

THE ROAD AHEAD IN PLASTIC POLLUTION: RESEARCH AND POLICY CONNECTIONS

Plastic pollution, including nano- and microplastics, has emerged as one of the most prominent global environmental issues, and developing integrated international networks will be essential to address this challenge effectively. Researchers from diverse fields, including chemistry, toxicology, environmental science, political science, and other social sciences, are required to address the complex challenges associated with plastic production/demand, (mis)use, final destination, pollution, and remediation.¹ A cohesive global effort to overcome geopolitical boundaries – sharing knowledge, technology, and innovative solutions – will be essential. This must include cross-sector collaboration,² inclusive participation in decision-making, and joint approaches among scientists, policymakers, industry, and communities, all supported by economic development and sustained political commitment.

Addressing this global challenge requires more than parallel expertise. Trans/Interdisciplinarity is not about mastering or listing every field, but about ensuring that knowledge is not epistemically isolated. Accordingly, plastic pollution research not only needs to engage a wide range of disciplines but also geographies. This is important because plastic pollution is global, yet its impacts are not distributed equally. Diversities of perspectives are necessary to ensure that evidence and solutions reflect the environmental, social, cultural, and economic realities of different regions. Efforts concentrated in a small number of geographic or socially homogeneous regions risk overlooking important dimensions. Science alone cannot adequately understand global plastic pollution, nor develop effective and equitable response/solutions without drawing on the knowledge generated and kept within diverse human contexts. As Knobel³ states, “To progress, science must be truly global”.

Knowledge production should generate the evidence that informs policy, and the global scientific community must engage thoughtfully to ensure that this evidence supports effective decision-making. Such engagement is vital to promote fairness and equity, avoid misconceptions, and prevent policies based on incomplete or misleading interpretations. Ramirez-Ruiz and Senninger⁴ discussed this dynamic, showing that government policy documents from 185 countries disproportionately cite sources originating from the Global North. The absence, or misrepresentation, of diverse and Global South perspectives must be addressed to ensure that proposed and put-in-place policies are effective and inclusive global solutions. Ensuring that scientists from diverse backgrounds are “at the table” is not merely a matter of capacity building, but of ensuring they interact equally as creators and as the power behind the solutions reached. All voices and perspectives are essential – Global South scientists and stakeholders must actively help shape the plastic pollution agenda, ensuring that global decisions reflect diverse realities and needs, and ultimately lead to more effective and equitable solutions.¹ The ongoing negotiations for an international legally binding instrument on plastic pollution, including the entire marine environment, offer a concrete opportunity: scientists from the Global South must help shape the treaty’s evidence base and provisions so that it reflects

diverse environmental and social contexts, ensuring a just transition that leaves no one behind, and can be effective across regions.

Funded by FAPESP (*Fundação de Amparo à Pesquisa do Estado de São Paulo*), the São Paulo School of Advanced Science on Microplastics brought together 25 distinguished speakers and 125 students at different career stages, representing 31 countries across all continents, to examine the nature and impacts of microplastics on the environment and human health. A school of this scale is unprecedented in the field of microplastics. Early-career scientists came together to strengthen and support the enduring global networks needed to connect expertise across disciplines and regions. These exchanges, though small, are a crucial step in preparing the next generation of scientists to collaborate across disciplinary and geographical boundaries in addressing plastic pollution.¹ Holding the School in Brazil underscored the need for scientists from the Global South to take a prominent role in the global discussion. Brazil is a strategic player in the Global South due to its size, population, biodiversity, economic importance, and long history of multilateral negotiations. As a multicultural and socio-environmentally complex country, Brazil has the expertise to address asymmetries and lead the development and implementation of solutions to the global plastic crisis.

To make more effective decisions, collective thinking is essential. Hundreds of thousands of studies on plastic environmental pollution and human health already provide a robust evidence base to inform public policy. Science must move beyond simply reproducing studies that already provide solid evidence – results that will not change whether tested in one laboratory or another. Instead, it should build on this established knowledge, using it as a scaffold to free scientists to investigate diverse local realities and address the gaps that remain in literature. Today, the key challenge is no longer generating more evidence of plastics’ presence and harm, but translating it across geopolitical, economic, innovation-related, and environmental contexts. Solutions must adapt global knowledge to local realities. Effective action therefore depends on the ability to think globally while adapting knowledge, policies, and interventions to regional and local contexts.

Twenty years after the term “microplastics” was introduced, more than 37,000 studies and 1,645,500 citations⁵ have been generated. These outputs have documented characteristics of plastic pollution in nearly all natural and human environments, identified sources, investigated ecological and human health risks, and led to the recognition that plastic pollution is a global crisis. Despite these achievements, the global production and consumption of plastics continue to increase, plastic debris accumulates throughout the environment, and meaningful policy action has not kept pace with the scale and urgency of the challenge.⁶

We urge scientists worldwide – at every career stage, from early-career researchers to established leaders – to think and work



beyond geopolitical and disciplinary boundaries, embracing diverse perspectives, experiences, and knowledge systems to confront persistent regional inequities and advance effective solutions to plastic pollution. Ultimately, success will depend on stronger connections between research and policy, sustained international collaboration, and the meaningful integration of diverse voices into decision-making. Only through this collective effort can science truly drive the transformative change needed to address the global challenge of plastic pollution.

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