REDUCING WATER USE ON TWIN CITIES LAWNS THROUGH RESEARCH, EDUCATION, AND OUTREACH
UNIVERSITY OF MINNESOTA TURFGRASS SCIENCE

September 2023

METROPOLITAN COUNCIL

The Council's mission is to foster efficient and economic growth for a prosperous metropolitan region

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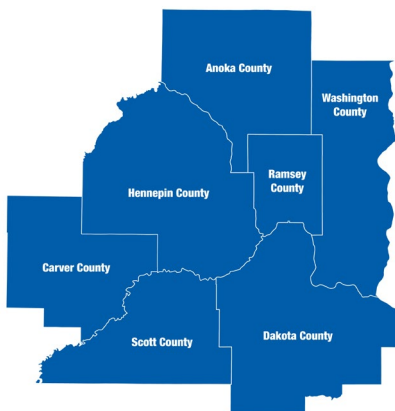
The Metropolitan Council is the regional planning organization for the seven-county Twin Cities area. The Council operates the regional bus and rail system, collects and treats wastewater, coordinates regional water resources, plans and helps fund regional parks, and administers federal funds that provide housing opportunities for low- and moderate-income individuals and families. The 17-member Council board is appointed by and serves at the pleasure of the governor.

Objective 1: Deliver Innovative Lawn Water Conservation Outreach Programs

Mobile Education Trailer and Met Council Booth Summary

Throughout the spring and summer of 2022, UMN Turfgrass Science team representatives visited fourteen neighborhoods, fairs, and events to share our knowledge and best management practices for lawn water conservation (Table 1 and Figure 1). Each event offered a chance to promote water conservation and environmental stewardship, with the opportunity to change the public's water use behavior through education (Figures 2 and 3). While questions varied by venue, overall interest in our expertise remained very popular. Some topic examples included:

- Best watering practices
- Smart irrigation products
- Summer drought issues
- Low-input lawns
- Grass seed selections and timing
- Dormant seeding
- Bee lawns

Table 1. Mobile education outreach events.

| Date	Event	Location
4/30/2022	Watershed Cleanup Day	Lakeville
5/07/2022	Environmental Fun Fair	Fridley
5/21/2022	Annual Trista Day	Minnestrista
6/04/2022	LakeFest	Eagan
6/28/2022	Summer in the City	Coon Rapids (Rockslide Park)
7/12/2022	Summer in the City	Coon Rapids (Crooked Lake Park)
7/16/2022	Washington County Master Gardener Tour	Oakdale/Maplewood
7/16/2022	Longfellow Garden Club Event	Minneapolis
8/07/2022	Camden Neighborhood Market	Minneapolis
8/20/2022	Blue Heron Days	Lino Lakes
8/21/2022	Camden Neighborhood Market	Minneapolis
8/25/2022 – 9/5/2022	Minnesota State Fair	Falcon Heights
9/10/2022	Brown's Creek Watershed District	Stillwater
9/17/2022	Operations & Maintenance Open House	Brooklyn Park
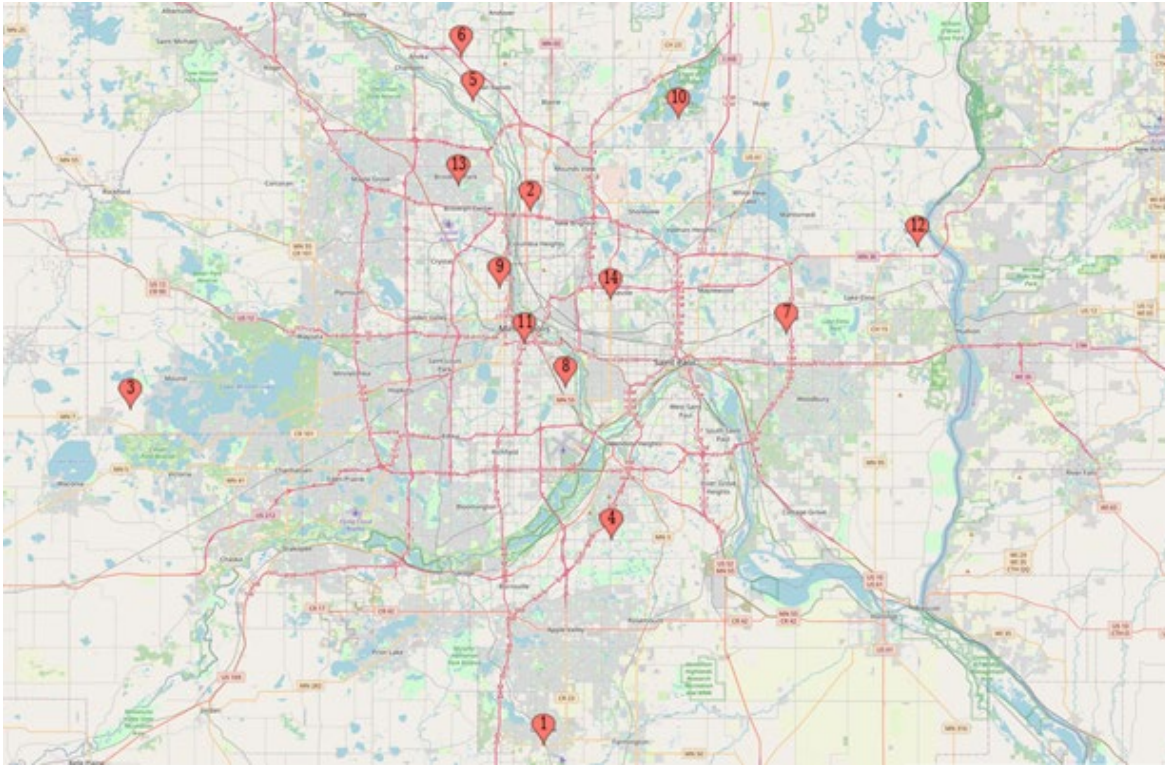
Figure 1. Locations of the mobile education outreach events.

Figure 2. Table setup with turfgrasses and bee lawn plants. Photo - Kim Sullivan.

Figure 3. Education trailer on display at outreach event. Photo - Dom Christensen.

Many people who visited us are familiar with our website and have a desire to improve their water use needs for a variety of reasons. Every resident has a unique situation or question, so it is important to have an abundance of information for their individual needs. We have examples of smart irrigation components, low-input turfgrasses, lawn weeds, handouts, and QR codes leading directly to our website and other turfgrass information. Each outreach event was advertised on our blog and tweeted to our 3,000 Twitter followers. An example of a blog post is UMN Turfgrass Team at Blue Heron Days!

Minnesota State Fair Lawn Water Efficiency Exhibit
As we have in the past several years, the turfgrass research group had an educational exhibit on display (Figures 4 and 5) in the College of Food, Agricultural and Natural Resources Sciences wing of the Agriculture Horticulture building at the Minnesota State Fair. Members of our entire team took turns staffing the booth for shifts from 9:00 a.m. to 9:00 p.m. for the twelve days of the fair (August 25 - September 5, 2022). While the 2022 Minnesota State Fair did not break any attendance records, the number of people who attended was 1,842,222 (Minnesota State Fair, 2022), which was still quite robust and about half a million more people than in 2021.

Figure 4. Potted weed and cool-season turfgrass species for identification at the Minnesota State Fair. Photo - Kristine Moncada.

Figure 5. Irrigation and lawn watering educational materials at the Minnesota State Fair. Photo - Kristine Moncada.

Our exhibit featured low-maintenance turfgrass species, smart irrigation controllers, and educational materials promoting water use efficiency. The exhibit allowed our team to answer any lawn care questions that fairgoers had from finding the right low-input grass seed to controlling weeds to best watering practices during a drought. The overall goal of this outreach event as it relates to lawn water conservation is to promote the importance of irrigation system audits, increase awareness about state regulations for landscape irrigation, and demonstrate some of the newer smart irrigation technologies.

We provided different handouts to fairgoers that included: Tips for Drought (about 300 copies distributed), Auditing Irrigation Systems and other Water-saving Strategies for Home Lawns, (about 300 copies distributed), and Turfgrass Species for Minnesota Lawns (about 1400 copies distributed), as well as several other handouts.

The state fair exhibit is one of the most productive events that we conduct on behalf of the Metropolitan Council. It provides us the opportunity to reach thousands of residents in the region and we have found this booth gets both a positive reaction and much attention from fairgoers. The 2022 (as was 2021) summer had been very dry for most of Minnesota and many people wanted to know how to care for their lawns during a drought; at times such as these, our services are needed more than ever.

Websites and Social Media
Because the Lawn Water Conservation educator position was unfilled for most of 2022, we are behind on updating the UMN Extension Lawn Care website with the new content on lawn water conservation that we had planned. However, with our newly hired educator, as well as a new Turfgrass Extension Educator who was hired at the end of 2022, we are in the process of expanding lawn water conservation web content.

One web highlight of 2022 was the development of a webpage devoted to a group of low-input turfgrass species - the fine fescues - that we often recommend in our outreach activities. "Planting and maintaining a fine fescue lawn" features the information that homeowners need to install and manage a fine fescue lawn that ultimately uses less water and fertilizer than traditionally used turfgrasses in Minnesota. This content and the other content we will develop will be something we utilize often for our Metropolitan Council events in upcoming years.

Another platform from Extension that we have and will continue to use to provide lawn water conservation tips is the Yard and Garden News website and newsletter. An example of articles from our group in 2022 is "Mid-summer lawn care" and "Recover, restore and maintain your lawn after drought".

Our group has a project website at turf.umn.edu that receives good traffic (approximately 200,000 pageviews per year). We use this and our @UMNTurf Twitter account (about 300,000 impressions per year) to publish content on lawn water conservation and to promote our mobile education trailer events. Blog posts and general pages we published or updated on our website (as well as tweeted) in 2022 included "Different mixtures of turfgrass species and their drought stress tolerance" and "May I Not Mow in May?"

In 2022, the UMN Turfgrass Science team started publishing an email newsletter devoted to home lawn care. In 2022 we gathered 720 subscribers. Our goals with this newsletter overlap with the Metropolitan Council project goals. These include educating residents on the best time to fertilize, how much to water, and using low-input species such as the fine fescues. The newsletter is monthly (except for December and February) and is a convenient way to promote our mobile education trailer, which we have been doing under our Events section. Please refer to the previous issues on our Lawn Care Newsletter webpage for examples.

Rely on Rain Initiative

From our partnership with the University of Minnesota Carlson Brand Enterprise (CBE) program from the University's Carlson School of Management, several high-impact ideas were created for maximizing our outreach and education efforts. The slogan "Rely on Rain" was one that we found compelling due to its direct and succinct message. We introduced Rely on Rain stickers (Figure 6) at our trailer events in 2022, and they were very popular.

Figure 6. Rely on Rain stickers. The sticker backing liner (not shown) has text that includes "Rely on Rain instead of irrigation for your lawn's water needs!".

We plan to refine the Rely on Rain design and then use it as appropriate in materials at all our events, in print and online publications, and in our displays.

Objective 2: Diffusion Network Project

Individuals can play a significant role in driving both individual level changes in their own yards but also changes among neighbors, and can slowly shift neighborhoods towards alternative practices. This is coupled with research conducted in the Twin Cities about the importance of neighbors as sources of information regarding specific yard maintenance techniques and broader dialogues about what's acceptable in a yard. Combined, the effects of a neighborhood 'yard maverick' who's educated and knowledgeable about best management practices could help shift neighborhoods toward sustainable yard maintenance practices.

We have been developing a pilot plan for the 'yard maverick' program in two neighborhoods, with Gary Deters (lawn water conservation educator) and Kim Sullivan (Master Gardener) serving as leads. The plan is for this pilot study to be used to evaluate effective types of lawn water conservation information, questions and concerns amongst residents, and common barriers and pitfalls in organizing neighborhood events. We have been working with University of Minnesota Extension on the recruitment of Master Gardener volunteers to launch the formal project.

Objective 3: Development of Research-Based Educational Material

Landscape Arboretum Efficient Irrigation Demonstration Area

Located at the Minnesota Landscape Arboretum, the irrigation system demonstration area did not receive regular maintenance during 2022 without a Lawn Water Conservation Educator in place (Figure 7). The low-maintenance turfgrass only received rainfall as its source of water in a year that was droughty. Since there was not consistent maintenance and supplemental water, summer weeds were able to germinate and out compete some areas in the turfgrass plots. Some of the original belowground irrigation parts from installation began to fail which has led to leaks and inconsistencies. The plan for 2023 is to update all below ground parts and nozzles. In November, the area was dormant seeded with fine fescues to hopefully fill in weak areas. Overall, the area is in good shape and with consistent management we are confident we will have a good demonstration plot for the many Arboretum visitors.

Figure 7. Landscape Arboretum Efficient Irrigation Demonstration Area. Photo - Gary Deters.

Optimal Cool-Season Turfgrass Species Mixture Project

Dry summers in Minnesota have been a source of trouble in lawns, turning the green lush landscape to withered brown. Without adequate irrigation, the expectation of a fantastic looking lawn is becoming unrealistic. To investigate this problem, we developed a field experiment during the summers of 2021 and 2022 to find the most optimal cool-season turfgrass species mixture and evaluate the effect of mycorrhizal inoculant for improved drought tolerance. This project will help to understand which

turfgrass mixtures result in better drought tolerances and whether an application of mycorrhizae inoculant assists in better water holding capacities.

The study consisted of two 30-day drought and two 30-day recovery periods with monocultures of Kentucky bluegrass, hard fescue, and perennial ryegrass; along with several mixtures of any two of these in 2:1 ratios by pure live seed (66% hard fescue: 33% perennial ryegrass, for example). Each of these mixtures were tested with and without mycorrhizae applied. The field experiment set-up was established under a rainout shelter structure that can be moved when needed to keep precipitation out (Figure 8).

Figure 8. The rainout shelter and plots. Photo - Gary Deters.

Data collection consisted of volumetric water content data to confirm the progression of the artificial drought. Species composition, turf quality, photochemical efficiency (fv/fm) and digital images were taken to evaluate species presence and incidence after complete establishment, and at the end of the drought-recovery experiments. Our goal was to assess the evolution of species composition in turfgrass mixtures from seeding, end of establishment, and drought-recovery treatments.

We found that the first drought-recovery period tends to be more stressful on the plants than the second drought-recovery, leading to the idea that the plants may adapt overtime. At the end of the first recovery the percent green averaged 57.29% and in the second recovery the average is 62.18%. Hard fescue displayed the best drought performance throughout the experiment indicating a limited stress response. Mixtures with hard fescue had the highest percent green throughout drought-recovery periods and stayed the most consistent in terms of percentage within species growth (Figure 9). Mycorrhizal inoculation did not have an effect on turf performance.

Figure 9. A visual comparison of turf pictures taken from different times in the experiment in the field. PRG = perennial ryegrass; KBG = Kentucky bluegrass; HF = hard fescue. Photo – Florence Sessoms.

A similar experiment was also run in environmentally controlled conditions, except we did not evaluate the effect of mycorrhizal inoculation. The same species, cultivars, and mixtures were established in large square pots for 15 weeks in greenhouse conditions (Figures 10 and 11). The pots were then moved in a growth chamber and acclimated for a two-week period prior to the beginning of the drought-recovery experiments. For this experimental set-up, the drought only lasted 21 days as we observed a faster decrease of the volumetric water content during the drought periods. The recovery lasted 28 days, like the field experiment. As for the field experiment, the data taken consisted of species composition, digital image, turf quality, and measures of turf health.

Figure 10. Digital image of the experimental set-up in environmentally controlled conditions. Photo - Florence Sessoms.
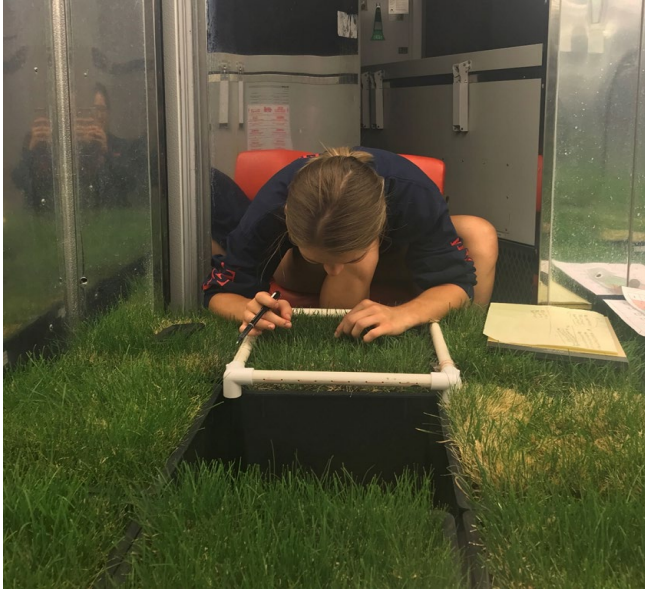
Figure 11. Gridline methodology to assess species composition in our environmental control study. Photo - Florence Sessoms.

Preliminary observations revealed that the first drought resulted in lower turf quality, percentage of green, and NDVI (Normalized Difference Vegetation Index, a measure of turf health) compared to the second drought period (Figure 12). We made the same hypothesis that turfgrass stands were able to better resist the second period from an adaptation process provoked by the first drought.
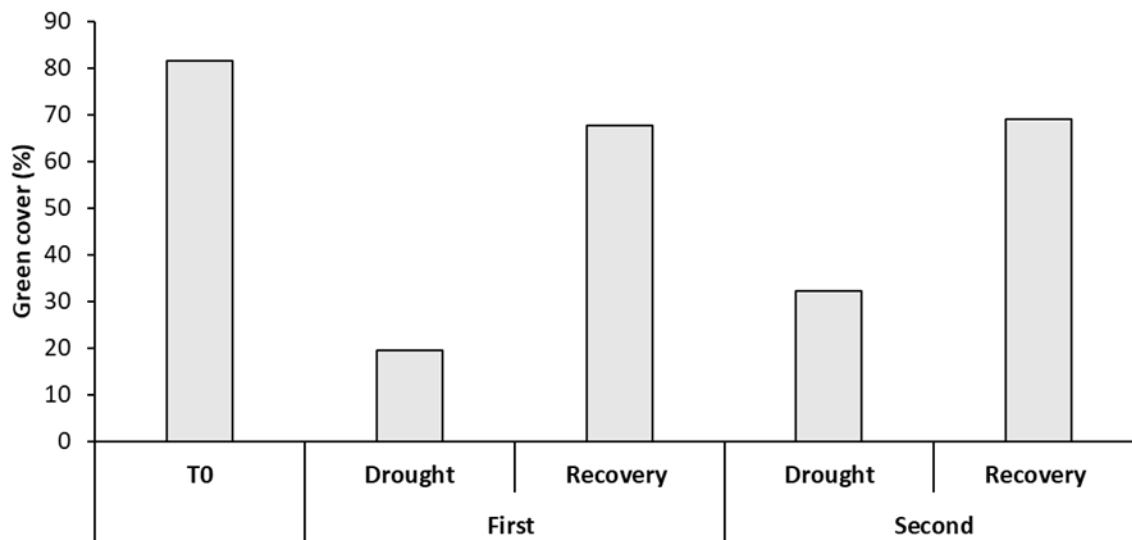

Figure 12. Overall percentage of green cover for all pots at the beginning of the first run (T0), and at the end of the drought and recovery periods.

In addition, hard fescue was the dominant species (determined by species composition after full establishment) and showed a higher percentage of green during the drought periods (Table 2). The

hard fescue dominant mixtures after establishment were: 100HF, 67HF+33KB and 67KB+33HF. All of these mixtures presented the highest percentage of green at the end of the first drought period. The results contrasted less for the second drought, as the drought intolerant species (Kentucky bluegrass and perennial ryegrass) seem to present a better drought tolerance during the second drought.

Table 2. Percentage of green cover for each individual time point (T0, 21d after drought, 28d after recovery). Each time point was analyzed separately; different letters indicate a significance at p <0.05. HF = hard fescue; KB = Kentucky bluegrass; PR = perennial ryegrass.

% species at seeding	T0	First round		Second round	
		Drought	Recovery	Drought	Recovery
100 HF	84.27	38.40 a	73.82	47.54 a	67.93
67 HF + 33 KB	86.09	26.27 b	61.54	29.05 c	67.06
67 HF + 33 PR	80.94	14.50 c	69.31	30.83 c	72.52
100 KB	87.86	14.38 c	69.42	32.93 bc	75.42
67 KB + 33 HF	87.32	25.99 b	71.64	42.49 ab	62.29
67 KB + 33 PR	82.13	10.85 c	71.09	28.40 c	73.63
100 PR	76.83	5.84 c	67.87	25.18 c	67.63
67 PR + 33 HF	76.72	8.44 c	67.51	23.70 c	70.42
67 PR + 33 KB	78.13	11.22 c	70.40	25.27 c	74.48

We have a blog, "Different mixtures of turfgrass species and their drought stress tolerance", with more information and a scientific publication is in progress. As we continue to work on cool-season species in turf, UMN turfgrass research hopes to find clear results on drought-tolerant species and use this knowledge to empower the community to find sustainable seed options for lawns in Minnesota.

Research Publications

Peer-reviewed publications are important because they contribute to the advancement of knowledge in a particular discipline or field of study, ensure our work is distributed to other researchers, help give support to recommendations, and can be communicated to decision makers. Three such publications have been published recently as a direct result of a survey funded through this project.

Barnes, M.R., C. Yue, and E. Watkins. 2021. Homeowner perceptions of watering restriction scenarios in the Minneapolis–St. Paul metropolitan area. *Crop, Forage & Turfgrass Mgmt*. 2021; 7:e20131. https://doi.org/10.1002/cft2.20131 [Open Access]

Kong, X., C. Yue, E. Watkins, M. Barnes, and Y. Lai. 2022. Investigating the effectiveness of irrigation restriction length on water use behavior. *Water Resources Management*. https://doi.org/10.1007/s11269-022-03367-y

Yue, C., M. Cui, X. Kong, E. Watkins, and M. Barnes, 2022. Landscape irrigation and water conservation in urban areas: An analysis of information-based strategies. *HortTechnology* 32(2): 213-225. https://journals.ashs.org/horttech/view/journals/horttech/32/2/article-p213.xml [Open Access]

Hiring of New Lawn Water Conservation Educator

Figure 13. Gary Deters, our Lawn Water Conservation educator.

We are excited to announce that Gary Deters (Figure 13) is our new lawn water conservation educator! Gary, who spent 23 years in golf course turf management, six of those years as a superintendent at St. Cloud Country Club, has been our field facility manager since March 2020. In his new role, Gary leads outreach and education efforts aimed to reduce water use on lawns in the Twin Cities through the implementation of technology, public demonstrations of low maintenance grasses and irrigation systems, and drought tolerant cool-season turfgrasses.

Hiring of New Extension Educator

Figure 14. Dr. Jon Trappe, our Turfgrass Extension Educator

Dr. Jon Trappe is providing Extension support to all Minnesotans within and around the turfgrass industry. His Extension program focuses on educating homeowners and professionals within the industry to maintain or improve turf conditions with fewer resources. Jon is also passionate about educating the public about the environmental and recreational benefits of turf.

Reference

Minnesota State Fair. 2022. Attendance | Minnesota State Fair. https://www.mnstatefair.org/about-the-fair/attendance/

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