Environment and Natural Resources Trust Fund

2027 Request for Proposal

General Information

Proposal ID: 2027-342

Proposal Title: Rebuilding After Fire: Investigating Soil Toxicity

Project Manager Information

Name: Grace Wilson

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

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Project Basic Information

Project Summary: Soils exposed to chemicals released during structural fires will be analyzed to identify pollutants present in order to characterize soil toxicity and inform remediation efforts

ENRTF Funds Requested: $310,000

Proposed Project Completion: June 30, 2029

LCCMR Funding Category: Resiliency (A)

Project Location

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

Region(s): Metro

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

Statewide

When will the work impact occur?

In the Future

Narrative

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

Structural fires are known to release many toxic pollutants into the environment, including heavy metals and persistent organic chemicals such as per- and poly-fluoroalkyl substances (PFAS), polychlorinated dioxins and furans, and polyaromatic hydrocarbons (PAHs). However, there is little information on the presence and persistence of these toxic chemicals in the soil following structural fires. In Minnesota, there has been an increase in wildland fires that impact developed areas, which increases the number of properties at risk of soil contamination following those fires. Without adequate data on the levels of these chemicals, residents are at risk of rebuilding on properties that have significant contamination, exposing the community to toxic pollutants. It is important to gain a better understanding of contamination of soils following structural fires so that property owners and regulators can make informed decisions regarding the risks of rebuilding on a site, and can determine if remediation is necessary. This project will examine the contamination of soils following structural fires, and data collected as part of the study can be used to develop recommendations about necessary remediation.

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.

We propose to examine the contamination of soils following structural fires using a combination of data collected in a lab setting, and field sampling from a controlled burn. Our specific approach will be to:

1) Design controlled lab experiments utilizing soil cores, and measure the concentration of chemicals in the soil at different depths and at different lengths of time following exposure to pollutants

2) Conduct a controlled burn of a structure and analyze soil samples taken at different depths and times

This analysis will include known pollutants released during structural fires, including those which have been more extensively studied in soils (like lead, mercury, and other heavy metals). However, we will also include analysis of other persistent organic pollutants that are known by-products of structural fires (such as PFAS, dioxins/furans, and PAHs), which have not been studied in the soil as extensively. By examining pollution under controlled situations (in the lab or with a controlled burn), we will be able to specify contamination levels for a single structure, and investigate how environmental factors (like temperature and soil type) influence concentrations and decomposition rates.

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?

Previous scientific investigation has explored the impact of wildfires on soil contamination. However, there has been less research into soil contamination that occurs following structural fires, including fires caused due to wildfire activity. This research project will provide much needed information regarding contamination of properties following structural fires. This includes studying a larger profile of chemicals than has previously been examined in order to better understand risks to human health and the environment for disturbing soils on burned properties. The information gathered as part of this research project is needed in order to make improved recommendations regarding remediation during rebuilding.

Activities and Milestones

Activity 1: Contamination analysis using soil cores

Activity Budget: $190,000

Activity Description:
Soil cores will be collected which represent common general soil types in the state of Minnesota. These cores will be installed in a laboratory setting at the University of Minnesota with controlled environmental factors. Soil cores will be treated with chemicals known to be released during structural fires, by pouring a solution with known concentrations of the chemicals over the surface of the soil. Potential chemicals included in the analysis include: PFAS (ubiquitous in household products and found in some fire-fighting foams), polychlorinated dioxins and furans (by-products formed when PVC plastics burn), heavy metals (used in structural components of buildings), polyaromatic hydrocarbons (formed during combustion of materials used in household items), and Phos-Check (a flame retardant used in fighting wildfires). Soil samples from within each core will be analyzed at different depths and different lengths of time after treatment to determine how concentrations change following the initial exposure. This experiment will be run considering variations in environmental factors as well, such as different air temperatures or soil moisture contents, to determine their impact on chemical concentrations and degradation rates.

Activity Milestones:

Description	Approximate Completion Date
Establish soil cores and experimental design	December 31, 2027
Treat soil cores with chemicals and measure concentrations in the soil	October 31, 2028
Analyze data and summarize findings	June 30, 2029

Activity 2: Field testing of soils following controlled burn

Activity Budget: $120,000

Activity Description:
In addition to soil core experiments in the lab, we will conduct a field experiment with a controlled burn of a structure. This controlled burn will involve either an existing structure, or a small structure that we build to represent a single-room and contents fire. A suitable burn location will be identified, and we will leverage existing relationships with local fire departments in executing a burn on the site. Baseline levels of pollutants already present in the soil prior to the burn will be established by taking soil tests prior to the burn. Pollutants we will consider for analysis from the controlled burn will be the same as those considered in the soil core experiments of Activity 1 (e.g. PFAS, PAHs, dioxin/furans, heavy metals). Following the burn of the structure, soil samples will be taken at different depths and lengths of time to track movement of contaminants and their concentrations. Depending on site characteristics, we may also place shallow groundwater wells that allow us to determine if there is movement of chemicals into the shallow groundwater system in the area.

Activity Milestones:

Description	Approximate Completion Date
Identify burn location	March 31, 2028
Construct structure and conduct pre-burn soil tests	July 31, 2028
Burn structure and collect soil samples at different depth and time intervals	September 30, 2028
Finish soil sample collection and lab analysis of samples	January 31, 2029
Analyze and interpret results	June 30, 2029

Project Partners and Collaborators

Name	Organization	Role	Receiving Funds
Matt Simcik	University of Minnesota	Co-investigator	Yes

Dissemination

Describe your plans for dissemination, presentation, documentation, or sharing of data, results, samples, physical collections, and other products and how they will follow ENRTF Acknowledgement Requirements and Guidelines.
The team will give open scientific presentations and publish scientific papers addressing the project objectives. Additionally, the team will provide a summary of the key results in the form of fact-sheets and presentations to the partnering fire-fighting organizations (such as Minnesota Department of Public Safety State Fire Marshal Division), and to local government units.

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?
The team will give open scientific presentations and publish scientific papers addressing the project objectives. We expect to achieve the stated objectives of this project within the bounds of this grant timeline. However, there has been little previous research in this area, and results of this work may indicate additional research is necessary to fully characterize the chemicals, their transport, and to consider mitigation strategies. Any additional work will be funded by separate grants after completion of the deliverables from this project.

Other ENRTF Appropriations Awarded in the Last Six Years

Name	Appropriation	Amount Awarded
Characterization of Chemicals in Structural Fire Wastewater	M.L. 2024, , Chp. 83, Art. , Sec. 2, Subd. 04b	$369,000

Project Manager and Organization Qualifications

Project Manager Name: Grace Wilson

Job Title: Assistant Research Professor

Provide description of the project manager's qualifications to manage the proposed project.
Dr. Wilson received her M.S. degree in Applied Plant Sciences, and her Ph.D. in Land and Atmospheric Sciences, both from the University of Minnesota. Dr. Wilson's research and academic experiences have focused on watershed hydrology, pollution of surface and groundwater, and soil health topics. Her long-term research interests involve finding solutions to water and soil resources problems using methods that combine chemical, biological, and physical sciences. Previous grant funding has been awarded for research projects focused on water quality in agricultural and urban watersheds, including studying pollutants resulting from structural fires. Through a recent grant with LCCMR investigating pollutants found in the wastewater of structural fires, her research group has amassed information about chemicals released in water following structural fires, and has developed the relationships with local firefighting agencies needed to provide support for planned burning activities.

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

Organization Description:
The College of Food, Agriculture, and Natural Resources Sciences (CFANS) at the University of Minnesota is dedicated to using science to find answers to the world's grand challenges and solve tomorrow's problems. The College includes twelve academic departments along with ten research and outreach centers, all representing a range of disciplines and research expertise. This breadth of expertise allows the College to tackle challenges in novel ways, including the Grand Challenge research and education investments program which specifically focuses on research geared towards water resources and uses.

Budget Summary

Category / Name	Subcategory or Type	Description	Purpose	Gen. Ineligible	% Benefits	# FTE	Classified Staff?	$ Amount
Personnel								
Faculty BBE Dept/ contract position, appointment dependent on funding		Manage project and consult on analysis of results; general grant management			36.6%	0.5		$58,010
Faculty Public Health		Manage project and consult on analysis of results; general grant management			36.6%	0.1		$26,363
Researcher		Conduct analysis of results; manage sample collection; general grant management			36.6%	0.1		$5,464
Graduate student		Provide research support and data analysis support			26.1%	1		$113,252
Undergraduate student		research support			0%	0.1		$3,911
							Sub Total	**$207,000**
Contracts and Services								
SGS Labs	Service Contract	Lab analysis for select chemicals				2		$94,000
							Sub Total	**$94,000**
Equipment, Tools, and Supplies								
	Tools and Supplies	Lab supplies	Supplies used to set-up soil core experiments (e.g. pipe and other supplies to build soil core systems)					$2,000
	Tools and Supplies	Controlled burn materials	Supplies required to build a structure and collect samples from controlled burn					$4,000
	Tools and Supplies	Lab analysis	Supplies and reagents to support internal lab analysis					$2,500
							Sub Total	**$8,500**

Capital Equipment								
							Sub Total	**-**
Acquisitions and Stewardship								
							Sub Total	**-**
Travel In Minnesota								
	Miles/ Meals/ Lodging	up to approximately 700 miles of travel assuming $0.7/mile	travel to and from controlled burn sites and picking up equipment and supplies					$500
							Sub Total	**$500**
Travel Outside Minnesota								
							Sub Total	**-**
Printing and Publication								
							Sub Total	**-**
Other Expenses								
							Sub Total	**-**
							Grand Total	**$310,000**

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	**-**

Total Project Cost: $310,000

This amount accurately reflects total project cost?

Yes

Attachments

Required Attachments

Visual Component

File: 527fa4a7-5cc.pdf

Alternate Text for Visual Component

Image of burning building with illustrations and text showing the outline of the project goals as numbered list: 1) fires generate toxic chemicals that leach into the soil, 2) soil sampling to investigate, 3) recommendations for rebuilding safely....

Supplemental Attachments

Capital Project Questionnaire, Budget Supplements, Support Letter, Photos, Media, Other

Title	File
UMN SPA approval letter	e57c1eea-0ab.pdf

Administrative Use

Does your project include restoration or acquisition of land rights?

No

Do you understand that travel expenses are only approved if they follow the "Commissioner's Plan" promulgated by the Commissioner of Management of Budget or, for University of Minnesota projects, the University of Minnesota plan?

Yes, I understand the UMN Policy on travel applies.

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

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?

No

Does your project include the pre-design, design, construction, or renovation of a building, trail, campground, or other fixed capital asset costing $10,000 or more or large-scale stream or wetland restoration?

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 as "the provision of care, treatment, education, training, instruction, or recreation to children")?

No

Provide the name(s) and organization(s) of additional individuals assisting in the completion of this proposal:

Wendy Moylan, University of Minnesota

Do you understand that a named service contract does not constitute a funder-designated subrecipient or approval of a sole-source contract? In other words, a service contract entity is only approved if it has been selected according to the contracting rules identified in state law and policy for organizations that receive ENRTF funds through direct appropriations, or in the DNR's reimbursement manual for non-state organizations. These rules may include competitive bidding and prevailing wage requirements

Yes, I understand