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Groundbreaking Report Reveals Plastics' Climate Impacts

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Plastics' Impacts Greater Than Previously Estimated

Washington, D.C., May 14, 2025 - A new report, "**Plastics: Exposing Their Climate Impacts,** *What we know, what we need to know, & recommendations for research and policy*" from The Plastics & Climate Project and Environmental Law Institute, reveals the state of scientific knowledge about the ways that plastics are impacting climate change. Synthesizing the latest peer-reviewed scientific research, the report systematically maps out three pathways through which plastics affect the climate. Plastics emit greenhouse gases throughout their lifecycle, disrupt key ecosystem processes essential to sequestering carbon, and affect how the Earth reflects and absorbs energy.

Key findings about the state of scientific knowledge on the plastics-climate nexus include the following:

- **Greenhouse Gas Emissions:** Current estimates do not fully account for the greenhouse gases emitted by plastics during their entire lifecycle. From raw material extraction and manufacturing to transportation, use, and disposal, plastics generate greenhouse gas emissions. Primary production (including fossil fuel extraction and creation of monomers or the building blocks of plastics) is the most emissions-intensive stage of the lifecycle, and incineration of plastic waste and certain forms of chemical recycling can also be emissions-intensive.
    - Current data indicate that plastics are responsible for approximately 4% of global greenhouse gas emissions, making the plastics sector at least the world's fifth-largest emitter if it were a country.
    - Current emissions are undercounted due to data gaps. With plastic production expected to triple by 2060, emissions are projected to rise considerably.

- **Disruption of the Carbon Cycle:** Plastic pollution, including microplastics and nanoplastics, can interfere with the planet's natural systems that absorb and store carbon, including in soils, plants, and the ocean. Plastics potentially reduce the ocean's carbon-absorbing ability, increase the release of carbon dioxide from soils, and harm microscopic marine plants vital for carbon storage. While some studies have conflicting results, studies generally find that plastics impact the carbon cycle in ways that contribute to additional warming.
- **Impact on Earth's Radiation Budget:** By changing surface reflectivity (albedo) and interacting with clouds and atmospheric energy exchange, plastics can physically alter how the planet reflects and absorbs energy, with possible implications for Earth's surface temperature. While this is a new and less understood area of research, the limited number of studies that have been done suggest that plastic particles in the atmosphere and on the Earth's surface might have somewhat of a cooling effect, but much remains unknown.

The clearest finding from the systematic review of the scientific literature is that the body of evidence regarding the impact of plastics on the climate is woefully incomplete, making it impossible, at present, to fully quantify the total climate impact of plastics.

The report's climate findings are particularly salient in the lead up to two pivotal global convenings: UN World Environment Day (June 5, 2025), which this year is focused on reducing plastic pollution, and the next round of UN negotiations on a global plastics treaty (August 5-14, 2025).

The report stresses that only by enhancing understanding of and rigorously accounting for the ways the global plastics and climate challenges are intertwined will it be possible to address them both effectively.

The report outlines a roadmap for future research to address existing knowledge gaps and fully account for all the climate impacts of plastics. These include:

- More estimates of GHG emissions and emissions intensities across all plastics lifecycle stages (especially for transportation, consumption/use, and unmanaged waste) and for different polymer types.
- More global and national-level GHG emissions and intensity data, particularly since national-level studies have only been done on 14 countries.
- Further investigation into the impacts of plastics on terrestrial, marine, and coastal blue carbon ecosystems, especially on the more understudied carbon sink factors (e.g., the biological carbon pump, marine bacteria, carbon dioxide drawdown into surface waters).

- More experimental and modeling efforts to understand the radiative impacts of plastics, including their influence on clouds, albedo, and ice melt.

The report also calls for this future research utilize realistic mixtures of plastic types, shapes, and weathered states that reflect what is found in the environment, and to report results with greater specificity and standardization to enable data comparability. In addition, as bioplastics production increases, their climate impacts must be studied with the same rigor as conventional plastics.

The ultimate goal of the report is to lay the groundwork to eventually be able to fully determine the extent to which plastics contribute to global average temperature rise, and to enable comprehensive accounting for all the climate impacts of plastics. To that end, the report urges the public and private sectors to help close the data gaps on the climate impacts of plastics and ensure that these impacts are integrated into all relevant assessment reports, models, and analyses that involve plastics, climate, or related issues.

Recommendations include the following:

- **Recommendations for the Public Sector Internationally:**
    - The Intergovernmental Panel on Climate Change (IPCC) should explicitly include allowance for plastics' full climate impacts in its assessment reports, emissions scenarios, and models.
    - The IPCC should produce a Special Report on Plastics, Petrochemicals, and Climate Change.
    - The forthcoming UN Plastics Treaty negotiations should incorporate climate impacts into environmental impact assessments and reporting requirements.

- **Recommendations for the Public Sector Nationally and Subnationally:**
    - Governments should provide financial and other support for research on the plastics-climate nexus and integrate plastics' climate impacts into GHG emissions inventories, climate vulnerability assessments, and nationally determined contribution (NDC) submissions under the Paris Agreement to the UN Framework Convention on Climate Change (UNFCCC).
    - Governments should modify laws and regulations to have the private sector be transparent about the ingredients used in plastics, which will aid in determining full-lifecycle emissions and impacts on planetary processes.

- **Recommendations for the Private Sector**

- Businesses operating in any part of the plastics lifecycle should monitor and disclose their contributions to greenhouse gas emissions and the release of micro- and nanoplastics, incorporating these into their sustainability reports, targets, and reduction initiatives.
- Companies can contribute to providing information essential to calculating plastics' impacts on climate by improving transparency about the polymer makeup of plastics and about the ingredients added to plastics.

Access the report and the paper: https://plasticsandclimate.com/publications

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About the "*Plastics: Exposing Their Climate Impacts*" Report:
The report synthesizes and elaborates on a comprehensive review of the scientific literature published in April 2025 in *Frontiers of Environmental Science*: "The knowns and unknowns in our understanding of how plastics impact climate change: A systematic review". The report is meant to provide a non-technical summary to help these issues reach an audience beyond the scientific community, including policymakers, businesses, and the public.

The authors of the scientific paper in *Frontiers* and the "Plastics: Exposing Their Climate Impacts" report include Dr. Xia (Alice) Zhu**,** Banting Postdoctoral Fellow at the Department of Ocean Sciences, Memorial University of Newfoundland, and Holly Kaufman, Senior Fellow at the World Resources Institute. They are the co-founders & directors of The Plastics & Climate Project. Other authors of the report include Cecilia Diedrich, Staff Attorney, and Dr. John Doherty, Science and Policy Analyst, from the Environmental Law Institute (ELI), with input from the Monterey Bay Aquarium and Dr. Karen Raubenheimer, Australian University of Wollongong.

Quotes from Report Authors, Advisors and Experts

Holly Kaufman, report author, Co-founder, The Plastics & Climate Project, Senior Fellow at the World Resources Institute:
"Our report highlights an urgent truth: plastic pollution is not only affecting the health of people and ecosystems but also increasing global warming. Even if all plastic production stopped today, most of the climate impacts from "legacy" plastics would continue. We have enough data to know that – but there are many holes in the data that we need to fill. You can't manage what you don't measure. If the world is going to tackle both the plastics and climate crises, we need to fully understand how one affects the other, and how much."

Dr. Xia (Alice) Zhu**,** report author, Co-founder, The Plastics & Climate Project, Banting Postdoctoral Fellow in the Department of Ocean Sciences, Memorial University of Newfoundland:
“Although we still need to gain a fuller understanding of how and the extent to which plastics contribute to global temperature rise, we have enough knowledge to begin to incorporate plastics’ climate impacts into assessment reports, climate models, and GHG emissions scenarios. We need to know more, but that can’t be an excuse for inaction.”

Dr. John Doherty, report author, Science and Policy Analyst, Environmental Law Institute (ELI):
"With plastic production expected to increase over the next few decades, our report makes clear that plastics’ climate impacts must be factored into any credible climate strategy to achieve the Paris Agreement’s 1.5°C target. An important thing this report highlights is that those impacts are not just from greenhouse gas emissions. The way plastics affect climate processes, like the Earth's carbon cycle, is still underappreciated and should be further studied."

Quotes from Report Advisors
Margaret Spring, report advisor, Chief Conservation and Science Officer, Monterey Bay Aquarium:
“This report reveals a new concern to add to the list of harmful effects of plastic pollution on our health and future well-being. Research indicates plastics also pose a risk to our ocean, coastal salt marshes and mangrove ecosystems—each a critical carbon sink that could lost capacity due to plastics’ increasing pervasiveness in the environment. The report elevates the need to further investigate the impact of plastic on these critical ecosystems, to help us preserve their capacity to absorb carbon dioxide and strengthen natural carbon sequestration and removal efforts.

Dr. Dan Lashof, report advisor, Senior Fellow, World Resources Institute:
“In light of the report findings, it’s clear that we need to know more about what we’re dealing with – and what we will have to deal with if plastics production continues to grow as rapidly as projected. People have been rightly focused on the direct impacts of plastic production and waste on health, but we need to add the impacts of plastics on climate to that list of concerns.”

Dr. Karen Raubenheimer, report advisor, Senior Lecturer, Australian National Centre for Ocean Resources and Security (ANCORS), University of Wollongong, Australia: “Plastic pollution comes in many forms and it’s often the invisible forms that will affect us the

longest. The findings of this report clearly illustrate that the climate impacts of plastics are one we can't afford to ignore. As the authors have stressed, a solid understanding of the effects, as well as the benefits of change, are urgently needed if we are to successfully reduce the cumulative impacts on the environment we rely on so heavily."

What The Experts Are Saying

Sylvia Earle, President and Chairman of Mission Blue / The Sylvia Earle Alliance, National Geographic Society Explorer in Residence
"We now know that plastics, from their start to their waste, are polluting the oceans and also fueling the climate crisis. This new research makes it clear: every stage of the plastic lifecycle emits greenhouse gases, and plastics may undermine the ocean's ability to store carbon. The evidence is growing, but so are the gaps in our understanding, and we have to fill in the gaps in our knowledge. We cannot afford to treat the ocean as a dumping ground and ignore the climate costs of plastic. It is time to act decisively– reduce our reliance on plastics, invest in science, and protect the blue heart of the planet before these changes become irreversible."

Monica P. Medina, Distinguished Fellow at Conservation International and former Assistant Secretary of State for Oceans, Environment, and Science
"This seminal report provides further evidence that the climate impacts of plastics have to be reckoned with. The scale of the problem still needs to be determined, but the plastics treaty negotiations in August present a clear opportunity for nations to begin to take action to factor the climate impact of plastics into the discussion."

Jo Banner, Co-Founder and Co-Director, The Descendants Project
"Those of us who live in Louisiana's Cancer Alley live every day with the toxicity of plastics production. It is making us sick, and now we know that its impact on the climate affects all of us. Plastics production is not just an environmental crisis - it is a continuation of a system rooted in exploitation, and in our case, echoing the legacy of slavery that still plagues Black communities today. Black and poor communities are disproportionately exposed to pollution and disease from these facilities. It's way past time to put this ever-increasing health and climate menace under control. We must have equitable solutions now to protect our communities and reduce the harmful impacts of plastics."

About the Plastics & Climate Project

The Plastics & Climate Project aims to comprehensively account for the climate impacts of plastics and help estimate the extent to which plastics and the petrochemicals they contain contribute to global average temperature rise. This initiative has resulted in the publication of a scientific paper, *The knowns and unknowns in our understanding of how plastics impact climate change: a systematic review*, and a summary report for non-technical audiences, *"Plastics: Exposing Their Climate Impact."* These publications examine the climate impact of plastics throughout their lifecycle, including their effects on the carbon cycle and the radiation budget. The Project is now engaged in a major outreach effort to share the findings and recommendations with scientists, policymakers, educators, communities, industry, investors and others, to garner support for the necessary subsequent research, and to include climate-relevant plastic impacts in climate models and greenhouse gas accounting, including the IPCC, the UN negotiations for a Global Plastics Treaty, and national, subnational and local efforts to address the plastics and climate crises. The Project also fosters communication among other researchers and institutions working on complementary aspects of the plastics and climate nexus. An annotated and ongoing collection of resources about the climate impacts of plastics is available to all at The Plastics & Climate Project website.

About the Environmental Law Institute

The Environmental Law Institute (ELI) makes law work for people, places, and the planet. For over 50 years, ELI has been a respected force in environmental law, known for nonpartisan integrity, cross-sector reach, and emphasis on long-term solutions at the intersection of law, policy, society, technology, and markets. We advance sustainable solutions by equipping decisionmakers with trusted, expert, and in-depth information relevant to today's pressing environmental challenges. We do this through world-class research, expert education, and multi-perspective convening.

About the Monterey Bay Aquarium

With a mission to inspire conservation of the ocean, the Monterey Bay Aquarium envisions a future where the ocean flourishes and people thrive in a just and equitable world. We create extraordinary experiences that inspire awe and wonder, champion science-based solutions, and connect people across the planet to protect and restore the ocean.

About the University of Wollongong (UOW)

UOW is one of the world's leading modern universities, recognized for excellence in teaching, learning, and research. Founded on the vision of local community members in Wollongong, New South Wales, UOW has grown into a global institution, working with industry, research partners, governments, and communities to address critical economic, environmental, social, and medical challenges. With a student population of over 31,000 and a network of campuses across the NSW East Coast and internationally in Singapore, Malaysia, India, Dubai, Hong Kong, and China, UOW is committed to inspiring a better future through education, research, and partnership.