Environment and Natural Resources Trust Fund
2018 Request for Proposals (RFP)

Project Title: **ENRTF ID: 097-B**

A Multi-Faceted Approach Towards Reducing Nitrogen Inputs and Loss in Urban Landscapes

Category: B. Water Resources

Total Project Budget: $ 284,300

Proposed Project Time Period for the Funding Requested: 3 years, July 2018 to June 2021

Summary:

Using in-person assessments to determine actual amount of fertilizer applied to lawns in conjunction with biological nitrification inhibition techniques to reduce amount of fertilizer applied to lawns.

Name: Jon Trappe

Sponsoring Organization: U of MN

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Location

Region: Metro

County Name: Hennepin, Ramsey

City / Township:

Alternate Text for Visual:

Visual aide portrays problems associated with applying fertilizer applied to home lawns (off-site movement of granules), describes the proposed activities to alleviate this problem, and the researchers proposed extension and outreach activities to homeowners to encourage responsible management practices of lawns.

_____ Funding Priorities	_____ Multiple Benefits	_____ Outcomes	_____ Knowledge Base
_____ Extent of Impact	_____ Innovation	_____ Scientific/Tech Basis	_____ Urgency
_____ Capacity Readiness	_____ Leverage	_____ TOTAL	_____%

PROJECT TITLE: A multi-faceted approach towards reducing nitrogen inputs and loss in urban landscapes

I. PROJECT STATEMENT

Why: Nitrate losses from fertilizer applications are a significant contaminant for Minnesota watersheds. We know very little about the amount and types of fertilizer applied to home lawns in Minnesota; this information would allow us to better inform the public about proper fertilization practices and help inform public policy. Every previous attempt at quantifying fertilizer applied to home lawns on a national or local level has relied on self-reporting of survey responses to estimate homeowner practices. Consequently, we do not know how much fertilizer is being applied to home lawns and our attempts at estimating the impact of lawn fertilization may be inaccurate and potentially missing other sources of nitrogen loss in the urban environment. There is also a need to reduce nitrogen inputs through changes in management practices and through the development of turfgrasses that need less nitrogen fertilizer. Biological Nitrification Inhibition (BNI) is a process resulting from a natural, plant secreted root exudate that reduces nitrate accumulation in the soil and therefore also reduces its potential to pollute the environment. Because BNI ability has been previously described in pasture grasses and various cereal crops, turfgrass species are very likely to possess the same ability. To our knowledge, there is no information in the scientific literature about the potential BNI of turfgrasses despite being an important avenue towards reducing nitrogen loss in perennial urban green spaces.

Goals: (1) Our main goal is to reduce the amount of nitrogen applied to lawns. Reducing the amount of nitrogen applied to lawns would decrease the amount of nitrogen entering waterways and diminish greenhouse gas emissions associated with their application. We will achieve this goal by quantifying the difference between perceived and actual amount of fertilizer applied by homeowners and lawn care operators and then targeting education efforts based on this information. (2) Our second goal is to screen commonly-used lawn grasses to determine if BNI is occurring and to what extent. If BNI is being activated by certain lawn grasses, this has the potential to lessen greenhouse gas emissions and nitrate leaching, thereby improving water quality in Minnesota.

Outcomes: Knowledge of actual homeowner fertilization practices is necessary for improving education and outreach methods of turfgrass scientists. Identifying the BNI ability of perennial grasses will result in more sustainable perennial grass systems through improved management and breeding.

How: We are proposing a holistic approach to this problem. First, we need to better understand how and when homeowners apply nitrogen to lawns, which will help us better educate the public about proper fertilization practices and also help social scientists understand the motivations that lead to over and under fertilization. This project will accomplish these goals by first implementing pre- and post-assessment surveys (Activity 1) throughout the growing season of approximately 150 home lawns in the Twin City metro area. In person observation will be used to determine the difference between the homeowner's perceived and actual fertilization practices. For Activity 2, we will investigate how turfgrasses can play an active role in nitrogen use reduction through BNI. We will assess the potential BNI of various (39) low-input perennial grasses in laboratory conditions using a published bacterial bioassay. In Activity 3, we will use information from in-person observations will be used to inform the creation of new outreach efforts such as new Extension publications and videos along with an educational field day for homeowners.

II. PROJECT ACTIVITIES AND OUTCOMES

Activity 1: Pre- and Post-assessment lawn fertilization surveys and estimation of average amount of N applied. **Budget: $128,234**

In person observations conducted twice in the growing season for the approximately 150 lawns will determine actual fertilization practices, including application timing, amount applied, and method of application. Because fertilizer applications are often weather dependent, we will conduct a second survey and in-person assessments using a separate but similar group of homeowners in year 2 of the experiment. Data from this experiment will allow researchers to better understand the impact of lawn fertilizations on MN waterways and the global environment.

Outcome	Completion Date
1. Six neighborhoods of representative socioeconomic backgrounds will be selected and surveyed within the Twin City area.	November 2018

2. Selected survey respondents will be visited by project team members in order to determine actual fertilizer amount and method applied during fertilization events.	March-November 2019, 2020
3. Submission of manuscripts for publication in peer-reviewed journal	June 2021

Activity 2: Examination of biological nitrification inhibition in low input perennial grass systems. **Budget: $94,381**

The BNI capacity of 39 low-input perennial grasses will be examined with a bacterial bioassay. The data obtained will be shared with turf professionals through trade journals and posted on the Turfgrass Science Blog of the UMN (turf.umn.edu). Results will be presented at scientific meetings and used for scientific publications.

Outcome	Completion Date
1. Laboratory experiment for BNI study	July 2020
2. Submission of manuscripts for publication in peer-reviewed journal	June 2021

Activity 3: Educate homeowners of responsible fertilization practices. **Budget: $61,687**

Results from Activity 1 and 2 will inform extension and outreach programing for homeowners and lawn care operators regarding best management practices and ways to reduce environmental impact of lawn fertilization.

Outcome	Completion Date
1. A field day specifically for homeowners concerning best management practices	June 2020
2. Extension publications detailing best management practices for lawn fertilization will be published and made free to public	June 2021

III. PROJECT STRATEGY

A. Project Team/Partners

Eric Watkins (Co-PI, paid), Professor in Turfgrass Science and Breeding (Dept. of Horticulture, Univ. of Minnesota) will be the principal coordinator for Activity 2. **Brian Horgan** (Co-PI, unpaid), Professor and Extension Turfgrass Specialist (Dept, of Horticulture, Univ of Minnesota) will coordinate the extension activities outlined in Activity 3. **Kristen Nelson** (Co-PI, paid), Professor of Natural Resources (Dept of Forest Resources, Univ. of Minnesota) will write and distribute the pre- and post-assessment surveys outlined in Activity 1. **Jon Trappe** (PI, paid), Postdoctoral Research Associate (Dept. of Horticulture, Univ. of Minnesota) will conduct the in person observations and data analysis outlined in Activity 1. **Florence Sessoms** (Researcher 5, paid), Researcher (Dept. of Horticulture, Univ. of Minnesota) will be responsible of the BNI experiment in low N input perennial grasses as outlined in Activity 2.

B. Project Impact and Long-Term Strategy

This research will be the first study of its kind to directly quantify and further estimate the amount of fertilizer applied to home lawns in the Twin Cities. This research will enable us to better understand the extent of home lawn care practices and allow scientists to make recommendations towards reducing their impact on the environment. Ultimately, the unravelling of BNI activity of grasses will benefit numerous and various stakeholders including homeowners, public land managers, professional turf and landscape managers (hundreds in the Twin Cities alone), sod farmers (approximately 50), grass seed producers (over 100 farmers in northern Minnesota), state agencies such as MnDOT, seed companies (numerous) and the broader scientific community.

C. Timeline Requirements

Because funding of approved projects will not commence until July 1, 2018 (after homeowners have begun maintaining their lawns in 2018), the remainder of the 2018 growing season (July-December) will be used to locate and contact potential participants. Once an appropriate and representative number of participants have agreed to be a part of the experiment, in-person observations will begin prior to the initiation of homeowner planned lawn care activities in spring 2019 and 2020 for the first and second runs, respectively, of the experiment. The BNI study will start in July 2018 and will be completed in December 2020. Once the experiment has been initiated (for activities 1 and 2), no anticipated specific timing constraints before or during this research implementation are expected.

2018 Detailed Project Budget

Project Title: A multi-faceted approach towards reducing nitrogen inputs and loss in urban landscapes

IV. TOTAL ENRTF REQUEST BUDGET 3 years

BUDGET ITEM	AMOUNT
Personnel:	$ -
E. Watkins (Co-PI), and K. Nelson (Co-PI), partial summer salary support (Each are on 9 mo. Appointments) + fringe + 3% inflation. Watkins (0.23 FTE/yr), .25 mo: $7,682 + $2,573, Nelson (0.23 FTE/yr), 0.25 mo: $8,487 + $2,843.	$ 21,585
Partial salary support for F. Sessoms (Researcher 5), who is conducting research for Activity 2: (3.6 FTE/yr) (30%) + fringe + 3% inflation, 47,755 + 15,998. Partial salary support for J. Trappe (PI), who is conducting research and extension activities for activity 1: (9.0 FTE yrs 1 & 2) (75%) + fringe + 3% inflation, and activity 3 (3.0 FTE yr 3) (25%) + fringe +3% inflation, 115,909 + 24,805.	$ 204,467
One part-time summer undergraduate to assist with on-site assessment and soil sampling in Activity 1, (3.7 FTE/yr) $11,520 ($12/hr, 30 hrs/wk/, 16 wks/yr, 2yrs) and one part time summer advanced undergraduate to assist with Qualtrics data in Activity 1, (0.23 FTE/yr) $480 ($12/hr, 40/hrs x 1 wks)	$ 12,000
Equipment/Tools/Supplies:	
Supplies for creating hydroponic containers used in Activity 2.	$ 1,050
Lab supplies for bioassays for Activity 2	$ 4,900
Growth chamber and greenhouse charges for Activity 2	$ 500
UMN Soil analysis lab - ammonium analysis for 2000 samples for Activity 2	$ 15,000
Travel:	
Vehicle expenses to visit on-site evaluation locations in Activity 1; help defray costs of UMN leased vehicle mileage and gas = $3000/ year for years 1 and 2 for Activity 1.	$ 6,000
Additional Budget Items:	
Educational and Outrach Materials: signs, website work, brochures, handouts, pubs, press releases, tri-fold pamphlet, online updates, etc	$ 5,500
Soil samples for survey participants (4,500/yr, 2yrs)	$ 9,000
Survey research $2,150/ year mailings, data analysis, info materials, for Activity 1	$ 4,300
TOTAL ENVIRONMENT AND NATURAL RESOURCES TRUST FUND $ REQUEST =	$ 284,302

V. OTHER FUNDS

SOURCE OF FUNDS	AMOUNT	Status
Other Non-State $ To Be Applied To Project During Project Period:	N/A	N/A
Other State $ To Be Applied To Project During Project Period:	N/A	N/A
In-kind Services To Be Applied To Project During Project Period:	N/A	N/A
Funding History:	N/A	N/A
Remaining $ From Current ENRTF Appropriation:	N/A	N/A

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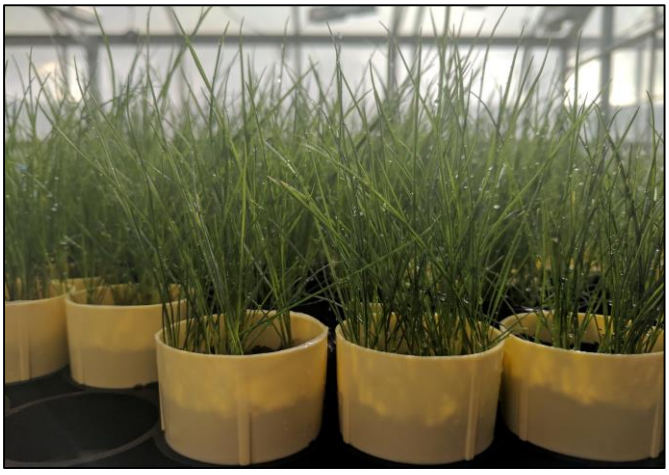
Driven to Discover℠

Reducing Nitrogen Applied to Home Lawns

Our goal is to reduce the amount of fertilizer applied to lawns to diminish the amount of nitrogen entering waterways and decrease greenhouse gas emissions associated with their application.

Activity 1: Implementation of pre- and post-assessment surveys throughout the growing season of multiple home lawns in the Twin City metro area.



Activity 2: Study of the potential biological nitrification inhibition of various perennial grasses in laboratory conditions.

Activity 3: We will use what we learn from Activities 1 and 2 to educate homeowners regarding responsible fertilization practices via outreach education, trade journals, a turf blog, and peer review publications

Environment and Natural Resources Trust Fund (ENRTF)
Project Manager Qualifications and Organization Description
Project Title: A multi-faceted approach towards reducing nitrogen inputs and loss in urban landscapes

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Dr. Jon Trappe is currently serving as a Postdoctoral Research Associate at the University of Minnesota. He has 16 years of experience working in the turfgrass industry as either an academic or professional. Dr. Trappe's research and education goals are centered on reducing water and fertilizer inputs to turfgrass systems. Already in his young career as a turfgrass scientist, Dr. Trappe has received various accolades from his peers in the forms of scholarships and awards for his work in turfgrass research and extension.

As a member of the turfgrass science research team at the University of Minnesota, Dr. Trappe is committed to pursuing research efforts that reduce inputs to turfgrass systems. He has conducted numerous research on turfgrass management practices that mitigate greenhouse gases, enhance soil carbon sequestration potential, reduce fertility, irrigation, mowing, and pesticide requirements, and improve establishment.

Dr. Trappe also values the importance of communicating recent scientific advancements to the stakeholders in the green industry. In his 10 years as an extension educator, Dr. Trappe has presented 35 extension talks to over 3,000 homeowners and professionals in the green industry. Dr. Trappe has also published numerous extension publications, popular press articles, blog posts, in addition to conducting on-site consultation visits with turfgrass professionals and homeowners alike. This broad extension and outreach experience has allowed him to work closely with turfgrass managers of multiple demographics and provide expert advice that is both relevant and environmentally sound.

Turfgrass Science Research Lab, Department of Horticultural Science, University of Minnesota
The University of Minnesota's Turfgrass Science Program conducts field-based research and offers education and consultation to both turfgrass professionals and homeowners. The Turfgrass Science Research Lab consists of seven faculty and extension positions, six full-time research staff, and six graduate students. This proficient research team has published over forty peer-reviewed journal articles in the last 10 years.