

**Environment and Natural Resources Trust Fund**

# 2022 Request for Proposal

## **General Information**

**Proposal ID:** 2022-266

**Proposal Title:** Sweetening the Crop: Perennial flax for pollinator/ecosystem benefits

## **Project Manager Information**

**Name:** Neil Anderson

**Organization:** U of MN - College of Food, Agricultural and Natural Resource Sciences

**Office Telephone:** (612) 624-6701

**Email:** ander044@umn.edu

## **Project Basic Information**

**Project Summary:** We will produce, select, and evaluate how perennial flax provides ecosystem (pollinator) services for the environment while enhancing yield for oilseed, fiber, and nectar/honey production.

**Funds Requested:** $791,000

**Proposed Project Completion:** June 30 2025

**LCCMR Funding Category:** Foundational Natural Resource Data and Information (A)

## **Project Location**

**What is the best scale for describing where your work will take place?** Region(s): SW, SE, NW, Central, Metro,

**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.**

Lack of food resources (flowers) is a leading cause of declines in pollinator populations and pollinator health. Current cropping systems do not provide adequate resources for pollinators. The University of Minnesota is breeding perennial flax to replace historic annual flax production. We seek funding to provide early stage crop development data, before direct commercialization. Establishing perennial flax as a reinvigorated oilseed and fibercrop and a new honey crop has the potential to improve seed/fiber/honey yield for farmers (2x harvest/yr.) and provide ecosystem services for pollinators (flowering May-November) within conventional cropping. The early/long flowering provides an unparalleled opportunity to provide resources to hundreds of pollinators. We will experimentally test the effectiveness of perennial flax for ecological services (pollinators, honey production) and realizable harvestable units for oilseed (yield, chemicals, proteins) and fiber types. This will provide critical selection data/breeding directives for the best lines for crop launching. We will communicate the economic potential of perennial flax oilseed/fiber/honey cropping with market pathway and supply-chain analyses. Communication of research findings and best practices with field days, farm demonstrations, and “AURI connects: Fields of Innovation” programming will support adoption of perennial flax to benefit Minnesotans.

**What is your proposed solution to the problem or opportunity discussed above? i.e. What are you seeking funding to do? You will be asked to expand on this in Activities and Milestones.**

A variety of benefits, particularly ecosystem services, are realizable with perennial flax, which we aim to research and generate data during the 3-year period: pollinator services (pollen/nectar sources enhance pollinator activity late into the fall), yield and chemical contents of harvestable products (oilseed, fiber, pollen, nectar/honey), and increased yield (two harvests/year instead of one with annual flax). Experimental and outreach plans include: Activity 1 involves breeding/selecting/evaluating perennial flax for pollinator/landscape services and yield for food product analyses (honey, oilseed, fiber and chemical constituents). Activity 2 concentrates research on perennial flaxseed yield and human/animal nutrient contents for oil, protein, amino acid, and meal. In Activity 3, the business development team will establish supply chain opportunities and investigate new markets for perennial flax, the technical team of process engineers, food scientists and analytical scientists will analyze perennial flax for food product development, assessing flax seed, oil, and honey. Finally, in Activity 4, outreach to stakeholders and clientele groups will build awareness, education and promote discussion of perennial flax in field days and programming. Results will guide future development with businesses for commercialization of perennial flax-based products.

**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?**

Our project will use methods and channels to conduct research, share findings and build awareness of environmental benefits and market potential of perennial flax: identifying valuable end use(s) with value to MN farmers and citizens, enhanced pollinator services, high oilseed, protein, fiber, & gene pool enhancement. Reports will be available via U of M and AURI websites. Project partners will present at events with broad and varied audiences: perennial flax field days, annual AURI “Fields of Innovation”. We will engage with print, broadcast, internet media to seek project coverage and build public awareness.

## **Activities and Milestones**

### **Activity 1: Producing, evaluating and selecting perennial flax for pollinator services, nectar components**

**Activity Budget:** $317,124

**Activity Description:**Flax may be a unique nectar source for bees (native, honey) for pollinator / ecosystem services and a new source of nutrient-rich honey. Objectives of this research are to quantify honey bee and native pollinator activity in perennial flax fields, nectar production, potential for honey production, and chemical constituents with nutritional value for bees. Yr. 1 walking surveys (sweep netting; observational) will be conducted in established fields to survey diversity and abundance of foraging bees and if they are collecting pollen and/or nectar. Honey bee colonies at plot edges will be used to measure weight gain; the proportion of colony pollen diet from flax. Nectar production data from sampling flax flowers (microcapillary tube spinouts) includes volume, nectar chemistry (amino acids, sugar types, concentrations, content). Yrs. 2-3 will focus on flax selections identified (Yr. 1) with high levels of nectar/pollen to conduct additional pollinator activity surveys, examine nectar/pollen for nutritional and nutraceutical components (lipids, proteins, phytocompounds), evaluate whether these compounds impact pollinator health and assess honey value for human consumption. AURI (Activities 3-4) will use yield and economic data on pollen/nectar sources to enhance pollinator activity and harvestable products (nectar, honey) to create business development model(s).

**Activity Milestones:**

|  |  |
| --- | --- |
| **Description** | **Completion Date** |
| Quantify pollinator activity | December 31 2023 |
| Determine nectar and pollen production | December 31 2024 |
| Determine pollen, nectar & honey nutritional, nutraceutical components | June 30 2025 |

### **Activity 2: Evaluation of yield for high value perennial oilseed to provide oil, proteins and meal for human/animal nutrition**

**Activity Budget:** $192,648

**Activity Description:**There is a global challenge to address food security and preserve land/water resources; consumers seek transparency and sustainability in their food supply. Food industries are interested in commercializing products formulated with ingredients derived from such crops; farmers are motivated to plant a crop with a strong market. As an oilseed, flaxseed is high in oil, fat, proteins, and flax meal is a useful byproduct. The proposed work involves a concerted effort from breeders, food scientists, and engineers to lead perennial flax development as a viable source of plant ingredients. Specific objectives are: Measure flowering/seed ripening periods (Yrs. 1-3); mechanical harvesting 2x/yr at 4 sites (St. Paul, Rosemount, Lamberton, Morris) will determine seed yield in Yrs. 1-3 (wt., size, oil, omega-3 content, meal); wherein protein extraction methodologies will be developed to produce protein isolates; followed by screen breeding lines for protein profile, structure, and functionality (Yrs. 1-3). Residual plant material will be used to study fiber potential in Activity 3. Generated data will direct the breeding program. AURI (Activities 3-4) will use yield and economic data on oilseed sources to enhance harvestable products (oilseed, oils, proteins, amino acids, omega-3s, meal, fiber) to create business development model(s).

**Activity Milestones:**

|  |  |
| --- | --- |
| **Description** | **Completion Date** |
| Grow, harvest, determine yield components | December 31 2023 |
| Oilseed extraction, chemical/nutritional profile determinations | December 31 2024 |
| Breeding line evaluations (oil, proteins) | June 30 2025 |

### **Activity 3: Assess value-added processes and products to support development of economically sustainable supply-chains for perennial flax in Minnesota.**

**Activity Budget:** $179,432

**Activity Description:**Work in this activity will examine uses of perennial flax and support the development of sustainable supply chains through technical assistance, commercialization, and stakeholder engagement. Using residual plant material harvested in Activity 2, an additional objective is to determine flax fiber yield (biomass, fiber type, length/width, tensile strength), suitable harvesting methods (hand harvest/rolling, mechanical) and determination of fiber potential in perennial flax based on these characteristics. Providing ecosystem services and economically-valuable products from perennial flax requires investigations into business development. We will use yield and economic data generated on pollen/nectar sources to enhance pollinator activity late into the fall and harvestable products (oilseed, fiber, nectar and honey, fiber) to create business development model(s). The business development team will establish supply chain opportunities and investigate new markets for perennial flax by engaging with private businesses (food, feed, bio-based materials) and other key value chain stakeholders.

**Activity Milestones:**

|  |  |
| --- | --- |
| **Description** | **Completion Date** |
| Determine economic potential | June 30 2025 |
| Identify market opportunities (supply chains) | June 30 2025 |
| Determine food product uses | June 30 2025 |
| Assess fiber potential | June 30 2025 |

### **Activity 4: Education and outreach on perennial flax production**

**Activity Budget:** $101,796

**Activity Description:**AURI staff will help organize and participate in two perennial flax field days over the grant period to assist in building awareness and educating key stakeholders about perennial flax with demonstrations to highlight perennial flax production and environmental benefits to farmers, beekeepers, government officials, local businesses, educators, and students. In addition to the field days, AURI will also include perennial flax programming at one “AURI Connects: Fields of Innovation” event each year during the project to facilitate discussion, build awareness, and disseminate information about perennial flax and its market potential. We will communicate results derived from Activities 1-3 so beekeepers, farmers, and processors can be informed on requirements to produce/process perennial flax, as well as the environmental and economic benefits of production (oilseed, fiber, and nectar/honey). Potential nutraceutical benefits of flax oilseed and honey will also be highlighted.

**Activity Milestones:**

|  |  |
| --- | --- |
| **Description** | **Completion Date** |
| Provide summary of market potential and supply chains in Minnesota from discussions with industry representatives. Present findings at perennial flax field days. | November 30 2024 |
| Present economic findings (field days) | June 30 2025 |
| Relay market opportunities | June 30 2025 |
| Provide summary of market potential and supply chains in Minnesota from discussions with industry representatives. Present findings at perennial flax field days. | June 30 2025 |
| Discuss market opportunities and supply chain findings of perennial flax for feed, food, fuel, and fiber in Minnesota. | June 30 2025 |

## **Project Partners and Collaborators**

|  |  |  |  |
| --- | --- | --- | --- |
| **Name** | **Organization** | **Role** | **Receiving Funds** |
| Donald Wyse | University of Minnesota, Department of Agronomy & Plant Genetics | Co-project Lead for perennial flax breeding & research; all activities | Yes |
| Kevin Betts | University of Minnesota, Department of Agronomy & Plant Genetics | Researcher on perennial flax; field production, maintenance, harvest for all Activities | Yes |
| Constance Carlson | University of Minnesota, Forever Green Initiative (FGI) | Engaged with MN Sustainable Farming Association and UMN Extension: Regional Sustainable Development Partnerships, market development, industry engagement, education and outreach, primarily working with Activities 2 - 4 | Yes |
| Bareem (Pam) Ismael | University of Minnesota; Plant Protein Innovation Center | Protein analysis of seed samples, Activity 2; help with Activities 3-4 | Yes |
| Marla Spivak | University of Minnesota, Department of Entomology | Pollinators, honey bee behavior, pollinator habitat, Activity 1; help with Activities 3-4 | Yes |
| Daniel Cariveau | University of Minnesota, Department of Entomology | Native, wild pollinators, ecology, pollinator habitat Activity 1; help with Activities 3-4 | Yes |
| Clay Carter | University of Minnesota, Department of Plant and Microbial Biology | Analyses of nectar, honey Activity 1; help with Activities 3-4 | Yes |
| Colin Cureton | University of Minnesota, Forever Green Initiative (FGI) | FGI Commercialization team; economics of perennial flax production with emphasis on profitability for growers; support pilot production; organize scale-up; advise future IP and release strategies. Activities 3,4 | Yes |
| Michael Stutelberg | Agricultural Utilization Research Institute (AURI) | Lead supply chain activities, AURI Scientist (chemist) analytical testing; primarily Activities 3, 4 | Yes |
| Harold Stanislawski | Agricultural Utilization Research Institute (AURI) | AURI fiber, seed expert; primarily Activities 3, 4 | Yes |
| Matthew Leiphon | Agricultural Utilization Research Institute (AURI) | Project manager, AURI; primarily Activities 3, 4 | Yes |
| Jennifer Wagner-Lahr | Agricultural Utilization Research Institute (AURI) | Commercialization for AURI; primarily Activities 3, 4 | Yes |
| Alan Doering | Agricultural Utilization Research Institute (AURI) | Fiber and seed processing, AURI; primarily Activities 3, 4 | Yes |
| Riley Gordon | Agricultural Utilization Research Institute (AURI) | Engineer, Fiber and seed processing, AURI; primarily Activiies 3, 4 | Yes |
| Abel Tekeste | Agricultural Utilization Research Institute (AURI) | Fiber and seed processing, AURI; primarily Activities 3, 4 | Yes |
| Nan Larson | Agricultural Utilization Research Institute (AURI) | Director of Innovative Networks, AURI, and will oversee networking and events associated with this project. Activities 3, 4 | Yes |
| Erik Evans | Agricultural Utilization Research Institute (AURI) | Director of Communications, AURI, and will participate in networking and outreach events to help build the supply chain for this project. Activities 3, 4. | Yes |
| Shelby Thooft | Agricultural Utilization Research Institute (AURI) | Associate Scientist, Chemistry, AURI. Assist in chemical analysis, Activities 3, 4 | 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 be funded?**This research is part of the Forever Green Initiative, a coordinated effort to develop the next generation of perennial crops to protect Minnesota’s environmental resources. Clean Water Funds allocated to the Forever Green Initiative are used for the basic breeding and early research to develop new crops. LCCMR funds are crucial for studying the environmental aspects of new crops and supporting field-scale deployment of perennial flax – which we have demonstrated from previous LCCMR appropriations. LCCMR funds help Minnesota citizens realize the environmental and economic benefits of new Forever Green crops. Related projects are supported by federal grants and industry.

## **Other ENRTF Appropriations Awarded in the Last Six Years**

|  |  |  |
| --- | --- | --- |
| **Name** | **Appropriation** | **Amount Awarded** |
| Enhancing Pollinator Landscapes | M.L. 2014, Chp. 226, Sec. 2, Subd. 06a | $864,000 |
| MITPPC #7: Tools to Distinguish Native from Exotic Reed Canary Grass | M.L. 2015, Chp. 76, Sec. 2, Subd. 06a | - |
| MITPPC 12: Developing Robust Identification Assays for Amaranthus Palmeri in Seed Mixtures | M.L. 2015, Chp. 76, Sec. 2, Subd. 06a | - |
| Data-Driven Pollinator Conservation Strategies | M.L. 2016, Chp. 186, Sec. 2, Subd. 03a | $520,000 |
| Bee Pollinator Habitat Enhancement - Phase II | M.L. 2016, Chp. 186, Sec. 2, Subd. 08a | $387,000 |
| Pollinator Research and Outreach | M.L. 2017, Chp. 96, Sec. 2, Subd. 03n | $500,000 |
| Farmer-Led Expansion of Alfalfa Production to Increase Water Protection | M.L. 2018, Chp. 214, Art. 4, Sec. 2, Subd. 04i | $500,000 |
| Using Perennial Grain Crops in Wellhead Protection Areas to Protect Groundwater | M.L. 2018, Chp. 214, Art. 4, Sec. 2, Subd. 04j | $250,000 |
| Develop BioMulch to Replace Plastic Soil Covering in Vegetable and Fruit Production to Increase Yield and Reduce Waste | M.L. 2018, Chp. 214, Art. 4, Sec. 2, Subd. 08b | $310,000 |
| Accelerating Perennial Crop Production to Prevent Nitrate Leaching | M.L. 2019, First Special Session, Chp. 4, Art. 2, Sec. 2, Subd. 04k | $440,000 |
| Farm-Ready Cover Crops for Protecting Water Quality | M.L. 2019, First Special Session, Chp. 4, Art. 2, Sec. 2, Subd. 04l | $741,000 |

## **Project Manager and Organization Qualifications**

**Project Manager Name:** Neil Anderson

**Job Title:** Professor

**Provide description of the project manager’s qualifications to manage the proposed project.**Neil Anderson is a Full Professor and J. William Fulbright Scholar, directing the Herbaceous Ornamental Breeding Program for the University of Minnesota, Dept. of Horticultural Science. His lab focuses primarily on winter-hardy herbaceous perennials with ornamental/agronomic value as well as R&D on ornamental plant crops which produce natural compounds useful as green pesticides. Additional research focuses on preventing invasiveness of ornamental crops during domestication. The program releases many asexually-propagated crops with Intellectual Property filings around the world. Professor Anderson is an internationally recognized expert in plant reproductive biology (crossing barriers), invasive species biology, geophytes, rapid generation cycling crops, tissue culture, molecular biology, plant breeding and genetics. In addition, his program also is involved in risk assessment to prevent new invasive species from being introduced into the market and causing future problems. His crop specialty is the genus Chrysanthemum, focusing on herbaceous perennial crops : pyrethrum, ornamentals, and the salt-tolerant N. American species. Additional herbaceous perennial crops being bred by his program include: Linum, Lilium, Gladiolus, Iris, Schoenocaulon, and Gaura. He is the lead flax breeder at the University of Minnesota, in cooperation with co-PI, Professor Donald Wyse. Seed protein content, nectar, fiber and nutraceutical production are of particular interest in his Linum (flax) breeding program. He is also a recognized plant explorer, having collected wild species of ornamental interest across the globe, in areas as diverse as the United States, Argentina, and South Africa. Dr. Anderson leads large lab research teams of scientists working on these crops (1 postdoc, 3 research scientists, 8 graduate students, 13 undergraduate students) and advises undergraduate / graduate students. He is adept in management of interdisciplinary research teams - both locally, regionally, nationally, and internationally - and experienced in managing large grants. (300 word limit)

**Organization:** U of MN - College of Food, Agricultural and Natural Resource Sciences

**Organization Description:**The University of Minnesota is a federal land grant public institution of higher learning. The above referenced proposal is hereby endorsed, and submitted, on behalf of the Board of Regents of the University of Minnesota. The University of Minnesota is registered in the FDP FCOI Clearinghouse certifying it has an active and enforced Conflict of Interest policy that is consistent with the provisions of 42 CFR part 50, Subart F, and 42 CFR part 94. The University of Minnesota’s frequently requested institutional information, including EIN, DUNS, and SAM information can be found on our website at https://research.umn.edu/units/spa/proposals/proposal-development/frequently-requested-institutional-information. The current negotiated F&A rate agreement can be found on our website at https://research.umn.edu/units/oca/fa-costs/fa-rate-agreements. Questions concerning programmatic aspects of the project should be directed to the Principal Investigator. Those having to do with contract and budgetary matters should be directed to LJ Turgeon at singh320@umn.edu in the Office of Sponsored Projects Administration.

## **Budget Summary**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Category / Name** | **Subcategory or Type** | **Description** | **Purpose** | **Gen. Ineli gible** | **% Bene fits** | **# FTE** | **Class ified Staff?** | **$ Amount** |
| **Personnel** |  |  |  |  |  |  |  |  |
| Faculty, Dr. Baraem Ismail / Salary and Fringe |  | Conduct, analyze seed protein research, Activity 2; consult with Activities 3-4; advise 1-M.S. student and 1-PostDoc / Yr. 1: 1%=$1387; Yr. 2: 1% pay=$1415; Yr.3: 1% pay=$1443; |  |  | 36.5% | 0.03 |  | $5,794 |
| Professional and Admin, Constance Carlson / Salary and Fringe |  | Engaged with MN Sustainable Farming Association and UMN Extension: Regional Sustainable Development Partnerships, / market development, industry engagement, education and outreach, primarily working with Activities 2 - 4 |  |  | 36.5% | 0.3 |  | $39,117 |
| Professional and Admin, Colin Cureton / Salary and Fringe |  | FGI Commercialization team / economics of perennial flax production with emphasis on profitability for growers; support pilot production; organize scale-up; advise future IP and release strategies. Activities 3,4 |  |  | 36.5% | 0.15 |  | $19,558 |
| PostDoc and Research Specialist (to be determined) / Salary and Fringe, 20% of $50K salary |  | Protein analysis of seed samples / Activity 2; help with Activities 3-4 " |  |  | 25.4% | 0.1 |  | $12,540 |
| Ph.D. graduate student, 50% RA, Applied Plant Sciences Graduate Program / Salary + Tuition (Academic Yr.) + Fringe (Academic Summer) - Grad Students (Acad/Summer) |  | Conduct Activity 1 research experiments / coordinate harvests with engineers/staff for Activities 1-3 |  |  | 19.9% | 1.5 |  | $149,520 |
| M.S. Food Science graduate student, 50% RA, Yrs. 2-3 / Salary + Tuition (Academic Yr.) + Fringe (Academic Summer) - Grad Students (Acad/Summer) |  | Conduct Activity 2 research experiments / coordinate harvests with engineers/staff for Activities 3-4 |  |  | 19.9% | 1 |  | $92,232 |
| Undergraduate Students / 1-3 undergrads at $12/hr.; 5-10 hrs/wk during semesters; possibly FT in summers; $10,000/yr |  | Conduct Activity 1 research experiments and coordinate harvests with engineers/staff for Activities 1-3 " |  |  | 0% | 0.75 |  | $30,000 |
| Civil Service, Kevin Betts (flax production), 15% time / Salary + Fringe |  | Researcher on perennial flax; field production, maintenance, harvest for all Activities |  |  | 31.8% | 0.45 |  | $42,871 |
| Civil Service, 25% technician (nectar chemistry; $50k base) / Salary + Fringe |  | Nectar chemistry analyses / Activity 1 |  |  | 31.8% | 0.75 |  | $50,421 |
| Civil Service, Honey bee technician, 25% time @ $55,000/yr / Salary + Fringe |  | Pollinator studies / Activity 1 |  |  | 31.8% | 0.75 |  | $55,463 |
|  |  |  |  |  |  |  | **Sub Total** | **$497,516** |
| **Contracts and Services** |  |  |  |  |  |  |  |  |
| Agricultural Utilization Research Institute (AURI) | Sub award | Technical staff for Activities 3-4; Michael Stuteberg: Lead supply chain activities, Scientist (chemist) analytical testing; Rod Larkin: fiber, seed; Harold Stanislawski: Economics, fiber processing; Matthew Leiphon: Project manager, AURI; Jennifer Wagner-Lahr: Commercialization for AURI; Riley Gordon: Engineer, Fiber and seed processing; Abel Tekeste: Fiber/seed processing; AURI Dir. Innovative Networks |  |  |  | 1.92 |  | $180,035 |
|  |  |  |  |  |  |  | **Sub Total** | **$180,035** |
| **Equipment, Tools, and Supplies** |  |  |  |  |  |  |  |  |
|  | Tools and Supplies | Lab/field/greenhouse or Medical Supplies (field supplies, weed control, greenhouse/lab supplies, harvesting supplies ($3,584/yr); plant protein analyses ($5K/yr); bee supplies, Yr. 1: Pollen traps (6 colonies/ 9 locations = 54 traps, $65 each)=$3510; Sweep nets ($30/each x 5)=$150; Soxhlet extractor (lipid analysis)=$300; Supplies (recurring, Yrs.1-3): Pollen analysis supplies, 10 boxes 100 glass slides (Glycerine, Calberla’s solution)= $840/yr; Pollen Substitute: MegaBee patties $2.00/colony x 135 colonies fed 2x/mo, 4 mos=$2160/yr; Protein and Fat analysis, Individual colony samples @ 12/site x 9 x 5 alternate month x $10 = $5,400/yr; Nectar chemistry analyses (amino acids and sugar types, concentrations, content): Nectar amino acid analyses (19 genotypes x 3 reps x 3 years x 3 sites x $30/sample for LC MS time) = $15,390 ($5,130/yr); Reagents & supplies for sugar analyses = $1,500 ($500/yr): TOTAL/YR.=$14,030) | Ensure all experimentation for research activities can be completed, such as lab experiments, greenhouse production / propagation, field production, all processing |  |  |  |  | $71,802 |
|  |  |  |  |  |  |  | **Sub Total** | **$71,802** |
| **Capital Expenditures** |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  | **Sub Total** | **-** |
| **Acquisitions and Stewardship** |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  | **Sub Total** | **-** |
| **Travel In Minnesota** |  |  |  |  |  |  |  |  |
|  | Miles/ Meals/ Lodging | Travel by Activities 1-4 Research Teams: $0.56/mile x 4068 mi./yr, M&EI @$55/day @$x 40 d/yr (Lamberton, Morris, Rosemount), lodging @$99/day (Crookston), @$x 12 d/yr | Travel to/from sites for all Activities and all Personnel; field production, irrigation, herbicide applications, data collection, seed.fiber harvests, pollinator studies |  |  |  |  | $16,999 |
|  |  |  |  |  |  |  | **Sub Total** | **$16,999** |
| **Travel Outside Minnesota** |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  | **Sub Total** | **-** |
| **Printing and Publication** |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  | **Sub Total** | **-** |
| **Other Expenses** |  |  |  |  |  |  |  |  |
|  |  | Greenhouse space rental (St. Paul); all Activities; all years | Greenhouse space rental, needed to produce plants for field trials, and maintain stock plants for propagation and crossings; greenhouse: 375 ft2 x $0.0308/ft2/day x 365 days = $4,216/yr for 3 yrs. |  |  |  |  | $12,648 |
|  |  | Actiivity 1; Plot charges: $1000/site x 4 ROCs x 3 years | Field plot charges to produce acreage of perennial flax for 1+A/site at Rosemount, Lamberton, Morris, St. Paul; all years; all activities |  |  |  |  | $12,000 |
|  |  |  |  |  |  |  | **Sub Total** | **$24,648** |
|  |  |  |  |  |  |  | **Grand Total** | **$791,000** |

### **Classified Staff or Generally Ineligible Expenses**

|  |  |  |  |
| --- | --- | --- | --- |
| **Category/Name** | **Subcategory or Type** | **Description** | **Justification Ineligible Expense or Classified Staff Request** |

### **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: [9620ca1e-667.pdf](https://lccmrprojectmgmt.leg.mn/media/map/9620ca1e-667.pdf)

#### ***Alternate Text for Visual Component***

Overview. The University of Minnesota is breeding perennial flax to replace historic annual flax production in MN. Establishing perennial flax (Linum spp.) as a reinvigorated oilseed/fiber and a new honey crop has the potential to improve yield for farmers (with 2x harvest/yr.) and provide ecosystem services for pollinators (flowering May-November). We seek funding to provide early-stage crop development data before direct commercialization and have assembled a state-wide team of experts to ...

### **Optional Attachments**

#### ***Support Letter or Other***

|  |  |
| --- | --- |
| **Title** | **File** |
| AURI Subcontract Budget Justification | [49459c78-f4d.pdf](https://lccmrprojectmgmt.leg.mn/media/attachments/49459c78-f4d.pdf) |
| AURI Subcontract Budget | [6724384d-120.pdf](https://lccmrprojectmgmt.leg.mn/media/attachments/6724384d-120.pdf) |
| AURI Scope of Work | [f7d77019-c24.pdf](https://lccmrprojectmgmt.leg.mn/media/attachments/f7d77019-c24.pdf) |
| Perennial Flax LCCMR 2021- AURI Subrecipient Commitment Form | [01a3424c-d7a.pdf](https://lccmrprojectmgmt.leg.mn/media/attachments/01a3424c-d7a.pdf) |
| Cover Letter, University of Minnesota | [70abc512-90d.docx](https://lccmrprojectmgmt.leg.mn/media/attachments/70abc512-90d.docx) |

## **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?**
 Yes

**Does the organization have a fiscal agent for this project?**
 Yes, Sponsored Projects Administration