



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

**Date of Status Update Report:** December 2013

**Date of Next Status Update Report:** June 2014

**Date of Work Plan Approval:**

**Project Completion Date:** June 30, 2016

**Is this an amendment request?** NO

**PROJECT TITLE:** Enhancing Environmental and Economic Benefits of Woodland Grazing

**Project Manager:** Diomy Zamora, PhD

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**Location:** Central and North-Central Minnesota (Beltrami, Benton, Carver, Cass, Crow Wing, Itasca, Kandiyohi, Koochiching, Lake of the Woods, McLeod, Meeker, Morrison, Renville, Scott, Sherburne, Sibley, Stearns, Todd, Wadena, and Wright)

**Total ENRTF Project Budget:**

**ENRTF Appropriation:** \$190,000

**Amount Spent:** \$0

**Balance:** \$190,000

**Legal Citation:** M.L. 2013, Chp. xx, Sec. xx, Subd. xx

**Appropriation Language:**

# DRAFT

## **I. PROJECT TITLE: Enhancing Environmental and Economic Benefits of Woodland Grazing**

### **II. PROJECT STATEMENT:**

Over 527,000 acres of unmanaged woodlands are being used for livestock grazing throughout Minnesota. Of that area, 40% (210,800 acres) is located in central and north-central regions representing more than 11,600 farms. Managing these grazed woodlands based on the use of best management practices will provide environmental and economic opportunities. Silvopasture, the practice of intentionally combining and managing trees, forage (grasses), and livestock (i.e., cattle) as one integrated practice, can enhance woodland grazing for environmental protection/conservation and production benefits. Managing the trees, forage and livestock together as a whole can improve functionality and health of the watershed, resulting in an improved water quality in streams, rivers and lakes due to reduced soil erosion and minimization of nitrate leaching.

Nitrogen applied in excess of what the plant uses results in inefficient use by the forage and contributes to nitrogen leaching below the effective rooting zone and therefore moves into the surface, subsurface drainage and groundwater. The complex root systems under silvopasture can mitigate the effects of nitrate leaching into the groundwater as they occupy different soil depths resulting in improved efficiency of nitrogen uptake, reducing nitrogen losses from soil compared with monoculture agronomic crop and tree plantations (Allen et al., 2004; Bambo et al., 2009). Silvopasture also enhances species (plant and animals) diversity. The timber stand improvement in silvopasture allows light to penetrate to the ground prompting seeds stored in the seedbank to germinate and grow for livestock grazing.

Economically, silvopasture maximizes forage production in wooded pastures while building long-term capital in high quality timber. Silvopasture helps avoid economic losses from reduced timber value and low quality of forage that could translate to decreased animal productivity due to inadequate nutrition. Shade from trees may translate to greater forage production, nutritive value, digestibility of pasture grasses grown under trees relative to open sites and mitigation of stress to animals, hence more livestock weight gain.

Because it utilizes best management practices, silvopasture would create a healthier working agricultural landscape. Silvopasture exhibits potential to enhance environmental and economic benefits within Minnesota's hardwood transition zone where livestock production is practiced. Compared to other parts of the US where silvopasture (e.g., Pine-based system) is a common practice, barriers exist in adopting silvopasture in MN because of lack of knowledge of how trees, forage, and cattle can be managed as one integrated system for environmental and economic benefits.

The goal of the study is to assess, monitor and demonstrate the effectiveness of silvopasture as a tool for enhancing woodland grazing particularly for improving water quality, reducing soil erosion, and enhancing plant species diversity while improving economic productivity of livestock producers in central and north-central Minnesota. Based on educational events that we will offer in conjunction with the Leader Lions Forage Council's educational events, approximately 4% of the 11,600 farmers in these regions will adopt some of the demonstrated silvopasture best practices at the end of the project resulting in reduced soil erosion rate, improved water quality, enhanced plant diversity and a healthier forest and agricultural landscape.

### **III. PROJECT STATUS UPDATES:**

**Project Status as of December 2013**

**Project Status as of June 2014**

**Project Status as of December 2014**

**Project Status as of June 2015**

**Project Status as of December 2015**

**IV. PROJECT ACTIVITIES AND OUTCOMES:**

Three farmer cooperators have committed the use of their land for land use and cooperative fees to demonstrate, monitor and assess the potential of silvopasture. We will establish and evaluate three systems serving as treatments in each cooperator’s farm: 1) conventional (traditional) open pasture, 2) unmanaged (traditional) woodland grazing, 3) silvopasture (managed woodland grazing with trees, livestock and forage together). Effects on water quality, erosion rate, and plant species diversity for each of these systems will be monitored and assessed. Forage quality and nutritional value, and cattle weight gain will also be assessed. An assessment of the overall economic benefits of silvopasture will also be conducted. Field days will be hosted in partnership with the Leader Lions Forage Council to educate livestock producers about silvopasture.

**ACTIVITY 1: Conduct needs assessment and educational programs.**

**Description:**

An online-survey using survey monkey will be designed and conducted to help us better understand barriers pasture owners with woodlands may have to adopting silvopasture within the target counties in central and north-central Minnesota (Beltrami, Benton, Carver, Cass, Crow Wing, Itasca, Kandiyohi, Koochiching, Lake of the Woods, McLeod, Meeker, Morrison, Renville, Scott, Sherburne, Sibley, Stearns, Todd, Wadena, and Wright. The survey would implement strategies described by Dillman et al. (2009). Prior to initiating the online survey, the target audience will be contacted via postcard containing information about the purpose and intent of the survey. The survey protocol (e.g., survey instrument, correspondence to be sent to individuals) will be developed by the Project Team with the assistance of the University of Minnesota Extension Evaluation Specialist, in cooperation with one or more nongovernmental organizations (NGOs) (e.g., MN Cattleman’s Association, Minnesota Milk Producers Association, and the Leader Lions Forage Council) who have knowledge of our target audience. Questions will be developed around 1) demographics (respondent age, farm size, woodlot size, herd size, water and fencing resources), 2) satisfaction with current grazing practices, 3) current use(s) of their woodlands, 4) use of woodlands for grazing (prior use for this purpose, perceptions about its use in the future), 5) prior knowledge about and perceptions of silvopasture, and 6) how they prefer to learn (e.g., face-to-face workshops, field day visits to plots, printed content, digital text, webinars).

Survey data will be entered into Excel and analyzed using descriptive and regression techniques to identify factors which contribute most significantly to implementing silvopasture approaches as well as to help us determine the “best” approaches for creating effective educational offerings to increase adoption of silvopasture.

Educational programs will be conducted on cooperators’ farms reaching at least 110 livestock producers, woodland owners and natural resource managers in central & north-central Minnesota in years 2 and 3 of the project. To create more impact and to minimize cost, field days and workshop will be offered in partnership and conjunction with the Leader Lions Forage Council’s summer tour (field tour) and winter workshop for livestock producers in the region.

**Summary Budget Information for Activity 1:**

**ENRTF Budget: \$11,240**  
**Amount Spent: \$ 0**  
**Balance: \$ 11,240**

**Activity Completion Date:**

<b>Outcome</b>	<b>Completion Date</b>	<b>Budget</b>
1. Survey questionnaires approved by UMN Institutional Review Board (IRB), beta-tested, and sent-out online;	December 2013	\$ 1,000
2. Survey data collection completed.	March 2014	\$ 0
3. Survey data analysis completed and recommendations provided for creating educational programs; a framework for education program developed.	May 2014	\$ 0

4. One in-door workshop offered each year for years two and three targeting at least 50 producers per year. Funds will be used to cover promotional materials for the workshop @ \$500/workshop x 2 workshops during the entire project	Winter 2014 and winter 2015	\$1,000
5. One field day conducted each year during years two and three reaching at least 60 producers per year. Cost will include bus rental, promotional materials, and one travel each year to arrange logistics for the tour.	Summer 2014 and summer 2015	\$2,000
6. Land rental fee to the landowner @ \$30/ac x 12 acres/landowner x 3 landowners x 3 years where the research activity is conducted and for allowing to set-up demonstration of silvopasture in their sites for 3 years. The rate is based on NRCS rate. Farmer cooperators assume all liability for the use of their cattle for the study and for people attending the field tours.	July 2013 to June 2016	\$3,240
7. Farmer Cooperator Fee @ \$500/field day x 2 field days during the entire project x 3 farmer cooperators. The farmer cooperator's fee will cover cost incurred by farmers (such farmers' time in preparing and hosting field days causing them to take time off from their normal work/field operations. Preparation includes setting-up tent, rent portable potty, chairs and tables necessary during field tour).	Summer 2014 and summer 2015	\$3,000
6. Post survey conducted to assess changes in practices and behavior of livestock producers, woodland owners and natural resource managers	January 2016	\$1,000
7. Extension materials (i.e., fact sheet and bulletin series) developed including best management practices (BMP) manual of raising livestock in woodlands will be made available online at <a href="http://www.extension.umn.edu/agroforestry/">http://www.extension.umn.edu/agroforestry/</a>	January 2016	\$0

**Activity Status as of:** December 2013

**Activity Status as of:** June 2014

**Activity Status as of:** December 2014

**Activity Status as of:** June 2015

**Activity Status as of:** December 2015

**Final Report Summary:** June 2016

**ACTIVITY 2: Establish and monitor demonstration/research sites for water quality, erosion rate reduction, plant species diversity, and assessment of economic parameters including forage quality and livestock performance.**

**Description:**

We will establish three systems in each cooperator's farm to demonstrate the potential of silvopasture as a tool of enhancing environmental and economic benefits of woodland grazing. These three systems are: 1) conventional (traditional) open pasture, 2) unmanaged (traditional) woodland grazing, 3) silvopasture (managed woodland grazing with trees, livestock and forage together). Each pasture system will cover 4 acres (a total of 12 acres for each farmer cooperator), and will be fenced using temporary electrical fencing to separate each treatment/system during livestock grazing. The following parameters will be collected:

**Soil Erosion Rate and Water Quality:** The rate of soil erosion in each of the three systems will be quantified using erosion pins. Erosion bar pins will be installed in each of the systems. An erosion pin is a long metallic pin

or stake that is driven into the ground to serve as a stationary point of reference to measure the amount of water driven erosion. Detailed landscape surveys, tied to reference bar pins, using survey grade GPS and/or laser level/rod measurements will be performed before, during and after paddock establishment. The measurements should capture degradation or aggradation of site sediment.

Water infiltrating through the vadose zone into ground water through leaching will be monitored and assessed in each of the three systems for biogeochemical change. Pan lysimeters will be installed in the vadose zone to assess nitrogen leaching and plant root nitrogen uptake. Pan lysimeters sample only water that freely drains from the soil matrix (Anderson, 1986), which relies entirely on gravity to supply water to the sampler. This zero-tension lysimeter has been determined to be better at monitoring the soil-water flux that recharges ground water; pan systems perform better than suction lysimeters (Hornby et al., 1986). Water quality in the site ponds and surrounding terrain will be monitored through the use of water table access tubes (pvc tubes cored into the soil and capped at the ground surface) positioned perpendicular to flow paths into the pond with supporting parallel tubes to statistically quantify spatial variability. The array of tubes will provide a minimum of seven locations, including a pond water grab sample. Water samples will be collected monthly for biogeochemical indicators (stable isotopes, selected cations/anions and nutrients during the soil thaw/snowmelt, following major precipitation events and monthly during the entire growing season when livestock are actively grazing in each system. A data logger will be placed in each management system to continuously track water stage, temperature and specific conductance.

***Plant Species Diversity:*** Species diversity among treatments in each of the 3 locations will be compared and assessed. Species diversity assessment will be done in a replicated manner in three locations for two consecutive years within the framework of a randomized complete block design. Plant species diversity will be sampled using a 1m x 1m plot systematically arranged on a set-up grid (Mayer and Houvinen, 2007). Plant species diversity assessment will be done immediately before and after cattle are introduced in each system as described below (***forage quality and livestock (cattle) quality***). Data collection will be done from May to October in years two and three of the project. To characterize species richness, species will be categorized or sorted based on botanical composition: 1) grasses (cool or warm season), 2) forbs, 3) legumes, and 4) tree/seedlings. Shannon-Weiner Diversity index will be used to analyze richness of species diversity in our treatments/systems.

***Forage Quality and Livestock (cattle) quality:*** Forage and livestock quality will be assessed for two consecutive years in our three locations in replicated manner following the Latin Square Experimental Design. At the onset of pasture spring growth, twelve cow/calf pairs will be assigned by age, body weight (BW), body condition score (BCS; 1 to 9 scale; 1 = emaciated, 9 = obese), calving date, and breed to one of three experimental cow/calf groups (A, B, and C). Each group will be assigned to one pasture treatment for 30 days of grazing. Following the 30 days of grazing, cow/calf pairs will be removed from the pasture treatment and be comingled in a common pasture for 30 days. This “resting period” will allow forage regrowth in each of the pasture treatment paddocks. Following the 30-day resting period, cow/calf groups will be rotated to a different pasture treatment for an additional 30 days. Following the second 30-day trial period, another 30-day resting period will occur, followed by a third, 30-day experimental period.

At the onset and conclusion of each of the three 30-day experimental periods cow BW and BCS will be assessed and calf BW will be taken. Similarly, at the onset and conclusion of each experimental period, forage quantity and quality will be assessed in each experimental pasture paddock. Forage quantity is defined as pounds of forage dry matter per acre and assessed using standardized methodologies that involve taking forage height measurements at set intervals within the paddock. Forage quality will be assessed by taking 20 forage samples in a grid pattern through the pasture, combining collected samples, and sending a homogeneous forage sample to a certified laboratory for quantification of dry matter, crude protein, acid detergent fiber (ADF), neutral detergent fiber (NDF), total digestible nutrients (TDN), net energy (NE), and relative feed value (RFV).

This approach allows for critical assessment of both animal performance and forage productivity. This approach is designed to allow a period of pasture regrowth to closely represent the rotational pasture management system often implemented by beef producers in Minnesota. It is expected that the silvopasture will dramatically improve forage quantity and quality when compared to unmanaged woodland grazing. Moreover, the availability of grazable forages is expected to be greater in the silvopasture than the unmanaged woodlands during the third

experimental period due to improved regrowth of forages during the resting periods. This improvement in forage quality and quantity will directly translate to improved animal performance. Demonstrating these improvements in grazable forages and animal performance with a scientifically valid experimental design will assist in convincing producers to implement the silvopasture management system in Minnesota.

**Economic analysis:** Using data generated by the graduate student, basic economic analysis will be conducted by a CINRAM economist to compare profitability of silvopasture with traditional woodland grazing and open pasture. Data collected for parameters described above, along with establishment and maintenance costs, will be used to quantify economic production of silvopasture.

**Summary Budget Information for Activity 2:**

**ENRTF Budget:** \$ 178,760  
**Amount Spent:** \$ 0  
**Balance:** \$ 178,760

**Activity Completion Date:**

<b>Outcome*</b>	<b>Completion Date</b>	<b>Budget*</b>
1. Demonstration/research plots established in each site that included employment of several activities including site prep, cutting trees in silvopasture treatment in each site to a specific basal area, and seeding (forage planted) employed in each treatment.	May 2014	
2. Water quality monitoring and soil erosion rate conducted.	Annually from May-October	
3. Species diversity assessment conducted.	Annually from May-October	
4. Forage quality and livestock performance assessed.	Annually from May to October	
5. Economic assessment completed.	March 2016	

\*The outcomes listed under activity 2 are integrated and inter-dependent with each other; hence only the total budget of this activity is shown.

**Activity Status as of June 2014**

**Activity Status as of January 2015**

**Activity Status as of July 2015**

**Activity Status as of January 2016**

**Final Report Summary: June 2016**

**V. DISSEMINATION:**

**Description:** Workshops and field days will be offered each year in year 2 (2014) and year 3 (2015) during the yearly events (Summer Tour and Winter Meeting) of the Leader Lions Forage Council. A total of 220 livestock producers, woodland owners, and natural resource managers over two years are estimated to participate in these events. Results of the silvopasture study will be shared in various meetings already scheduled such as the “Beef Day” and the annual gathering of the Minnesota Cattlemen’s Association. Results will also be presented during workshops and conferences of professional organizations in Minnesota. Fact sheets and Woodland Grazing Best Management Practices (BMP) will be developed and posted at the UMN Extension Agroforestry website at <http://www.extension.umn.edu/agroforestry/>, which will be linked to the myminnesotawoods website at <http://www.mymminnesotawoods.umn.edu>, and the Minnesota State Cattlemen’s Association (<http://www.mnsca.org>). Both of the latter websites are often visited by producers and natural resource managers for information related to woodland management.

Status as of June 2015:

Status as of December 2015

Status as of June 2016

**VI. PROJECT BUDGET SUMMARY:**

**A. ENRTF Budget:**

Budget Category	\$ Amount	Explanation
<p><b>Personnel:</b>            1 UMN Graduate Research Assistant Student (50% time) Salary (\$81417) + Fringe (Tuition and Health Insurance)             CINRAM Economist (Dean Current) (3% Salary and Fringe)             Labor @ \$12/hour for 100 hours/year</p>	<p>\$111,423          \$4,500          \$3,600</p>	<p>A Graduate student will be hired for 3 years at 50% time to work on the project with supervision of the project team.             To conduct economic analysis of silvopasture using data provided by Graduate student of the project. This will be done in year 3.             Payment to local a worker on an hourly basis, as needed.</p>
<p><b>Professional/Technical/Service Contracts:</b>            Payment for a Forester @ \$250/site x 3 sites)             Payment to a Logger @ \$1,850/site x 3 sites             Site Clearing and Site Prep @\$1,500/site x 3 sites             Infrastructures such as fencing and water systems for the study             Land rental @ \$30/ac x 12 acres/farmer = \$360/yr/farmer x 3 yrs</p>	<p>\$750          \$5,550          \$4,500          \$0.00          \$3,240</p>	<p>A Forester will be hired to conduct tree inventory, mark trees to be cut in silvopasture treatment necessary to arrive at a specific basal area of the project. Rate is based on actual rate provided by a Forester.             A Logger will be contracted to cut down trees marked by the Forester. Assessment of the sites showed no values of the woods to be cut down. The logger will be responsible in removing trees from the project site making sure that the site is free of cut down trees.             After site visit by the Project Lead, it was determined that clearing the sites is necessary             Estimated cost is \$9,000; The Central Region Sustainable Development Partnerships (CRSDP) approved funding to cover this cost.             Land Rental payment to Farmer Cooperators for allowing the use of their land to set up the research activity and set-up demonstration of silvopasture in</p>

<p>Farmer Cooperators Fee @ \$500/farmer/yr x 3 farmers x 2 yrs</p>	<p>\$3,000</p>	<p>their site. Farmer cooperators assume all liability for all the cattle to be used for the study and for people attending the field tours. Rate is based on NRCS rate.</p> <p>Farmers' time in preparing and hosting field days (set-up tent, rent portable potty, chairs and tables necessary during field tour) causing them to take time off from their normal work/field operations; use of their machineries for the study; assistance in managing the project such as rotating the experimental cattle while any members of the project team and the graduate student cannot perform such function during school days; Farmer Cooperators also assume all liability for all people attending the field tour at their farms, and cattle used in the study</p>
<p><b>Equipment/Tools/Supplies:</b></p> <p>Soil erosion rate monitoring devices + water quality monitoring devices (pan lysimeter)</p> <p>3 Field Monitoring Weather Stations @ \$500 a piece</p> <p>Rectal thermometer</p> <p>Other field supplies (seeds, fertilizers, Ziploc bags, vials)</p>	<p>\$8,060</p> <p>\$1,500</p> <p>\$300</p> <p>\$2,500</p>	<p>Field supplies and materials water quality soil erosion rate assessment</p> <p>Field supplies necessary for the conduct of the study.</p> <p>Equipment for use in assessing livestock performance</p> <p>Field supplies necessary for the conduct of the study and collection of samples.</p>
<p><b>Travel Expenses in MN:</b></p> <p>Mileage, Lodging and Per Diem</p> <p>Collaborator travel</p>	<p>\$19,845</p> <p>\$1,412</p>	<p>Travel necessary to conduct and implement the project by the project team: (Zamora - 7 trips/yr, Bridges - 7 trips/yr, Burkett - 7 trips/yr, Wyatt - 1 trips/yr, Grad Student-56 trips for yr 1 and 14 trips/yr for yr 2-4) @ 300 miles/travel x 0.55 mile/travel) + Lodging &amp; meals for 10 days @ \$126/day</p> <p>Amount representing travel cost by Dr. Dusty Water - University of Missouri Silvopasture Expert to assist project team set up research @ \$1,412/trip x 1 trip. This will include air fare, accommodation, and meals.</p>



<b>Other:</b>		
Soil Analysis	\$1,080	Soil analysis necessary for the study @ 3 samples/trt x 3 trt/site x 3 sites x 1 collection/year x 2 years x \$20/samples)
Water Quality analysis	\$4,860	Water quality analysis @ 3 samples/trt x 3 trt x 3 collection/year/trt x 3 sites x 2 year x \$30/sample
Forage Mineral Analysis	\$1,620	Forage mineral analysis @ 3 sample/ trt x 3 trt/site x 3 sites x 1 collection/year x 2 year x \$30/sample
Forage Analysis	\$4,860	Forage analysis @ 3 samples/trt x 3 trt/site x 3 sites x 3 collection/year x 2 year x \$30/sample
Outreach Activities	\$3,000	Outreach activities of the study to share information generated to producers. Cost will include 2 field days (will involve costs such as bus rentals and promotional materials) and 2 indoor workshops that will involve cost of promoting the workshop @ \$500/workshop x 2 workshops during the entire project. Leader Lions Forage Council will share cost to offer these events
Survey Costs	\$2,000	Printing and mailing of postcards for pre and post surveys
Maintenance of Chute and Scale @200/trip x 6 trips/year	\$2,400	Maintenance of University of Minnesota's owned chute and scale for use in assessing performance (weight gained) of cattle in our study
<b>TOTAL ENRTF BUDGET:</b>	<b>\$190,000</b>	

**Explanation of Use of Classified Staff:** N/A

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

**Number of Full-time Equivalent (FTE) funded with this ENRTF appropriation:** 1.53 (0.5 FTE/year x 3 years +0.3 in year 3)

**Number of Full-time Equivalent (FTE) estimated to be funded through contracts with this ENRTF appropriation:** 0.2 FTE

**B. Other Funds:**

<i>Source of Funds</i>	<i>\$ Amount Proposed</i>	<i>\$ Amount Spent</i>	<i>Use of Other Funds</i>
<b>Non-state</b>			
	\$	\$	
<b>State</b>			
<i>In-kind services during project period: (UMN Extension In-Kind contribution through staff and salary fringes)</i> PI – (Zamora) – Salary (\$24,554) + Fringe (\$8,287) @ 15% time/year = \$32,841 Co-PI – (Burkett) - Salary (\$23,943) + Fringe (\$8,356) @ 15% time/year = \$32,299 Co-PI (Bridges) (1%) – Salary (\$2,245) + \$757) = \$3,002 Co-PI (Wyatt) – Salary (\$1,202+ +Fringe (419) @ 2% time/year = \$1,621)	\$69,763	\$	In-kind contributions of UMN Extension staff working on the project.
Other Sources	\$9,000		Cost to cover infrastructure for the project such as fencing, and water systems
<b>TOTAL OTHER FUNDS:</b>	<b>\$78,763</b>	<b>\$</b>	

**VII. PROJECT STRATEGY**

**A. Project Partners:**

The University of Minnesota will receive and manage all of the LCCMR funding and contribute in-kind time and effort to the project. Project staff involved are: Diomy Zamora (Associate Extension Professor & Project Leader), Allen Bridges (Assistant Professor), Eleanor Burkett (Associate Extension Professor), Charlie Blinn (Professor), Dean Current (Program Director), who will perform economic analysis, and Gary Wyatt (Extension Professor). Dr. Dusty Walter from the University of Missouri will serve as collaborator. He will contribute his time at no cost but will be reimbursed for his travel-related expenses (1 trip) to MN to help the project team set-up the project. USDA-NRCS (Jeff Duchene – Grazing Specialist) District Conservationist (Jessica Weis), SWCD Crow Wing country (Melissa Barrick), the National Agroforestry Center, and the Minnesota State Cattleman’s Association will collaborate and participate at no cost to the project. The Leader Lions Forage Council will co-facilitate the outreach activities of the project in conjunction with its summer tour and winter meeting events.

**B. Project Impact and Long-term Strategy:**

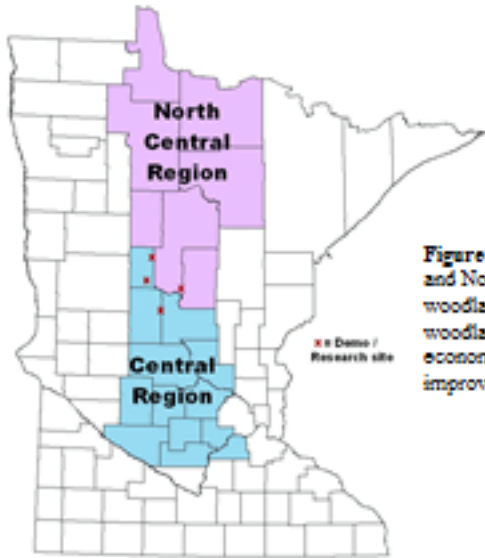
This project will be the first silvopasture agroforestry demonstration and research trial in Minnesota. Information collected will be used to further expand and promote silvopasture as a tool of enhancing the environmental and economic benefits of woodland grazing in other parts of MN with greater applicability. We will continue to seek funding from other funding agencies to carry on this effort beyond the life of the project.

**C. Spending History: N/A**

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

VIII. ACQUISITION/RESTORATION LIST: N/A

IX. MAP(S):



PROJECT GRAPHICS

Figure 1. Location of the silvopasture demonstration /research trials in Central and North-Central, MN. There are at least 210,800 acres (40%) of unmanaged woodland grazing in Central and North-Central, MN. Managing these grazed woodlands through best management practices would provide environmental and economic benefits such as improved water quality, reduced soil erosion, and improved species diversity.

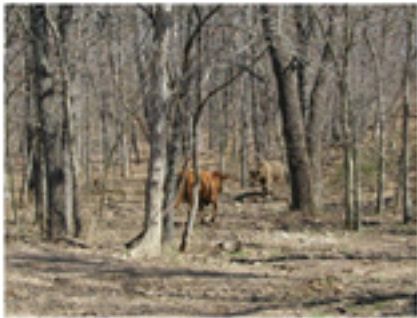


Figure 2. Unmanaged Woodland Grazing.

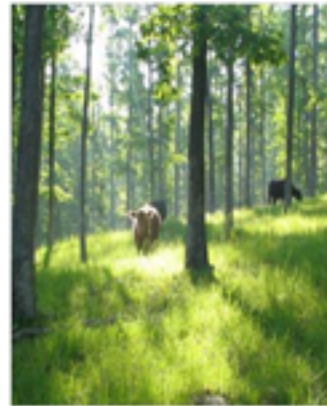


Figure 3. Managed Woodland Grazing through the application of silvopasture principles.

**X. RESEARCH ADDENDUM:** Submitted on October 15, 2012 as agreed upon with LCCMR.

**XI. REPORTING REQUIREMENTS:**

Periodic work plan status update reports will be submitted not later than December 2013, June 2014, December 2014, June 2015 and December 2015. A final report and associated products will be submitted between June 30 and August 15, 2016 as requested by the LCCMR.

Attachment A: Budget Detail for M.L. 2013 Environment and Natural Resources Trust Fund Projects								
Project Title: Enhancing Environmental and Economic Benefits of Woodland Grazing								
Legal Citation:								
Project Manager: Diomy Zamora								
M.L. 2013 ENRTF Appropriation: \$ 190,000								
Project Length and Completion Date: July 1, 2013 to June 30, 2016; 3 Years								
Date of Update: December, 2013, June 2014, December 2014, June 2015, December 2015, June 2016								
ENVIRONMENT AND NATURAL RESOURCES TRUST FUND BUDGET	Activity 1 Budget	Amount Spent	Balance	Activity 2 Budget	Amount Spent	Balance	TOTAL BUDGET	TOTAL BALANCE
	Conduct Needs Assessment and Educational Programs			Establish, monitor and collect data				
<b>BUDGET ITEM</b>								
<b>Personnel (Wages and Benefits)</b>								
1 Graduate Assistant: \$111,423 (54% salary, 46% fringe benefits); 50% FTE				111,423	0	111,423	111,423	111,423
UMN-CINRAM Economist: \$4,500 (75% salary, 25% Fringe benefits); 3% FTE				4,500	0	4,500	4,500	4,500
<b>Professional/Technical/Service Contracts</b>								
Private Forester to conduct inventory and mark trees				750	0	750	750	750
Site Prep Contractor to do site preparation				4,500	0	4,500	4,500	4,500
Logger to cut down and remove woods				5,550	0	5,550	5,550	5,550
Hourly Labor as needed for project				3,600	0	3,600	3,600	3,600
Land Rental fee to Landowner (Farmer) @ \$30/ac x 12 acres/farmer x 3 farmers x 3 years where the research activity is conducted at their farms and for for allowing establishment of silvopasture demonstration site in their farms; Cost also involved cooperators assuming liability for people attending field tours, and use of cattle.	3,240	0	3,240				3,240	3,240
Farmer Cooperators Fee @ \$500/farmer x 3 farmers x years covering cost of time involved in hosting field days (setting-up tent, renting portable potty, chairs and tables during field days)	3,000	0	3,000				3,000	3,000
<b>Equipment/Tools/Supplies</b>								
Water Quality and Soil erosion rate monitoring devices				8,060	0	8,060	8,060	8,060
3 field weather stations at \$500 each				1,500	0	1,500	1,500	1,500
1 rectal thermometer				300	0	300	300	300
Lab and field supplies (seeds, fertilizer, vials, ziploc)				2,500	0	2,500	2,500	2,500
Printing for postcards for survey	2,000	0	2,000				2,000	2,000
<b>Travel Expenses in Minnesota</b>								
Project Team Travel to project site to implement project (mileage, and lodging, and meals) and offer field tours				19,845	0	19,845	19,845	19,845
Collaborator 's travel (University of Missouri - Dr. Dusty Walter) to help set-up project				1,412	0	1,412	1,412	1,412
<b>Other Expenses</b>								
Soil samples analysis				4,860	0	4,860	4,860	4,860
Water Quality samples analysis				1,620	0	1,620	1,620	1,620
Forage Mineral samples analysis				4,860	0	4,860	4,860	4,860
Forage Samples analysis								
Outreach activities to prepare and host 2 field days and 2 workshops (cost includes bus rental, promotional materials)	3,000	0	3,000				3,000	3,000
Maintenance of University of Minnesota's Chute and Scale to be taken at each farm 6 times a year				2,400	0	2,400	2,400	2,400
<b>COLUMN TOTAL</b>	<b>\$11,240</b>		11,240	<b>\$178,760</b>		178,760	190,000	190,000

