Microplastics: What's trapping the emerging threat in our streams?

April 21 2025, by Maddie Johnson

Stream algae is seen in a stream at the Notre Dame Linked Experimental Ecosystem Facility, or ND-LEEF, where the experiments were conducted for the study titled "Transport and retention of microplastic fibers in streams are impacted by benthic algae, discharge, and substrate." Credit: Shannon Speir

Microplastics, tiny plastic particles found in everyday products from face wash to toothpaste, are an emerging threat to health and ecology, prompting a research team to identify what keeps them trapped in stream ecosystems.

Everyday actions like washing synthetic clothing and driving, which wears down tires, contribute to an accumulation of microplastics in environments from city dust to waterways. These plastics often carry toxic chemicals that can threaten the health of humans and wildlife.

"We are the key source of microplastics," said Shannon Speir, assistant professor and researcher in the Dale Bumpers College of Agricultural, Food and Life Sciences, and for the Arkansas Agricultural Experiment Station, the research arm of the University of Arkansas System Division of Agriculture.

Microplastics are unique in size, structure and weight, Speir said. They measure less than five millimeters across and can be round, as found in some face washes and toothpastes, or they can be string-like fibers like the tiny particles that can shed while laundering synthetic clothing materials such as polyester or nylon. Eventually, these microplastics can end up in rivers and oceans.

These differing sizes and shapes make microplastic movement more complex, leading Speir to join a team of researchers in examining what factors lead to their being trapped in streams. The research team's study, "Transport and retention of microplastic fibers in streams are impacted by benthic algae, discharge, and substrate," is published in *Limnology and Oceanography* in February.

Speir noted that scientists have only realized the scope and magnitude of the problem microplastics pose in the last decade.

The study explains that microplastics in streams are concerning because they can be ingested by aquatic organisms, posing threats to their digestion and fertility—all while easily spreading given their small size and exposing wildlife and humans alike to the toxins they can carry.

Pinpointing removal areas

The team designed the experiment by lining four artificial streams with substrates—or the materials that make up a stream bed—made of cobble, pea gravel, sand and a mixture of the three. Then, they colonized the streams with benthic algae (algae that live on the bed surface), and experimentally released microplastics over three days to test microplastic retention as substrate, discharge levels and algae presence varied.

Stream discharge refers to the volume of water moving down a stream over a given time period. As this volume of water rises, for example, stream flow typically becomes faster.

The team found that streams with higher levels of algae, larger stream substrates and higher levels of stream discharge all saw increased levels of microplastic retention during the study's three-day experimental period.

Findings also revealed that in instances of rapid increase in discharge, such as a storm, microplastics can become resuspended, meaning they are lifted from the bottom of the stream where they have settled. These events increase the potential for these particles to be transported downstream.

John J. Kelly, biology professor and department chair at Loyola University Chicago, served as corresponding author of the study. Reflecting on the study's results, Kelly emphasized how the findings can inform best practices for working to reduce the threat of microplastics.

"The results of this study demonstrate that certain stream characteristics, for example a rocky bottom compared to a sandy stream bottom, can determine where microplastic particles will be deposited within a stream, which could be used to determine which locations to prioritize in cleanup efforts," Kelly said.

"In addition, our results demonstrate that storms can result in the movement of microplastics from the stream bottom to the water and their subsequent transport downstream, which could be used to determine the best timing for efforts to remove microplastics from streams," he continued.

Collective action

Speir explained the everyday ways individuals can combat microplastic deposition in stream ecosystems, and she cautioned them against thinking these singular actions will not be impactful.

"I think that if we all do a little bit, that amounts to a large amount," Speir said.

She cited the use of laundry bags designed to catch microplastics that shed from clothes as they are washed.

"I think we always need to keep in mind when thinking about environmental things that are individual actions. Even though they're small, collectively, we have the opportunity to make a really, really big difference," she said.

Elizabeth M. Berg, formerly of Loyola University Chicago's biology department, served as the leader of the project.

Co-authors of the work also included Arial J. Shogren and Martha M. Dee, formerly of the University of Notre Dame department of biological sciences; Anna E. S. Vincent, formerly of Loyola University Chicago's biology department and the University of Notre Dame department of biological sciences; Jennifer L. Tank of the University of Notre Dame's department of biological sciences; and Timothy J. Hoellein of Loyola University Chicago's biology department.

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