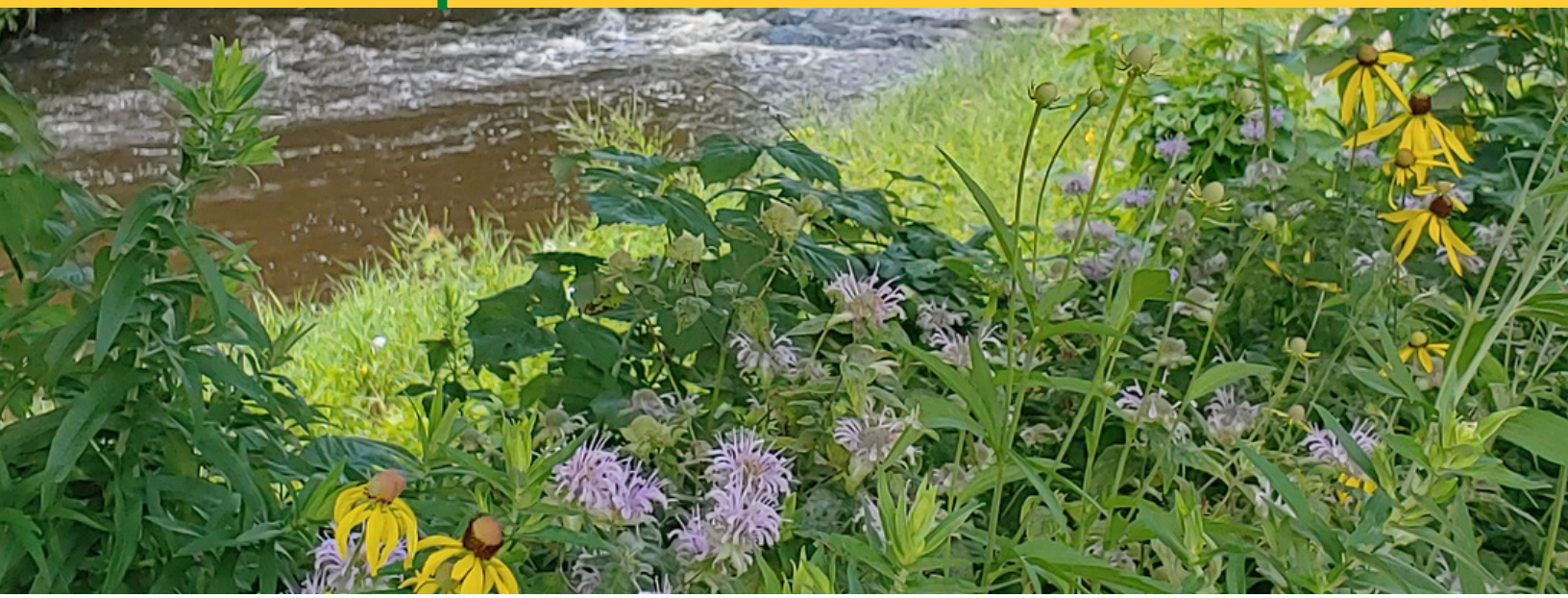
WAYNE STATE UNIVERSITY

SMART MANAGEMENT OF MICROPLASTIC POLLUTION IN THE GREAT LAKES

Community Engagement Summary & Lessons Learned



Community Engagement Project Overview

This portion of the project engaged households across Michigan using a variety of methods and demonstrated that awareness of microplastic pollution can be increased through community engagement. It was beneficial to use a variety of outreach methods in our target communities, reaching 108,880 individuals and engaging 15,996 using brief, accessible and empowering messages, focusing on microplastics as a “here and now” problem. Recycling and "macroplastic" pollution were used as a gateway for increasing understanding of microplastic pollution, aligning our project with reduction campaigns like "Plastic Free July" to build upon familiar themes with a broad reach. Our target communities were supportive as evidenced by municipal staff time and outreach avenues such as websites, social media, newsletters, mailings and meeting space. Successful engagement strategies were connected to activities or values a community was already passionate about such as classroom education, litter clean-up, demonstration sites, sculptures and interpretive signage. Visual reminders that communities are taking action on this issue had powerful community impacts.

Throughout this project, people were willing to act. To empower action, 300 microplastic filtering laundry bags were provided; 77% of respondents indicated that this project would motivate them to take additional actions and 82.4% planned to share microplastic pollution information with others. Over 70% agreed with community-wide measures such as bag bans, container deposits, and taxes on producers of single-use plastics to reduce microplastic pollution. Other strategies for inspiring action during this project included organizing community cleanups, inviting people to take a pledge to reduce plastic pollution, providing access to or information about recycling options, and promoting plastic alternatives. Youth programs and schools added field trips and lesson plans using our project materials. Regardless of the approach communities took during this project, successful “small steps” created a sense of accomplishment and inspired continued action.

Project Goals

The overall goal of the Smart Management of Microplastic Pollution in the Great Lakes project is to reduce microplastics in the Great Lakes. To achieve this goal, the community engagement team raised public awareness of microplastic pollution and empowered individuals and communities to reduce plastic inputs to our environment.

Background Information

Microplastics are 5mm or smaller and are a growing environmental concern. They may be intentionally manufactured as industrial abrasives or cleaning products, or may break down from larger plastics like bags, bottles and straws. The shedding of synthetic fibers from clothing such as polyester fleece is one of the major sources of microplastics in water.

Microplastics have been found in our rivers, lakes, oceans, drinking water, food and bodies. The abundance and small size of microplastics allows them to bypass water treatment and be easily ingested by wildlife and humans. One study found that we ingest about 5 grams of plastic each week, enough to make a credit card. Microplastics have been found in environments around the globe, even in some of the most remote places on Earth. While the impacts of microplastic pollution are not yet fully understood, they can build up in body tissue, cause inflammation, disrupt the gut biome, and cause neurodegeneration. Other pollutants can attach themselves to microplastic particles and be carried into our bodies, where their small size allows them to be incorporated into heart, lung and other tissues.

Community Engagement Project Activities

The target communities for this project were the cities of Williamston and Pontiac, Michigan. These communities differ in size, land use, economics, demographics and microplastic pollution, due to different drinking water sources, wastewater treatment systems and solid waste disposal. Both were interested in addressing microplastic pollution and coordinating with our project team, including hosting focus groups as discussed in the companion publication, How Community Leaders Perceive Risks of Microplastics Pollution. In addition, classroom and field trip microplastics education activities were conducted with 4th grade through high school students in several other communities.

Outreach Activities in Williamston, Michigan

The City of Williamston is located along the Red Cedar River. The Red Cedar is a tributary of the Grand River, the longest river in Michigan feeding over 2.7 billion gallons into Lake Michigan every day (USACE, 2019). According to Baldwin et al (2016), fibers are the most frequently detected microplastic particle in Great Lakes tributaries. Outreach in Williamston used the theme "Red Cedar River - Heart of Williamston" because the community of Williamston is physically centered around the Red Cedar River and there is local interest in protecting the river. Outreach efforts were designed to draw attention to this important resource.

The Williamston community outreach team, led by the Ingham Conservation District, raised awareness of microplastics by distributing information cards, posting pollution prevention content on social media, attending local events, and including microplastic-related content in newsletters. Awareness-building efforts were bolstered by providing a Guppyfriend laundry washing bag to participants recruited through community outreach events and social media. These bags trap microplastic fibers from synthetic clothing during machine washing, keeping these fibers out of our waterways. Bags were mailed to participants along with bag use instructions, microplastic information cards, eye-catching graphics, and a link to an online pledge to reduce microplastic pollution. Participants were asked to complete a feedback survey after using the bag for two months. While originally designed as a project specific to Williamston, this opportunity was extended through collaboration with the Clinton River Watershed Council to any interested household in Michigan who heard about the project.

Guppyfriend Washing Bag

Outreach Activities in Pontiac, Michigan

In Pontiac, led by ReRoot Pontiac, the outreach theme was "Economic Incentives – What's in Your Water Bill," framing microplastics pollution as a challenge to affordability. Pollution mitigation efforts focused on plastic debris inputs to stormwater management systems. These efforts were supported by the construction of a biofiltration area--a type of green stormwater infrastructure (GSI)--designed to collect runoff from a residential street and also trap plastic debris. This runoff diversion reduced the volume of stormwater reaching the wastewater treatment plant and also reduced the intensive maintenance effort required to remove litter from stormwater catch basins and pipes. If installed widely, this practice would help to lower stormwater utility bills. This was a message that resonated widely in this community. To inspire awareness of plastic pollution, demonstration sculptures were constructed and filled with plastic debris that had been trapped in the biofiltration area, and youth programs actively promoted GSI and plastic pollution reduction through art and social media.

River and community clean-up events took place in both Williamston and Pontiac as another means of raising awareness and providing an opportunity for positive action. In Pontiac, tires removed from the river during clean-up events led by the Clinton River Watershed Council were used to construct retaining walls at ReRoot as an additional visual reminder of plastic pollution.

Bioretention area installed at ReRoot Pontiac

Classroom Activities

The project classroom education team reached out to schools and youth programs in a variety of communities. Input about community interests and needs led to the development of videos and classroom activities for 4th through 12th grades. The team focused on Detroit, Michigan, and other classrooms where they could build on established and complementary projects. Fishing clubs with a commitment to inspiring young anglers were also a venue for several educational presentations about microplastics.

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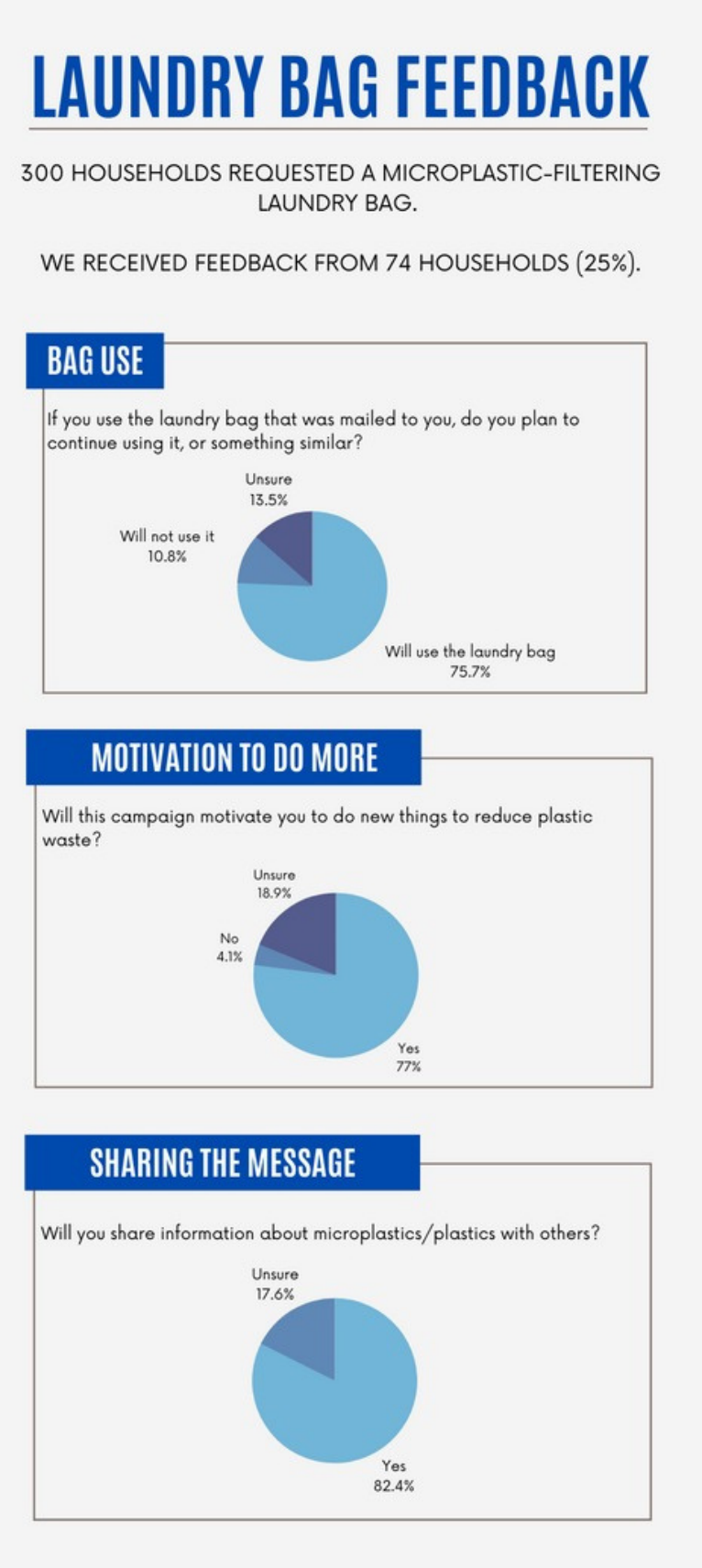
Community Impact

Microplastic-Filtering Laundry Bags

We reached our goal of recruiting 300 laundry bag users over a 4-month recruitment period (July 2021 - October 2021). Recruitment methods included press releases, social media, newsletters and information booths at events. Our total reach was estimated at 52,760. The project staff and partners that helped promote this initiative were Ingham Conservation District, Clinton River Watershed Council, local Watershed Groups, Tri-County Regional Planning and Groundwater Management Board, Meridian Township and the Williamston Rotary.

Twenty-five percent of laundry bag users responded to a follow up survey. Over 75% of those who used the bag will continue to do so. Three individuals responded with specific concerns about how well clothing was being cleaned inside the bag. At least 50 respondents indicated they take other actions to reduce/control plastic pollution including using reusable water bottles, grocery bags and food containers. They also opt for natural, recycled, or non-plastic packing options when available. Respondents were offered six options regarding what additional information about microplastic pollution they would like to have, and could submit their own suggestions. More than half wanted information about the human health and environmental impacts of microplastics. Respondents were also asked what community-based methods for plastic reduction they agreed with. Over 70% were in favor of bag bans, container deposits, taxes on producers of single-use plastics, requiring new washing machines to filter microfibers, litter cleanup programs, and removing plastics from the ocean. The only unfavorable option was incinerating plastic.



Community Cleanup Events

Cleanups are a great opportunity to engage communities in learning about and preventing microplastic pollution, because they tend to be popular and well-attended. They are suitable for many ages and ability levels, boost civic pride, and provide a sense of empowerment and accomplishment because they achieve immediate results. You can make a direct connection between removing plastic from a river or landscape and how that prevents plastic from breaking down into harder-to-manage microplastics.

At the community cleanup events, staff and volunteers set up a table with project information and examples of different sources and types of microplastics. Before volunteers began cleaning up, the event organizers introduced themselves and shared the goals for the event, which included awareness of microplastic pollution. After the event, organizers posted pictures of the variety of plastics removed from the river. This made a direct connection between the removal of plastic from the river and preventing its degradation into microplastic pollution.

Event Name	Number	Volunteers	Debris (lbs.)
Weekly Cleans	33	273	4562
Pontiac Cleanups	6	70	2209
Trash Runs	3	44	1000
Red Cedar Cleanup	1	25	225
Clinton Cleanup	14	236	2150
Private Cleanups	11	139	500

Volunteer removing trash from the Red Cedar River

In the Classroom

Organizers held 8 in-the-classroom events with 398 total participants. School outreach activities were developed and implemented to educate students for positive change. During one-day workshops for middle and high school students from the Detroit Public School District, students were introduced to the issue of microplastics in the environment using a hands-on exercise counting plastics on a simulated lake and beach. Project staff reported that students are very interested in microplastics and asked great questions.

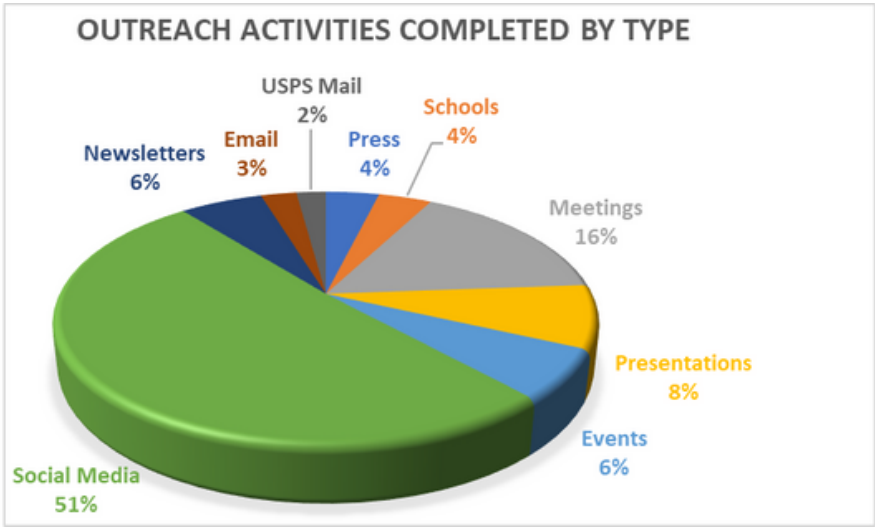
Graduate student Darrin Hunt leading a microplastics classroom activity at WSU

Outreach Results Analysis

Community partners delivered microplastic pollution information to community members using a variety of methods, particularly online in 2020 due to the Covid-19 pandemic. As of February 2022, the project had reached 108,880 individuals (based on contact) and engaged 15,996; with engagement including in-person events and online survey completion, or sharing, commenting or liking online content. 235 activities were completed from January 2018 – January 2022, including 69 direct engagements during meetings, education/outreach events, and presentations.

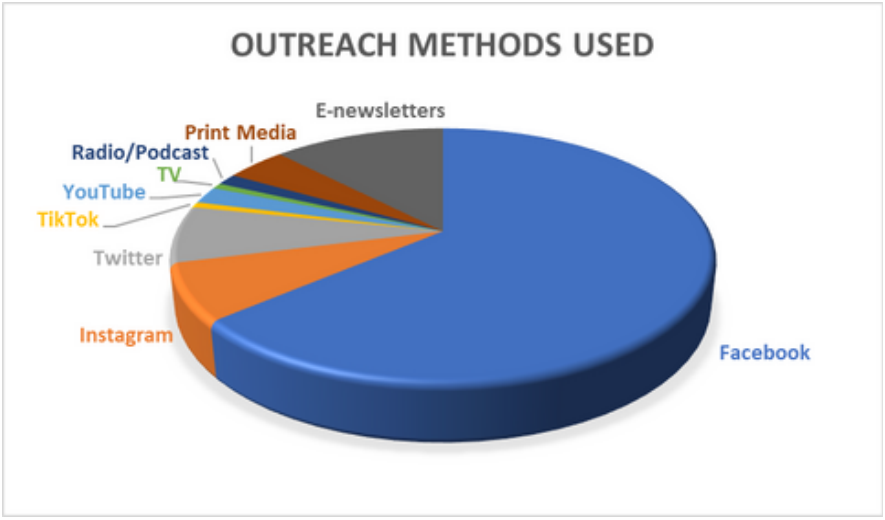
Direct Outreach

4,928 people were reached through meetings, presentations and events from 2018-2022, including 66 leaders throughout the Great Lakes region who were contacted to participate in an advisory board (of whom 56 accepted the invitation), 28 leaders in Pontiac and Williamston who participated in focus groups in summer 2019, and 30 leaders who responded to a survey about what they would find most useful to address microplastic pollution. Survey responses are discussed in the "Lessons Learned" section.



Indirect Outreach

Indirect online outreach led by community partners more than doubled from 2019 to 2020 to compensate for having to cancel in-person events due to the Covid-19 pandemic. Facebook was the most frequently used method with a reach of over 34,000 individuals. Print media still has the largest potential reach due to circulation numbers, but there is no way to determine how many subscribers actually read what is published. Our team only used TikTok briefly in 2020, but the response was dramatic, with a reach of over 900 with a single video.



Outreach Product Overview

597 Microplastics in the Great Lakes Rack Cards were distributed, shown at right.

An online Microplastics Pledge was actively promoted for 6 months with a total reach of 50,144 (72 participants took the pledge).

A list of lesson plans and active learning activities for 4th - 12th grade teachers was developed into a Classroom Resource Guide.

An Online Community Toolkit was developed with feedback from community leaders and members of the project Advisory Board. The Toolkit is at microplastics.wayne.edu and contains downloadable copies of all outreach products, links to educational videos, social media graphics, results from our focus group studies, and answers to frequently asked questions about microplastics.

Lessons Learned

Messaging

Our Project Advisory Board, including leaders from throughout the Great Lakes region, reviewed outreach materials and provided the following feedback:

- Keep materials simple and short
- Use a positive tone
- Identify realistic and accessible solutions
- Clearly link actions to impacts
- Explore multi-lingual options
- Use universal symbols for clear messaging across cultures and languages

Focus Groups

Community leaders were enlisted early in the project in summer 2019 to attend small group discusions to: (1) understand how residents of Williamston and Pontiac perceive the risk of microplastic pollution; (2) inform outreach in these communities: the laundry bag give-away in Williamston, green infrastructure installation and community youth programs in Pontiac; (3) inform the design and implementation of microplastic sensor technology; and (4) develop a leadership network that could address microplastic pollution in the region. The focus group study, led by the Communication Department at WSU, addressed two research questions. 1) How do these communities perceive the risk of microplastic pollution, especially in their water systems; and 2) How can these communities be encouraged to adopt pro-environmental behaviors in response to microplastic pollution?

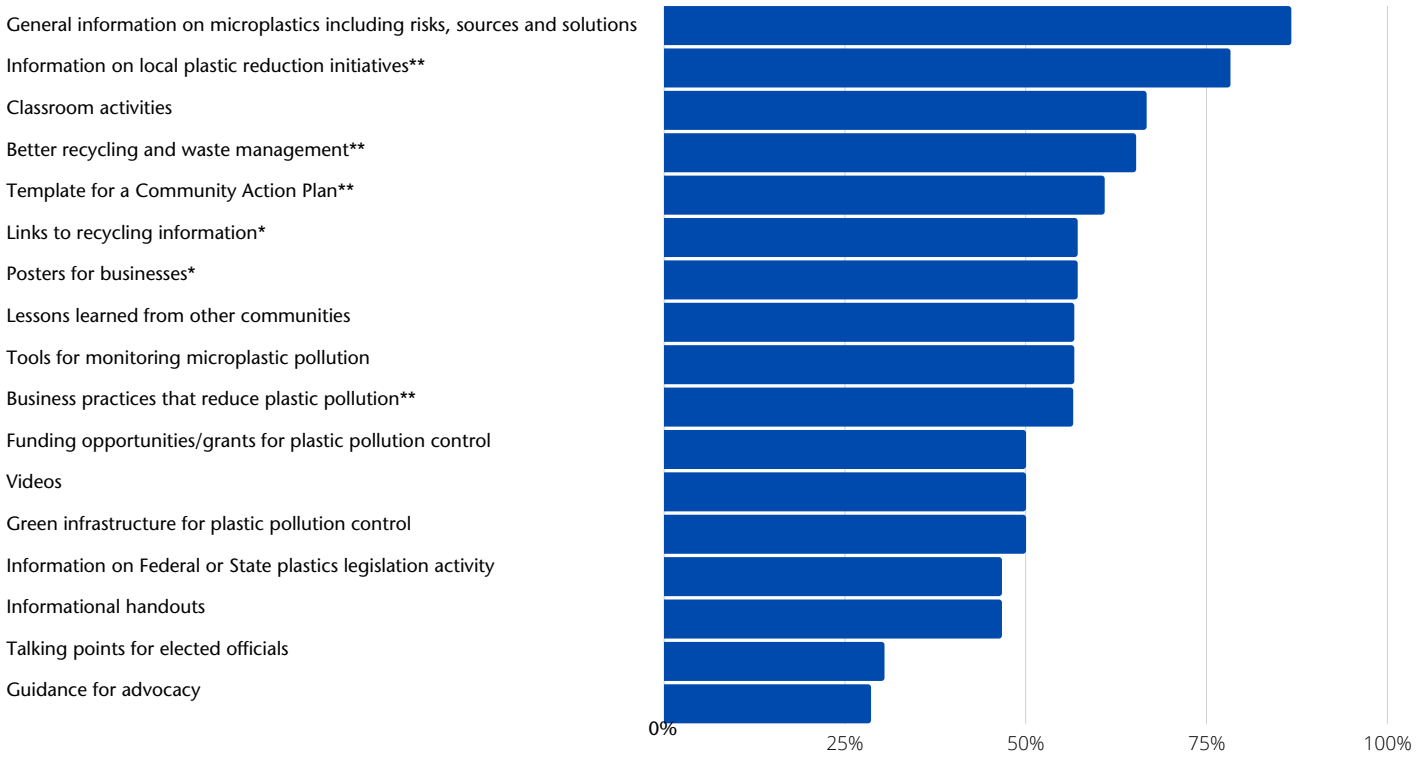
These challenges to community microplastics awareness and action were identified by the focus groups:

- Institutional arrangements for and limitations on recycling access and knowledge
- Perception that microplastic pollution is a “faraway” problem, or not “here and now”
- Other more pressing issues, particularly economic and health challenges
- Cultural emphasis on and glamorization of consumption
- Suspicion of the capability and intention of authorities to solve the problem
- Uncertainty about the effectiveness and trustworthiness of proposed mitigations
- Unidentified impacts and solutions
- Lack of incentives to address the problem (financial, reputation-based, punitive)
- Lack of local symbols and places in microplastics messaging that could build on community pride
- Absence of local community networks in the development of mitigation strategies

Community Engagement Needs

Our work with communities made it clear that more information about microplastic pollution is nee and wanted. Over 86% of community leaders indicated that knowing the risks, sources and solution would help them address this form of pollution. When asked what single resource would be most helpful, "general information" was the most common response out of the options we provided. This supported anecdotally by project staff working at outreach booths who reported that many members of the public had never heard of microplastics before.

Community Leader Questionnaire Feedback



*question was only in 2021 questionnaire (7 responses)
**question was only in 2022 questionnaire (23 responses)

Outreach Strategies

Due to the outbreak of Covid-19, community meetings and school visits were not possible during most of 2020 and 2021. Businesses were overwhelmed with new procedures and uncertainties, making it harder also to connect with them. The doubling of online outreach to compensate for the lack of in-person activities required new messaging and engagement options such as the Microplastics Pledge.

Due to lack of public awareness of microplastics, events about microplastic pollution instead resulted in public connections to macroplastics such as litter. While litter cleanup was not the intended message, the impact of macroplastic debris in the Pontiac area was an effective pathway for increasing awareness of other sources of microplastic pollution such as microfibers from clothing. Social media remained the primary engagement pathway through 2021, with few requests for presentations.

During early project planning, partners committed to physical activities such as mailing surveys that turned out to be impractical due to reliance on digital communications, or to provide space at public venues or on websites whose policies did not allow this use due to the many organizations seeking similar support. Flexibility and persistence were important to the many project successes, such as the infographic cards included in "new resident packets" and booth space at weekly Farmers Markets.

In-Home Microplastic Mitigation

After requesting and receiving a microfiber-filtering bag from the project team, over 10% of participants reported that they will not use it. This is similar to the results of the Huron River Watershed Council's study with Cora Balls, another laundry microfiber mitigation device: 12% of those participants reported that they rarely or never used the Cora Ball they received.

Community Cleanups

The Red Cedar River Cleanup event in Williamston was a success due to partner collaboration. Trout Unlimited, Friends of the Red Cedar River, Williamston Township, the City of Williamston, Michigan United Conservation Club (MUCC), Ingham Conservation District, and the Middle Grand River Organization of Watersheds all shared and participated in the event. ICD Collaborated with the MUCC "On the Water Program" to carry out this cleanup, which provided logistic support, supplies, and food for volunteers. The City of Pontiac and Clinton River Cleanup events were successful largely due to the Clinton River Watershed Council's (CRWC) legacy of carrying out land and water based cleanup efforts. CRWC holds weekly events that provide an opportunity for community service. The consistency of cleanup events and the fact that they provide a mutually beneficial arrangement has allowed CRWC to build a robust and well-trained volunteer crew. Volunteers are retained in part due to CRWC’s efforts to appreciate volunteers, including through perks such as small promotional gifts, awards, and an annual appreciation event. CRWC also provides materials and guidance to volunteers that want to organize their own cleanup, like American Rivers which is a similarly-engaged national organization. Tracking the types of plastics removed can help a community target the most common sources of pollution and hone local messaging. Getting better metrics on your cleanup can also help with evaluating the success of a cleanup and planning future events. River Network is another national resource, especially for organizations seeking to improve leadership and equity.

Motivating Continued Engagement

This project developed an online "Community Toolkit" to provide resources to communities, students, scientists and the general public seeking to take action on microplastic pollution. The Toolkit is based on a growing body of data on community perceptions, microplastic detection and identification, sources and sinks of microplastic pollution, and health and environmental effects. It provides downloadable materials including informational handouts, social media graphics, this and other guidebooks based on lessons learned during this project and a microplastic pledge. The Toolkit also contains classroom activities and three videos to suit elementary to high school education levels. These and other insights helped to inform the development of the Toolkit:

Insights from Community Leaders and Activists

The majority (>70%) of our laundry bag users (n=75) agreed with measures such as bag bans, container deposits, and taxes on producers of single-use plastics. This is encouraging for communities that want to enact policies to reduce plastic consumption and waste.

If practical sustainability or waste/plastic reduction efforts are already in place in a community, integrating microplastic messaging can enhance existing efforts with a lower barrier to entry.

Microplastic information can be adapted to a variety of audiences, particularly through videos: ours were shared with over 50 partners and subsequently with their audiences. Statewide interest connected us to government agencies, community leaders, non-profit organizations, and environmental groups. Diverse audiences can help create a strong network and increase project reach and impact.

Our project participants were willing to share microplastic information with others when it was easy for them. Opportunity for action incorporated into awareness-building is the most effective approach (see graphic on page 2). When sharing information at public events, interactive displays are more engaging than informational literature. Frequent and interactive social media posts (daily or multi-daily) are more effective than sporadic postings.

It is helpful to connect microplastics to what your audience is already passionate about such as fishing, wildlife habitat, and clean water. In more diverse communities, centering messaging around social justice may have more impact.

Nanoplastics, which are molecular-sized fragments of microplastics, are easier to connect to environmental and human health because their small size, abundance and bio-chemical reactivity give them a direct pathway into the human body. Nanoplastics have been found in all water sources on the planet. Audiences that are disengaged on the issue of microplastics and macroplastic litter may be more likely to receive messages relating to the human health threat of nanoplastics.

Insights from Scientific Professionals & Engineers

The project team hosted a session called "Microplastics in the Environment: Source, Fate, Impact, Detection, and Mitigation" at the 2019 International Association for Great Lakes Research (IAGLR) conference. This was one of the most well-attended sessions of the conference. The scientific community can build on the interest in this topic by utilizing tools developed by this project.

Project engineers developed a bench-scale Raman spectroscopy prototype for detecting and identifying microplastics, and established a first-of-its-kind online library of Raman spectra for plastic samples obtained from the environment. Algorithms to query these known spectra allow researchers to compare their own Raman data to this library, via an online tool. This library helps the broader scientific community to scale-up automated identification of environmental microplastic, with potential applications in drinking water intake monitoring and food/drink processing plants, to increase public health and safety from microplastics.

Modeling to estimate community microplastic risks was done by the project team, to develop a framework for targeted pollution prevention strategies. Plastic materials flow analysis was based on industry norms during manufacture, packaging, transportation, maintenance, consumption, disposal and other phases of product life. The resulting user-friendly decision-making tool for reducing plastic wastes in the environment will better support community planners and others who are trying to make a difference during the entire cycle of plastic manufacture, use and disposal.

Strategies for Working with Community Leaders

Engagement with local community groups can be a powerful networking source. In small communities, group members are often affiliated with more than one group. If your message is well received by one group, it can open the door to invitations to connect with additional groups/events. Reach out to municipal leaders and request a commitment of support before taking action. Work with your community to develop strategies, rather than just delivering what you think they need. Be specific about what support you are seeking such as coordinating on social media or mailings, use of municipal space, or staff time. Maintaining engagement is challenging, but important to sustaining support. Attend public meetings and provide regular updates on your activities. Some communities may be willing to put you on the agenda, others may prefer you to contribute during public comment periods. Recruit community council or board members to be liaisons with the rest of their members for greater efficiency and buy-in.

Anticipate resistance to social media and graphics that imply public concern about the quality or safety of drinking water. Consider graphics that raise awareness about microplastics without implying local threats to safety. Put concerns in a global context, and provide positive proactive solutions, to counteract unanticipated local consequences.

Project Team

Our team represents a group of collaborating research, watershed and environmental organizations, informed by advisors in private enterprise, government, academia and non-profit organizations. We represent diverse disciplines from engineering to biology to communication. Primary funding for this project comes from the Great Lakes Protection Fund (GLPF).

Dr. Yongli Wager, Principal Investigator - Dr. Wager is an Associate Professor in the Department of Civil and Environmental Engineering. Her research focuses on the water-environment-energy nexus through the development of advanced technologies and system modeling and optimization.

Dr. Weisong Shi is a Professor of Computer Science at Wayne State University where he directs many initiatives including the Mobile and Internet Systems Laboratory, Intel IoT Innovators Lab, and Wayne State Data Science Initiative. Dr. Shi is one of the world leaders in edge computing research.

Dr. Carol Miller is a professor of Civil and Environmental Engineering at Wayne State University and the Director of WSU's Healthy Urban Waters program. Dr. Miller is also the US Co-Chair of the Great Lakes Science Advisory Board of the International Joint Commission.

Dr. Donna Kashian is a professor of Aquatic Ecology at Wayne State University, and a visiting scientist at the Great Lakes Environmental Research Laboratory. Her fields of specialization include assessing the influence of global climate change on contaminants in the Great Lakes and multidisciplinary collaborations in addressing complex environmental issues.

Dr. Rahul Mitra is an Associate Professor of organizational and environmental communication. His focus is on environmental organizing, corporate social responsibility, and social-ecological resilience.

Lara Treemore-Spears, Project Manager is a project manager with the Healthy Urban Waters program in the Department of Civil and Environmental Engineering at Wayne State University. She brings an interdisciplinary background in aquatic and terrestrial ecology, resource conservation behavior, brownfield redevelopment, water chemistry and wetland construction to her role coordinating complex research projects.

Dr. Mark Cheng is a Professor of Electrical and Computer Engineering, Biomedical Engineering, and Nanoengineering at University of Alabama. He is an expert in sensor design and microsystem packaging and integration. His research focuses on spectrometry and wireless sensing technology for environmental sensing.

Michelle Beloskur is the (former) Executive Director of the Ingham Conservation District, an organization dedicated to empowering Ingham County residents to engage in environmental stewardship. She led community outreach and engagement efforts in the City of Williamston.

Project Team Continued

Jonathan Weyhrauch is the Founder and President of Reroot Pontiac. Mr. Weyhrauch led community outreach and engagement efforts in the City of Pontiac, particularly those centered around green infrastructure.

Chris Bobryk is the Watershed Planner at the Clinton River Watershed Council. Chris leads the WaterTowns™ program and other initiatives related to supporting community development and climate resilience along the Clinton River and Lake St. Clair. He led and supported community outreach and engagement in the Pontiac area.

Kathleen Sexton is the (former) Program Manager at Clinton River Watershed Council. Kathleen led and supported community outreach and engagement in the Pontiac area.

WSU Student Support: Lacey Brim (Communications), Ziming Huang (Major), Michael Ewing (Computer science)

Project Contacts

Dr. Yongli Wager **Wayne State University**
Department of Civil and Environmental Engineering
5050 Anthony Wayne Drive Detroit, Michigan 48202 313-577-9962
microplastics@wayne.edu https://microplastics.wayne.edu

Partnerships

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