

2011-2012 MAIN PROPOSAL

PROJECT TITLE: Switchgrass: A Biofuel Crop or Invasive Species?

I. PROJECT STATEMENT

1) Native switchgrass has been selected and bred to establish dense, productive biofuel stands with little nutrient or water requirements. This major advance in biofuel sustainability also poses a significant risk to native biodiversity; selectively bred switchgrass shares many characteristics that typify our most invasive species. Little is known about the invasion risk posed by selective breeding of native grasses.

Invasion risk assessment is urgently needed because these crops are being established widely across the state. This research complements current work on *Miscanthus* because selectively bred switchgrass could pose a greater invasion risk since it spreads by seed and is being established on larger areas in the state. We will integrate three focus areas:

- **Invasion Risk**— Little is known about the potential for improved switchgrass varieties to invade prairie and impact local biodiversity. We will evaluate invasion risk by comparing competitiveness of improved switchgrass varieties versus a study control, local genotypes of switchgrass.
- **Risk Management**— We will develop recommendations for managing buffers to limit the spread of potentially invasive grass biofuel crops. We will test several strategies for managing switchgrass escapees; recommendations will balance effective control with management cost.
- **Biofuel Sustainability**— Invasion risk and impacts on native biodiversity is often overlooked as a critical consideration for biofuel crop sustainability. We will integrate information from concurrent studies on biofuel production, carbon sequestration, and profitability to determine the trade-offs associated with more productive but potentially more invasive biofuel crops.

2) This research will be used to develop a community-based and sustainable biofuel industry for the Central Sand Plains. Our team will include agronomists and ecologists from the University with a central goal of developing productive biofuel systems that do not threaten the state's native biodiversity. At the core of this project is the Energy and Agricultural Center of Central Lake College in Staples, Minnesota. The Energy Center is well connected to regional producers, agriculture, and bioenergy facilities.

II. DESCRIPTION OF PROJECT ACTIVITIES

Activity 1: Invasive Risk of Selectively Bred Switchgrass Budget: \$95,000

We will test invasion into prairie by improved switchgrass varieties versus local genotype (study control) switchgrass. Five improved varieties and five local genotypes of switchgrass will be introduced into newly established and remnant prairie in four locations. We will determine the relationship between arriving seed number and dominance by improved switchgrass varieties.

Outcome	Completion Date
Predictions of invasion risk for selectively bred switchgrass varieties	December 1, 2013
Communicate relevance to Minnesota biofuels through peer-reviewed journals, websites and field days.	December 1, 2012, 2013

Activity 2: Risk Management

Budget: \$25,000

We will to determine buffer size based on seed dispersal distance and the relationship between arriving seed number and probability of invasion. We will test management strategies (mowing and grass selective herbicide) and investigate the role of buffer composition (ie. tree windrow versus grasses) in biofuel crop containment.

Outcome	Completion Date
Recommendations for buffer size, composition, and management to contain potential invasion by grass biofuel crops.	December 1, 2013
Communicate relevance to Minnesota biofuels through peer-reviewed journals, websites and field days.	December 1, 2012, 2013

III. PROJECT STRATEGY

A. Project Team/Partners

- Robert Schafer, Director-Central Lakes College Ag & Energy Center, Staples MN
Provide land and equipment, financial accounting with MNSCU system, and publicity.
- Jim Eckberg, Research Fellow, (Soil, Water and Climate) – University of MN.
Lead scientist, technical writing, develop protocols, and supervisory services.
- Michelle Johnson, Technician – Central Lakes College Ag & Energy Center
Establish experimental plots and treatments, data collection
- Shelby Flint, Graduate Trainee in Risk Analysis, (Conservation Biology) – University of MN.
Collaboration on research protocols, data collection, and publications
- Dr. Ruth Shaw, Professor, (Ecology, Evolution and Behavior) – University of MN.
Consulting on invasiveness of grass varieties
- Dr. Neil Anderson, Associate Professor, (Horticulture Science) – University of MN.
Consulting on improved grass variety invasiveness

B. Timeline Requirements

- Summer-Fall 2011— Collect switchgrass seed from local populations.
- Spring 2012— Establish experimental treatments.
- Summer 2012-December 2013— Maintain experimental treatments, collect data, and provide annual reports.

C. Long-Term Strategy and Future Funding Needs

This research is a part of a larger effort to develop a community-based and sustainable biofuel industry for the Central Sand Plains. The funding requested here is essential to address invasion risk associated with selective breeding of native grasses and develop risk management recommendations for biofuel crops. Funding beyond the scope of this proposal will be important to understanding the long-term dynamics of perennial biofuel invasiveness in native prairie.

2011-2012 Detailed Project Budget

IV. TOTAL TRUST FUND REQUEST BUDGET

2.5 years

BUDGET ITEM	Grant
Personnel:	
Robert Schafer, Co-Project Manager, Annual Salary \$56,523 plus fringe \$24,916 = \$81,439 x .05 FT = \$4,072 x 3 years	\$ 12,216
Michelle Johnson, Research Technician, Annual Salary \$27,266 plus fringe \$19,463 x .10FT = \$4,673 x 3 years	14,019
Contractual / Professional Services:	
Jim Eckberg, Co-Project Manager, will oversee the project consultation, research protocols and publications and professional writing	\$ 45,000
Shelby Flint, develop research protocols, data collection, and publication	\$ 12,000
Dr. Ruth Shaw, Consulting	9,000
Dr. Neil Anderson, Consulting	9,000
Equipment/Tools/Supplies:	
Seed, Herbicide	\$ 3,422
Planting, spraying equipment	4,000
Travel:	
Ag Center Travel for Project Manager, Research Technician and Equipment Operator between off site plots for project purposes. Anticipated number of sites 12 x 24 mile average RT x (Once per week x 24 weeks) = 6,912 miles annually x .50/mile	\$ 10,368
Additional Budget Items:	
Annual Field Days (2 field days in total) will include tours, educational seminars for farmers, educators, industry and Gov't Agencies estimated cost per event including guest speakers, facilities and set-up = \$300/event	\$ 600
Materials and publication of newsletters (1 issues per year)	375
TOTAL ENVIRONMENT & NATURAL RESOURCES TRUST FUND \$ REQUEST	\$ 120,000

V. OTHER FUNDS

SOURCE OF FUNDS	AMOUNT	Status
Other Non-State \$ Being Applied to Project During Project Period:	-	
	-	
Other State \$ Being Applied to Project During Project Period:	-	
Do you have any other funds that you are applying for from the state?		
In-kind Services During Project Period:	-	
Central Lakes College Ag Center land, facilities and incidental equipment	6,000	Secured
Funding History:		



Native Switchgrass has been selected and bred to establish dense, productive stands with little nutrient or water requirements. Switchgrass now shares many characteristics that typify our most invasive species. Little is known about the invasion risk of improved and selectively bred varieties of native switchgrass biofuel crops

Co-Project Manager Qualifications

Robert Schafer is the Director of the Central Lakes College Agriculture and Energy Center. Bob is a former high school Vo-Ag instructor from the Brainerd area with twenty five years of experience in the food, dairy, and livestock feeding industry and five years in the biofuels industry. Supporting activities include work as the Project Manager for a NextGen grant titled "Dedicated Energy Crop Production". He will coordinate the Ag Center's resources allocated toward the project, facilitate education and outreach efforts, and provide financial accounting through the MNSCU system.

Jim Eckberg is a research fellow at the University of Minnesota. Jim received a Masters in Ecology while working with Dr. Svata Louda at the University of Nebraska-Lincoln. The Louda lab has shown that biocontrol insects released to control noxious plants can themselves become invasive pests. Jim's research addressed the role of native insects as an alternative means to control noxious weeds, specifically thistle. Jim has designed and implemented multi-site invasion studies, constructed models to predict invasive spread, and has published scientific papers on plant population dynamics and invasions.

As co-project manager, Jim will be responsible for coordinating research to address the emerging issue of invasive biofuel crops. Jim will collaborate with Dr. Ruth Shaw, Dr. Neil Anderson and Shelby Flint; their combined experience in selective breeding, invasiveness and genetics will help guide the development of studies to illuminate the potential for engineered invasiveness in biofuel crops. Jim's experience with on-the-ground invasion tests and use of field data to construct invasion models will be instrumental to understanding potential impacts of invasive biofuel crops on native biodiversity. As a Udall Scholar in environmental policy, Jim is highly interested in using this research to inform ecologically sensitive bioenergy policies.

Organization Description

The Ag and Energy Center is a 500 acre research and demonstration station located in the central sand plains. The sand plains are a potential epicenter for perennial biofuel crops given the wide availability of marginal, sandy land. The mission of the Ag and Energy Center is to lead the development of a community-based and sustainable biofuel industry. The Ag and Energy Center is well connected to regional producers, agriculture, bioenergy facilities and the University of Minnesota.

The Center has an established array of biomass demonstration plots containing hybrid poplar, survivor false indigo, hazelnut, Miscanthus, switchgrass, big bluestem, mixed prairie, prairie cordgrass, wheatgrass and many more. Approximately twenty five acres of wasteland are planted to annual and perennial biofuel crops to test their drought tolerance, growth characteristics, nutrient requirements, economic value and environmental benefits.