people reported having little experience or even motivation to monitor their restoration projects. This one-day session, attended by 45 people, featured practical sessions on weed mapping, detecting vegetation change, monitoring establishment of prairies, and using free statistical analysis software.

Developing seedling identification skills for monitoring prairie seedling establishment

The workshop was capped at 45 to allow for a high-level of participation by attendees. Detailed information on the workshop (including a list of session leaders) is provided in the supplemental report. Student feedback was very positive, with many commenting on the practical relevance and field-based emphasis of the workshop. The workshop was free, which appealed to participants, as well. It is uncertain if workshops can be offered annually, as originally proposed, without charging a significant fee to cover facilities, registration, and coordination of the event.

Development Team:

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Part I

Website, Webinars, and Monitoring Workshop

PRACTITIONER'S NETWORK

187 members connect with their peers via the Practitioner's Network to share information and methods related to ecological restoration and habitat management. Postings include jobs, professional development opportunities, conferences, stewardship opportunities, and resources of interest to network members. Visit the Practitioner's Network at **http://restoringminnesota.ning.com/**.

The Restoring Minnesota website links professionals to Ecological Restoration Training Cooperative training opportunities.

Visit Restoring Minnesota at http://www.cce.umn.edu/Restoring-Minnesota/index.html

WEBINAR SERIES

Building Better Native Seed Mixes

Tuesday, November 15, 2011

Presenters

Peter MacDonagh, Kestrel Design Group
Susan Galatowitsch, University of Minnesota
Moderator: Ken Graeve, Minnesota Department of Transportation

Attendees: 177

Ten Things to Know About Planting Wet Areas

Wednesday March 28, 2012

Presenters

Dan Shaw, Minnesota Board of Water and Soil Resources
Greg Berg, Shoreland Specialist, Stearns Soil and Water Conservation District
Moderator: Susan Galatowitsch, University of Minnesota

Attendees: 256

Selecting Seed Sources to "Future-Proof" Restored Plant Communities

Thursday, November 29, 2012

Presenters

Ruth Shaw, University of Minnesota
Jason Garms, Minnesota Department of Natural Resources
Moderator: Susan Galatowitsch, University of Minnesota

Attendees: 300

Interseeding Prairies to Enhance Biodiversity

Thursday February 21, 2013

Presenters

Paul Bockenstedt, Stantec
Dave Williams, Tallgrass Prairie Center – University of Northern Iowa
Moderator: Laura Phillips-Mao

Attendees: 166

Biocontrol for Ecological Restoration in Minnesota: Looking Back and Looking Forward

Tuesday April 30, 2013

Presenters

Laura Van Riper, Minnesota Department of Natural Resources
Monika Chandler, Minnesota Department of Agriculture
Moderator: Susan Galatowitsch, University of Minnesota

Attendees: 140

VEGETATION MONITORING WORKSHOP

Tuesday May 21, 2013

Keynote: Susan Galatowitsch, University of Minnesota

Concurrent Session 1: Weed Mapping Techniques
Ken Graeve, Dave Hanson, and Kyle Van Wagner, Minnesota Department of Transportation

Concurrent Session 2: Monitoring Vegetation Change
Dan Shaw and Carol Strojny, Minnesota Board of Water and Soil Resources and Julia Bohnen, University of Minnesota

Concurrent Session 3: Monitoring Establishment of New Prairie Vegetation
Jason Garms, Minnesota Departmentof Natural Resources and Paul Bockenstedt, Stantec

Concurrent Session 4: Using Available Software for Basic Analysis
Sergey Berg and Marcus Beck, University of Minnesota

Attendees: 54

Vegetation Monitoring Workshop
May 21, 2013
Minnesota Landscape Arboretum

Program Information

TIME			
8:15-9:00 a.m.	**Continental Breakfast and Registration**		
9:00—9:15	**Welcome** - *Susan Galatowitsch*, Department of Fisheries, Wildlife and Conservation Biology, College of Food, Agricultural and Natural Resource Sciences, University of Minnesota		
9:15-10:00	**Is Ignorance Really Bliss? Monitoring as a Crucial Part of Restoration Efficiency and Effectiveness.** *Susan Galatowitsch*		
10:00-10:15	**Break**		
10:15-11:45	**Concurrent Sessions**	**Concurrent Sessions**	**Concurrent Sessions**
11:45-12:30 p.m.	**Lunch**		
12:30-2:00	**Concurrent Sessions**	**Concurrent Sessions**	**Concurrent Sessions**
2:00-2:15	**Break**		
2:15-3:45	**Concurrent Sessions**	**Concurrent Sessions**	**Concurrent Sessions**
3:45	**Adjourn**		

Concurrent Sessions:
(F=Field, C=Classroom)

1. **Weed Mapping Techniques (F)** ***Outdoor Apparel/Footwear Recommended***
   Ken Graeve, Dave Hanson, and Kyle Van Wagner, Minnesota Department of Transportation

   Weed mapping can be used to establish weed management priorities, plan weed control efforts, and to monitor weed management progress. Learn about weed mapping techniques, data collection technologies, and field data collection protocols in this hands-on field session.

2. **Monitoring Vegetation Change (F)** ***Outdoor Apparel/Footwear Recommended***
   Dan Shaw and *Carol Strojny*, Minnesota Board of Water and Soil Resources and *Julia Bohnen*, University of Minnesota

Monitoring is a necessary tool for evaluating restoration quality and status. A well designed monitoring program allows for detection of establishment and colonization of species, as well as changes in species abundance. It also allows for determination of the effectiveness of vegetation management actions. In this session learn how to design and implement a monitoring program that will provide useful information for making ongoing restoration management decisions.

3. **Monitoring Establishment of New Prairie Vegetation (F)** ***Outdoor Apparel/Footwear Recommended***
Jason Garms, Minnesota Department of Natural Resources and *Paul Bockenstedt*, Stantec

A basic quantitative planting evaluation is a useful way to detect potential problem areas in a recently seeded restoration so that timely intervention can be planned if necessary. Learn about field sampling techniques and the steps to conduct a seeding evaluation in this hands-on field session.

4. **Using Available Software for Basic Analysis (C)** ***Participants Must Bring Laptop Computer***
Sergey Berg, Department of Fisheries, Wildlife and Conservation Biology, University of Minnesota and *Marcus Beck*, Department of Fisheries, Wildlife and Conservation Biology, University of Minnesota

It's never been more affordable to analyze the information you collect to assess the progress and outcomes of your restoration projects. With a little coaching, it can even be easy! In this session you'll learn how to use readily available (Excel) and free (R) computer applications to do some commonly useful statistical tests. This session is for people with limited comfortable level with statistics (e.g., rusty skills). Bring a laptop with MS Office (you'll receive instructions on how to easily download R.

Registration and Program Information

Registration and Fees
The workshop is limited to 45 participants, and registration fees are complimentary. Your registration includes workshop sessions, materials, refreshment breaks, and lunch, and Continuing Education Units (CEUs). Registration is available on a first come, first served basis.

Registrants will select 3 of the 4 concurrent sessions they plan to attend. Concurrent sessions are listed above. Once the sessions are selected, we will schedule the sessions based on registration selections.

Who Should Participate
With a goal of promoting best practices in ecological restoration, this training series is targeted at early career professionals, but even well-seasoned practitioners will benefit from the depth of the content.

For Further Information
Emily Strong, University of Minnesota, 612-624-3492, cceconf3@umn.edu.

Welcome to the Ecological Restoration Training Cooperative!

The Ecological Restoration Training Cooperative was established in 2011 to provide training opportunities for both professionals and community members who would like to enhance their restoration skills and knowledge. The Training Cooperative provides opportunities to learn from the best available knowledge from research and practice via:

Courses and Training | Webinars | Conferences | Resources | Discussion Forum on the Practitioner's Network

Learn more at www.restoringminnesota.umn.edu.

Sponsored By
College of Food, Agricultural and Natural Resource Sciences
College of Continuing Education

Funded By
Minnesota Environment and Natural Resources Trust Fund

Project Partners
Department of Natural Resources (DNR)
Department of Transportation (MnDOT)
Minnesota Board of Water and Soil Resources (BWSR)

VEGETATION MONITORING WORKSHOP PHOTO GALLERY

Ken Graeve introduces weed mapping

Monitoring data analysis tutorial using Excel and R

Using monitoring to make management decisions

Monitoring vegetation change – line intercept method

Identifying native seedlings as part of evaluating a prairie seeding

Evaluating a prairie seeding with square foot monitoring plot

PART II

ONLINE COURSES

RESTORING MINNESOTA

www.restoringminnesota.umn.edu

Ecological Restoration Online Courses

Welcome

Ecological restoration is increasingly relied on as a conservation strategy in Minnesota. In order to increase project success rates, the Ecological Restoration Training Cooperative has developed five online restoration courses that teach practical in-field applications, as well as the theory behind the practice, for specific aspects of restoration.

Who Should Participate

With a goal of promoting best practices in ecological restoration, this training series is targeted at early career professionals, but even well-seasoned practitioners will benefit from the depth of the content.

Instructor

Susan M. Galatowitsch, Professor/Head, Department of Fisheries, Wildlife & Conservation Biology, University of Minnesota

Course Descriptions

SITE ASSESSMENT AND SETTING RESTORATION GOALS (Required)

Two sessions scheduled.
September 3-October 6, 2013
January 20-February 23, 2014

This required introductory course will simulate the initial steps of planning a restoration project from gathering background information to collecting relevant data, and then use the information gathered to formulate restoration goals. This course covers how to assess the ecological condition of degraded sites, diagnose the restoration needs of a site prior to restoration, and plan meaningful project goals. **This course is a prerequisite to each of the other four courses.**

DESIGNING AND USING NATIVE SEED MIXES

Two sessions scheduled.
October 7-November 10, 2013
February 24-March 30, 2014

Many ecological restoration projects rely on re-vegetation from seed. This course discusses successful steps for designing and implementing a seed mix, from choosing appropriate species to preparing the planting site. This course covers how to assess the need to seed, use seed biology to make practical decisions about seeding projects, design seed mixes, acquire and store seeds, prepare sites and seeds for sowing, seed a restoration site, and manage a site after sowing to promote vegetation establishment. *Field Training Sessions included.

MONITORING ECOLOGICAL RESTORATIONS

Two sessions scheduled.
October 7-November 10, 2013
February 24-March 30, 2014

Monitoring is necessary for evaluating the effectiveness of restoration actions. Learn how to design an efficient and effective monitoring program that yields information helpful for ongoing restoration management decisions and problem solving. This course covers how to select monitoring parameters, develop monitoring protocols, monitor implementation and quality control, summarize and visualize data, analyze data, and keep records.

DESIGNING, INSTALLING, AND MANAGING NATIVE PLANTINGS

Two sessions scheduled.
November 11-December 15, 2013
March 31-May 4, 2014

Ecological restorations of small sites often rely primarily on installing plants to restore the desired native vegetation. Even large sites, which are typically seeded, may be supplemented with plantings. This course covers how to assess the need to plant, design a planting and select species, choose planting stock, create a planting plan, prepare to plan, plant a restoration site, and manage a planting.

VEGETATION MANAGEMENT FOR RESTORED ECOSYSTEMS

Two sessions scheduled.
November 11-December 15, 2013
March 31-May 4, 2014

Restored and degraded ecosystems may take many years to recover. During that time, they need ongoing management. Techniques used in two broad categories of management strategies for restorations: re-establishing natural disturbances and controlling invasive species will be presented. This course covers disturbances and introduced species as management priorities, non-chemical management techniques, vegetation management with herbicides, and long-term management of prairies, forests, and wetlands. *Field Training Sessions Included.

Field Training Sessions

Participants who successfully complete the Designing and Using Native Seed Mixes, and Vegetation Management for Restored Ecosystems online courses have the opportunity to join staff from the Department of Natural Resources (DNR) Division of Parks and Trails to participate in an all-day field training session. During the field session, participants will tap into the experiences of DNR Parks and Trails Area and Regional Resource Specialist staff to gain new skills in a hands-on environment.

More information is available at **www.restoringminnesota.umn.edu.**

Time Commitment

It takes most students 20-25 hours to complete each course. All requirements must be completed by the last day of the course period to receive continuing education credit.

Course Deadlines and Final Exam

The course includes recommended deadlines for submitting assignments and a final exam. If you submit your assignments and exam by the recommended deadline, you'll know which questions you didn't answer correctly in time to try again.

Professional Credit

Each course has been approved for 2.5 Continuing Education Credits (CEUs) and 25 Professional Development Hours (PDHs). A CEU certificate will be sent to each participant after the course is passed and completed. The University of Minnesota maintains a permanent record of CEUs earned.

Registration and Fees

Your registration includes access to the course within the course dates and a CEU certificate upon passing and completion of the course. The fee for each course is $375.

How to Register

Online registration is available on the website at:
www.restoringminnesota.umn.edu.

For Further Information

Emily Strong
University of Minnesota
612-624-3492
cceconf3@umn.edu

Online Training

For those of you who avoid online courses because they don't seem like a great way to learn – give these a try! These online courses have been designed to be interactive and as "real world" as possible. This means you'll be able to visit warm, sunny field sites even when it is 20 degrees below. How bad can that be? All courses will be delivered online, and each course will have a specific start and end date.

Sponsored by:

College of Food, Agricultural and Natural Resources Sciences

College of Continuing Education

Funding:

Funding for this project was provided by the Minnesota Environment and Natural Resources Trust Fund as recommended by the Legislative-Citizen Commission on Minnesota Resources (LCCMR)

Project Partners:

Minnesota Department of Natural Resources

Minnesota Department of Transportation

Minnesota Board of Water and Soil Resources

ONLINE COURSE PILOT OFFERING SUMMARY

In winter 2013 the Ecological Restoration Training Cooperative online course series was offered as a pilot offering at no cost to anyone interested increasing their knowledge of topics in ecological restoration. The Pilot offering was marketed through the University of Minnesota Continuing Education and via the agency partners.

2013 Pilot Online Course Summary

Course	# Enrolled	# Started	# Passed	# Didn't start course
Site Assessment 1	48	38	27	10
Site Assessment 2	37	30	26	7
Seeding	19	14	11	5
Planting	14	9	9	5
Monitoring	16	6	3	10
Vegetation Management	17	16	15	1

2013 Pilot Course Participants by State Agency or Non-state Entity

Course	State Agency	Non-State Entity	Total
Site Assessment 1	26	21	47
Site Assessment 2	17	19	36
Total	43	40	83
Percent	52	48	

ONLINE COURSE LEARNING OBJECTIVES

Course 1: Site Assessment and Setting Restoration Goals

The course covers how to:

- Gather and analyze data needed for assessing the ecological conditions of degraded sites
- Diagnose the restoration needs of a site prior to restoration
- Plan meaningful project goals

Course 2: Designing and Using Native Seed Mixes

The course covers how to:

- Evaluate whether there are seed sources on site or in the landscape that could contribute to revegetation
- Design seed mixes so restored vegetation supports ecosystem functions and project goals
- Obtain adequate supplies of seed and how to handle this seed so it maintains its viability
- Prepare a site to be sowed

Course 3: Designing, Installing, and Managing Native Plantings

The course covers how to:

- Evaluate whether there are sources of plants on the site or in the landscape that could contribute to revegetation
- Determine which species will be best suited for a restoration planting
- Select and acquire the optimal kinds of planting stock for site conditions and project goals
- Develop a planting plan
- Prepare a site to be planted

Course 4: Monitoring Ecological Restorations

The course covers how to:

- Select parameters for monitoring
- Develop monitoring protocols
- Implement monitoring protocols and quality control procedures
- Effectively summarize data in graphs and tables
- Analyze monitoring data to make practical decisions
- Create and maintain records needed for ongoing restoration decision-making

Course 5: Vegetation Management for Restored Ecosystems

The course covers how to:

- Determine the kinds of natural disturbances that may need to be re-established on a site and the invasive species that may require management
- Use non-chemical management techniques to control invasive species and promote a self-regenerating native plant community
- Use chemical management (i.e. herbicides) to control invasive species in natural and restored ecosystems
- Develop strategies for sites with many vegetation challenges that require the use of multiple methods

Site Assessment & Setting Restoration Goals

Welcome!

Welcome to the first course in the Ecological Restoration Training Cooperative series. These courses were developed to introduce restoration professionals in Minnesota to the basic concepts and skills required in practice. The courses are taught online to allow people statewide to participate. Online courses are also great because they allow self-paced learning and flexible scheduling. If this is your first online course, you may need a little coaching to get the most from the opportunity. This course overview, as well as information at the beginning of the online presentation, should get you rolling. This course is self-guided, not instructor-led. However, if you have questions about the content of the course, contact me at ertc@umn.edu.

I hope you enjoy the course and it gives you a good foundation to begin planning your restoration projects!

Dr. Susan Galatowitsch, Professor, University of Minnesota

What does this course cover?

Planning a restoration begins by becoming familiar with the current conditions of a site and thinking about what might be possible to achieve there. In this course, you'll simulate the initial steps of planning a restoration project – from gathering background information, to collecting relevant data and observations, and then making sense of the information you've gathered to formulate sound restoration goals.

The course covers how to:

- Gather and analyze data needed for assessing the ecological conditions of degraded sites
- Diagnose the restoration needs of a site prior to restoration
- Plan meaningful project goals.

Date: 2/19/13

What background is needed to take this course?

This training series is targeted at early career professionals. This course does not assume a technical background in any particular field and there are no pre-requisites for the course. However, this course does require basic computer and internet skills (such as word processing, browsing the web, uploading and downloading files).

What kind of computer technology is required?

For technical requirements please check the document, “Working in the Moodle Course Management System” on the course home page. Pay close attention to the guidance on browsers – using the right browser and configuring it correctly will definitely reduce your frustration (and that of the long-suffering tech support people at the U).

What are all the things I need to do to complete this course?

There are six units in this course: 1. Topography, 2. Soils, 3. Land Use, 4. Hydrology, 5. Vegetation and Biodiversity, 6: Goal-setting. The objectives for each unit are highlighted on the course home page and at the beginning and end of that unit’s online presentation.

Each unit generally consists of an online presentation (i.e., the lecture), site assignments, and a quiz. First, you’ll move through the online presentation, which is a set of narrated slides, some with interactive content. You’ll be directed to complete a site assignment after covering the content related to a particular restoration application. You’ll submit your assignments on-line through Moodle (more on that later). At the end of each unit there is an ungraded quiz that will help determine if you need to spend more time with the information in the unit before moving on. After you’ve completed all of the units, you’ll take a final multiple choice test.

Where are all the resources I need to complete this course?

The information “hub” for this course is a Moodle web site, which is where you will find all of your course materials, assignments, glossary, and link to the final test.

How long will it take to complete the course?

It takes most students 20-25 hours, including reviewing resource materials and completing assignments. All requirements must be completed by the last day of the registration period to receive credit.

Can I learn as much in an on-line course as in a classroom?

This online course is more content-rich than many comparable credit classroom courses. That’s because well-done multi-media presentations are more efficient (and hopefully interesting) than standard classroom lectures. So, the challenge is making sure you comprehend what’s

presented and are able to apply it. Your comprehension will likely be much greater if you follow the ancient student ritual of taking good lecture notes as you go through the course. Having a bunch of downloaded documents may be satisfying, but most people learn more if they are organizing and summarizing information as it is presented. If you want to have a copy of some of the slides, use the print screen function (Fn + Prnt Scrn) to capture your screen. Open up a word or powerpoint document and paste the image there.

Also, note that a glossary for the course is accessible from the course home page.

What's involved in the site assignments?

Another key to learning a lot in this course are the site assignments. In the site assignments you'll apply the concepts you've learned in the online presentation to restoration problems on a real site. For this course, the site is a place called Elk River Farm in Sherburne County (this isn't the actual place name). You'll experience the site through the Site Portfolio, which is a little website with lots of interactive maps and data sets, that is accessible from within the online course (i.e., it isn't public). The site portfolio presents the kinds of information you would gather when getting to know a restoration site in order to make decisions about planning, implementation, or management.

Each site assignment is a set of problems organized in a pdf. The pdf file is linked within each unit of the online course and is also available on the course home page. Unless you are very techie and have two computer screens, it will be easiest to print the assignment document and jot down your answers as you view the site portfolio on your screen. As you complete the assignments, be sure to return to the online course as needed and review the information presented there. After drafting answers for the questions, record them in Moodle as directed in the online course information. On the moodle screen it will suggest you are taking a quiz—ignore that little oddity – that's the name of the tool we're using for submitting site assignments.

If you submit your assignments by the recommended deadline, we'll review your answers within a few days of receiving them, and score each one as "passed" or "not passed". If your answer is completely or mostly correct, you'll receive a pass and a reply that provides the "official" answer. If you don't pass an assignment the first time, you can try one more time, as long as you have met the recommended deadline and as long as the course hasn't ended. On a second attempt, you can record new responses for questions that weren't correct on the first attempt and record "already passed" for questions you answered correctly on the first attempt. You need to correctly answer at least 70% of the site assignment questions to pass the course.

Are there deadlines for submitting assignments?

As mentioned above, there are recommended deadlines for submitting assignments. If you submit your assignment by the recommended deadline, you'll know which questions you didn't answer correctly and you can try again. If you submit your assignment after the recommended deadline, you will not be able to resubmit the assignment to improve your score. All

assignments (first or second attempts) must be submitted before the end of the course registration period to be evaluated.

The recommended deadlines for this course generally fall on Wednesdays (submit by midnight):

First day of course:	February 25
Introduction:	February 27
Unit 1A, Unit 1B, Unit 2:	March 6
Unit 3, Unit 4,	March 13
Unit 5A, Unit 5B	March 20
Unit 6:	March 25 (Monday)
Last day of course:	March 29

Are there required reading assignments?

There isn't a required book for this course. Throughout the course, there are links to resources that you should review. Take time to read through the information; many of these resources are critical to completing site assignments. More important, though, many of these resources will be useful to you in your professional practice. Resources available through internet links are also presented in a document on the course home page ("Course Resources at a Glance").

What's on the final test?

That's one of the most frequently asked questions in university classrooms (much to the dismay of instructors)! Happily, in this course there is a student-friendly answer: go look. The Final test link is at the bottom of the home page. You can enter the final test up to three times. So, you can look at the test early in the course if you'd like to get a sense of what's expected and still have two tries to pass. You'll need to score at least 70% on the multiple-choice final test to get credit for the course.

After you've clicked on the link to the final test you will be prompted to "Preview quiz now". Although the button says preview quiz now, it is neither a preview nor a quiz – another moodle oddity. It is the test and if you click on it and the "Start attempt" link in the message box that appears next, it will count as one of your attempts. Choose cancel if you are not ready to either review or attempt the test.

How can I interact with other restoration professionals during or after this course?

The Ecological Restoration Training Cooperative provides opportunities to learn from other practitioners through webinars, conferences, and the online practitioner's network. To learn more about these, visit www.restoringminnesota.umn.edu. This website also has information about upcoming offerings of the other courses in this series that you can take once you've successfully completed this course.

Date: 2/19/13

University Policy on Academic Integrity

Academic integrity is essential to a positive teaching and learning environment. All students enrolled in University of Minnesota courses are expected to complete their coursework responsibilities with fairness and honesty. Failure to do so—by seeking unfair advantage over others or by misrepresenting someone else's work as your own—may result in losing credit for work completed.

The University of Minnesota Board of Regents Policy on Student Conduct defines scholastic dishonesty as "submission of false records of academic achievement; cheating on assignments or quizzes; plagiarizing; altering, forging, or misusing a University academic record; taking, acquiring, or using test materials without faculty permission; acting alone or in cooperation with another to falsify records or to obtain dishonestly grades, honors, awards, or professional endorsement."

If you submit any other person's work as your own without proper acknowledgment, you are guilty of *plagiarism*. Plagiarism includes borrowing any concepts, words, sentences, paragraphs, or entire articles or chapters from books, periodicals, or speeches without quotation marks and citations to properly acknowledge your sources. If you have any questions about proper acknowledgment, consult a writing handbook. Plagiarism also refers to copying another student's assignment and submitting it for grading as if it were your own. You are equally guilty of scholastic dishonesty if you allow another student to copy your assignment.

Academic Accommodations for Students with Disabilities

It is University policy to provide, on a flexible and individualized basis, reasonable accommodations to students who have disabilities that may affect their ability to participate in course activities or to meet course requirements. Students with disabilities are encouraged to contact the instructor at the beginning of the course in order for accommodations to be made. Students with disabilities are required to work with the University of Minnesota Disabilities Services Office to help define the necessary accommodations.

Date: 2/19/13

COMMENTS FROM BETA TESTERS AND PILOT COURSE STUDENTS

Fabulous layout of info and I love all the links to more details and it looks really incredible (and looks like a ton of work!). Species list – nice!

Thank you so much for putting this course together - I am enjoying the learning opportunity.

Thanks to you and others for all your work on the other courses, it was sort of fun to be a "student" again.

...great classes. I wish I could have been in 2 others and that is where my strengths lie...but they were full. Thanks ahead of time.

I found the first class very informative and even knowing a lot of the theory I learned a great deal about the details and setting a more effective approach to investigating and thinking through a planning direction.

I am very interested in future classes you have available in the future. I would appreciate being on your notification list should future class opportunities become available. Many thanks

This one [Vegetation Management] was A LOT tougher than Site Assessment and I know all about invasives, control methods, growth patterns, chemical and mechanical options.

Thank you for the opportunity to learn from the materials you have brought together for these courses. This is good stuff and hits the mark for the type of considerations that are germain to developing successful wildlife habitat projects. Keep up the good work!

Thanks for including the MCBS map as part of the data.

I found the course to be well-put together and very thorough.

I think you all did an excellent job with this, but I would encourage you to add one more really useful resource – the Minnesota geologic atlases (in counties where they have been completed). These give a great overview of bedrock geology, surficial deposits, groundwater movement, etc.

There is a lot of material in this course – just the beginning of learning about the restoration process.

I think it would be very helpful to go more in depth on seed collection and processing.

I didn't expect the depth of the course. I felt it is well put together.

I found [the course] very informative and useful.

I learn visually, so the photos, diagrams, videos helped a great deal! I found the mixed media very helpful in emphasizing main objectives, details, etc.

The course provided a good intro to what resources are out there and what to look for in the field.

This course would be a great intro for those just entering a natural resources position where reviewing or planning restoration plans will be part of their job.

I think goal setting could be supplemented to great benefit with in-person and in-field training.

I really liked the Spring Peeper Meadow case study and would like to read more case studies as part of the course.

I thought the portfolio site was very interesting and felt that it did offer a virtual look into potential situations.

Good job with explanation of concepts. I was easily able to grasp the point of each sub-unit slide. The Elk River site as a practice tool was great! Practicing what I was reading/hearing definitely helps me "own" what I am learning.

I appreciated the external links on the course slides, both for extra information about the topic and to see where to go in the future for my own work.

In-field vegetation identification is a major need of mine. Not just prairie plants, but woodland groundcover species. I have been looking for a good field course and have not found anything.

The course was informative and made me think about analyzing and connecting "layers" of information that I had not connected before.

I thought the content and format of the site portfolio was genius, what a wonderful tool.

I found the course very interesting and useful, and I really appreciate the opportunity to test it out – thank you!

In my specific case, in-field training is always helpful for skill sets I am still building (vegetation and soils). I would take advantage of that if available.

Overall the course and content was very good, and I enjoyed serving as a beta-tester for this course. Having no experience with online learning, I was pleasantly surprised at the quality of the content, interactive aspects, and additional "help" features (links) provided.

I found the lack of interaction with an instructor or fellow students to be alienating.

Having an additional course on stakeholder interactions would be helpful. The more experience in this field that you get, the more you realize that the best planned project can easily fail when you lose the stakeholder support in the process.

This was my first on-line course. It was a very interesting format. Good job bringing in lots of resources.

RESTORING MINNESOTA

PART III

FIELD SESSIONS

Ecological Restoration Training Consortium
2013 Field Courses

Field training session: Designing and Using Native Seed Mixes

If you have successfully completed the Designing and Using Native Seed Mixes online course, you can join staff from the DNR Division of Parks & Trails to participate in an all-day field training session. During the field session, you'll be able to tap into the experiences of DNR Parks & Trails Area and Regional Resource Specialist staff to gain new skills in a hands-on environment.

In this field session, you will have the opportunity to learn how to:

- Clean and store native seed.
- Use cues to determine when native seed is ready to be collected.
- Collect seed using hand-held collecting tools.
- Determine preparations needed to adequately prepare a seed bed.
- Install native seeds according to a seeding plan using a seed drill and broadcast seeder.

You'll gain first-hand experience learning these restoration skills on site in a Minnesota State Park from the experienced practitioners in the DNR Division of Parks & Trails. Each of the following sessions provides the same field training experience.

Session 1- Southeastern Minnesota
June 19, 2013 (Register by 6/12/13)
8:00-4:30
Rice Lake State Park

Session 2- West Central Minnesota
September 11, 2013 (Register by 9/4/13)
8:00-4:30
Glendalough State Park

Session 3- Southeastern Minnesota
September 12, 2013 (Register by 9/5/13)
8:00-4:30
Rice Lake State Park

Session 4- Southwestern Minnesota
September 12, 2013 (Register by 9/5/13)
8:00-4:30
Camden State Park

Fee: Free with registration for the Designing and Using Native Seed Mixes online course.

To Register: Call the MNDNR Division of Parks & Trails (651-259-5600) or e-mail Kristel.Peters@state.mn.us. Put ERTC Field Course Registration in the Subject Line

Prerequisite: You must have passed the Designing and Using Native Seed Mixes online course prior to the date of the field course to be eligible to participate in the field course.

Cancellation Policy: Due to the limited enrollment, there may be a waiting list for the field courses. Please let us know if you cannot attend and must cancel your registration. That way we can let someone from the waiting list participate in the field course.

For cancellations:
Prior to the registration deadline, contact Kristel Peters at (651-259-5600) or e-mail Kristel.Peters@state.mn.us. Put ERTC Field Course Cancellation in the Subject Line.

After the registration deadline, please respond directly to the course instructor via the e-mail you will be receiving from them prior to the field training session.

What to Expect: Prior to the field course you will receive an email with details about where to meet and what to bring for the day. You should anticipate spending a full day outdoors, so dress appropriately for the weather. You will also be working with equipment, so you will need to provide your own work attire including work boots, leather gloves, eye protection, etc. The day will be jam-packed with hands-on skills. Breaks will be brief and there will not be time to pick up lunch outside of the park. Bring your own lunch, snacks, and beverages for the day.

Vegetation Management for Restored Ecosystems Field Courses Offerings

If you have successfully completed the Vegetation Management for Restored Ecosystems online course you can join staff from the DNR Division of Parks & Trails to participate in an all-day field training session. During the field session, you'll be able to tap into the experiences of DNR Parks & Trails Area and Regional Resource Specialist staff to gain new skills in a hands-on environment.

In this field session, you will have the opportunity to learn how to:

- Identify invasive species.
- Diagnose the extent of weed populations.
- Strategize solutions to manage multiple weed problems.
- Apply appropriate methods to mechanically control invasive species.
- Apply appropriate methods to chemically control invasive species.

You'll gain first-hand experience learning these restoration skills on site in a Minnesota State Park from the experienced practitioners in the DNR Division of Parks & Trails. Each of the following sessions provides the same field training experience.

Session 1- East Central Minnesota
June 19, 2013 (Register by 6/12/13)
8:30 -4:00
St. Croix State Park

Session 2 - West Central Minnesota
June 20, 2013 (Register by 6/13/13)

8:30 -4:00
Glendalough State Park

Session 3 - Metro Region
June 20, 2013 (Register by 6/13/13)
8:30 -4:00
Fort Snelling State Park

Session 4 - Northeast Region
September 25, 2013 (Register by 9/18/13)
8:30 -4:00
Jay Cooke State Park

Fee: Free with registration for the Vegetation Management for Restored Ecosystems online course.

To Register: Call the MNDNR Division of Parks & Trails (651-259-5600) or e-mail Kristel.Peters@state.mn.us. Put ERTC Field Course Registration in the Subject Line

Prerequisite: You must have passed the Vegetation Management for Restored Ecosystems online course prior to the date of the field course to be eligible to participate in the field course.

Cancellation Policy: Due to the limited enrollment, there may be a waiting list for the field courses. Please let us know if you cannot attend and must cancel your registration. That way we can let someone from the waiting list participate in the field course.

For cancellations:
Prior to the registration deadline, contact Kristel Peters at (651-259-5600) or e-mail Kristel.Peters@state.mn.us. Put ERTC Field Course Cancellation in the Subject Line.

After the registration deadline, please respond directly to the course instructor via the e-mail you will be receiving from them prior to the field training session.

What to Expect: Prior to the field course you will receive an email with details about where to meet and what to bring for the day. You should anticipate spending a full day outdoors, so dress appropriately for the weather. You will also be working with equipment, so you will need to provide your own work attire including work boots, leather gloves, eye protection, etc. The day will be jam-packed with hands-on skills. Breaks will be brief and there will not be time to pick up lunch outside of the park. Bring your own lunch, snacks, and beverages for the day.

FIELD COURSE PHOTO GALLERY

Designing and Using Native Seed Mixes Field Course Photos

Seed collection and processing

Transferring a planting plan to the ground

Using a cultipacker to ensure good seed to soil contact

Jacking up the seed drill in preparation for calibrating it

Measuring the drive wheel during seed drill calibration

Assessing seed distribution after drilling

Vegetation Management for Restored Ecosystems Field Course Photos

Choosing the right cutting tool for vegetation management

The DR mower is a versatile tool for vegetation management

Using the DR mower for vegetation management

Personal protective equipment for safe herbicide use

The right tools can help accurately measure herbicides

Calibrating a boom sprayer for vegetation management

ECOLOGICAL RESTORATION TRAINING COOPERATIVE

Seeding Field Training Outline

Designing and Using Native Seed Mixes			
Time	**Lesson**	**Lesson Competencies**	**Timing**
8:00	Check-in/Welcome/Introductions		**30**
8:30	1. Seed Collection and Processing	Apply appropriate methods to clean and store native seed, based on species and the seeding technique to be used.	**30**
9:00	Transition		**15**
9:15	Seed Collection and Processing cont.	Use cues to determine when native seed is ready to be collected. Collect seed using hand-held collecting tools.	**30**
9:45	Transition		**15**
10:00	2. Preparing to Seed	Determine preparations needed to adequately prepare a seed bed, based on field inspections of sites.	**90**
11:30	Transition		**15**
11:45	Preparing to Seed cont.	Determine preparations needed to adequately prepare a seed bed, based on field inspections of sites.	**45**
12:30	Transition/Break		**30**
1:00	3. Seeding	Install native seeds according to a seeding plan.	**195**
4:15	Closing/Course Evaluation		**15**
4:30	Adjourn		

6.5 hours for instruction

2.0 hour for transitions/break

8.5 hours total

Lesson 1	Seed Collection and Processing (60 minutes)				
Competency: Collect seed and apply appropriate methods to clean and store native seed, based on species and the seeding technique to be used.					
Sub-Competency	**Training Sequence**	**Set-up**	**Time**	**Page**	**Equipment/Materials**
A. Determine appropriate level of seed processing based upon the seeding technique to be used. Select and use simple methods for processing seed of common native prairie species.	Compare seed prepared to be seeded in a drill versus seed to be seeded by Vicon. Students perform simple seed processing techniques to process seed for use in a Vicon seed broadcaster.	Inside work space	30 minutes	2	Samples of seed cleaned for seed drill vs Vicon broadcast seeder. Screens Sieves Food processor Hammermill Drying facilities
B. Determine when native prairie seed is ripe and ready to be collected and use a variety of hand-held seed harvest tools to collect seed.	Trainer demonstrates use of multiple styles of seed collecting methods using a variety of equipment/tools. Students practice with seed collecting equipment/tools	Prairie site	30 minutes	2	Seed collecting equipment: Handheld powered seed stripper – flail or brush Racket & light-weight hopper Hand stripper Vacuum stripper Pruning shears/scissors Collecting bags

Lesson 2	Preparing to Seed (135 minutes)					
Competency: Determine preparations needed to adequately prepare a seed bed, based on field inspections of sites.						
Sub-Competency	**Training Sequence**	**Set-up**	**Time**	**Page**	**Equipment/Materials**	
A. Formulate a site preparation plan to organize the logistics that must be coordinated prior to seeding.	Trainer presents problem – site needs to be prepared for seeding. Students work in pairs to assess need for site preparation vegetation management, soil preparation, identify planting zones (wet spots, etc). Outline a schedule for site preparation steps. Students convene to share their process. Trainer compares strategies of each group and offers his/her assessment. Trainer identifies methods (chemical prep, cropping, tilling) for site/seedbed preparation. The uses, attributes, and limitations of each method are discussed.	Degraded site that could be prepared for seeding.	45 minutes	2	Aerial photograph of site if large enough.	
B. Transfer a seeding plan to the ground	Students each have copy of the map. Working in pairs, students determine where landmarks are located from which to measure. Determine distances to be measured. Each pair of students transfers 2 points from the map to the ground.	Use the plowed field or a nearby open field site where there are landmarks that can be measured from. Assume that 2 or more zones need to be marked on the ground.	45 minutes	3	Aerial map/Topo map Mock/real planting design map surveyors flags wooden stakes marking pens measuring tape compass/GPS	
C. Select appropriate soil preparation method/equipment and assess soil seed bed conditions to ensure a suitable habitat for germinating seeds and establishing seedlings. Select the installation method best suited for site conditions and the species being sown.	Students respond to site preparation scenarios: which would you use to prep compacted soil, for site with corn stubble, etc. Students assess or rate field site prepared with different # of passes with disk for quality of seed bed. Answer question: which is most ready to seed? Trainer discusses use of seed drill and Vicon; strengths and limitations of each. Which is best for different site prep conditions, seed types? Students as a group determine which piece of equipment is suited for site conditions prepared by the various site prep methods.	Equipment shed with equipment pulled out for easy display. To demonstrate soil preparation a nearby site has been prepared: 1 pass with disk 2 passes with disk, 3 passes with disk 3 passes with disk + cultipacker Use the site that has been prepared with a pass from each type of implement and implement combinations.	15 minutes 15 minutes 15 minutes	3	Soil preparation equipment: Disk Cultipacker Handout summary of seedbed preparation criteria. Vicon seeder Seed drill	

Lesson 3	Seeding (195 minutes)				
Competency: Install native seeds according to a seeding plan.					
Sub-Competency	**Training Sequence**	**Set-up**	**Time**	**Page**	**Equipment/Materials**
A. Clean seed drill to prevent sowing wrong species at the next site.	Trainer points out all places where seed can remain in seeding equipment. Students, guided by trainer, clean all tubes, bins, and etc of seed.	Storage shed area	20 minutes	2	Seed drill Tools to access tubes Shop vac Brushes
B. Prepare and calibrate seed drill for seeding and troubleshoot problems.	Trainer discusses/demonstrates what types of seed go in each bin and which seed can be combined in a single bin. Students assist with calibration, measuring the wheel, spinning the wheel, collecting, and measuring the seed output.	Storage shed area; need to run drill on hard surface to calibrate.	50 minutes	2	Seed drill Grass seed mix Forb seed mix Cover crop seed Buckets Measuring tape Tools
C. Install seed using a drill at a specified seeding rate.	Trainer demonstrates seed installation using a seed drill at specified rate. Students inspect the sown area to observe seed in ground: depth and density.	Field site, driveway, or turf area near storage shed area	40 minutes	3	Seed drill Seed
D. Prepare and calibrate a seed broadcaster for seeding and troubleshoot problems. Clean seed broadcaster.	Trainer discusses/demonstrates how seed weight and seed size affect distribution by Vicon. Demonstrate how seed mixes affect distribution. Calculate output based on working width, application rate and driving speed. Students, guided by trainer, clean all tubes, bin	Storage shed area	50 minutes	4	Vicon broadcaster Seed mix Bucket Tools to access parts Filler/carrier Shop vac Brushes http://www.viconspreadingcharts.com/en-Metric/Home/VICON
E. Install seed using a broadcaster at a specified seeding rate.	Trainer demonstrates seed installation using a broadcast seeder at specified rate. Students inspect the sown area to observe seed placement and density.	Field site or driveway near storage shed area	20 minutes	5	Vicon broadcaster Seed mix
F. Discuss how a post-sowing evaluation of seedling establishment can be used to determine if corrective action is needed.	Trainer discusses formal and informal methods that can be used for post seeding evaluation. Show the tools that could be used for formal monitoring.	Stay at the field site or driveway near storage shed area	15 minutes	6	½ sq m monitoring plots (or 1 sq ft monitoring plots) Seedling guides Guidelines for satisfactory establishment Pooled data

Ecological Restoration Training Cooperative
Designing and Using Native Seed Mixes
Lesson 1: Seed Collecting and Processing

Learning Objectives:

After completing this lesson, participants should be able to

- Use a variety of hand-held seed collecting tools to harvest native prairie seed.
- Determine when seed is ripe and ready to be collected.
- Determine an appropriate level of seed processing based upon the seeding technique to be used.
- Select and use simple methods for processing seed of common native prairie species.

Timing:

Late August to mid-September (unless the seed collecting/seed processing lesson is not taught, then this field course could be taught in May/June).

Locations:

Seed cleaning and storage area with room to process seeds.

A prairie site, where several species of grasses and forbs have ripe seed that is ready to be collected.

Equipment/Materials from the Bin (B), in the Folder (F) or provided by DNR (D):

- Seed collecting equipment: stripper, pruning shears (D)
- Scissors (B)
- Collecting bags (D)
- Grass seed sample cleaned for drill (B)
- Forb seed sample vials - to demonstrate size variation (B)
- Local source seed for use in the drill and broadcaster (D)
- Screens (D)
- Sieves (D)
- Clipper fanning mill (D)
- Drying facilities (D)
- Seed storage containers (D)
- Drying screens (D)
- Fans (D)
- Marker for labeling (B)

Note:

Meet at the seed cleaning area and teach Seed Processing first, then transition to the prairie location to teach Seed Collecting.

Sub-competency A. Determine the appropriate level of seed processing based upon the seeding technique to be used. Select and use simple methods for processing seed of common native prairie species. (30 minutes)

At the inside work space, the Trainer shows seed samples. One sample is processed for use in a seed drill. The other sample is processed for use in a Vicon seed broadcaster. The students compare and contrast the characteristics of the seed mixes and determine which is cleaned/processed for which seeding method. (10 minutes)

Demonstrate the space and equipment used for the drying process – screens, floor, fans, etc.

The Trainer demonstrates the use of basic seed processing equipment that would be used to pre-clean seed for use in a seed broadcaster. Students practice adjusting and using the seed cleaning equipment for different species and for different degrees of seed cleaning. (20 minutes)

Ask:

- What is the difference between seed processed for a seed broadcaster vs. for a seed drill?
- Why isn't seed processed for a broadcaster cleaned as well as seed for a drill?
- How should seed be handled after harvest?
- How should seed be handled for short-term storage? Long-term storage?
- What tools are useful for the basic processing of native seed?
- How can these tools be adjusted for different species and a variety of seed sizes?

Do:

- Analyze batches of seed prepared for different seeding techniques and note the differences in their quality.
- Use simple seed processing equipment and procedures to pre-clean small batches of seed.

Note: Transition to prairie for seed collecting [15 minutes]

Sub-competency B: Determine when native prairie seed is ripe and ready to be collected and use a variety of hand-held seed harvest tools to collect seed. (30 minutes)

At the prairie site, the trainer picks several species that are ripe and for contrast, several species that are not ripe. Demonstrate to the students the cues that are used to know when seed is ripe: seed color, seed capsule color, capsule beginning to split, separates from the plant with a gentle pull, plant turning brown, etc. Students practice using this knowledge by testing a few different species. Discuss exceptions to the rule and unique species. (15 minutes)

At the prairie site, various hand harvesting methods are demonstrated: flail stripper, hand cut and bag, etc. Students harvest seeds with the seed collecting equipment and tools. (15 minutes)

Ask:

- What cues guide you to know when seed is ripe?
- What methods are useful for hand collecting small quantities of seed or seed of minor species?

Do:

- Observe seed heads of a variety of species to observe the cues used to determine ripeness.
- Use different hand-held seed harvesting tools to harvest seed of prairie grasses and forbs.

Note: Transition to Lesson 2 location for site preparation and transferring a seeding plan to the ground. [15 minutes]

This Ecological Restoration Training Consortium (ERTC) course was developed by the University of Minnesota and the Department of Natural Resources in partnership with the Minnesota Department of Transportation and the Minnesota Board of Water and Soil Resources. The ERTC was funded by the Minnesota Environment and Natural Resources Trust Fund as recommended by the Legislative-Citizen Commission on Minnesota Resources (LCCMR).

Learning Objectives:

After completing this lesson, participants should be able to

- Formulate a site preparation plan to organize the logistics that must be coordinated prior to seeding.
- Select appropriate soil preparation method/equipment and assess soil seed bed conditions to ensure a suitable environment for seed germination and seedling establishment.
- Transfer a seeding plan to the ground.
- Select the installation method best suited for the site conditions and the species being sown.

Locations:

A site that is slated for restoration (real or mock), where students can formulate a site preparation plan and practice transferring a seeding plan to the ground.

A site near the restoration site where the soil has been prepared with various passes of a disk and cultipacker.

Equipment/Materials from the Bin (B), in the Folder (F) or provided by DNR (D):

- Disk (D)
- Cultipacker – optional (D)
- Chain link fence section – optional (D)
- Tractor (D)
- Vicon seed broadcaster (D)
- Seed drill (D)
- Aerial map of site (D)
- Soils map (D)
- Topographic map of site (D)
- Planting design map (D)
- Wooden stakes – optional (D)
- Wire flags/Forestry tape (B)
- Measuring tapes(B)
- Marker for labeling (B)
- Compass/GPS (B)
- Clipboards, paper, pens (B)
- Sample planting plan (F)
- List of soils prep equipment (F)
- List of seed mix components (F)
- Handout summary of seed bed preparation criteria (F)
- Worksheet (F)

Note:

There is a transition between Sub-competency B and Sub-competency C.

Sub-competency A: Formulate a site preparation plan to organize the logistics that must be coordinated prior to seeding. (45 minutes)

Location: A site that is slated for restoration (real or mock), where students can formulate a site preparation plan and practice transferring a seeding plan to the ground.

At the restoration site, the trainer presents the problem and prepares the students to formulate a site preparation plan. The trainer identifies methods for site/seed bed preparation including chemical prep, cropping, and tilling. The uses, attributes, and limitations of each method are discussed. The trainer discusses how conditions and equipment used would differ for different site conditions, including soil type, vegetative cover, and topography. (20 minutes)

The site needs to be prepared for seeding. Itemize the issues that need to be dealt with at this site. Recall from the online course the steps that must be taken to prepare a site for seeding:

- Pre-planting vegetation management
- Identify planting zones and appropriate seed mixes
- Soil preparation

Students should work in pairs to assess the need for site preparation vegetation management, to identify planting zones that may need unique seed mixes, and to outline the steps that should be taken for soil preparation prior to seeding. Students should outline a schedule for the site preparation steps. (15 minutes)

Gather the students to share their site preparation process. The trainer should encourage comparison of different strategies and offer his/her assessment of site preparation needs. (10 minutes)

Ask:

- What weeds are present on the restoration site and how should they be controlled prior to restoration?
- If seeding into bare soil is recommended, how should the soil be prepared for seeding?
- What habitat zones/moisture gradients are present that should have distinct seed mixes?
- Under what conditions would you choose to use chemical site prep or tilling or cropping?
- What are advantages to chemical site prep? Disadvantages?
- What are advantages to cropping site prep? Disadvantages?
- What are advantages to tilling as a site prep method? Disadvantages?
- Where should the seed mixes be distributed (dry, mesic, meadow)?

Do:

- Itemize the issues that need to be dealt with

- Assess the need for site preparation vegetation management and soil preparation.
- Identify planting zones based on soil moisture, light exposure, or other environmental variation.
- Outline a schedule for site preparation.

Sub-competency B. Transfer a seeding plan to the ground. (45 minutes)

Location: A site that is slated for restoration (real or mock), where students can practice transferring a seeding plan to the ground.

Provide each pair of students with copies of topo maps, an aerial photograph, and a planting plan map of the restoration site. The planting plan map should have at least 2 different planting zones marked and may show the transition zone where two adjacent seed mixes would be blended.

Explain the objective of this exercise, and highlight simple methods used to accurately transfer a planting plan to the ground prior to seeding. Review with the students the features that can be seen on the aerial photographs and topographic map. (15 minutes)

Working in pairs, the students should transfer the planting plan to the ground by identifying landmarks that they can measure from to set the boundaries of each planting zone. Each pair of students should transfer at least 2 points from the map to the ground and mark them with surveyor's flags or stakes. (30 minutes)

Ask:

- What identifiable features can be seen on the map and can also be seen on the ground?
- What are low-tech methods to transfer a planting plan from paper to the ground?
- Why is it important that the planting zone boundaries be accurately transferred to the ground?

Do:

- Pick out identifiable landmarks and using GPS, a compass direction, and/or pacing, measure from the landmarks to the planting zone boundary. Mark the boundary.

Note: Transition to the site where the soil has been prepared with various passes of a disk.

Sub-competency C. Select appropriate soil preparation method/equipment and assess soil seed bed conditions to ensure a suitable environment for germinating seeds and seedling establishment. Select the installation method best suited for site conditions and the species being sown. (45 minutes)

Location: A site near the restoration site where the soil has been prepared with various passes of a disk.

The Students assess or rate the quality of the seed bed in a field site prepared with a different number of passes with the disk, and a seed bed prepared with the disk and a pass with the cultipacker, if one is available. Answer the question, “which plot is most ready to seed with different seeding methods - drill, Vicon broadcast, interseeding, hand broadcast”.

The trainer discusses the use of the seed drill and Vicon broadcaster, including the advantages and limitations of each. Point out which is better for different site preparation conditions and seed types, etc. The Students as a group should determine which method is suited for the site conditions anticipated based on the site preparation plan they developed for Sub-competency A.

Ask:

- How does seed bed quality differ with increasing passes with a disk?
- Which condition is most suitable for seeding?
- Optional - How does a cultipacker improve seed bed quality?
- Under what circumstances is it more desirable to use a seed drill?
- Under what circumstances is it more desirable to use a seed broadcaster?
- What are the advantages of using a seed drill? The limitations?
- What are the advantages of using a seed broadcaster? The limitations?
- Are some species best sown via a drill vs. a broadcaster?

Do:

- Assess the quality of a seed bed prepared using 1, 2, or 3 passes with a disk.
- Optional - Assess the quality of a seed bed prepared using 3 passes with a disk followed by a cultipacker.
- Assess the anticipated outcome of each site assessment plan and determine which seeding method is most suited to the site conditions that will occur.

Note: Transition to the maintenance area and take a brief lunch break before resuming with Lesson 3.

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Learning Objectives:

After completing this lesson, participants should be able to

- Prepare and calibrate a seed drill and troubleshoot common problems.
- Install seed using a drill at a specified seeding rate.
- Clean a seed drill to prevent sowing the wrong species at the next site.
- Prepare and select settings for a seed broadcaster and troubleshoot common problems.
- Install seed using a broadcaster at a specified seeding rate.
- Clean a broadcast seeder to prevent sowing the wrong species at the next site.
- Conduct a post-seeding evaluation of seedling establishment.
- Evaluate if corrective action is needed based on typical establishment times.

Location:

Maintenance area, adjacent to a driveway or a turf area where seed can be sown.

Equipment/Materials from the Bin (B), in the Folder (F) or provided by DNR (D):

- Tractor (D)
- Vicon seed broadcaster (D)
- Seed drill (D)
- Grass seed mix (D)
- Forb seed mix (D)
- Grass seed mix sample (B)
- Forb seed sample vials (B)
- Cover crop seed (D)
- Filler (cracked corn, vermiculite, cat litter) (D)
- Vermiculite filler sample (B)
- Buckets/bags for capturing seed (D)
- Scale (measures ounces and grams) (D)
- Jack(D)
- Tool set(D)
- Shop vac (D)
- Brushes (D)
- Clipboards, pens, paper(B)
- Measuring tapes(B)
- Marker (B)
- Rulers/screwdrivers to determine seed depth (B)
- ½ meter square monitoring plots - optional (D)
- 1 square foot monitoring plots (B)
- Bonestroo Prairie Seedling and Seeding Evaluation Guide (B)
- Weed Seedling Key (B)
- USDA NRCS Prairie Seedling Key (B)
- Hand lens (B)
- Truax calibration guide (F)
- Drill bin designation handout (F)
- Summary of satisfactory establishment criteria (F)

Note: Ideally these sub-competencies are all taught at the same location to minimize transition times.

Sub-competency A. Clean seed drill to prevent sowing the wrong species at the next site. (20 minutes)

The Trainer identifies all the locations on the seed drill where seed can get stuck and remain in the seed drill. Students help the trainer to remove feeder tubes and clean them of seed. The Students help to clean the seed boxes.

Ask:

- Where are all the locations in the seed drill that should be checked for leftover seed?
- What is the best method to remove leftover seed from the seed drill after a seeding is done?

Do:

- Remove feeder tubes to clean out leftover seed.
- Remove seed remnants from the seed boxes and seed cups.
- Replace feeder tubes.

Sub-competency B: Prepare and calibrate a seed drill and troubleshoot common problems. (50 minutes)

Review Truax drill manual: http://www.truaxcomp.com/manuals/4-Operating-the-Drill.pdf
Review Pages 60-69 and 71-72 in 'The Tallgrass Prairie Center Guide to Prairie Restoration'
Review Pure Live Seed (PLS) calculations on Pages 19-21 in 'The Tallgrass Prairie Center Guide to Prairie Restoration'

The Trainer discusses/demonstrates what types of seed go in each seed box (fluffy seed, small seed, and cool season), which seeds can be combined to go in the same box, and how to handle forb seed (drill vs. sow by hand). Discuss the rationale and importance of seed location in the drill. Adjust the sliding gates to demonstrate how much seed flows out at different settings. Choose an appropriate setting for the seed being sown.

Students assist the Trainer with calibrating the drill. Seed is loaded into boxes. Students measure the wheel. Remove the hoses from the seed cups and attach collecting bags. Then spin the wheel for the measured distance (or pull the drill for the length of the field with bags attached to the seed cups). Collect and weigh the seed output. Students should calculate the seeding rate and determine how to make adjustments to get the desired seeding rate. See the Truax manual for calibration details.

If using a no till drill, discuss how the no-till coulters need to be adjusted depending on the thatch and residue covering the soil and the hardness of the soil. Demonstrate adjusting the no-till coulters. Allow time for the students to practice adjustments if there is time for hands-on.

Humidity, seed purity, seed density, ground speed, site conditions, seed germination, seed box used, and seed mixes all affect seeding rate.

Ask:

- What characteristics of seed determine which seed box they go in and which seeds can be combined in a single bin?
- What are some variations on seed box recommendations and why would you choose them?
- How does seed cleaning affect seed placement in the seed boxes?
- How do the seed boxes physically differ from one another?
- How does the drill regulate seed output?
- Does ground speed affect seed distribution and seed soil contact?
- What is the formula for calculating seeding rate?
- How does PLS affect seeding rate?
- What factors can affect seed rate?
- How should the drill be calibrated in order to drill the site twice?
- Should the filler be added for the calibration?
- How can the Vicon and drill be used to complement each other?
- How does operation of the drill differ when no-till drilling versus drilling into a prepared seed bed?
- How are the no-till blades adjusted?

Do:

- Set up the drill for calibration, filling bins, etc.
- Measure the planting wheel or measure 100 feet on the ground.
- Spin the wheel for a measured distance or pull the drill 100 feet.
- Collect the seed as it is dispersed from each tube.
- Weigh the seed and calculate seeding rate.
- Adjust settings and retest the seeding rate.

Sub-competency C. Install seed using a seed drill at a specified seeding rate. (40 minutes)

The trainer demonstrates seed installation with a seed drill at a specified seeding rate and at the specified depth for each seed box.

Discuss strategies to achieve good seed distribution, such as seeding the whole site at half the rate and then drilling the whole site again at half the rate perpendicular to the direction of the first pass or using filler in the seed boxes. Discuss how filler should be chosen to match the size and weight of the seed in each seed box.

The Students should inspect the sown area to observe the seed in the ground.

Ask:

- What strategies are used to get good seed distribution and minimize the drill pattern?
- When should a filler/carrier be used?
- What materials can be used as filler?
- How does no-till drilling differ from drilling into a prepared seed bed?
- How does a no-till seed drill differ from a traditional drill?
- How does ground speed affect seeding rate?
- How are the depth bands adjusted?
- How do humidity or other environmental factors affect seeding?

Do:

- Adjust the depth bands.
- Stop during drilling to inspect for misses and blocked tubes
- Inspect the drilled area to determine if seed was evenly distributed, if there were blocked tubes, and if the seed is deep enough or too deep.

Sub-competency D. Prepare and calibrate a seed broadcaster for seeding and troubleshoot common problems. (50 minutes)

Review Pages 59-60 in 'The Tallgrass Prairie Center Guide to Prairie Restoration'

The trainer discusses the use of the Vicon broadcaster. Demonstrate how the feeder gate and other settings can be adjusted to modify the seeding rate and discuss how ground speed affects seeding rate with a broadcast seeder. Calibrate the broadcast seeder. Demonstrate tips and strategies to improve quality of seeding with a broadcast seeder.

The Students should measure the width of the seeding strip (how wide the seed is broadcast) and calculate how many passes it will require to seed the site by dividing the width of the site by the width of the seeding pass. Place a pre-weighed amount of seed in the bin. Drive at the recommended ground speed and broadcast seed down a 100 foot length of the site. Reweigh the remaining seed. Calculate how much seed was used to seed a 100 foot length. Divide 100 feet into the length of the field. Multiply this number by the amount of seed used in 100 feet to get the amount of seed that will be needed for one full pass, then multiply this amount by the number of passes to determine the amount of seed needed to seed the entire site. If the amount calculated is higher or lower than your pre-determined seeding rate, you must increase or decrease your ground speed, or open or shut the feeder gate to regulate seed flow.

The trainer demonstrates how to clean the broadcast seeder to remove all seed that might contaminate the next seeding. Any points were seed can get stuck and block the outflow are checked and cleaned.

The Students should help clean out the bin after all seed is broadcast and assist with cleaning other parts of the seeder.

Ask:

- Are there standard settings for broadcast seeding native grass mixes or native grass and forb mixes?
- What adjustments can be made to modify seeding rate?
- How does using a filler affect seeding rate?
- What are some strategies to improve outcomes from broadcast seeding?
- Where can seed get stuck in the seeder, and how are those areas accessed for cleaning?
- Are there areas of the seeder that should be monitored for blockage during seeding?
- How does seed character affect broadcast seeder calibration?

Do:

- Adjust the settings on the broadcast seeder.
- Calculate the seeding rate by weighing the seed, measuring the seeding width, and determining the seed output on a measured length of the site.
- Adjust seed output and seed flow by adjusting the feeder gate and ground speed.
- Clean the broadcast seeder to prevent seed contamination from site to site.

Sub-competency E. Install seed using broadcast seeder at a specified seeding rate. (20 minutes)

The trainer demonstrates seed installation using a broadcast seeder at a specified rate. Drive the seeder over the driveway/parking lot or a prepared field site, broadcasting the seed mix.

If using a site with prepared soil, demonstrate how good seed to soil contact is achieved using a drag harrow or piece of chain link fence, otherwise discuss the importance of seed to soil contact.

The students inspect the sown area to observe seed placement and density. Students should observe and contrast seed to soil contact when the seed bed has been dragged and when it has not been dragged.

Ask:

- How do you get good seed to soil contact?
- What does good seed to soil contact look like?
- What does the seed density on the ground look like for a specified seeding rate?

Do:

- Inspect the sown area to assess seed placement and seed to soil contact.

Sub-competency F: Discuss how a post-sowing evaluation of seedling establishment can be used to determine if corrective action is needed. (15 minutes)

As concluding remarks, the Trainer should discuss how to check a seeding to assess whether it is a success, needs management to promote establishment, or needs reseeding. Discuss situations where the seeding may not look like a success, but more patience is required: timeframe is too short for an accurate determination, a drought has prevented the seed from germinating, forb seeds have not germinated because they must undergo an overwinter stratification period, etc. Discuss the pros and cons of casual observation versus systematic monitoring.

Ask:

- How should environmental variability be accounted for when evaluating a seeding?
- What resources are available to help with a seeding evaluation?
- What native forb and grass seedling density constitutes adequate establishment.
- When should reseeding should be conducted.
- Should a management action such as mowing be implemented to promote establishment.

Note: Transition back to the morning's meeting location. [15 minutes]
Have students fill out an evaluation form.

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June 2013

ECOLOGICAL RESTORATION TRAINING COOPERATIVE

Vegetation Management Field Training Outline

Vegetation Management for Restored Ecosystems			
Time	**Lesson**	**Lesson Competencies**	**Timing**
8:30	Check-in/Introductions/Transition		**30**
9:00	1. Mechanical Control of Invasive Species	Identify invasive species, diagnose extent of weed populations, and strategize solutions to manage multiple weed problems. Apply appropriate methods to mechanically control invasive species.	**120**
11:00	2. Chemical Control of Invasive Species	Apply appropriate methods to chemically control invasive species.	**75**
12:15	Transition/Break		**30**
12:45	Chemical Control of Invasive Species cont.	Apply appropriate methods to chemically control invasive species.	**45**
1:30	Transition		**15**
1:45	3. Assessing Weed Problems	Identify invasive species, diagnose extent of weed populations, and strategize solutions to manage multiple weed problems.	**120**
3:45	Closing/Course Evaluation		**15**
4:00	Adjourn		

6.0 hours instruction

1.5 hour break/transitions

7.5 hours total

Lesson 1 - Mechanical Control of Invasive Species (120 minutes)					
Competency: Apply appropriate methods to mechanically control invasive species and promote native vegetation.					
Sub-Competency	**Training Sequence**	**Set-up**	**Time**	**Page**	**Equipment/Materials**
A. Describe how to develop solutions to manage multiple weed problems and promote establishment of the native plant community based on invasive species traits, site conditions, and existing or potential native species.	Site A - Trainer identifies invasive species, describes the weed problem, discusses management priorities. Trainer discusses management methods that could be used and a timeline.	Site A – a restoration site with multiple weed problems, can be small - .5 acres. Have all equipment laid out at site A.	20 minutes 20 minutes	2	PPE: helmet, gloves, safety glasses Tick gaiters Invasive species identification guides Mower Brush saw Girdling tool Weed wrench/Root Talon DR/Jari mower Loppers/pruning shears Hand pulling
B. Use simple mechanical control equipment, e.g. select settings, perform required maintenance, change blades, sharpen blades, etc.	Trainer demonstrates use of equipment/ tools. Students practice using tools for which there are no hazards – girdling tool, weed wrench, etc. Trainer discusses limitations and strengths of each. Students as a group determine which piece of equipment can accomplish some parts of the prescribed treatment from sub-competency A.	Site A – a restoration site with multiple weed problems, can be small - .5 acres. Have all equipment laid out at site A.	30 minutes	2	Equipment: Girdling tool Weed wrench Root Talon Loppers Pulaski/mattock Pruning shears Hand pulling techniques Sharpening tools, files
C. Demonstrate power tools commonly used for mechanical control including: adjust settings, perform basic maintenance, change blades, sharpen blades, etc.	Trainer discusses/demonstrates use of equipment, essential maintenance and cleaning of equipment. Students adjust settings and perform basic maintenance as demonstrated by trainer.	Site A – a restoration site with multiple weed problems, can be small - .5 acres. Have all equipment laid out at site A.	50 minutes	4	Pick at most 2(?) pieces of equipment to focus on: Mower Brush saw Chainsaw DR mower/Jari mower Maintenance tools – grease gun, socket set, sharpening tools

Lesson 2 - Chemical Control of Invasive Species (120 minutes)					
Competency: Choose appropriate equipment and apply appropriate methods to chemically control invasive species.					
Sub-Competency	**Training Sequence**	**Set-up**	**Time**	**Page**	**Materials**
A.Select an appropriate herbicide application method to achieve minimal impact to non-target plants and maximum impact to target plants based on species and existing site conditions. Match the scale of the equipment to the scale of the problem.	Trainer describes use of equipment discusses considerations of herbicides, timing, and equipment Students assess best tool for herbicide application on Site A, consider herbicide, timing, and equipment	Equipment is set out at site A where the backpack sprayers can be used. Have a water supply on hand. Optional: This may be at the equipment shed.	20 minutes	2	Variety of herbicide application equipment: Backpack sprayers Spray bottle Wick system Invasive species factsheets Herbicide label
B.Troubleshoot a backpack sprayer to fix leaks, poor pressure, etc. Use best practices to use a backpack sprayer to minimize herbicide drift and chemical overspray: nozzle selection, maintain appropriate pressure, walking speed, wand height, etc. Clean the backpack sprayer. Optional: Monitor overspray damage and the need for follow-up control.	Trouble-shoot backpack sprayer problems Use of backpack sprayer including various nozzle spray patterns, and appropriate use to get kill, avoid overspray, and prevent herbicide resistance. Trainer demonstrates best practices for cleaning a backpack sprayer. Determine a timely interval to monitor effectiveness and impacts of overspray.	Equipment is set out at site A where the backpack sprayers can be used. Have a water supply on hand. Optional: This may be at the equipment shed.	55 minutes	2	Backpack sprayers Backpack sprayer parts 15 PSI pressure valve Water source Dye/bark oil Wire flags/forester's tape Copy of cleaning chart Calibration handout
C. Use best practices to calibrate, set-up, operate, and clean a small herbicide tank with boom sprayer.	Trainer demonstrates calibrating tank sprayer - drive ATV with sprayer (filled with water) operate over a measured distance of known width and speed. Students assist with measurements, refilling, etc. Trainer demonstrates use of tank sprayer including appropriate use to get kill, avoid overspray, and prevent herbicide resistance.	Equipment is set out at a site where the rolling stock with boom can be used. Near water source. This may be at the equipment shed.	45 minutes	3	ATV tank sprayer with boom Water source Measuring tape Cones/ wire flags Container to hold water Tool set

Lesson 3 - Assessing Weed Problems (120 minutes)					
Competency: Identify invasive species, diagnose extent of weed populations, and strategize solutions to manage multiple weed problems and promote native vegetation.					
Sub-Competency	**Training Sequence**	**Set-up**	**Time**	**Page**	**Materials**
A.**Identify** Site B invasive species, define the scale of the weed problem, and determine weed and native species management **priorities** based on field inspections, species traits, site conditions, and existing or potential native plant community.	Site B – Trainer describes weed problems. Does not indicate weed management priorities/strategy. Trainer holds up live plant samples and points out characteristic features. Students have same plants in hand. Students work in pairs to establish weed mngt priorities and devise strategy. Convene to share priorities. Trainer compares strategies of each group and offers his/her assessment.	Site B with multiple weed problems, can be a small area - .5 acres.	10 minutes 15 minutes 10 minutes	2	Aerial photograph/Site map Handout Color photocopy of weeds Invasive species samples Look alike samples Training information - DNR terrestrial invasive species TNC invasive spp. Table to fill in
B.Select management **methods** to control the invasive species problems and promote the native plant community.	Students work in pairs to outline management methods for a site with multiple weed problems: Cut to x height, apply herbicide, implement prescribed burn, etc. Convene to share methods. Trainer compares methods of each group and offers his/her assessment.	Site B	25 minutes 10 minutes	3	Table to fill in
C.Develop a **timeline** to implement the proposed vegetation management techniques.	Students work in pairs to outline a management timeline for Site B to achieve control of multiple weed problems. Convene to share timelines. Trainer offers his/her assessment of timelines.	Site B	20 minutes 10 minutes	4	Table to fill in
D.Use **monitoring** and adaptive management to adjust management actions.	Wrap-up with brief discussion about monitoring the outcomes of management actions and using that information to drive subsequent management actions.	Site B	20 minutes	5	

Ecological Restoration Training Cooperative
Vegetation Management For Restored Ecosystems
Lesson 1: Vegetation Management using Mechanical Methods

Learning Objectives:

After completing this lesson, participants should be able to

- Identify and evaluate the degree of multiple weed problems on a site.
- Identify and evaluate the status of native vegetation on a site.
- Select mechanical management tools best suited to achieve invasive species control and manipulate the growth of the native plant community.
- Use simple non-powered mechanical tools to control invasive species and manipulate the growth of the native plant community.
- Select settings and perform basic maintenance for common power tools.

Timing:

Late May to Early June, once vegetation has established enough

Location:

Site A – a restored habitat or old field, etc. invaded by at least two invasive species, with or without a native component. It does not need to be a large area, 0.5 acres would be adequate. Have tools on site at this location.

(Rain Day Option: Equipment storage facility with common power and non-power tools displayed.)

Equipment/Materials from the Bin (B), in the Folder (F) or provided by DNR (D):

- Bundle of Site A weeds for each pair of participants. Two species maximum (ex: reed canary grass, wild parsnip)(D)
- Loppers/pruning shears (D)
- Girdling tool (D)
- Weed wrench (D)
- Root Talon (D)
- Mowers (D)
- DR or Jari mower (D)
- Chainsaw (D)
- Brush saw + attachments (D)
- Files/sharpening tools, etc. (D)
- Parsnip hand tool (optional) (D)
- Scythe (optional) (D)
- Chaps, helmet, leather gloves (D)
- Ear plugs (B)
- Invasive species references (B)
- List of references (F)
- List of mechanical management tool options (F)

Note: After check-in, transition to Site A. [15 minutes]

Sub-competency A: Describe how to develop solutions to manage multiple weed problems and promote establishment of the native plant community based on invasive species traits, site conditions, and existing or potential native species. (40 minutes)

Site A – a restored habitat or old field, etc. invaded by at least two invasive species, with or without a native component. It does not need to be a large area, 0.5 acres would be adequate. Have tools on site at this location.

Use Site A as an example case study to establish a context for making decisions about which management tools to use and how and when to apply them to manage undesirable species and promote desirable native species.

Use samples of the invasive species found in Site A to teach identification. Give a bundle of the weeds to each pair of students. Give each student a set of the DNR invasive species fact sheets. Point out identifying characteristics of each problem species. Compare these species to similar native species that they could be confused with it. Discuss the life history of each species. How does it spread and compete? When does it flower? When does it set seed? How is it dispersed? What additional competitive advantages does it have over native species? When is it actively growing? How are the two species distributed on Site A? What is their abundance? (10 minutes)

Given the life history, invasive characteristics, and risks of each invasive species on Site A, as well as the existing or latent native plant community, the Trainer should discuss how he/she would prioritize management of each invasive species, including take no management action. Assess why this weed is a problem here? How can conditions be changed to favor desirable species? Rank the invasive species based on their management priority and the order of management actions to be taken. Discuss management techniques that would promote a healthy native plant community whether by reducing competition from invasive species or by increasing the competitive advantage of the native species. (10 minutes)

Discuss the mechanical and chemical management methods to be used to either manage invasive or weed species or alternatively to promote desirable native species. Discuss the order the mechanical or chemical methods should be implemented, including multiple treatments and the relationship between any combination of methods that will be implemented to control a particular species or promote native species growth. (10 minutes)

Discuss the timeline for implementing the management methods based on species biology, the mode of action of the management method to be used, and management priorities. (10 minutes)

Sub-competency B: Use simple mechanical control equipment, e.g. select settings, perform basic maintenance, change blades, sharpen blades, etc. (30 minutes)

Location: Site A – a restored habitat or old field, etc. invaded by at least two invasive species, with or without a native component. Have tools on site at this location.

Note: There will not be time to have the students practice with all of these tools. Highlight the priority tools for your region.

The Trainer demonstrates the use of mechanical methods of removal for both herbaceous and woody weed species. The Trainer demonstrates the use of the Root Talon and/or Weed Wrench for tree removal. The students practice using the Root Talon/Weed Wrench. Discuss the advantages/disadvantages of using these tools compared to other methods. Discuss the size of trees that is optimum for each tool. Discuss how root structure affects efficacy of the tool. Discuss options for controlling larger trees (girdling or cut and paint).

The Trainer demonstrates the use of a girdling tool. Students practice adjusting and using the girdling tool. Remind students of the principle of girdling – cut just deep and wide enough into the cambium to disrupt the flow of water, nutrients, etc. through the xylem and phloem.

The trainer demonstrates the difference in cutting efficiency using sharp versus dull tools. The Trainer then demonstrates how to maintain loppers and pruning shears. The students adjust and sharpen loppers and pruning shears. Sharp, well-maintained tools increase work efficiency.

Trainer demonstrates/discusses hand pulling techniques. Works well for annual or tap-rooted species. Hand pulling does not work well for rhizomatous perennials. How should the weeds be disposed of? Can the pulled weeds be dropped on site or should they be bagged or piled for removal from site?

Optional: Demonstrate the use of hand-scythe and/or wild parsnip tool. Demonstrate maintenance of these tools: sharpening. What invasive or weed species are these tools useful to manage? What situations are these tools useful for?

Trainer discusses how to manage weed disposal to prevent seed dispersal. It is usually illegal to dispose of plants in the trash, and commercial composting sites may not be managed well enough to achieve temperatures hot enough to kill weed seeds. In fact, in some compost sites the weeds themselves may grow in the compost pile if the pile is not turned adequately. It is often necessary to compost weeds on the restoration site. When on-site compost piles are used to manage invasive weed species, the compost pile and the area around the pile should be monitored regularly. Weed control around the compost area should be planned into the restoration management schedule.

Ask:

- How is this tool used?
- In what situations is this tool useful?
- What are the advantages of this tool over other methods
- What are the limitations of this tool?
- What are alternatives to this tool?
- Can this tool be adjusted, if so, how?
- How should this tool be maintained?
- How should invasive weeds be disposed of?

Do:

- Students practice using various hand tools to mechanically remove or kill invasive and undesirable species.
- Students perform basic maintenance of the hand tools.

Sub-competency C: Demonstrate power tools commonly used for mechanical control. Adjust settings and perform basic maintenance. (50 minutes)

Location: Site A – a restored habitat or old field, etc. invaded by at least two invasive species, with or without a native component. Have tools on site at this location.

Note: It makes sense to highlight the tools that you use more in your region.

The Trainer introduces and demonstrates typical power tools used for vegetation management: flail mower, Jari mower (sickle bar), Brush hog (DR Mower), brush saw, and chainsaw.

The Trainer discusses/demonstrates the use and capabilities of the power tools depending on the target species or management goal. Management goals may include controlling invasive species or promoting native vegetation establishment. Students perform basic maintenance and make basic adjustments: raise mowing height, change the cutting head attachment of the brush saw, tighten chainsaw chain, identify grease zerk locations and grease mowers, clean mowers of plant debris that might contain weed seeds.

Provide students with a basic working knowledge of the equipment, required or recommended PPE, and safety procedures for use of the equipment.

A properly maintained tool will increase productivity and will be safer to operate. Demonstrate use of the right tools to properly perform regular equipment maintenance. Discuss timing of maintenance and procedures to reduce wear on equipment. Display different types of files and discuss how to select the right type of file for the job, such as for sharpening a chainsaw.

Remind students that courses are offered to improve their knowledge and skill in chainsaw use.

Ask:

- How is this equipment used?
- In what situations is this equipment useful?
- What are the limitations of this equipment?
- What are alternatives to this equipment?
- Can this equipment be adjusted? If so, how?
- How should this equipment be maintained?
- What safety precautions should be taken when using this tool?

Do:

- Students perform basic mower maintenance.
- Students make basic mower adjustments.
- Students clean mower to remove plant parts and seeds that could contaminate other sites.
- Students perform basic chainsaw maintenance; tighten the chain, etc.
- Students perform basic maintenance for a brush saw.

Note: Remain at Site A for Lesson 2.

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Learning Objectives:

After completing this lesson, participants should be able to

- Identify appropriate herbicide application equipment to match the scale of the problem: broadcast vs. spot spray.
- Assess and make basic repairs for a backpack sprayer.
- Select a spray nozzle to match the application job.
- Manage backpack sprayer output using walking speed, tank pressure, and nozzle selection.
- Clean a backpack sprayer using best management practices.
- Calibrate a tank sprayer with boom.
- Monitor overspray damage and application effectiveness.

Locations:

Site A – a restored habitat or old field, etc. invaded by at least two invasive species, with or without a native component. It does not need to be a large area, 0.5 acres would be adequate. Have backpack sprayers on site at this location along with water tank to fill sprayers.

Maintenance shed area where small tank with boom is set up and a measured distance is marked out.

Equipment/Materials from the Bin (B), in the Folder (F) or provided by DNR (D):

- Small tank with boom sprayer on an ATV, etc. (D)
- Multiple backpack sprayers (D)
- Backpack sprayer pulled apart to demonstrate problem sites (D)
- Selection of spray nozzles (D)
- 15 PSI pressure valve(D)
- Backpack repair parts; gaskets, etc. (D)
- Containers to collect water(D)
- Water source/ water tank(D)
- Bark oil(D)
- Dye(D)
- Tool set (D)
- PPE - boots, glasses, long-sleeves (D)
- PPE – Gloves (B)
- Measuring tape (B)
- Cones (optional) (D)
- Flagging tape/wire flags (B)
- Invasive species references (B)
- Cleaning chart handout (F)
- Technotes handout (F)
- List of references (F)
- Herbicide label w/ re-entry, PPE (F)

Note:

There is no transition between Lesson 1 and Lesson 2. There is a transition within Lesson 2.

Sub-competency A. Select an appropriate herbicide application method that maximizes impacts to target species, minimizes negative impacts to non-target species, and potentially promotes native community establishment based on species traits and existing site conditions. (20 minutes)

Location: Site A –a restored habitat or old field, etc. invaded by at least two invasive species, with or without a native component. It does not need to be a large area, 0.5 acres would be adequate.

Describe the options for herbicide application equipment and discuss considerations of herbicides, timing, and equipment choice. Discuss the timeline for implementing herbicide management methods based on species biology, the mode of action of the herbicide to be used, and management priorities. Discuss herbicide application techniques that can be used to control competition from invasive species and thereby promote a healthy native community (i.e. dormant overspray). Reinforce that the equipment used should match the scale of the problem. (15 minutes)

Mention and briefly describe application tools that will not be demonstrated, such as use of 2-quart hand-held pressurized sprayer, wick application including glove wick system, spray bottle to apply herbicides to cut stumps, etc. (5 minutes)

Sub-competency B. Set-up and use a backpack sprayer for different applications. Use best practices to clean the sprayer tank. Evaluate herbicide application effectiveness. (55 minutes)

Location: Site A – a restored habitat or old field, etc. invaded by at least two invasive species, with or without a native component. Have backpack sprayers on site at this location along with water tank to fill sprayers.

Students and Trainer put on Personal Protective Equipment as the Trainer discusses the importance of protection. The herbicide label prescribes what PPE should be used. Boots, gloves, safety glasses, and long sleeves may be used. Gloves are rated for the types of chemicals they can be used for and the duration for which they will provide protection. Leather boots should not be worn, as they absorb and hold chemicals.

Mention backpack sprayer add-ons to make the job more comfortable and stable – waist strap, padded shoulder straps. (5 minutes)

Students, guided by Trainer, problem solve backpack sprayer problems and perform basic maintenance and repairs that should be conducted annually prior to a spray season and during the season when problems are encountered. This may include gasket/O-ring replacement and identifying other parts that may need replacement such as diaphragm, pressure cylinder, etc. (20 minutes)

Students fill tanks with water. Using various spray nozzles and tank pressures, observe the spray patterns by spraying on a smooth surface (driveway pavement) or on vegetation. Trainer discusses how to control spray

pattern and sprayer pressure for particular site conditions and management situations. Nozzles and pressure valves are important add-ons to increase efficiency. Identify nozzle spray patterns that work best for various tasks and conditions (spot treatment of herbaceous weeds vs. basal bark treatment). Trainer demonstrates chemical overspray by using too much pressure or poor application technique. Demonstrate and then have students practice techniques that prevent overspray. Discuss factors that affect spray drift. (20 minutes)

Students use best practices to clean a backpack sprayer after herbicide application. Discuss how to handle leftover herbicide and how to clean the tank. Stress how important it is to remove traces of herbicide from the tank so that the wrong plants are not inadvertently killed the next time the sprayer is used with a different chemical. (10 minutes)

Optional: If an area of Site A has been sprayed within a reasonable timeframe, have the students evaluate overspray and herbicide efficacy on a previously sprayed site. Assess effectiveness of control based on application timing and method. Assess the need for follow-up control.

Ask:

- What personal protective equipment should I wear for the herbicide and conditions?
- Where are common problem spots in a backpack sprayer and how can I troubleshoot them?
- What nozzle spray pattern is best for the application?
- How does sprayer pressure affect herbicide output and overspray?
- What application techniques can be used to improve best practices?
- How should the backpack sprayer be cleaned after use?
- When and how should herbicide effectiveness be evaluated?

Do:

- Troubleshoot common sprayer problems and perform basic maintenance.
- Select an appropriate spray nozzle for the task.
- Practice maintaining sprayer pressure and use application techniques to avoid overspray and to apply an appropriate amount of herbicide.
- Clean the backpack sprayer after use in preparation for the next application session.
- Evaluate herbicide application effectiveness.

Transition to 2nd location to calibrate small tank sprayer with boom. Take a lunch break at this location. [30 minutes]

Sub-competency C. Use best practices to calibrate, set-up, operate, and clean a small tank sprayer with a boom (20-25 gallons on an ATV, etc.). (45 minutes)

Location: Maintenance shed area where small tank with boom is set up and a measured distance is marked out.

The Trainer should discuss considerations for nozzle types, nozzle spacing, nozzle angle, and boom height that can all affect spray patterns and output when using a boom sprayer. Review situations where a boom sprayer is an

appropriate method for herbicide application. The trainer should identify issues and problems with boom application of herbicides and how to troubleshoot common problems. (15 minutes)

Trainer demonstrates calibrating a tank sprayer with a boom. Using one of the following methods:

Method 1: With the sprayer running for one minute, the amount of water dispensed from each spray nozzle is measured. The average output of the nozzles is calculated and converted from ounces/minute to gallons/minute (GPM). Gallons/Acre = (GPM* 5940)/(speed *nozzle spacing). See handout for details. http://www.qdma.com/forums/archive/index.php/t-16448.html

Method 2: Drive the ATV and operate the sprayer filled with water over a measured distance of known width and at a constant speed appropriate for the terrain. The ground speed driven during calibration should be the ground speed that would be used during spray application. The amount of water dispensed over the distance is measured by the refilling the tank method. See handout for details.

Method 3: If you have a proven method that you use, demonstrate that instead of method 1. [Let me know so I can provide a handout outlining your method.]

Students should assist with measuring the distance and measuring the volume of water that was displaced. The students should each complete the calculations to determine the required gallons per acre. (30 minutes)

Ask:

- What conditions are appropriate for boom herbicide application?
- What are common problems that occur with a boom sprayer?
- What are tips for troubleshooting common problems?
- How should the boom be set-up?
- How can a boom sprayer be calibrated?
- How do nozzle type, nozzle spacing, boom angle, and boom height affect application and overspray?
- What lengths are available for the boom?
- What is an appropriate ground speed for boom applications?

Do:

- Students observe spray pattern with various boom set-ups.
- Students troubleshoot boom sprayer problems, old or blocked nozzles, etc.
- Students assist with calibration, measuring distance and collecting water.
- Students perform calculations to determine gallons per acre.

Note: Transition to Site B for Lesson 3.

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Learning Objectives:

After completing this lesson, participants should be able to

- Identify and evaluate the degree of multiple weed problems on a site.
- Prioritize weed management actions based on abundance and life history of target species.
- Select appropriate management methods to control weeds and promote native vegetation.
- Develop a vegetation management timeline for implementing weed control and promoting native vegetation.

Location:

Site B – a restored habitat or old field etc. invaded by at least two invasive species, with or without a native component. Site B should have distinctly different invasive species problems than Site A.

Equipment/Materials in the Bin (B), in the Folder (F) or provided by DNR (D):

- Bundle of Site B weeds for each pair of participants. Suggest 2-3 species only (ex: smooth brome, Queen Anne's lace, spotted knapweed) (D)
- Invasive species resources (B)
- Pens (B)
- Clipboards(F)
- TNC weed management document (F)
- Lesson outline w/ "Ask questions" (F)
- List of references (F)
- List of management tools available(F)
- Table for student pairs to fill out (F)

Note:

For Lesson 3, transition to Site B. There are no transitions within Lesson 3. [15 minutes]

Sub-competency A: Identify Site B invasive species, define the scale of the weed problem, and determine weed and native species management priorities based on a field inspection and knowledge of invasive species traits, site conditions, and existing or potential native plant community. (35 minutes)

Location: Site B – a restored habitat or old field invaded by at least two invasive species, with or without a native component.

Use Site B as an example case study to demonstrate the process for prioritizing weed management, manipulating the native plant community, developing a management plan and creating a timeline for management.

Give each pair of students a bundle of the weeds and a set of the DNR invasive species fact sheets. Point out identifying characteristics of each problem species. Compare these species to similar species that they could be confused with it. Discuss the life history of each species. How does it spread and compete? When does it flower? When does it set seed? How is it dispersed? What additional competitive advantages does it have over native species? How abundant is the species on the site? How are the species distributed on Site B? What native species can be found on the site? How will management actions affect the native species? Can certain management methods be used specifically to promote a healthy native plant community? (10 minutes)

Tell the students they have 15 minutes to walk onto the site to assess the status of the native species and the focus weed species in Site B and to establish weed management priorities based on the field assessment and the combination of weed problems that they observe. For this exercise, tell the students to ignore other weed species they encounter. Direct the students to use the "Ask questions" to guide their decision-making process. The students walk into the site to observe the species on the site and to gain a perspective of the weed problem and the potential of the native plant community. Take note of the abundance of native and weed species and where each is located in the landscape. Students should use the fact sheets to understand the life history of the invasive species and their mode of invasion. (15 minutes)

Gather the students together. Have the students summarize the extent of the weed problem on Site B, as well as the status of the native plant community. Then have the students share how they have prioritized the management of the weed species and the rationale for their choices. Discuss their proposals. Given the life history and invasive characteristics of each species on Site B, the Trainer should now discuss how he/she would prioritize management of each species, including take no management action. Are there actions they would take to specifically promote the native plant community? (10 minutes)

Ask:

- What is the abundance and distribution of native and weed species on the site?
- What management methods can be used to promote a healthier native plant community?
- Are the invasive species intermixed on the site or do they occupy different zones?
- What life history characteristics need to be understood in order to control the weed species or promote the native species? (annual/perennial/biennial, graminoid/forb, cool season/warm season, dispersal mode, bloom time)
- Based on the distribution, abundance, and life history of each weed species, which is a higher or lower management priority?

- Which weed species is a higher or lower priority based on the risk it poses to the habitat?
- Should some weed species not be managed at this time?
- Should some weed species only be managed after the top priority species is managed?
- Will some species need to be managed at a later time due to conflicts with management techniques?
- What impacts will management have on the native plant community?

Do:

- Students make a determination of the extent of the invasive species problem on Site B.
- Have the students make a determination of the status of the native species on the site.
- Students learn from their resources the characteristics of each species that will affect management decisions.
- Students establish management priorities for native and weed species.
- Fill in priority levels on worksheet provided.
- Share weed and native species management priorities/strategies.

Sub-competency B: Select management methods to control the invasive species problems and promote the native plant community. (35 minutes)

Location: Site B – a restored habitat or old field invaded by at least two invasive species, with or without a native component.

Trainer tells the students they have 15 minutes to work with their partner to select weed management methods to implement control of the focus weed species. They should select methods/tools or combinations of methods/tools from the list provided. Direct the students to use the "Ask questions" to guide their decision-making process. Participants work in pairs to select management methods for the site that will achieve weed control or promote establishment of natives to meet the management priorities established for the site. (25 minutes)

Gather the students together. Have the students share the management methods they propose to use to control the invasive species and promote establishment of native species. Have the students share the rationale for their choices. Discuss their proposals. Discuss the management methods to be used and the order they should be implemented including multiple treatments and combinations of vegetation management treatments that will be implemented to control a particular species or promote a particular species or group of species. (10 minutes)

Ask:

- Can each species be managed with similar methods?
- Do different management methods need to be used for each invasive species?
- Which management method is most effective for each species?
- Do any of the proposed methods promote another invasive species?
- How will the weed management methods affect the native plant community?
- What methods can be used to promote a healthy native plant community that can compete with invasive species?

Do:

- Students select management methods to control invasive species.
- Students select management methods to promote growth of native species.
- Fill in management methods on worksheet provided.
- Share proposed vegetation management methods.

Sub-competency C: Develop a timeline to implement the proposed vegetation management techniques. (30 minutes)

Location: Site B – a restored habitat or old field invaded by at least two invasive species, with or without a native component.

Trainer tells students they have 15 minutes to work with their partner to develop a management timeline for controlling the focus weed species and promoting native species establishment . Direct the students to use the" Ask questions" to guide their decision-making process. Students work in pairs to develop a vegetation management timeline based on the techniques proposed to manage invasive species, promote native species, and achieve the desired outcomes for the site. (20 minutes)

Gather the students together. Have the students share their proposed management timeline as well as the rationale for their timeline. Discuss their proposals. Discuss the timeline for implementing the management methods based on species biology, the mode of action of the management method to be used, and management priorities. (10 minutes)

Ask:

- How should timing be taken into account knowing that some management techniques may conflict with one another, making one less effective or ineffective, if the timing is not appropriate?
- How does the timing of implementing the management practices action affect the native plant community?
- What is an appropriate interval between repeat treatments?
- What growth stage does the invasive species need to be at for the treatment to be effective?
- Is there a particular time of the season when control efforts are more effective?
- How does the timing of management actions affect native plant establishment and growth?
- If using a combination of treatment methods, what will be the interval between treatments with the different techniques?

Do:

- Students develop vegetation management timeline.
- Fill in timeline on worksheet provided.
- Share timeline for implementing management methods.

Sub-competency D: Use monitoring and adaptive management to adjust management actions. (20 minutes)

Location: Site B – a restored habitat or old field invaded by at least two invasive species.

As a wrap-up, the Trainer should discuss follow-up monitoring and adaptive management. Whether monitoring is very formal (quantitative) or more informal, the outcome of previous management actions should be assessed and the information gathered should be used to determine what management actions should be taken next. Stress the importance of committing to follow-up management over time so that the initial management effort is not wasted. (20 minutes)

Note: Transition back to the morning's meeting location. [15 minutes]
Have students fill out an evaluation form.

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