Plastics and the Triple Planetary Crisis

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Scientists' Coalition for an Effective Plastics Treaty

Fact Sheet:
Plastics and the Triple Planetary Crisis

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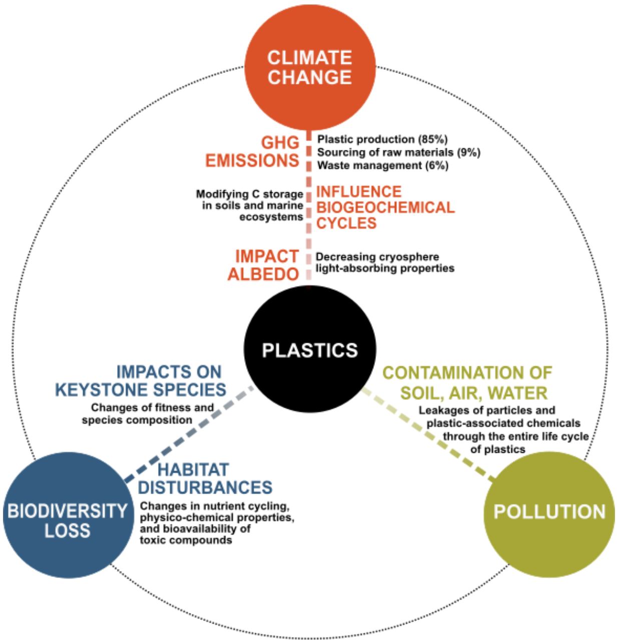

The Triple Planetary Crisis identifies climate change, biodiversity loss and pollution as the three major risks to humanity. Scientific evidence demonstrates that plastics and associated chemicals (hereafter referred to as plastics), including some bio-based plastics, are destabilizing the biosphere, disrupting basic Earth system processes, harming the natural environment and living organisms including humans [1], and threatening the right to a clean, healthy, and sustainable environment (UNHCR A/HRC/RES/48/13).

What is the Triple Planetary Crisis?

The United Nations and its Environment Programme recognize that we are facing a Triple Planetary Crisis, with irrefutable evidence for the impacts of human activities on the planet. We face the unprecedented threats of anthropogenic **climate change, biodiversity loss, and pollution**, driven by unsustainable production and consumption of energy, chemicals, materials, products, and technologies. Each of these crises drives profound biophysical changes to the planet and poses threats to the rights of nature, and human rights, health, and wellbeing. Combined, these three compounding contributors render the planet less hospitable and more unpredictable. Interactions between the three crises risk initiating synergistic knock-on mechanisms that hasten and exacerbate impacts.

How do plastics cause pollution?

Plastics are a source of pollution throughout their entire life cycle, with releases to air, land, and water at all stages globally [2]. Plastics are chemicals [3], many known to be substances concern. This pollution begins at the extraction of feedstocks destined for the production of plastics (i.e., fossil fuels or biobased carbon sources), with releases of greenhouse gases (GHG), fracking water, oil spills, chemicals, fertilizers, and pesticides. At polymer and production stages, chemicals and micro and nanoplastics (MNPs) are released, including monomers, polymers, additives, pellets, flakes, powders, and fragments [4]. Spills and releases also occur during transportation [5]. During commercial, industrial and consumer use phases, plastics are intentionally and unintentionally released, e.g., via use of fishing gear, agricultural plastics; and releases and emissions of chemicals and MNPs from plastics in the environment. Further releases occur during waste management including recycling [6]. In addition, plastics weather constantly, making these smaller particles in permanently movement, a difficult target to assess with small particles shed and chemicals liberated [7]. Plastics pollution mitigation and remediation of habitats can also result in releases of MNPs, as well as monomers, polymers, and combined with other intentionally and unintentionally added chemicals. Plastics pollution impacts environmental [8] and human health [9] via daily exposure, multiple exposure routes (e.g., contaminated food or inhalation of particles), and cumulate impacts.

How are plastics connected to climate change?

Ninety-nine percent % of plastics are produced from fossil feedstocks and with large volumes of fossil energy. In 2015, plastics caused 4.5% of global GHG emissions, and its global carbon footprint is expected to increase at the same speed as projected plastics production [10]. GHG emissions (e.g., carbon dioxide and methane) occur at all stages of the plastics life cycle, from extraction and transportation of the raw materials to polymer and chemical production, plastic product conversion, energy inputs into recycling, waste incineration and uncontrolled burning, plastics removal, and remediation of contaminated ecosystems [10]. and environmental degradation [11]. Most GHG emissions occur in the early life stages of sourcing raw materials (9%) and plastic production (85%), and 6% of emissions occur during waste management [10]. The amount of plastics in municipal solid waste streams is rapidly increasing, as are GHG emissions from waste management [12]. Furthermore, there is evidence that plastics may also affect climate via indirect mechanisms. Common types of microplastics, could impact albedo (or fraction of solar radiation reflected by a surface) and melting of the cryosphere via their light-absorbing properties [13,14]. MNPs influence biogeochemical cycles in aquatic [15] and terrestrial environments [16], modifying the potential C storage in soils and aquatic ecosystems [17]. Not only do plastics affect climate, but climate change can affect the fate of plastics. Extreme weather events are significantly increasing plastics pollution in all ecosystems [18,19].

The costs of emissions of CO_2 and other GHGs from plastics production is estimated at $341 billion (USD) annually, due to economic losses associated with climate change, environmental degradation, and human health impacts [9].

How do plastics impact biodiversity?

Throughout its supply chain, plastics can impact biodiversity by being (un)intentionally added to products and (un)intentionally released into the environment (e.g., water and air). These releases happen for example, through spillages, landfill leachate, MNPs leakages, tire wear, dumping, and sewage (sludge) applications. Macro, micro- and nanoplastics have impacts on living organisms and community compositions, both through their physical nature and disturbances to habitats, as well as through the toxicity of plastics, particles, and associated chemicals.

Landfills and dumpsites are increasingly covering land areas, with resulting impacts on species composition and native vegetation food safety and sovereignty, and the health, rights, economic sustainability, and wellbeing of proximate human populations [20]. Habitat destruction occurs as plastics smother and harm important ecosystems, like mangroves [21] and coral reefs [22]. Macroplastics, like fishing gear or single-use plastics debris, can result in impacts on keystone species through ingestion, entanglement, suffocation, and death, especially for endangered species [23].

Plastics also affect the very foundations of food chains [24]. In aquatic ecosystems, MNPs have deleterious effects on photosynthetic plankton [25]. MNPs affect soil biodiversity [26] and can drive changes in soil properties and microbial communities [27], including changes in nutrient cycling in sediment microbes [17]. Microplastics can adsorb inorganic [28] and organic contaminants [29] and modify their fate (bioaccumulation, bioavailability) and toxicity. Additionally, they can promote the spread of pathogens and antibiotic resistance genes through the ecosystems, a particular concern for the agriculture sector [30].

Chemicals, including those used in plastics, have been identified as drivers of ecosystem degradation and biodiversity decline via overt toxicity mechanisms (e.g., mortality), or sublethal impacts on, for example, species interactions, and changes in food chains [8]. Plastics additives have negative impacts on reproduction and development in humans [31], other mammals, birds, fish, invertebrates, and insects [32].

How can the Plastics Treaty complement and potentially strengthen other multilateral environmental agreements (MEAs) addressing the Triple Planetary Crisis?

There are synergies between the future Plastics Treaty and existing multilateral environmental agreements in addressing the triple planetary crisis. Several MEAs address different forms of pollution, including plastics. These include the **Basel, Rotterdam and Stockholm (BRS) Conventions**, the **Minamata Convention**, the **Global Framework on Chemicals**, and **the Montreal Protocol**. However, individually and collectively they lack the mandate, the level of ambition and regulatory measures required to achieve the primary objective of UNEA Resolution 5/14: to end plastics pollution. Importantly, while virtually all plastics are made of fossil fuel-based chemicals, only 1-6% of the >16 000 plastics chemicals, are regulated under existing MEAs [3,33]. Further, almost a quarter of these chemicals are known to be hazardous [3], underlining the importance of addressing these chemicals in the future plastics treaty.

The Convention on Biological Diversity (CBD) addresses plastics directly in its calls to reduce pollution to levels that are not harmful, using municipal solid waste, plastics debris, litter, and microplastics as indicators (Target 7). Further addressing plastics pollution throughout the entirety of the life cycle, as is the goal of the Plastics Treaty, will reduce pollution pressures at each stage. In addition, as hazardous chemicals are recognized as drivers of ecosystem degradation and biodiversity loss [8], reducing the amounts and complexity of hazardous chemicals in plastics through the Plastics Treaty will reduce the toxic footprint of plastics and these pressures on the environment.

The United Nations Framework Convention on Climate Change (UNFCCC) aims to protect the climate system and through its Paris Agreement, there is a legally binding agreement to limit global warming by peaking and reducing GHG emissions by scientific evidence. Reducing the use of fossil fuels in all sectors of the economy is essential to achieving the target of the convention. Ambitious globally aggregated primary plastic polymer reduction targets will significantly reduce global GHG emissions. This, coupled with mandated safety, sustainability, essentiality and transparency criteria for polymers, products, technologies and services will support safe and sustainable design, production, consumption and disposal to enable the ambition of the Plastics Treaty to end plastics pollution.

The importance of independent and multidisciplinary science and knowledge

The **United Nations Agenda 21** (31.4.d) advocated for enhancing scientific and technological guidance at the highest levels of the UN and other global institutions, to ensure that policies and development approaches are consistent with the best available scientific knowledge. The UN High Commissioner for Human Rights emphasized the importance of ensuring the universal right to science and stressed the need for environmental policy to be rooted in impartial scientific findings, devoid of conflicts of interest. Science should support the human right to a clean, healthy, and sustainable environment [34].

There are currently two science advisory mechanisms addressing two of the identified threats, namely climate via the **Intergovernmental Panel on Climate Change (IPCC)**, and biodiversity via **Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES**). The IPCC has emphasized that current plastics production is not in alignment with goals to cut GHG emissions associated with fossil fuels, and IPBES emphasizes growing concerns on the impacts of plastics in ecosystems. Member states have identified the need for a similar scientific panel to support knowledge sharing concerning pollution, and the **Science-Policy Panel on Chemicals and waste (SPP)** is currently being negotiated. This panel will further contribute to the management of chemicals and waste, prevent pollution, and should interface with a subsidiary science of the future Plastics Treaty. A dedicated **science-policy interface (SPI)** is needed under the future Plastics Treaty to strengthen these other bodies, taking advantage of resources while avoiding duplication.

The Plastics Treaty can help mitigate the Triple Planetary Crisis by eliminating plastics pollution throughout the full plastics life cycle, including feedstock extraction, production, manufacture, use, transportation, and management of plastics and mitigation of unintentional releases. Reliance on robust, independent multidisciplinary science and multistakeholder knowledge is essential, and synergies between the Plastics Treaty and other MEAs can strengthen global efforts to protect planetary health, and a safe and sustainable future for humanity.

Contributors

This briefing was prepared by members of the Scientists' Coalition for an Effective Plastics Treaty
Please cite this as: Scientists' Coalition for an Effective Plastics Treaty (2024), Plastics and the Triple Planetary Crisis, DOI pending
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