



Environment and Natural Resources Trust Fund

2024 Request for Proposal

General Information

Proposal ID: 2024-284

Proposal Title: Native Prairie Grass for Human Food and Habitat

Project Manager Information

Name: Steve Apfelbaum

Organization: Applied Ecological Institute, Inc.

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Project Basic Information

Project Summary: Virginia wildrye is a native prairie grass that produces edible seeds for direct human consumption. We will study its production, processing, and commercialization to expand it for wildlife and agriculture.

Funds Requested: \$596,000

Proposed Project Completion: June 30, 2027

LCCMR Funding Category: Methods to Protect, Restore, and Enhance Land, Water, and Habitat (F)

Project Location

What is the best scale for describing where your work will take place?

Statewide

What is the best scale to describe the area impacted by your work?

Statewide

When will the work impact occur?

During the Project and In the Future

Narrative

Describe the opportunity or problem your proposal seeks to address. Include any relevant background information.

More than 16 million acres of Minnesota's native prairies and forests have been converted to row-crop agriculture, most of which are covered by annual crops that grow for only a short period of the year. When not growing, these fields are left barren and subject to soil erosion, nutrient leaching and runoff. This land is largely uninhabitable for most of Minnesota's native wildlife including ground-dwelling insects, pollinators, small mammals, songbirds, and waterfowl. Efforts to develop and deploy perennial grain crops to mitigate these environmental challenges are underway. Minnesota is paving the way as a global leader in this innovation, and with support from previous LCCMR projects, this team has made significant advancements in the development of Kernza, a new perennial grain crop, to protect drinking water sources from nitrate leaching. Minnesota has planted Kernza on several hundred acres of wellhead protection areas, and similar efforts have helped launch new businesses to process and distribute this new healthy grain. Preliminary trials using Virginia Wildrye, a native perennial grass that functions similarly as Kernza, show great promise. Consumer demand for healthy, whole grains could drive the expansion of this perennial grass as a grain crop, which would benefit wildlife and humans alike.

What is your proposed solution to the problem or opportunity discussed above? Introduce us to the work you are seeking funding to do. You will be asked to expand on this proposed solution in Activities & Milestones.

Virginia wildrye (VWR) is a native prairie grass that is found throughout Minnesota. It is an early-successional species that is quick to emerge after seeding and can compete well with weeds. Virginia wildrye is an important contributor to prairies for habitat as they provide overwintering cover and seed for small mammals and birds. This seed also happens to be edible by humans, and for several years AEI has made intensive efforts to commercialize VWR as a novel perennial grain. Early work has resulted in the development of processing specs, multi-year contracts with growers, and product and market development. However, some basic science is needed to expedite the commercialization of VWR. Specifically, a stronger understanding of the genetic base of VWR is necessary for future efforts to improve the species as a crop. Fundamental information about how VWR uses nitrogen is also currently limited but necessary to ensure that growers can profitably grow VWR, especially in areas where it can reduce nitrogen leaching to groundwater. This proposal will leverage basic science capacity with private sector expertise to rapidly develop new commercial opportunities for growers and products for consumers through nature-based solutions that will protect native species and Minnesota's natural resources.

What are the specific project outcomes as they relate to the public purpose of protection, conservation, preservation, and enhancement of the state's natural resources?

Outcomes will include new economic opportunities to expand the area of VWR - a native prairie grass in Minnesota. Expansion of VWR will benefit wildlife who depend on this species for habitat, and will prevent nitrate leaching to groundwater as it replaces annual row-crops in ecologically sensitive areas. The introduction of VWR as a new food ingredient will stimulate local economies by catalyzing business opportunities to clean and process this grain. New information on the basic understanding of VWR genetics and growth will support future work to expand this native species as a food crop.

Activities and Milestones

Activity 1: Evaluate nutrient requirements and habitat potential of Virginia Wildrye managed for grain production

Activity Budget: \$212,559

Activity Description:

Populations of Virginia Wildrye (VWR) have been collected and propagated for use as a perennial grain crop. Questions remain as to whether this native prairie grass can be economically grown as a food crop by Minnesota farmers. One fundamental aspect of growing any grain crop relates to nitrogen needs. We will conduct a field experiment to determine the nitrogen needs of this new crop on two distinct soil types in regions varying in climate. This experiment will apply five rates of nitrogen fertilizer to VWR plots, and seed, biomass, and fall regrowth will be measured. These data will be used to determine how VWR grain and biomass yields vary across growing conditions and how nitrogen rates affect grain and biomass production. Nitrogen removal in grain and uptake in stems and leaves will be measured to determine the potential for this species to reduce nitrate leaching to groundwater. We will measure how much biomass regrows in the fall after grain is harvested to evaluate overwintering cover and habitat for wildlife. The amount of cover will be measured by clipping biomass and by measuring density using a Robel pole - a common method for waterfowl habitat research.

Activity Milestones:

Description	Approximate Completion Date
Evaluate growth and development of VWR across different climate and soil conditions in Minnesota	June 30, 2025
Determine optimum nitrogen inputs for maximizing grain, biomass, and fall regrowth production	June 30, 2026
Report vegetation properties of VWR grain production systems as they relate to wildlife habitat	June 30, 2027

Activity 2: Evaluate the nutritional and end-use quality of Virginia Wildrye as affected by different nitrogen levels

Activity Budget: \$165,400

Activity Description:

To develop Virginia Wildrye as an ingredient for food applications, it is important to understand its nutritional and end-use properties. In this activity, nutritional characteristics such as protein, carbohydrates, lipids, dietary fiber, mineral content, amino acids, starch content, expected glycemic index or starch digestibility and protein digestibility will be determined. The results generated will form the basis for developing products from Virginia Wildrye. In this activity, we will also evaluate the impacts of different levels of nitrogen as applied to Virginia Wildrye in activity 1 on the aforementioned nutritional properties. This will enable us to determine the optimum levels of nitrogen to be applied to the crop. We will for the first time explore the use of extrusion to develop ready-to-eat snack products from Virginia Wildrye.

Activity Milestones:

Description	Approximate Completion Date
Generate information on nutrition and end-use properties of Virginia Wildrye	June 30, 2025
Document the effects of nitrogen on nutrition and end-use properties of Virginia Wildrye	June 30, 2026
Develop ready-to-eat snack products from Virginia Wildrye	June 30, 2027

Activity 3: Assess population diversity and evaluate Virginia Wildrye germplasm for crop development

Activity Budget: \$105,895

Activity Description:

Understanding how Virginia Wildrye can function as a food crop across a wide range of growing conditions in Minnesota will require rigorous evaluation of VWR genetics. The genetic makeup of this perennial species is yet to be understood and development of genetic tools for future breeding purposes have not been carried out. Specific activities will include an assessment of the breadth of genetic diversity in current native populations and sub-populations. This information is also useful for determining potential VWR “ecotypes” found in Minnesota. Approximately 500 individuals evaluated in Activity 1 will be randomly sampled from the field and subjected to high-throughput DNA sequencing to obtain genomic information. Best-performing individuals will also be selected, cloned, and crossed in a greenhouse to obtain progeny, which will be re-evaluated in subsequent years in small field trials across different climate conditions in Minnesota. Identification of populations with desired traits (e.g. growth vigor, biomass, disease resistance) can expedite the expansion of VWR on agricultural lands to diversify our current crop portfolio as well as in its potential in providing ecological services.

Activity Milestones:

Description	Approximate Completion Date
Select best-performing Virginia Wildrye individuals under Minnesota conditions	June 30, 2025
Discover genetic markers and study population genetic diversity in Virginia Wildrye	May 31, 2026
Evaluate the progeny obtained by intermating the best performing Virginia Wildrye individuals	June 30, 2027

Activity 4: Commercialization

Activity Budget: \$112,146

Activity Description:

Activity 4 will be led by Steven Apfelbaum and Applied Ecological Institute (AEI) with support from the Forever Green Commercialization team at University of Minnesota. There is great demand in food webs-from farmers to global consumer packaged goods companies to consumers-to bring to market nutritionally dense food that also restores healthy soil and habitat. The Climate Food Co., a studio company at AEI, combined an exceptional team of experts from the regenerative agriculture, natural and organic food, and ecological restoration industries to create a commercial pathway for VWR. Activity 4 will incorporate the findings of Activities 1-3 and build upon the existing work at The Climate Food Co. to commercialize products made with VWR which are a win for farmers, wildlife, water quality, consumers and the planet. Streamlining their experience from their work with Kernza, The Forever Green Initiative will play a key role in connecting partners and activities across basic science of crop development and the market-based commercialization process.

Activity Milestones:

Description	Approximate Completion Date
Develop farmer and market partnerships in Minnesota to pilot grow VWR and create VWR grain products	June 30, 2025
Develop process for integration of science and commercialization of new opportunities for perennial grain crop development	June 30, 2026
Market analysis for new food products made with VWR	June 30, 2027

Project Partners and Collaborators

Name	Organization	Role	Receiving Funds
Jacob Jungers	University of Minnesota	Oversee research on field production and testing, genetic evaluation, and food science testing of Virginia wildrye	Yes

Long-Term Implementation and Funding

Describe how the results will be implemented and how any ongoing effort will be funded. If not already addressed as part of the project, how will findings, results, and products developed be implemented after project completion? If additional work is needed, how will this work be funded?

Implementation of results obtained from this project will be done via careful communication and meaningful partnerships with other stakeholders, researchers, farmers, and interested parties. Findings will be immediately deployed through incorporation into ongoing commercialization efforts for VWR being led by AEI, which will be boosted through access to FGI's strong networks and relationships in MN. Results and findings from all activities will be made publicly available through publication in open-access journals, websites, and other print and digital media. In case additional support for research work is needed during or after the project is completed, we will pursue larger grants.

Project Manager and Organization Qualifications

Project Manager Name: Steve Apfelbaum

Job Title: Executive Director & Senior Ecologist

Provide description of the project manager's qualifications to manage the proposed project.

Steven Apfelbaum has conducted ecological research, designed award-winning projects, successfully navigated regulatory programs, and contributed his innovative scientific expertise and enthusiasm to over 9,000 projects throughout North America and beyond. He is one of the leading ecological consultants in the U.S., providing technical restoration advice and win-win solutions where ecological and land-development conflicts arise. Steven has authored hundreds of technical studies, peer-reviewed technical papers, books, reports, ecological restoration plans, and regulatory monitoring and compliance reports. Steve founded Applied Ecological Institute, a nonprofit venture studio creating nature based solutions company, after starting and building Applied Ecological Services (AES). Over 30+ years AES executed projects across the world focused on restoring and optimizing natural resources at every scale. Steve's book, *Nature's Second Chance* (Beacon Press), won accolades from the New York Times, and was listed as one of the "Top 10 Environmental Books of 2009." Steve is also the recipient of many conservation awards including the John T. Curtis Lifetime Achievement Award from the Aldo Leopold Foundation in 2010.

Organization: Applied Ecological Institute, Inc.

Organization Description:

Applied Ecological Institute Inc (AEI) is the first non profit venture studio for nature-based startups. Natural ecosystems are the planet's best business model: diversified, regenerative, and designed to create compounding returns. Business solutions designed to restore soil, water, and biodiversity have the power to outperform traditional investments by capitalizing on the natural abundance of those healthy ecosystems. We call this approach Ecological Intelligence (EI), and we use it to create and invest in startups that deliver return on investment by restoring the healthy systems needed for all life to thrive.

Budget Summary

Category / Name	Subcategory or Type	Description	Purpose	Gen. Ineligible	% Benefits	# FTE	Classified Staff?	\$ Amount
Personnel								
Senior Ecologist		Oversee and guide ecological systems analysis of activities			0%	0.18		\$36,000
Managing Director		Coordinate Commercialization Research, Partners, and Analysis			0%	0.45		\$22,500
Climate Food Studio Impact Lead		Incorporate findings from the project and collaborate with partners on creating MRV strategy for positive environmental and nutritional impact			0%	0.63		\$32,000
							Sub Total	\$90,500
Contracts and Services								
UMN - Jacob Jungers	Sub award	UMN Faculty / PI - Lead and oversee research related to activities				0.1		\$28,152
UMN - George Annor	Sub award	UMN Faculty / CoPI Lead and oversee research related to activities				0.24		\$41,839
UMN - Prabin Bajgain	Sub award	UMN Faculty / CoPI Lead and oversee research related to activities				0.3		\$40,970
UMN - Colin Cureton	Sub award	UMN Faculty / CoPI Lead and oversee research related to activities				0.15		\$20,393
UMN - Professional & Admin - Andrew Leach	Sub award	Oversee economic analyses - Activity #4				0.3		\$30,490
UMN Graduate Student	Sub award	Coordinate field trials, manage and analyze data				2		\$112,958
UMN Summer Interns	Sub award	Maintain Field Plots, Collect Data, Process samples				0.24		\$7,988
UMN Researcher 5	Sub award	plant experiments, schedule sampling, oversee labor and equipment, supervise interns				0.6		\$45,375

UMN Graduate Student	Sub award	Coordinate food science and nutrition analysis, manage and analyze data				2		\$95,215
UMN - Researcher 3	Sub award	Sample, clone, and assist with tissue preparation for genomic sequencing				0.45		\$41,580
UMN	Sub award	Activity 1: Mileage expenses for the graduate student, Researcher 5, and interns to travel from the St. Paul campus to Becker and Waseca Research and Outreach Centers is requested for 400 miles in year 1 and approximately 800 miles in years 2 and 3 at \$0.65 per mile.				0		\$1,342
UMN	Sub award	Activity 1: General operating supply expenses for the field trials including plot stakes, sample bags, labels, grain envelopes, and bottles for ground biomass are requested at \$250 per year for years 1-3.				0		\$750
UMN	Sub award	Activity 1: Lab and medical services expenses for plot fees at the research and outreach centers is requested at \$275 per acre for 2 acres per year for three years.				0		\$1,650
UMN	Sub award	Activity 2: Funds of \$10,000 (total) is requested for expendable materials and chemicals needed for analyzing seeds from the crop and product development.				0		\$10,000
UMN	Sub award	Activity 3: General operating supply expenses for preparing plants for propagation and genomic sequencing in years 1.				0		\$1,000
UMN	Sub award	Activity 3: Lab and medical supplies expenses for reagents and lab consumables is requested for year 1.				0		\$3,000
UMN	Sub award	Activity 3: Lab and medical services expenses for the genomic sequencing lab are requested in years 1.				0		\$10,000
UMN	Sub award	Activity 4: Mileage expenses for the commercialization team to travel from the St. Paul campus to meetings with end-users and potential growers is requested for 1000 miles in years 1 - 3 at \$0.65 per mile.				0		\$1,965
							Sub Total	\$494,667

Equipment, Tools, and Supplies								
	Tools and Supplies	500# VWR Seed	For planting / research					\$5,000
							Sub Total	\$5,000
Capital Expenditures								
							Sub Total	-
Acquisitions and Stewardship								
							Sub Total	-
Travel In Minnesota								
	Miles/ Meals/ Lodging	20 with average 200 miles @\$.65/mile plus lodging and meals	Farmer Outreach Meetings					\$4,798
	Miles/ Meals/ Lodging	1 per year / 3 total for Senior Ecologist - 300 miles @.65 + food & lodging	Share findings / Report outs / Check field and lab work					\$1,035
							Sub Total	\$5,833
Travel Outside Minnesota								
							Sub Total	-
Printing and Publication								
							Sub Total	-
Other Expenses								
							Sub Total	-
							Grand Total	\$596,000

Classified Staff or Generally Ineligible Expenses

Category/Name	Subcategory or Type	Description	Justification Ineligible Expense or Classified Staff Request
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Non ENRTF Funds

Category	Specific Source	Use	Status	Amount
State				
			State Sub Total	-
Non-State				
			Non State Sub Total	-
			Funds Total	-

Attachments

Required Attachments

Visual Component

File: [a30ee582-ba3.pdf](#)

Alternate Text for Visual Component

Elymus Virginicus - Virginia Wild Rye...

Administrative Use

Does your project include restoration or acquisition of land rights?

No

Does your project have potential for royalties, copyrights, patents, or sale of products and assets?

No

Do you understand and acknowledge IP and revenue-return and sharing requirements in 116P.10?

N/A

Do you wish to request reinvestment of any revenues into your project instead of returning revenue to the ENRTF?

N/A

Does your project include original, hypothesis-driven research?

No

Does the organization have a fiscal agent for this project?

No

Does your project include the design, construction, or renovation of a building, trail, campground, or other capital asset costing \$10,000 or more?

No

Do you propose using an appropriation from the Environment and Natural Resources Trust Fund to conduct a project that provides children's services, as defined in Minnesota Statutes section 299C.61 Subd.7?

No

