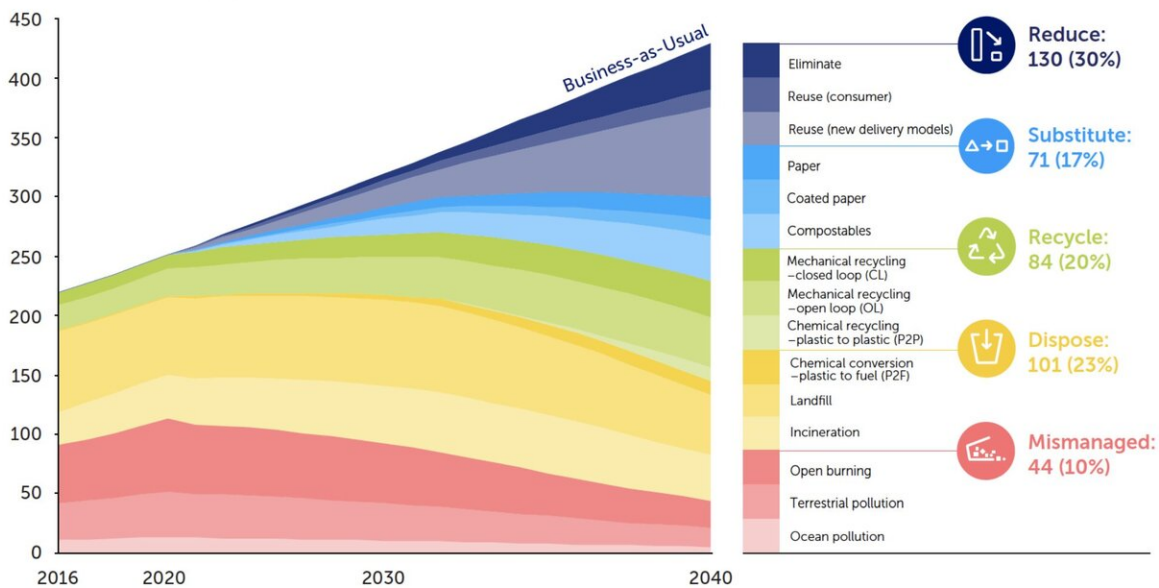


A world drowning in plastic pollution

July 23 2020

There is a credible path to significantly reduce plastic leakage into the ocean but only if all solutions are implemented concurrently, ambitiously, and starting immediately

Million metric tons per year



This 'wedges' figure shows the share of treatment options for the plastic that enters the system over time under the System Change Scenario. Any plastic that enters the system has a single fate, or a single 'wedge.' The numbers include macroplastic and microplastic.

There is a credible pathway to significantly reduce ocean plastic flow into the ocean, but only if all solutions are implemented Credit: The Pew Charitable Trusts/SYSTEMIQ

More than 1.3 billion tonnes of plastic will be dumped on land and in the oceans over the period from 2016 to 2040 unless the world acts, say a team of 17 global experts who have developed a computer model to track the stocks and flows of plastic around the world.

The modelling suggests that even with immediate and concerted efforts, 710 million tonnes of [plastic waste](#) will be discarded into the environment—460 million tonnes on land and 250 million tonnes in watercourses.

In a groundbreaking study, they have revealed the scale of a problem caused by global waste management systems unable to cope with the increasing volume of plastic waste.

Although the study's primary focus was to investigate how plastic reached the oceans, it has also revealed that each year nearly 30 million tonnes is dumped on land and nearly 50 million tonnes is burned in the open—in addition to the 11 million tonnes ending up in the seas.

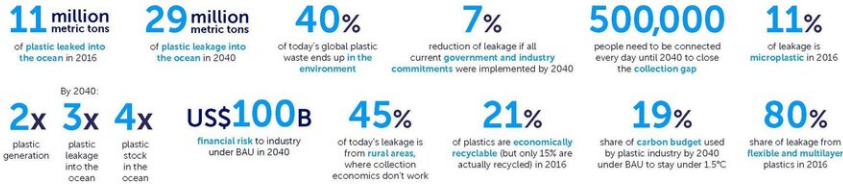
The level of pollution is predicted to rise on an annual basis. In the year 2040, 133 million tonnes will be burnt and 77 million tonnes dumped on land, with 29 million tonnes ending up in the oceans. That will happen even if governments act on their commitments to reduce [plastic pollution](#)

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FAST FACTS

'Breaking the Plastic Wave' in numbers

Scale of the problem



Integrated system change achieves social, environmental, and economic benefits



A first-of-its-kind analysis describes actions needed to stop plastic from entering the ocean. Credit: The Pew Charitable Trusts/SYSTEMIQ

Academics from the University of Leeds provided analysis of the role that effective waste management plays in reducing pollution, and in modelling what happens when waste is either not collected or is mismanaged.

The lead investigator from Leeds was Dr. Costas Velis, a Lecturer in Resource Efficiency Systems in the School of Civil Engineering who has been involved in various international initiatives to stem the flow of plastic into the oceans.

He said: "This [scientific inquiry](#) has for the first time given us a

comprehensive insight into the staggering amounts of plastic waste that are being dumped into the world's terrestrial and aquatic ecosystems. We now have a much clearer picture of the sources of the pollution and where it eventually ends up.

"Unless the world acts, we estimate more than 1.3 billion tonnes of plastic pollution will end up on land or in water bodies by 2040. Enormous as that figure is, it could be even bigger if it were not for the fact that a vast quantity of waste is openly burned—but that burning also carries a major environmental cost."

The scientists say there is no single magic bullet to reduce plastic pollution in the seas, and call for a range of interventions from industry and governments which they say are achievable.

Their findings—Breaking the Plastic Wave—are published today. A separate scientific paper describing the assumptions that went into the computer model underpinning the report is published in the peer-review journal *Science*.

The project was funded by the US philanthropic organisation, The Pew Charitable Trusts. The research was conducted by four key institutions: The Pew Charitable Trusts, SYSTEMIQ, University of Leeds and University of Oxford.

Scale of the challenge

Around 95 percent of aggregate plastic packaging is used just once before it becomes waste.

The analysis showed that the biggest source of plastic pollution was uncollected solid municipal waste, a lot of it from households.

Currently, around a quarter of all plastic waste is not collected, leaving individuals to dispose of it themselves. By 2040, a third of all plastic waste generated will be uncollected. That will amount to 143 million tonnes a year.

As the scientists modelled the flows of waste plastics through the economy, they identified a hidden aspect to the problem—the vast quantities of plastic waste being openly burnt.

Although burning reduces the amount of waste being discarded onto land and into the seas, it generates potentially toxic fumes and contributes to greenhouse gas emissions.

Without action, the computer modelling estimates that approximately two and a quarter billion tonnes of plastic waste will be openly burned between 2016 and 2040, that is more than twice the amount that is projected to be dumped on land and into the aquatic environment.

Ed Cook, Research Fellow in the School of Civil Engineering at the University of Leeds and one of the scientists involved in the study, said: "Modern incinerators with air pollution control technology, emit very few hazardous substances. But with open burning, the combustion is often incomplete, and all sorts of potentially toxic emissions are released, which can result in a range of negative health outcomes.

"Those obnoxious substances are being breathed in by people who are working with waste and also in the communities that live nearby.

"Burning is a double-edged sword. It reduces the amount of plastic that could eventually end up in the seas and on land but it also poses many other environmental problems, including a significant contribution to global warming"

The solutions

The study revealed that improving waste collection services would be the single most influential factor in reducing pollution.

According to the UN's Global Waste Management Outlook, around two billion people in the world do not have access to a waste collection service—and that is expected to grow to four billion people by 2040, according to the research.

Dr. Velis said: "In the absence of collection services, people have to make difficult choices about how to manage the waste themselves by openly burning it, dumping it on land, or putting it directly into rivers and coastal waters. Our modelling shows that every additional tonnes of plastic collected reduces pollution of the aquatic environment by 0.18 tonnes.

"Waste collection is indeed the most effective way to prevent pollution.

"So at the heart of any effective solution should lie the provision of solid waste management services and infrastructure to all, a key target of the UN Sustainable Development Goal 11."

The lack of a formal waste collection service has resulted in the growth of an informal waste collection system made up of waste pickers.

A conservative estimate indicates that there are at least 11 million waste pickers worldwide. This marginalised sector makes a living sifting through uncollected waste, looking for material that they can sell-on for recycling. It is believed they collect about 58 percent of all plastic material that is recycled worldwide—more than all the formal authorities put together.

Despite playing a major role in reducing global plastic waste, many waste pickers lack basic employment rights or safe working conditions.

Dr. Velis said: "Waste pickers are the unsung heroes of recycling in the Global South, without whom the mass of plastic entering the aquatic environment would be considerably greater. Thus, it is critical that supportive policies are implemented to eliminate the health and safety challenges and wider societal challenges associated with their activities."

Inclusion, integration and enabling self-organisation of waste pickers is critical to supporting the circular economy in the Global South.

The scientists conclude that there is no single solution that would reduce the flow of plastic waste into the oceans. They used the computer model to investigate the effectiveness of various interventions involving six scenarios, which ranged from business as usual to improving levels of recycling or finding alternatives to plastics—to a complete overhaul of the system. None of the single solutions was sufficient. Brought together, though, they could reduce plastic flow into the oceans by 80 percent of the level projected for 2040.

Although the task is huge, the report says it is attainable and can be achieved using existing technology and know-how, by:

- Reducing growth in plastic production and consumption to avoid nearly one third of projected plastic waste generation.
- Substituting plastic with paper and compostable materials.
- Designing products and packaging for recycling.
- Expanding waste collection rates in middle/low-income countries to around 90% in all urban areas and around 50% in rural areas and support the informal collection sector.
- Building facilities to dispose of the 23% of plastic that cannot be recycled economically, as a transitional measure.

- Reduce plastic waste exports.

The focus in high income countries should be to decrease plastic consumption, improve product design and recycling. In low-to-middle income economies, the push should be on improving waste collection and in investing in sorting and recycling, say the scientists.

Mr Cook said: "The interventions explored here are all achievable using existing and already mature technologies. The suite of approaches we've proposed is already within our capability—but it requires the political, societal and corporate will in order to achieve it.

"There is not one single solution. We can't simply say we're going to recycle everything or use less material, we need to take a holistic approach and look at the whole system.

"Although the report looks at the flows of plastic waste into the oceans, the benefits will extend far beyond the marine environment."

Breaking the Plastic Wave acknowledges that these interventions will reduce—but not stop—plastic pollution into the seas. Trying to reach near-zero plastic pollution would require "...technological advances, new business models, significant spending and, most crucially... innovation".

For Dr. Velis, the plastic pollution study has the potential to kickstart a scientific revolution, similar to the way that early reports from the Intergovernmental Panel on Climate Change began to raise awareness of global warming—and the steps needed to tackle it.

Dr. Velis added: "This paper shows the huge mobilisation across the global scientific community and our determination to find cost-effective solutions to the problems of plastic pollution in the marine environment and elsewhere.

"I can't predict the future but I hope our most realistic scenarios could be reality in 2040."

More information: W. Lau et al., "Evaluating scenarios toward zero plastic pollution," *Science* (2020). [science.sciencemag.org/lookup/...1126/science.aba9475](https://science.sciencemag.org/lookup/doi/10.1126/science.aba9475)

Provided by University of Leeds

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