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# Turning the tide on plastic in Europe’s rivers

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# From drones and smart cameras to biodegradable packaging, EU-funded researchers are working to remove plastic from rivers before it ever reaches the sea.

By Tom Cassauwers

Key Takeaways

From his bedroom desk in the Belgian town of Dendermonde, Gert Everaert used to watch the river Scheldt flow past. Barges and small boats drifted by. Birds fished. But the river also carried something less picturesque – a steady stream of litter and plastic waste.

“Cars would stop and people threw rubbish straight into the water,” he recalled. “All kinds of trash floated by. That always made me incredibly sad.”

Today, Everaert is no longer just watching. As deputy research director at the Flanders Marine Institute, he now leads INSPIRE, a major EU-funded research initiative bringing together scientists and innovators from 13 EU countries, plus Serbia and Thailand.

Their aim is ambitious but straightforward: stop plastic in rivers before it reaches the ocean – and prevent it from ever entering our waterways in the first place.

The INSPIRE team is developing a wide range of new tools to help clean up Europe’s rivers. From smart detection systems using drones and AI-powered cameras, to clean-up processes capable of capturing even tiny plastic particles. They are also working upstream, trying to stop plastic at the source before it reaches rivers.

## Why rivers matter

When people think about waterborne plastic pollution, they often picture vast patches of rubbish swirling in the open ocean or beaches covered in debris. But much of that plastic started its journey inland.

> Cleaning up rivers is the most efficient way to tackle the pollution, besides preventing pollution in the first place.
> Gert Everaert, INSPIRE

“Most of the plastic pollution in our oceans flows out of rivers,” Everaert explained. “The longer you wait to collect it, the more it breaks down into microplastics and spreads. Cleaning up rivers is the most efficient way to tackle the pollution, besides preventing pollution in the first place.”

INSPIRE is part of a wider European effort to reduce plastic pollution. By 2030, the EU aims to reduce plastic litter at sea by 50% and reduce microplastics released into the environment by 30%. If those targets are to be met, rivers will be central to the solution.

Unlike ocean clean-up projects, which deal with waste that has already dispersed widely, river-based approaches allow researchers to intervene closer to the source – before plastic disintegrates into smaller and harder-to-remove particles.

## Stop it at source

When it comes to pollution, prevention matters even more than removal. Once plastic enters a river system, it starts to degrade. Eventually, it breaks down into microscopic particles that are extremely difficult – sometimes impossible – to retrieve.

Everaert points to packaging as one target area.

“Today, vegetables are often packed in plastic, to keep them fresh longer. We’re testing whether we can replace that with chitosan, a biodegradable film derived from shellfish.”

Another target is agricultural plastic. Farmers widely use plastic films for mulching, covering soil to protect crops and retain moisture. But fragments often remain in the soil long after use. INSPIRE researchers are trialling bio-based polymers that could replace these materials and degrade naturally instead of accumulating.

These alternatives are being tested at agricultural sites across Europe. The idea is not simply to invent new materials, but to ensure they work in real-world conditions.

## From the Danube to the Douro

The INSPIRE researchers are developing and testing 20 different technologies across six European rivers, including the Scheldt in Belgium, the Rhine in the Netherlands, the Danube in Romania and the Douro in Portugal.

The variety is deliberate.

“Plastic pollution contains many types of polymers, and they come in different forms and sizes,” Everaert said. “In the Danube, pollution looks different than in the Scheldt. There’s no one-size-fits-all solution.”

Some rivers carry large floating debris. Others contain more fragmented or industrial plastic waste. Weather, shipping traffic, urbanisation and local waste systems all influence what ends up in the water.

To better understand and track pollution, researchers are deploying drones and AI-powered cameras that can automatically detect and classify plastic waste along riverbanks and on the water surface. These systems help authorities identify hotspots and act faster.

## Smaller than a human hair

The researchers are also developing technologies to remove plastic from the water in all its forms and sizes. One of the most challenging sources of pollution is also the hardest to see: microplastics and nanoplastics.

Microplastics are particles smaller than 5 millimetres. Nanoplastics are smaller still – less than one micrometre in diameter. For comparison, a human hair measures about 70 micrometres across.

These particles are now found almost everywhere – in water, soil, air, and even inside the human body. Scientists are still investigating the full health implications, but early research suggests possible links to inflammation and other health concerns, including cancer, allergies and immune system disorders.

Delvec, a Greek nanomaterials company involved in INSPIRE, is

developing a way to remove the tiniest plastic particles from water.

> “I think microplastics and nanoplastics are to us what asbestos was to the previous generation. Jeorge Deligiannakis, INSPIRE

“I think microplastics and nanoplastics are to us what asbestos was to the previous generation,” said Jeorge Deligiannakis, Delvec’s CEO. “We are only beginning to understand the risks, but we need to learn how to remove them.”

Delvec has created a prototype filter that captures nanoplastics without blocking water flow. The filter is coated with specially designed nanomaterials that bind to plastic particles.

“It’s like a reactive powder on the filter surface,” Deligiannakis explained. “It grabs the plastic nanoparticles as the water passes through.”

The prototype has already been tested in Slovenia. However, it still needs to be scaled up to handle the much larger volumes processed in wastewater treatment plants.

“The next step is industrialisation,” Deligiannakis said. “We need to make it robust enough for full-scale treatment facilities.”

## Turning the tap off on plastic

The INSPIRE researchers will continue their collaboration until spring 2027. By then, the team hopes to deliver not just individual technologies, but a practical blueprint that can be rolled out across Europe.

“We need to turn off the tap on plastic,” Everaert said. “Most plastic trash accumulates in rivers and can ultimately be flushed to the ocean.”

At the same time, rivers are not just waterways, he points out. They are ecosystems in their own right, rich in biodiversity and essential to human communities.

For Everaert, the mission remains deeply personal. The river he once watched as a boy is now part of a Europe-wide effort to rethink how plastic is used, managed and prevented.

If INSPIRE succeeds, the sight of rubbish drifting downstream

could become a thing of the past. Instead of carrying plastic toward the sea, Europe's rivers may once again run clean.

Research in this article was funded by the EU's Horizon Programme. The views of the interviewees don't necessarily reflect those of the European Commission. If you liked this article, please consider sharing it on social media.

Interviewee