

PROJECT TITLE: Prairie management for wildlife and bioenergy: Final phase

I. PROJECT STATEMENT

We are requesting funds to continue the LCCMR project “Biofuel production and wildlife conservation in working prairies” initiated in 2008. Upon receiving the first three years of LCCMR funds, members of the LCCMR peer review committee recommended that this project be funded for seven or more years. After refining our schedule and assessing preliminary results, we can reach the long-term goals in less time. Therefore we are requesting three more years of funds to finish the project in six years total.

Minnesota faces two major concerns with its natural resources: (1) Maintaining and improving the state’s multi-million dollar investment in conservation-land acquisition and easements, and (2) reaching the 25% renewable energy objective by 2025. This proposed project will collect the remaining data to complete our state-wide analysis of best management practices (BMP) for Minnesota’s prairies, to conserve the floral and wildlife diversity and integrity of those areas while simultaneously producing bioenergy.

This project will directly address natural resource concerns from three legislative documents (1) *2010: The Auditor’s Report of Natural Resource Land*. This project will test innovative and economical tools and techniques that harness biofuel markets to meet the goals of providing wildlife habitat and recreational areas on public and private conservation lands (e.g., strategic biomass removal as a periodic alternative to prescribed burning). (2) *2007: NexGen Renewable Energy Objective*. This project will address the state’s goals to build a renewable energy industry during the first quarter of this century. It will determine how grassland biomass can help achieve energy goals while maintaining ecological integrity. (3) *2008: LCCMR Minnesota Statewide Conservation and Preservation Plan*. We will continue to address renewable energy options that do not compete with food by measuring the ability to harvest prairies for economically feasible yields while maintaining environmental health.

Using LCCMR funds and substantial leveraged federal and university dollars, we have established a large landscape-scale study in multiple regions across Minnesota on state, federal and private conservation lands. These areas are harvested in the fall leaving refuges of different sizes and shapes for wildlife. In each site we are conducting a wide range of wildlife, floral, and soil surveys that will create a long-term data set to reveal the effects of harvesting on wildlife and prairies.

In this phase of the project, as in previous years, we will continue bird, small mammal, and insect surveys to determine longer-term effects of harvesting on a range of wildlife. New to this project cycle, we will incorporate surveys of nesting waterfowl and gamebirds, due to their recreational importance and public concern, and also pollinators, due to their role in maintaining natural and cultivated plant communities and to address concerns of regional decline. Also new in this phase of the project, we will expand the floral and soil surveys to provide deeper insight to other ecological changes prairies might experience during harvesting, including carbon storage potential, plant diversity, and soil-nutrient sustainability. Finally, samples from harvested biomass will be analyzed to parameterize feedstock potential and produce life-cycle analyses. We expect the these features to be funded in part by leveraged funds we are seeking from other federal and local sources, as we have done successful before.

II. DESCRIPTION OF PROJECT ACTIVITIES

Activity 1: Wildlife Sampling **Budget:** \$225,000

Survey crews will sample songbirds, gamebirds, small mammals, and insects. Bird surveys will be conducted in the spring. Duck and pheasant nesting success will be determined. Insects will be sampled at least once during the summer in all plots. Small mammal surveys will take place in all plots in the fall of each year using catch-and-release live traps. .

Outcome	Completion Date
1. Determine relative abundance of small mammals in various harvesting regimes.	Spring 2014
2. Determine relative abundance of song birds in various harvesting regimes.	Spring 2014
3. Determine biomass of insects of various size classes and functional groups.	Spring 2014

Activity 2: Vegetation and soil sampling **Budget: \$72,000**
 Survey crews will measure plant composition in all plots. Soil cores will be collected in all plots. Clip strips from plot and bale cores will be collected in all plots. Stubble height will be measured at selected locations in all plots during harvest.

Outcome	Completion Date
1. <i>Determine effects of harvest on plant community composition.</i>	Spring 2014
2. <i>Determine carbon sequestration potential under various harvest regimes.</i>	Spring 2014
3. <i>Determine biomass productivity and harvest yields.</i>	Spring 2012-2014

Activity 3: Sample analysis **Budget: \$327,000**
 Biomass collected from the bale cores will be analyzed for nutrient content and sugar content. Soil cores will be analyzed for carbon/nitrogen ratios and nutrient content. Sweep net and pitfall samples of insects will be sorted to functional group and size, in part to estimate biomass value as food for other wildlife.

Outcome	Completion Date
1. <i>Determine ethanol, gasification, and other energy potential of biomass.</i>	Spring 2012-2014
2. <i>Identify trends in nutrient stocks in soil and biomass to understand ecosystem nutrient sustainability.</i>	Spring 2012-2014
3. <i>Biomass of insects as food source for waterfowl, game-birds, and songbirds.</i>	Spring 2014

Activity 4: Production-scale biomass harvest **Budget: \$192,000**
 Each plot must be harvested using farm-grade harvesting equipment. Each plot will have an assigned harvesting regime, which includes a precise size and shape of refuge. Refuges will be left as 50%, 25%, and 0% of the plot and left as either a block or a set of equally distributed strips. Harvesting will take place after the primary nesting season when plants have senesced, yet before spring green-up.

Outcome	Completion Date
<i>Provides treatment effects for experiment.</i>	Spring 2012-2014

Activity 5: Reports and dissemination **Budget: \$134,000**
 Results will be distributed in the form of academic publications, public reports, project web site pages, local newsprint, and other forms of media. Substantial funds are allocated to this activity because multiple publications are needed for a variety of audiences to disseminate the results of this broad study.

Outcome	Completion Date
1. <i>Economic and logistic analysis report of harvest feasibility</i>	Spring 2014
2. <i>Final report for DNR explaining ecological impacts of harvesting for BMP</i>	Spring 2014
3. <i>Multiple peer-reviewed publications on impacts of harvesting prairies for energy</i>	Spring 2014
4. <i>Comprehensive land management report on harvesting prairies for BMP</i>	Spring 2014

III. PROJECT STRATEGY

A. Project Team/Partners. Clarence Lehman will receive funds as project manager to aid with experimental design, project direction, analysis of results, and related scientific tasks. The following faculty are critical partners, but will not receive funds from this project: David Tilman, Don Wyse, Todd Arnold, and Roger Moon will be providing essential guidance and time. Others supporters not receiving funds include the MN DNR, The Nature Conservancy, U.S. Fish and Wildlife Service, USDA Natural Resource Conservation Service, Rural Advantage, Pheasants Forever, and multiple private landowners who have provided their land for our use.

B. Timeline Requirements We are requesting three years of funding to complete the wildlife/biofuel project that was initiated in 2008.

C. Long-Term Strategy and Future Funding Needs Due to the expense of this kind of study and the urgent need for renewable energy and information on best management practices, we have worked to accelerate the project and are confident that the goals set forth by the LCCMR peer review committee can be accomplished at the end of this phase. This project feeds information to the entire suite of projects shown in the attached illustration.

2011-2012 Detailed Project Budget

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IV. TOTAL TRUST FUND REQUEST BUDGET 3 years

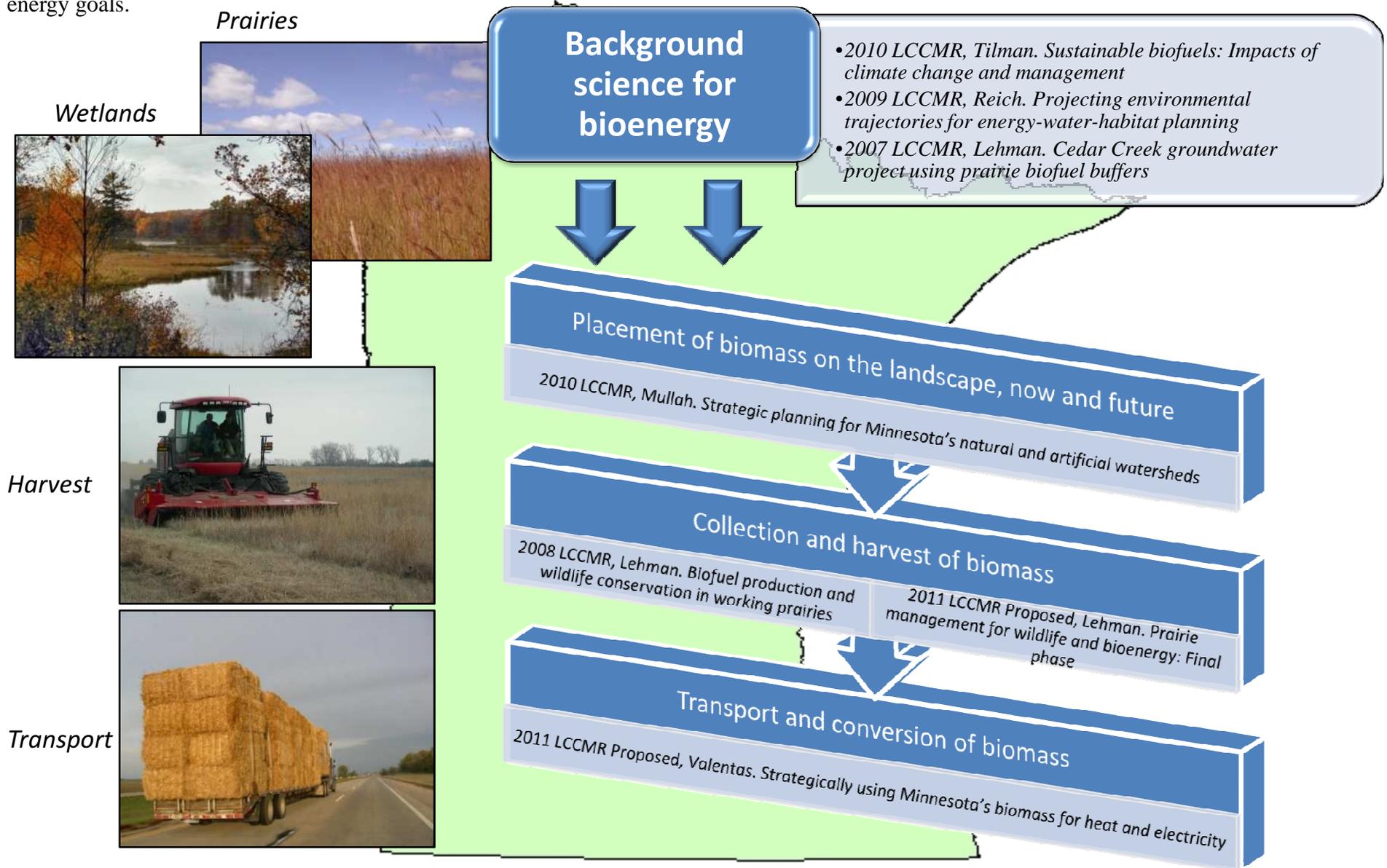
BUDGET ITEM	AMOUNT
Personnel (Staff): 1 Assistant Scientist (Troy Mielke) 20% FTE for 3 yr. @ \$14,100/yr. (Including 40.1% fringe); 2 Research Coordinators (Colleen Satyshur and Kevin Johnson) FTE for 3 yr. @ \$54,300/yr. (Including 40.1% fringe) each; Includes possible 3% increases for inflation*.	\$ 377,200
Personnel (Seasonal): 5 Interns \$1827/month/intern for 24 months	\$ 218,000
Personnel (Academic): Graduate Student for 2 yr. @ \$38,900/yr. (Including 80% fringe during academic yr. and 25% during summer), Manager (Clarence Lehman) 20% FTE for 3 yr. = \$60,000 (Including 33.3% fringe). Includes possible 3% increases for inflation*.	\$ 137,800
Contracts: Minnesota Native Landscapes to harvest all experimental plots across the state and ship biomass to final destination.	\$ 170,000
Equipment/Tools/Supplies: Field equipment: Replacement bamboo poles, flagging tape, replacement small mammal traps, microscope parts, sorting supplies, disposable insect pit-fall traps, cleaning chemicals/tools for small mammal traps, safety equipment for field interns	\$ 15,000
Travel: Travel to and from plots in three sampling locations: near Windom MN, Morris MN, and Crookston MN throughout field season; Lodging expenses for sampling in Morris and Crookston MN (\$10,000/year).	\$ 30,000
Chemical Analysis: Biomass-150 samples: Mineral analysis (\$14/sample), Carbon/Nitrogen (\$3/sample) and sugar analysis (\$15/sample). Soil- 195 samples: Carbon/Nitrogen (\$4/sample), p.H. Organics, N,P,K (\$20/sample)	\$ 2,000
TOTAL ENVIRONMENT & NATURAL RESOURCES TRUST FUND \$ REQUEST <i>*Including an inflation rate is part of the U of M planning process. Actual inflation increases, if any, will depend on economic and other financial conditions that prevail in the future.</i>	\$ 950,000

V. OTHER FUNDS

SOURCE OF FUNDS	AMOUNT	Status
Other Non-State \$ Being Applied to Project During Project Period: National Fish and Wildlife Foundation project to investigate the effects of harvesting wetlands for biofuel on wildlife and hydrology	\$300,000	<i>Pending</i>
Other State \$ Being Applied to Project During Project Period:	\$ -	<i>Indicate: Secured or</i>
In-kind Services During Project Period: The Minnesota DNR is providing a house near the Windom, MN plots for the research team to use throughout the summer. Nearly 1200 acres of land has been loaned to the team without charge. This in-kind service has been critical to the success of the project.	\$ -	
Remaining \$ from Current ENRTF Appropriation (if applicable):	\$ -	<i>Indicate: Unspent?</i>
Funding History: This project was initiated with a \$750,000 LCCMR grant in 2008. Since then, the project has leveraged \$300,000 from the National Fish and Wildlife Foundation to expand sampling locations and taxa, and \$500,000 from the NRCS in a Conservation Innovation Grant to support outreach and educational activities regarding perennial bioenergy, wildlife, and the environment in the Upper Midwest.	\$ 1,550,000	

2011 LCCMR Proposal - Prairie management for wildlife and bioenergy: Final phase

Organization of LCCMR Projects. Building a sustainable bioenergy industry in Minnesota requires a rich composite of research, development, and demonstration projects. Minnesota faculty have teamed up with organizations and industry to provide background research to meet renewable energy goals.



This proposed project is at the center of the overall environment/renewable-energy picture. In light blue boxes are related projects with participants from our coalition of faculty. The projects are designed as links in a chain, each contributing an essential part of the whole.

Project Manager Qualifications

Clarence Lehman is Adjunct Faculty in the Department of Ecology, Evolution, and Behavior at the University of Minnesota. He serves part time as Associate Dean for Research in the College of Biological Sciences and also holds the position of Resident Fellow at the Institute on the Environment. For six years he served as Associate Director of Cedar Creek Natural History Area (now named Cedar Creek Ecosystem Science Reserve).

All three academic degrees are all from the University of Minnesota, with Masters and PhD received studying under Prof. David Tilman, one of the participants in this proposed project. Clarence Lehman's research covers theoretical, experimental, and computational ecology, renewable biofuel energy and the planet's future temperature trajectory, biodiversity and its ecosystem properties, connections between ecology and economics, and restoration of natural habitats. He has restored several areas of native prairies, savannas, and wetlands in northwestern Minnesota and maintains them through specialized experiments for adaptive management.

Clarence Lehman has experience designing a number of experiments related to the present proposed project, including the computerized aspects of the design and layout of Cedar Creek's two long-term biodiversity experiments and its long-term carbon dioxide enrichment experiment. He also has designed and managed three practical prairie experiments located in northwestern Minnesota to determine best establishment practices, seeding times, and burning frequencies for restored native prairies. He is the project manager on two LCCMR grants, one on bioenergy and water purification, another on bioenergy and wildlife conservation. He also designed and established a new prairie biofuel experiment located on the St. Paul Campus of the University of Minnesota, in partnership with David Tilman.

Scientific papers authored and coauthored cover topics such as biodiversity and the functioning of ecosystems, habitat destruction and extinction, competition among species, environmental change, long-term carbon cycling, bioenergy and wildlife, and ecological economics. He was a principle author of the prescribed burning plan for maintaining prairie areas at Cedar Creek and a co-author on the Science paper on carbon-negative biofuel (Tilman et al., Science 314:1598-1600, Dec. 8, 2006). He also has long-term experience in computer science and practical experience in the business world. Software development related to this project includes a computer system to select native prairie plants suited to a specified geographic location in Minnesota under specified soil, moisture, and sunlight conditions.

Organization Description

The University of Minnesota is the state's main research and graduate teaching institution. Our university has been repeatedly ranked number-one in the nation for Ecology/Environment, based on the citational influence of its scientific publications.