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A ‘Paris Agreement for plastic’ could slash plastic pollution to almost zero

With both plastic production and waste projected to escalate to unmanageable levels by 2050, scientists at UC Santa Barbara and UC Berkeley have launched a new [AI-powered online tool](#) that provides unprecedented insight into how the nations of the world can combine policies to end plastic pollution with the United Nations global plastics treaty, currently under negotiation. In March 2022, more than 175 nations agreed to develop the international, legally-binding treaty to end plastic pollution. Sixty of these nations, from the United Arab Emirates to Palau, have committed to achieving this by 2040.

Researchers say that if no action is taken, annual plastic production will rise 22% between 2024 and 2050, and plastic pollution will jump 62% between 2024 and 2050. By continuing business as usual, the world would generate enough litter between 2010 and 2050 to cover the entire island of Manhattan with a 3.5 kilometer-tall heap of plastic — nearly 10 times the height of the Empire State Building.

But, the scientists say, a strong UN plastics treaty that incorporates the right mix of nine plastic reduction policies could see plastic pollution virtually eliminated in 2040, with the generation of mismanaged waste reduced by 89% to a more manageable 10 million metric tons per year.

At the same time, the research finds that a business-as-usual scenario places the greatest burden of mismanaged plastic waste — waste that is littered or not properly disposed of, leading to polluted waterways and overflowing landfills — on less wealthy countries. Without intervention, mismanaged waste in the Global South will be 4.8 times greater in 2050 than in NAFTA countries, the 30 countries in the European Union, and China combined in 2050. Such a future further exacerbates similar types of disproportionate environmental justice harms already created by climate change.

“The developing countries house much more of the world population than NAFTA and EU combined,” said Nivedita Biyani, a researcher on global plastic modeling at the UC Santa Barbara-based Benioff Ocean Science Laboratory (BOSL). “If they start using plastics at the rates that NAFTA and EU are, we will be in much more trouble. That said, there is a way out of this mess. By including all the policies outlined, we can reach a near-zero mismanaged waste scenario. I hope world leaders in NAFTA and the EU will commit to a high ambition treaty to help other countries leap-frog their way out of this.”

The new tool and underlying analysis were developed by a team of plastic researchers, data scientists and AI researchers at BOSL, the Bren School of Environmental Science & Management at UC Santa Barbara, and the Eric and Wendy Schmidt Center for Data Science & Environment at UC Berkeley. Using machine learning to combine information about population growth and economic trends to forecast the future of plastic production, pollution and trade, the tool projects global and regional plastic pollution trends from 2010 to 2050, 10 years beyond the High Ambition Coalition’s 2040 goal of ending plastic pollution.

This interactive model, released as negotiators head to Nairobi, Kenya, for the first round of plastics treaty negotiations, reveals a host of policy insights that can help shape the UN treaty.

“Finally solving the plastics crisis means a win for the environment, a win in our fight against climate change, and a healthier and more just future for all people,” said Douglas McCauley, director of BOSL and an associate professor at UC Santa Barbara. “A weak treaty would be worse than no treaty at all. But I was so thrilled to see scientific proof that a strong treaty could virtually end the problem of plastic waste forever. Nothing makes me happier than knowing that my generation could be the

last generation to live with the cancer of plastic pollution. I can only hope the nations meeting in Nairobi pay attention to these findings.”

“I confess that when I first saw these nations promising to end plastic pollution by 2040, I thought that this would be impossible,” added McCauley, also an adjunct professor at UC Berkeley. “I was blown away to discover a pathway to near-zero in this research.”

The policies

The research shows that five specific actions implemented in conjunction would take the biggest chunk out of plastic pollution: 1) a minimum recycled content commitment; 2) a cap on production of virgin plastic; 3) investment in plastic waste management infrastructure; 4) similar investments in new recycling capacity; and 5) a small tax on plastic packaging (e.g., items like plastic bags).

Establishing a minimum recycling content rate that requires certain plastics be made of at least 30% recycled materials would, by itself, slash annual mismanaged waste by about 31% in 2040. Similarly, capping plastic production to 2025, an action analogous to policies common in the climate domain, could, by itself, reduce annual mismanaged waste by approximately 15% in 2040, and 26% in 2050.

Under the treaty, funding to combat plastic pollution could be built using revenue from taxes or related types of “extended producer responsibility” programs that enlist the aid of plastic producers. This research suggests that, dollar for dollar, more can be done by investing in waste management (e.g., collection services, landfills, waste processing plants) versus recycling plants — and that return on investment is even greater when this funding is directed to countries in the Global South.

“The tool is unique in that it allows real-time interactive prediction for UN negotiators,” said Sam Pottinger, a senior research data scientist at UC Berkeley. “They can quickly simulate outcomes of different policy scenarios which they can make both by selecting policies built into the tool and by creating their own. Bringing their expertise into conversation with the modeling, this gives them the opportunity to use the AI and engine to explore scenarios that maybe we didn't even consider. This freedom and speed let the tool keep up with conversations as they evolve and ultimately enables nations to align on an ambitious informed suite of treaty policies

to reduce mismanaged waste.”

The scientists in the team stress that, while it is critically important to make good on our global commitment to end plastic pollution by 2040, there are many other wins to be had in the treaty. For instance, the analysis includes an option to phase out single-use packaging, including plastic straws, shopping bags, cutlery and expanded polystyrene “styrofoam” cups. Such single-use items are extremely common in river and ocean ecosystems and create significant environmental harm.

A portfolio of policies such as those highlighted in the researchers’ 2040 zero plastic waste solution already has existing precedent in many regions. Many facets of this treaty package, for example, mimic the plastic pollution roadmaps already used in California and the EU. And a host of other countries (e.g., Kenya, Rwanda, Palau, Seychelles, India, China) have phased out certain single use plastics, like bags. Nations such as the Philippines and Vietnam have extended producer responsibility laws already on the books.

“We cannot recycle our way out of this,” said Biyani. “We need countries and companies to come on board to help limit the amount of plastic going into our oceans and larger environment. Especially fast-moving-consumer goods companies can make a marked difference here, by rethinking the packaging choices they make on behalf of their consumers.”

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