# Microplastics in Oregon

## A survey of waterways

ENVIRONMENT OREGON
RESEARCH & POLICY CENTER

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Cover photo: Waldo Lake, Staff

# Executive Summary

Plastic is everywhere and in everything. It's used as packaging, it's in food service products, and it's in clothing. All told, Americans generate over 35 million tons of plastic waste every year, 90% of which is landfilled or incinerated.[1] In fact, the U.S. throws out enough plastic every 16 hours to fill the Dallas Cowboys stadium, and that amount is increasing.[2]

Often when talking about plastic pollution, the images that come to mind are turtles snared in bags or straws, massive trash gyres in the Pacific Ocean, or whales washed ashore with hundreds of pounds of plastic waste in their stomachs. So it may not be surprising that studies found 59% of all seabird species had ingested plastic, with that number expected to rise to 99% by the year 2050.[3]

Studies have also estimated that by 2050 there will be more plastic in our oceans than fish.[4]

While the problem is global in scale, Oregon is facing the issue of plastic pollution directly. River cleanup events held on the Willamette River have found that 60% of the debris being removed is plastic.[5] One organization alone removed 389 pickup beds' worth of plastic from just the lower Willamette in one year, which is a fraction of the actual amount of plastic in the river.[6] To make matters worse, more than 10,000 tons of plastic recycling were dumped into landfills in 2018, illustrating the state's challenges with effective plastics waste management.[7]

However, litter alone doesn't capture the full scope of our plastic pollution problem. Research suggests that we could be not counting 99% of the plastic that makes its way into the ocean.[8] That's because plastic doesn't degrade in the environment like an apple or a piece of paper, instead it breaks into smaller and smaller pieces called microplastics. Microplastic is plastic less than 5mm in length, or smaller than a grain of rice.[9] They've now been found in the deepest depths of the ocean and on the highest mountains in the world.[10, 11] A report from Oregon Public Broadcasting suggests that more than 57 million microplastics pass through the Willamette in Portland each day on their way to the Pacific Ocean.[12]

A growing area of concern regarding our plastic waste is the environmental and public health threat posed by these microplastics. They are severe suffocation and starvation hazards to wildlife and have been found in our air, food, and bodies.[13, 14, 15] Microplastics also attract pollutants that may already exist in the environment at trace levels, accumulating toxins like DDT & PCBs and delivering them to the wildlife that eat them, often bioaccumulating through the food chain.[16]

And microplastics don't arrive in the environment from just one source. Plastic littered on roads, in streams, or in the ocean can release tons of microplastics, but plastic waste disposed of in landfills can also release microplastics into the environment through wind, rain, and landfill leachate.[17] The burning of plastic or other waste can also create airborne microplastic particles.[18] Microbeads from cosmetic and personal care products can enter the environment at their manufacture or through sinks and drains.[19] Nurdles, the raw plastic feedstock that are used to make new plastic items, are lost by the millions every year.[20] Synthetic materials, like those used in car tires, release microplastics onto roads that are swept into stormwater infrastructure.[21]

Clothing and other textiles are also a major source of microplastics. Fibers are one of the most commonly found types of microplastic and they're sourced from synthetic and hybrid materials like fleece.[22] Normal wear and tear will release microplastics into the air, and cleaning these textiles in a washing machine releases millions of microfibers into wastewater infrastructure that treatment plants are unable to fully filter out.[21, 23]

**To better understand the scope of the microplastic problem in Oregon, Environment Oregon sampled 30 of Oregon's most iconic rivers, lakes, and urban waterways. <u>We found microplastics in 100% of our samples.</u>**

The project took samples from these waterways over the course of 2019 and tested them for four types of microplastic pollution:

1. Fibers: primarily from clothing and textiles
2. Fragments: primarily from harder plastics or plastic feedstock
3. Film: primarily from bags and flexible plastic packaging

4. Beads: primarily from facial scrubs and other cosmetic products.

**The results were troubling. Of the 30 sites tested, 30 (100%) contained one or more type of microplastic:**

- **30 sites (100%) contained fibers**
- **Six sites (20%) contained fragments**
- **1 (3%) contained film, and microbeads were not found at any site.**

It's clear that the scope of plastic pollution in Oregon extends far beyond what was previously thought. Many of the waterways sampled had little to no visual litter at the point of access and have dedicated organizations and volunteers working diligently to regularly clean up litter and trash. Yet despite those efforts, Oregon's most beloved waterways continue to be contaminated with plastic pollution.

**In order to address the environmental crisis being caused by plastics, federal, state, and local leaders should implement the following policies:**

**1. Congress should pass bills like the federal Break Free From Plastic Pollution Act, which includes a strong national ban on single-use plastic bags, polystyrene and other polluting single-use plastic products.**

**2. The Oregon Legislature should ban the sale and use of single-use polystyrene (aka Styrofoam) takeout containers and cups, packing peanuts, coolers and other wasteful product packaging.**

**3. The Oregon Legislature and Congress should pass a full Extended Producer Responsibility Law that makes manufacturers responsible for dealing with the waste their products will become.**

**4. Communities and legislators should oppose measures that double down on the fossil fuel-to-plastic or plastic-to-fuel pipeline and that incentivize the creation of new plastic.**

**5. State and local governments should pass laws preventing overstock clothing from being sent to landfills so that clothing manufacturers and retailers stop producing more clothing than we could ever need.**

**6. Cities should develop green infrastructure and stormwater programs to help stem the tide of plastics and microplastics being washed into our waterways and greater environment.**

**7. Oregon should require filters on all new washing machines to prevent microplastics from ending up in our waterways.**

# Introduction

Every day, Americans throw away tons of plastic "stuff" -- cups, plates, bags, containers, forks, knives, spoons and more.[24] Sadly, much of this plastic waste never makes it to the trash can and ends up soiling our parks and public lands, where it also washes into our rivers, harming wildlife. Once in our environment, plastic does not biodegrade.[25] Instead, it breaks into smaller and smaller pieces known as microplastics.

Microplastics can enter our environment through a myriad of pathways. Litter, illegal dumping, and what is broadly recognized as plastic waste are all obvious culprits. Microfibers are a prevalent type of microplastics and are introduced into the environment through clothes washing,[26] with wastewater treatment plants unable to fully filter these plastic fibers out, they can end up washed into waterways and ultimately into drinking water.[27, 28] The creation of new plastic products uses small pellets called nurdles which are easily lost and frequently enter waterways.[29] Packaging and the factory processes in the creation of products like bottled water can even cause microplastic contamination.[30]

The small size of microplastics makes it easy for them to be carried by wind and rain and deposited in the environment far from their source. Meaning, plastic disposed of in a landfill can still contaminate waterways.[31]

For a bird or fish, it's easy to mistake these small pieces of plastic for food -- especially when there are billions of pieces of microplastic floating in the waterway. Scientists have found that ingesting even tiny particles of plastic can alter the behavior and metabolism of fish in our lakes and rivers – and people can ingest these pollutants as they make their way up the food chain.[32, 33]

## A Widespread Problem

Scientists are still documenting the scope of plastic pollution and investigating its effects in freshwater ecosystems, but microplastics have recently been found in a number of remote environments throughout the world, showing how pervasive the problem has become:

- Microplastics have been found in global and domestic samples of **tap water, sea salt, and beer;**[34]
- Microplastics have been found in a study of some of the most popular **bottled water** brands across several countries that point to contamination from packaging and manufacture;[35]
- U.S. Geological Survey (USGS) researchers found microplastic in 90% of rainwater samples collected from sites in **Rocky Mountain National Park** and the Denver-Boulder urban corridor;[36]
- Researchers at the University of Strathclyde in Scotland found microplastic concentrations in the air of a remote section of the **French Pyrenees Mountains** that were as high as concentrations in Paris;[37]
- Plastic pollution has now been found in isolated marine environments in **the Arctic and Antarctic;**[38]
- Research from the Chinese Academy of Sciences has shown that microplastics in the soil can be taken up by the roots of **wheat and lettuce crops** and transferred to the edible portions of those plants;[39]
- Recent studies from Utah State University and the University of Strathclyde among others have found high concentrations of microplastics in **fog, dust, and ocean air;**[40, 41]
- In Oregon, a recent study from Portland State University found microplastics in the stomachs of oysters and razor clams off the Oregon Coast. In fact, only two out of the nearly 300 mollusks tested were found to be plastic-free;[42]

- Microplastic pollution has been recorded at the highest elevation on Earth, **Mt Everest**, and the lowest, **the Mariana Trench** at the very bottom of the Pacific Ocean;[43, 44]
- Microplastics have been found in human placentas.[45]

Frighteningly, it's estimated that humans consume roughly a credit card's worth of plastic every week. The effects of this on human, animal, and environmental health are an evolving area of research.[46]

Research from the National Oceanic and Atmospheric Administration has also shown that microplastic particles can attract heavy metals and chemical contaminants which are then consumed by fish, birds, and humans (among other organisms).[47] These can include PCBs and pesticides which can pose significant health risks when consumed by animals and humans.[16]

# Methodology

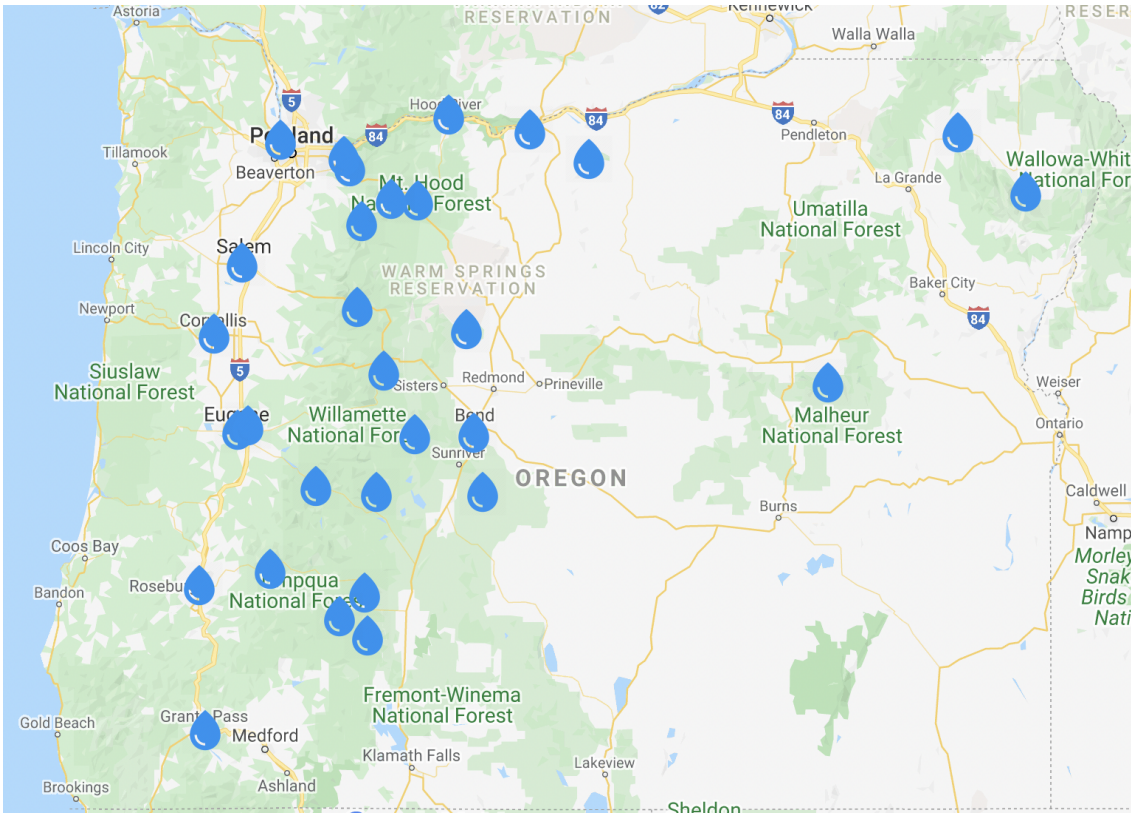
## Sampling

The goal of the microplastic study was to examine the presence and type of microplastics in waterways across Oregon. Our 30 study sites were selected from three categories: scenic lakes, wild and scenic rivers, and urban waterways. We intended to capture a range of physical geography, population pressures and waterbody types.

For water sampling and processing, we used the *Microplastics: Sampling and Processing Guidebook* protocol developed by the National Oceanic and Atmospheric Administration (NOAA), Mississippi State University Extension, Dauphin Island Sea Lab and Sea Grant.[48] To aid in our identification of microplastics, we also used the *Guide to Microplastic Identification* by the Marine & Environmental Research Institute, (now Shaw Institute).[49]

Water samples were collected from our 30 sites in glass quart jars that had been cleaned and triple-rinsed in filtered water. Jars were sealed during storage, transport, and before sampling. At each site before collecting samples, jars were rinsed again, this time with the source water. To fill the jars, samplers walked to the water access point to a water depth of approximately two feet (where possible), and drew water samples from this point to avoid collecting sediment. For sites with no access to a depth of two feet, samples were taken at the deepest accessible depth.  When taking samples from moving water, samplers collected upstream from themselves to minimize the potential for contamination. Samplers were instructed to avoid wearing fleece and other synthetic clothing materials to minimize the risk of contamination by clothing fibers.

Six quarts were drawn at each site. All jars were labeled and recorded in a field data sheet with the sample number, site description, and date. The jars were then transported to the lab for analysis.




*Locations of where the samples were taken. A more detailed map can be found at [https://bit.ly/microplasticsinOR](https://bit.ly/microplasticsinOR)*

## Analysis

All lab materials, including the filter funnel and petri dishes, were triple rinsed with filtered water between samples to minimize potential contamination from outside sources.

Samples were processed by using a filter flask and hand pump to pass water through 47 mm gridded filtered papers. The filter paper was then transferred to a petri dish for visual inspection under a digital microscope at 40x magnification.

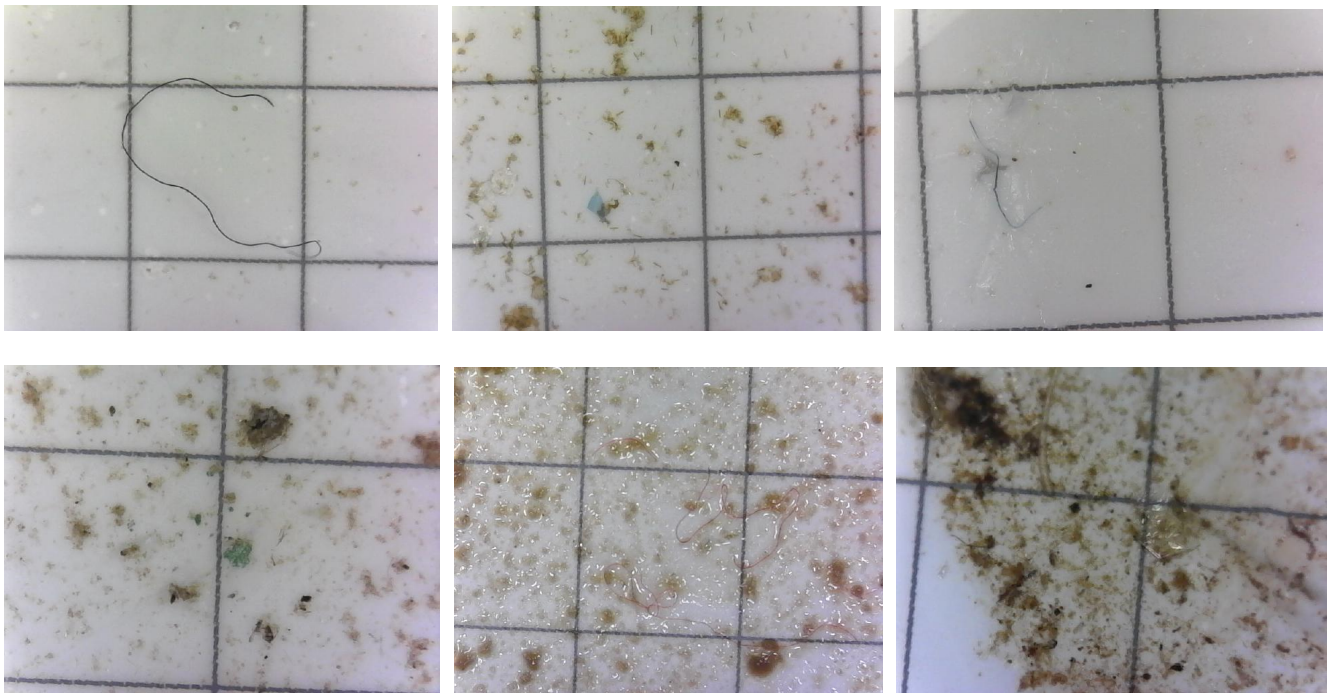
To aid in visual identification, additional "squeeze tests" were performed with fine-tipped tweezers on any potential microplastic pieces. Any pieces that could not be positively identified through both a visual and squeeze test were not recorded.

Identified microplastics were categorized into four types:

- **Fibers** from synthetic fabrics and filaments, such as fishing line and bailing twine;
- **Fragments** from rigid plastics, including polystyrene and clear plastic containers;
- **Film** from plastic bags and food wrappers; and
- **Microbeads** from older cosmetics and personal care products.[50, 51]

A digital photo was taken of each identified microplastic, and totals for each site were recorded in a data table.

## Examples of observed microplastics



*Top row from left to right: Microfiber from Crater Lake, microplastic fragment from Paulina Lake, microfiber from Clackamas River: Fish Creek; Bottom row from left to right: microplastic fragment from the Deschutes River, microfiber from John Day River, microplastic film from the South Umpqua River in downtown Roseburg.*

# Results

Of the 30 sites tested, 30 (100%) contained one or more types of microplastic.

30 sites (100%) contained fibers; six sites (20%) contained fragments; 1 (3%) contained film. Microbeads were not found at any site.

### TABLE 1: RESULTS

| Type of Site | Access Site Name | Waterbody | Microplastic Present? | Observed Microplastic Types | | | |
|---|---|---|---|---|---|---|---|
| | | | | Fiber | Fragment | Film | Microbead |
| **Scenic Lake** | Crater Lake | | Yes | • | | | |
| | Wallowa Lake | | Yes | • | | | |
| | Trillium Lake | | Yes | • | • | | |
| | Waldo Lake | | Yes | • | | | |
| | Paulina Lake | | Yes | • | • | | |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | Detroit Lake | | Yes | • | | | |
| | Lake Billy Chinook | | Yes | • | | | |
| | Strawberry Lake | | Yes | • | | | |
| | Devil's Lake | | Yes | • | • | | |
| | Diamond Lake | | Yes | • | | | |
| | Clear Lake | | Yes | • | | | |
| **Wild and Scenic River** | Salmon River Trailhead | Salmon River | Yes | • | | | |
| | Deschutes River State Recreation Area | Deschutes River | Yes | • | • | | |
| | Dodge Park | Bull Run River | Yes | • | • | | |
| | Cottonwood Canyon State Park | John Day River | Yes | • | | | |
| | Fall Creek Falls Trailhead | North Umpqua River | Yes | • | | | |
| | Upper Rouge River Trail | Rouge River | Yes | • | | | |
| | North Fork of the Middle Fork Willamette | Willamette River | Yes | • | | | |
| | Minam State Recreation Area | Wallowa River | Yes | • | | | |
| | Oxbow Regional Park | Sandy River | Yes | • | | | |
| | Fish Creek Trailhead | Clackamas River | Yes | • | | | |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Urban Waterway** | Cathedral Park | Willamette River | Yes | • | | | |
| | Salem | | Yes | • | | | |
| | Corvallis | | Yes | • | | | |
| | Eugene | | Yes | • | | | |
| | Springfield | McKenzie River | Yes | • | | | |
| | Downtown Roseburg | South Umpqua River | Yes | • | • | • | |
| | Grants Pass | Rogue River | Yes | • | | | |
| | Hood River | Hood River | Yes | • | | | |
| | Downtown Bend | Deschutes River | Yes | • | | | |

An interactive map with the full findings and more photos can be found at https://bit.ly/microplasticsinOR.

# Policy Recommendations

Given how widespread the threat of plastic and microplastic pollution is, there is no silver bullet solution to address the problem. Multiple policy changes at the local, state, and federal level are needed to combat this problem. Below are several recommendations and a chart of specific fixes.

Phase out single use plastics

Nothing we use for a few minutes should be able to pollute the environment for hundreds of years. Congress, state governments, and municipalities should pass laws that phase out unnecessary single-use plastics such as polystyrene food service products, single-use plastic bags, and plastic utensils. Cutting off the source of some of the most prevalent forms of plastic pollution will help curtail the tide of microplastics entering the environment. The Oregon Legislature passed a ban on single-use plastic bags in 2019, but there is still more work to be done to reduce single-use plastics in the state.

Pass "Producer Responsibility" laws

Producer responsibility is a mechanism to shift the costs and management of postconsumer waste from local governments and consumers to producers themselves, requiring producers of plastic products to design, manage, and finance waste and recycling programs. The Oregon Legislature passed a law in 2021 that will bring in producers to start bearing some of the costs of the waste management system. The legislature should consider a *full* producer responsibility model for packaging and paper products in the coming years. Additionally, Congress should pass federal measures like the *Break Free From Plastic Pollution Act* to make these programs more widespread and shift the burden onto those who create the pollution.

Encourage reuse

Whenever possible, municipalities should adopt practices that make it easier for residents to use reusable materials instead of single use plastics. The State of Oregon should also update the rules to allow consumers to bring their own reusable food containers and produce bags to grocery stores and restaurants.

Fight fast fashion

Clothing production and use could spew 22 million metric tons of microplastics into the ocean between 2015 and 2050.[54] To fight textile waste, retailers must stop sending overstock, unsold and unused clothing, to landfills and incinerators. State and local governments should pass laws preventing this practice so that clothing manufacturers and retailers stop producing more clothing than we could ever need.

Develop green infrastructure

A recent study from the San Francisco Estuary Institute found that car tire debris from stormwater runoff may be a significant contributor of microplastic pollution.[55] To keep this debris out of our water, municipalities need to reduce combined sewage overflow and ensure runoff is treated. Green infrastructure projects can reduce the amount of stormwater and plastics that wash directly into our waterways.

## TABLE 2: POLICY SOLUTIONS

*Easing the burden on the overall waste system is imperative to mitigating plastic pollution. Minimizing various waste streams and creating systems to better prevent waste from being created will make it easier to deal with sources of plastic and microplastic pollution.*

| **Reduce** | **Reuse** | **Recycle** |
|---|---|---|
| Ban unnecessary single use plastics such as polystyrene foam (commonly called Styrofoam) food containers. | Pass Right to Repair Laws, giving consumers and independent repair shops the ability to fix their stuff when it breaks. | Pass full Extended Producer Responsibility Laws that make manufacturers responsible for dealing with the waste their products will become. |
| Require unnecessary single-use plastic accessories such as straws, utensils, and condiment packets, to be given only upon customer request | Allow consumers to bring their own reusable containers and produce bags to grocery stores and restaurants. | Expand curbside recycling and composting efforts. |
| Oppose the creation of new plastic production infrastructure. | Require sit-down restaurants to use reusable plates and foodware. | Mandate new products contain a certain percentage of recycled material. |
| Enact “Pay As You Throw” programs that charge consumers less if they throw out less trash. | Facilitate textile recycling and reuse programs to prevent clothing from becoming waste and disincentivize new clothing manufacture. | Ban food waste from landfills and encourage the creation of a comprehensive composting system. |

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