

A binding global agreement to address the life cycle of plastics

To eliminate plastic pollution, a holistic approach is needed

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Amid the global plastic pollution crisis, a growing number of governments and nongovernmental actors are proposing a new global treaty. In February 2021, at the fifth meeting of the United Nations Environment Assembly (UNEA)—the world's highest-level decision-making body on the environment—many governments spoke in favor of an international agreement to combat plastic pollution. In the past, the international community tended to view the plastics problem from a predominantly ocean-focused and waste-centered perspective. However, plastics are increasingly found in all environmental media, including terrestrial ecosystems and the atmosphere, as well as human matrices, including lungs and placenta. We therefore argue for a new international legally binding agreement that addresses the entire life cycle of plastics, from extraction of raw materials to legacy plastic pollution. Only by taking this approach can efforts match the magnitude and transboundary nature of this escalating problem and its social, environmental, and economic impacts. Targeting the full life cycle of plastics allows for a more equitable distribution of the costs and benefits of relevant actions across the global value chain.

Civil society organizations focusing on biodiversity conservation, health, climate change, and human rights have for years called for a binding global plastics agreement. In 2017, UNEA established the Ad Hoc Open-Ended Expert Group on Marine Litter and Microplastics, a group of international experts who have discussed options to address plastic pollution at a global level, on

the basis that maintaining the status quo was not an option (1). Support for a legally binding global agreement now comes from at least 79 governments, who endorse the Oceans Day Plastic Pollution Declaration from 1 June 2021. Many civil society organizations, as well as a large coalition of major companies, have for years favored a UN treaty on plastic pollution (2). In May 2021, Peru and Rwanda announced they would table a resolution at the upcoming UNEA meeting in February 2022 to establish an intergovernmental negotiating committee to begin developing such an agreement.

The start of negotiations is overdue. In 2019, 368 million metric tons of newly made (or “virgin”) plastics were produced. Current solutions will not match the expected growth in plastics production and waste generation, even if massively scaled (3). In addition, the

further increase in virgin plastics production could, by 2050, consume 10 to 13% of the remaining global carbon budget permissible to keep global warming below a 1.5°C increase from preindustrial levels (4). Plastic pollution poses a considerable, even though not yet fully understood, threat to the environment, species, and habitats, as well as to cultural heritage. Its social impacts include harm to human health, in particular among vulnerable communities, and it comes with substantial economic costs affecting especially regions depending on tourism (5). Addressing these challenges requires a transformative approach that facilitates measures to reduce production of virgin plastic materials and includes equitable steps toward a safe and circular economy for plastics.

A binding treaty must be ambitious to eliminate the impacts of current amounts of plastic pollution and mitigate impacts of the projected increase in production in a business-as-usual scenario (6). An agreement should pursue a vision of zero plastic pollution and no harm to humans and the environment throughout the full life cycle of plastics. To realize this vision, negotiations will need to address the regulatory scope and architecture of the agreement, how it will complement and fill gaps in existing global and regional frameworks, and how the plastics value chain should be transformed, particularly in the “upstream” design and production phases. It is essential to involve all relevant stakeholders in negotiations and get them engaged in implementation efforts, from governments through producers and manufacturers, academia, civil society organizations and consumers, to the informal sector, including waste pickers.

THE NEED FOR AN INTERNATIONAL AGREEMENT

Based on a review of 20 global and 34 regional binding and voluntary instruments, the UN Environment Programme (UNEP) concluded that the existing fragmented governance landscape is inadequate for addressing marine plastic pollution (1). Two major gaps underscore the need for a global agreement.

First, there is a lack of a comprehensive global governance arrangement that addresses all sources of plastic pollution, in particular land-based. Most existing agreements are restricted to marine litter, especially sea-based sources, even though the majority of sources are located on land. For example, the London Convention and Protocol and the International Convention for the Prevention of Pollution from Ships (MARPOL) Annex V prohibits the discharge of garbage from ships into the sea. In addition, a range of nonbinding declarations and action plans

Safe circularity principles

The following principles provide guidance for developing criteria for the circularity of plastics:

Durability

Single-use plastics for which safe and environmentally sound alternatives exist are eliminated; and product design accommodates for safe reusability, repairability, and refillability

Recyclability

Recycling enables cost-effective material recovery with minimum energy loss and multiple recycling rounds without downcycling; and minimum threshold for recycled content agreed

Safety

Use of substances of concern eliminated; and use of primary microplastics eliminated and secondary releases minimized

Transparency

Labelling schemes guide informed choices; definitions are agreed including for “bioplastics” and “biodegradable plastics”; and information is available on the chemical content of products

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aim at reducing marine plastic pollution, e.g., Sustainable Development Goal target 14.1. Regional seas conventions and action plans, regional fisheries management organizations, and other regional instruments focus on coordinated strategies to combat marine litter at sea-basin scale (11). Marine litter is also the focus of several UNEA resolutions as well as G7 and G20 Action Plans.

Second, there is no global governance arrangement that addresses the entire life cycle of plastics. Many arrangements cover the waste phase but are weak on the design, production, and use phases (1). The gap in addressing the design and production phase is problematic because only 21% of all plastics currently produced are theoretically recyclable, and a mere 15% are actually recycled in practice (8). The international trade of plastic waste is regulated under the Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and Their Disposal, which enjoys near-universal participation. Only clean, sorted plastic waste effectively destined for recycling can be freely traded, whereas mixed, contaminated, or hazardous plastic waste requires the prior informed consent of the importing country. Only the Stockholm Convention on Persistent Organic Pollutants regulates the production phase of plastics, but this includes a limited set of prohibited chemicals that may no longer be used as additives. Most additives are therefore not addressed comprehensively under any international agreement, even though more than 1500 have been identified as chemicals of concern in plastics (9). Likewise, microplastics are addressed through a patchwork of national and regional initiatives instead of global regulations (10, 11).

These gaps underscore the need for a legally binding global governance arrangement that would effectively and measurably limit and control plastic pollution (1, 2, 12). The governance failure manifests in various ways, entrenching the entire life cycle of plastics. It starts with the increasing production of virgin nonrenewable materials, and the manufacture of plastic products that are not designed for safe reusability and recyclability and which may be chemically contaminated. At the point of purchase, retailers and consumers are not informed about a product's chemical content and are faced with inconsistent and vague labeling (e.g., compostable, biodegradable, recyclable), leading to suboptimal end-of-life treatments. During use, the release of additives of concern and microplastics may negatively affect the health of consumers (9). And the most visible outcome is the rapidly increasing amount of macro- and microplastic waste in the environment.

CORE GOALS OF A PLASTICS AGREEMENT

An international agreement that addresses these governance gaps and effectively combats pollution throughout the plastics life cycle and facilitates a sustainability-focused transformation needs to include three core goals (see the figure).

GOAL 1: Minimize virgin plastics production and consumption

Controlling and minimizing plastic pollution first and foremost requires agreement on a progressively decreasing global production allowance for virgin plastics. Transformative scenarios that outline how plastic pollution can be prevented point toward the need to reduce virgin plastics production as a major contribution (6, 8).

This goal is modeled after the Montreal Protocol, which sets a maximum level for production of ozone-depleting substances and progressively reduces volumes to safe levels (7). Similarly, the Paris Agreement sets a measurable goal for limiting the increase in the global average temperature, which can only be achieved by rapidly reducing global greenhouse gas (GHG) emissions. The former caps production by targeting inputs and the latter by focusing on outcomes.

A cap is a powerful instrument that can be tailored to a specific challenge to incentivize action to reduce production and consumption and to find and use more benign alternatives. However, determining the volumes at which production and consumption should be capped will require robust knowledge of current and safe levels of pollution, environmentally sound and cost-effective alternative materials and processes, and a comprehensive tracking system of all materials, processes, and effectiveness of parallel measures undertaken.

An agreed goal to reduce production and consumption of virgin plastic materials would send the clearest signal from governments to producers, consumers, and others along the plastics value chain. It is the key measure needed to reverse worsening trends. It would signal that manufacturers need to enhance their efforts toward sustainability of plastics considerably, that they will need to produce less of it, and that innovation and safety improvements offer substantial new market opportunities. The goal would also prevent GHG emissions by discouraging further investments in expanding plastics production capacities.

Given the urgency of the climate crisis and the need to reach net-zero carbon emissions by 2050, the production and consumption targets should be aligned accordingly: By 2040, the use of virgin plastics should be largely phased out, and most plastic products should be made from recycled content



to the extent possible. Exemptions should only be granted for materials like medical supplies for which no safe and nonplastic alternatives exist.

The goal could be reached through a “start and strengthen” approach, first targeting the most problematic types of plastic that are difficult or impossible to recycle and for which alternatives can be easily applied. The agreement will need measures for phasing out or ultimately banning products using plastics (virgin or recycled) unnecessarily—i.e., when safe, affordable, and environmentally benign alternatives exist—and foster the development and use of such alternatives. There are many existing national and regional policy approaches on which to build and expand (10). With the Single Use Plastics Directive, the European Union (EU) follows the example of other states, including African and Small Island Developing States, and bans a range of throwaway products. A global plastics agreement should establish international norms to scale up such bans and other appropriate regulations.

Demand for virgin plastics can be further reduced by setting a complementary progressively increasing consumption target for use of recycled content in products, which leads to the second core goal.

GOAL 2: Facilitate safe circularity of plastics

A circularity goal for plastics will incentivize design for recycling, improve recycling rates,



Plastic pollution is a quickly growing problem for human health and the environment. Only by focusing on the entire life cycle of plastics can the challenges be addressed.

teria will assist countries in adopting necessary regulatory, voluntary, and market-based measures (12). Extended producer responsibility (EPR) schemes should be one of the mechanisms shifting the financial and physical burden of waste management to plastics producers and incentivizing design for circularity from the onset.

Examples for circularity goals include the EU's strategy for plastics in a circular economy, which aims at all plastics packaging used in the EU to become reusable or recyclable in an economically viable way by 2030. The goal of facilitating circularity is closely linked with the global net reduction in consumption of both virgin polymers and chemical additives as per Goal 1. Currently there is a glaring gap between waste management capacities and waste production in many developing countries, but also in developed countries with regards to recycling capacity. Slowing the growth rate of plastic waste, and ultimately reducing total waste, reduces the need to scale waste management to meet the current growing demand. This is a key benefit of fostering transformation of production and consumption patterns, stimulating innovation toward "design for circularity," and promoting systems for reuse, refill, repair, and recycling.

GOAL 3: Eliminate plastic pollution in the environment

This goal aims to safely remove and sustainably dispose of plastics accumulated on land, on waterways, and in oceans. It also aims at preventing those plastics currently in use from ending up in the environment because of their low value at the end of life. Regarding the latter, the agreement should set strict pollution prevention targets, to be implemented at the national and subnational level, and based on analyses of plastic flows.

This goal is designed to complement and scale up instruments already used at the national and regional level. Especially for developing countries, the lack of waste management services will require particular attention. Funding through the plastics agreement should be made available to establish and enhance the use of market-based instruments, including EPR schemes, to subsidize waste management and cleanup. For instance, the EU Single Use Plastics Directive applies EPR schemes to tobacco filters and fishing gear to cover the cost of cleaning up litter.

Engaging in large-scale cleanup measures is a costly undertaking even if an effective

and foster the use of recycled content. Safe circularity can be achieved through elimination of hazardous substances. Reuse and refill systems, as well as alternative low-to-no waste delivery systems, also eliminate substantial volumes of plastic pollution and should be prioritized ahead of recycling.

Measures to achieve these goals will help transform the value chain of plastics, bring competitive advantages to producers and retailers, create jobs, and provide health benefits to consumers and ecosystems. The agreement must establish binding technical standards for the design and recyclability of plastics. Hazardous additives, such as phthalates and bisphenols, must be phased out to ensure human safety and minimize impacts on wildlife populations (9). Chemical controls required by the agreement should include rules to share information on any potentially harmful additives along the value chain.

Circularity will require a fundamental transformation of the plastics value chain, and though incurring costs, it could benefit all actors in the long term (13). In the upstream phases, the agreement must ensure a level playing field for producers and manufacturers through harmonized rules for product safety and sustainability, thus preventing companies from adhering to different standards. In the midstream phases, the agreement should set requirements and a legal basis for information sharing, establishing labeling and certification schemes and

detailing harmonized definitions. This will enhance transparency on product contents and sustainability, and it will enable retailers and consumers to make informed choices that will help drive markets toward safe and sustainable products. It will also empower consumer organizations to sue producers and retailers that do not adhere to the strict sustainability and transparency standards.

The general population will also benefit from increased product durability (including reuse, repair, and refill) and safety (less substances of concern in products). In the downstream phases, technical standards on plastic waste enshrined in the agreement will lead to benefits for recyclers, particularly low-income workers, from better-quality and higher residual value, leading to increased investment and job opportunities and improved livelihoods, especially for the informal sector. The legal basis for protecting the rights of the informal sector can be set in the agreement. Once hazardous chemicals are removed from the plastics life cycle, there are potentially substantial economic gains for the recycling industry (2, 8, 13). Furthermore, the population will be able to enjoy health benefits, including through reduced disposal of plastic waste in suboptimal conditions such as incineration, particularly open burning.

To reach the goal, the agreement must define global criteria for the circularity of plastic products placed on global and domestic markets (see the box). Such harmonized cri-

agreement leads to reduced amounts of plastic waste entering the environment. For many nations and cities, it is advantageous to clean up polluted sites, because clogged waterways, drains, and sewers increase the risk of flooding and the spread of diseases. This will also redress reduced tourism revenues from polluted destinations. However, in other areas, there will only be limited economic incentives to clean up. For these areas, additional support measures are required. Such measures could include a fund dedicated to cleanup, requiring contributions from producers, which could fund citizen science audit and cleanup campaigns and repatriate plastics back to producer countries for responsible management.

OPERATIONAL ELEMENTS

To effectively implement the agreement and follow up on its goals, concrete obligations, support measures, institutional arrangements, and mechanisms for strengthening nonstate action and for coordination with existing treaties need to be developed (12).

Implementing and tracking progress

A set of binding procedural obligations will help ensure that parties implement and stay on track with the agreement's goals. Countries will still need flexibility in the national pathways; hence, the agreement should include an obligation to develop and implement regularly updated national plastic pollution prevention plans (N4Ps). These must describe how countries endeavor to meet the core goals, based on national circumstances and capacities, and measures. They should contain ambitious and measurable national targets in line with the core goals. The plans must include all relevant measures to be taken by national and subnational governmental actors. They should be well-integrated into existing policies, legislation, and strategies and build on regionally coordinated plans or strategies, where in place. To ensure that the plans help meet the goals, common criteria should be defined for the contents of the plans, such as the setting of targets, determining baselines for various indicators, implementation time frames, and monitoring methodologies used. Moreover, following the model of the Paris Agreement, the agreement should ensure that N4Ps are progressive, reflecting increasing levels of ambition over time.

The plans should also address previously identified main sources of leakage. For this, the preparation of national inventories on the production, consumption, trade, and end-of-life treatment is needed to assess leakage points across the value chain and to enable targeted interventions (1). These inventories can also be used for identifying hotspots of accumulation and assessing types of plastics and volumes found there, which can help determine the most cost-effective action.

Another procedural obligation concerns regular reporting by parties on implementation and performance in achieving the core goals. Building on experiences in other agreements, reporting should use a format that requires quantitative and qualitative data that are considered meaningful. A secretariat to the convention will need to be established, which should support reporting (12). To ensure that the information provided by gov-

of the agreement. This could be achieved by aggregating data gathered through reporting on performance and monitoring impacts. Lastly, the agreement will also need a transparent compliance mechanism that allows parties to foster mutual implementation of its provisions and create a level playing field. At a minimum, it should help deal with cases of persistent noncompliance, as well as instances in which parties do not comply with their core procedural obligations of submitting regular N4Ps and reporting. More ambitiously, the agreement could explicitly state countries' right to prohibit imports of plastic products from noncompliant parties, because these pose an unacceptable social, environmental, and economic risk.

Supporting mechanisms

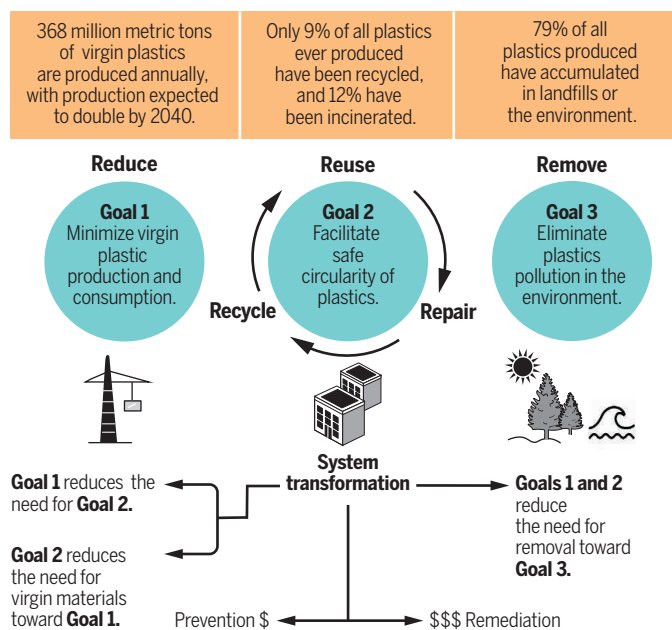
Supporting mechanisms are needed to give greater effect to other measures. Funding from both domestic budgets and private sources, coupled with international support, is needed to fund the necessary legislation, infrastructure, technology and capacity building.

To have an impact, the agreement must include mechanisms to support developing countries in the implementation of measures committed to under the agreement, including for enabling activities, such as reporting and the development of N4Ps. This could include a dedicated funding mechanism, which could be managed by an existing body such as the Global Environment Facility (GEF), or be a new fund. Entrusting the GEF would help to avoid proliferation of funding mechanisms and allow for synergies with the Facility's other focal areas, including chemicals and waste and climate change. The problem with the GEF is that it relies

on voluntary contributions. The advantage of establishing a new fund is that it could be based on mandatory contributions using the UN scale of assessment that intends to accommodate a country's "capacity to pay," resembling the Multilateral Fund for the Montreal Protocol. Additional voluntary funds could be established, inviting major producers of plastics and plastic products to contribute. Furthermore, a clearing-house mechanism could channel knowledge about existing funds and programs and assist developing countries in accessing them.

Funds should be allocated to spur the use of market-based instruments, helping countries to internalize externalities of plastic

Core goals of a plastics agreement



ernments is comprehensive and to inform future policy-making, a transparent review mechanism for national reports should be included. In addition, countries would need to monitor the presence of plastic pollution in the environment to ensure that the three goals are delivering their intended impacts using harmonized methodologies that are practical, scalable, economically viable, and ecologically representative. Monitoring and assessment should address gaps and create synergies with existing programs at the local, national, and regional level (11).

The preparation of a transparent and participatory iterative global review is needed to regularly inform parties of the effectiveness

pollution. Raising funds from plastics producers would align with the “polluter pays” principle and resemble a liability mechanism (14). It is important that the agreement ensures equity by helping countries to place the burden on the industry responsible for plastic pollution rather than the consumer. This can be achieved by encouraging the use of market-based instruments that target upstream measures, such as a levy on domestically produced virgin plastics, both generating funds and disincentivizing the excessive use of plastics. Ideally, these are earmarked levies channeled to fulfill the obligations of the agreement including by supporting research, development, and use of benign alternatives.

At the national level, a plastics authority should be designated to ensure the implementation of the agreement. The authority would be responsible for translating the internationally agreed sustainability criteria to the national context.

An evolving and inclusive framework

Not all relevant aspects can be addressed in detail in the agreement itself. A framework for further action will be needed, as well as institutional arrangements to redevelop rules and implementation arrangements. This includes a governing body to convene the contracting parties to adopt decisions, annexes, and protocols where necessary, including technical standards and guidelines on design and production, reuse, recycling, disposal, and retrieval. In addition, subsidiary bodies would be established for areas where scientific and technical support is needed, including defining criteria for the safe circularity of plastics and developing and facilitating use of harmonized methodologies for data collection. A science-policy interface should support the transfer of knowledge between expert communities and policy-makers (15).

Lastly, as the agreement is situated in a complex governance landscape, mechanisms would be needed to engage a wide array of societal actors and institutions. Specifically, a stakeholder engagement mechanism to facilitate nonstate and subnational action must support the agreement. This mechanism should include a global commitment platform where nonstate and subnational actors could announce voluntary commitments to be tracked and displayed online, and facilitate the organization of global and regional high-level events, technical dialogues, and other activities. These would allow learning from best-practice examples as well as from failures and to identify opportunities for upscaling ambition and action. A particular challenge will be to include the informal sector in the development and implementation

of the agreement—for example, waste pickers as a major component of waste management systems in developing countries. In addition, the agreement would need a coordination mechanism for enhancing cooperation and synergies with existing other multilateral environmental agreements and relevant frameworks.

NEXT STEPS

The decision to launch an intergovernmental negotiating committee lies with the UNEA. The next decision-making meeting (UNEA 5.2) is scheduled for February 2022. A preparatory Ministerial Conference is scheduled for 1 to 2 September 2021 on invitation by Germany, Ghana, Ecuador, and Vietnam.

It will take several years for a new agreement to be negotiated, enter into force, and begin to have an impact. Hence, it is necessary to continuously develop and strengthen action through existing regional and multilateral institutions. Yet governments need to boldly go beyond existing approaches. Although a new agreement will come with costs, it will unlock sizable environmental, social, and economic benefits (2, 8, 13). ■

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PERSPECTIVE

The myth of historical bio-based plastics

Early bio-based plastics, which were neither clean nor green, offer lessons for today

By **Rebecca Altman**

Bioplastics are a broad category of materials encompassing bio-based, biodegradable, or both bio-based and biodegradable plastics. They can be manufactured from diverse sources, including crops (e.g., corn, sugar cane, and, historically, cotton), wood pulp, fungi, and other bio-based feedstocks produced with the help of algae or microbes. Some bio-based plastics, such as polyhydroxyalkanoates (PHAs) and polylactic acid (PLA), are biodegradable under specific environmental conditions. Others, such as bio-polypropylene (bio-PP) and bio-polyethylene terephthalate (bio-PET), are also bio-based but are chemically equivalent to their conventional counterparts and do not biodegrade. Bioplastics can also include materials designed for biodegradation that are derived from fossil fuel-based rather than bio-based sources (1). Although bioplastics represent a small and growing segment within the industry, they are not a new idea and have a long history that is often overlooked or misunderstood.

The earliest iterations of industrial-scale molding materials date to the mid-1800s and were sourced from trees (e.g., resins, gums, and latex). Hard rubber and gutta-percha are two early examples. Later bio-based plastics were made using cellulose, including celluloid and viscose rayon (fiber) and cellophane (film). Despite their biological origins, these materials had consequences for human health and the environment, leading to displacement, deforestation, environmental degradation, and workplace hazards.

Popular accounts and even corporate advertisements from this era portray early-generation plastics relieving pressure on natural resources such as tortoise shell or ivory because they could imitate their appearance.

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