Scientists' Coalition for an Effective Plastics Treaty

Policy Brief

Impacts of plastics across the food system

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What are food systems?

The food system is a term that describes all the actors and activities involved in bringing foodstuffs into human diets, from production, processing and transportation to retailing, consumption and waste management. Industrial food systems are a leading driver of plastic production, set to almost triple by 2060, and are simultaneously vulnerable to all plastic pollution impacts [1]. Food systems represent a major sectoral opportunity for substantial action against plastic pollution that, if implemented effectively and appropriately, could support food system resilience, sustainability and planetary health.

Why is it important to consider the impacts of plastic pollution from food systems?

1. The big picture: Food systems drive plastics production with lifecycle impacts on planetary health

The capacity of food systems to provide sufficient, safe, sustainable and equitable food and nutrition to global populations is entrenched in the triple planetary crisis of climate change, biodiversity loss and pollution.

Globalised food systems account for a third of global greenhouse gas emissions [2] and use millions of tonnes of plastics each year; more than 99% of which are derived from fossil fuels [3]. The entire life cycle of these plastics contributes to climate change and the exceeding of planetary boundaries [4] long before and after fulfilling their intended use in food systems.

Vast quantities of plastics used in agriculture and fisheries are poorly managed, lost or discarded [1,5]. The industrial agricultural sector accounts for 3.5% of annual global plastic use, including for plastic mulch, polytunnels, greenhouses, encapsulated fertilisers and seeds, irrigation and storage equipment [6,7]. Intended to support yields, control weeds, mediate resource use, and reduce spoilage, the majority of these are either not practically recyclable nor safely or sustainably managed [8].

Food and drink packaging accounts for approximately 10-20% of plastics produced (based on conservative estimates) [9,10]. They have extremely short life spans and are among the most prevalent environmental pollutants globally [11] contributing to broad public health risks including infectious diseases [12].

Toxic chemicals: Like all plastics, those used across food systems contain thousands of chemicals, of which at least 3,000 are of concern - associated with hazards related to persistence, bioaccumulation, and toxicity, all of which affect human health and the environment [13]. Chemicals in plastic food contact materials are of particular concern as they directly contaminate crops, soils and foodstuffs for human and animal consumption. They also indirectly (re)circulate into food chains throughout their life cycles, including when recycled [14].

Open burning of plastic food packaging is prevalent in low-income settings with limited waste management systems, and leads to the formation of highly toxic and persistent dioxin compounds, putting vulnerable populations, livelihoods, and ecosystems at disproportionate health risks, while mounting pressure on public health systems [15].

2. Harms of their own making: Food system vulnerabilities to plastic pollution

Food production and food chain contamination: Plastics and their associated chemicals used across food systems contaminate food production environments and enter (and circulate in) food chains via terrestrial, atmospheric, and aquatic pathways [15]. Soil health is critical to sustaining life on earth [16], but toxic plastic residues and fragments are now abundant in soils, introduced through processes such as agricultural mulching, plastic-coated agrochemicals and seeds, wastewater for irrigation, sewage sludge for fertilizer, and compost contaminated with micro- and nano-plastics when post-consumer food waste is depackaged for biomass [17]. This pollution can lead to changes in critical soil properties e.g. carbon and nutrient cycling [18] as well as uptake into plants and crops [19,20].

Ruminant animals commonly ingest plastic both on and off-farm [21], while high levels of microplastics have been identified in aquatic food sources [22]. Such sustained contamination of food production environments and food chains may affect food security and food sovereignty long term [19], with potentially acute implications for lower-income economies reliant on agriculture and/or experiencing food and nutrition insecurity. As such, the Food and Agriculture Organization of the United Nations (FAO) states that "the urgency for coordinated and decisive action [on agricultural plastics] cannot be understated" [6].

Food safety and waste: While plastics can shield against bacteria and preserve shelf life, there is strong evidence that they transfer nanoplastics, microplastics and hazardous chemicals into foodstuffs consumed by humans, contributing to increasing cardiovascular disease, obesity, diabetes and many other non-communicable diseases [10,23]. These impacts are likely to be many times worse in informal economies where food and non-food grade plastics are commonly misused. Over a third of the world's food is lost or wasted annually [24], with higher rates of food waste in countries with more supermarkets and packaged foods [25]. Although driven by various socio-economic factors, data from the EU shows that food waste has increased alongside the growth in plastic food packaging [25,26].

3. Solutions for mitigating the harms of food system plastics are often not supported by evidence

Plastic packaging for food and beverages are often marketed as 'X% recyclable'**,** but recycling capacities can never scale-up to handle the volume of plastics already in circulation, nor eliminate current or projected macro-plastic pollution [27]. Recycling post-consumer plastic waste is energy and water-use intensive, (re)introducing both microplastics and toxicants into ecosystems and the food chain via new products; leading to chemical cocktails which can seriously impact human and planetary health [28,29].

Alternative plastics (bio-based and plastics with biodegradable properties) and chemicals (e.g. plasticizers) have entered markets rapidly. However, evidence shows they may be as harmful, if not worse, than the products they are replacing [28, 30-32]. The production of bio-based plastics can involve mono-cropping, diverting land from food-production, and requires water and chemicals such as synthetic pesticides and fertilisers, leading to socio-economic and environmental impacts [33]. Most plastics marketed as compostable – for instance, polylactic acid (PLA), require industrial facilities that are seldom widely available. In the absence of global safety, sustainability, and transparency standards, consumers can be misled into believing that they are making responsible purchasing and waste management decisions [34].

How can the treaty address drivers and impacts of food system plastic pollution?

1. **Treaty negotiations must commit to a full lifecycle definition of plastic pollution** which recognises that food systems plastics, like all others, inflict adverse impacts from extraction and production through to waste management, removal, and environmental remediation [3].
2. **Circular economies and food systems are by definition regenerative and restorative.** Retaining these key principles in treaty negotiations is fundamental for the protection of food chains and ecosystems against the (re)introduction of harmful synthetic polymers and chemicals. Reducing production and consumption of plastics alongside chemical simplification, is the primary means of achieving authentic circularity [35] and such transitions must be "fair, equitable and inclusive for all stakeholders across the [full] plastics lifecycle" [36].
3. **Food-related plastics; including the chemicals they contain, should be made transparent throughout supply chains** to ensure that trade-offs can be appropriately navigated. This will support efforts to determine which products and polymers are truly essential, those that are unnecessary and/or substitutable in the context of food system applications. These decisions may be aided by guidance from multidisciplinary scientific evidence and Indigenous knowledge systems [37,38].
4. **Precautionary and prevention principles are critical**
   - Evidence is rapidly mounting that known plastics chemicals - particularly those in food contact materials - cause harm to humans, animals and the environment [39]. However, thousands of unknown chemicals have also been found in plastics. The burden of proof should not be to demonstrate harms in retrospect, but to demonstrate that plastics and their associated chemicals (including non-intentionally added substances [NIAS]) are safe (i.e. non-hazardous after standardised testing) and will *do no harm* before being deployed for use.
   - Evidence on the impacts of plastics (including those from food systems) is overwhelmingly derived from high-income settings where waste management systems benefit from greater resources [40,41]. Extraction-phase, use-phase and end-of-life impacts are likely to be vastly under-estimated in lower-income settings (i.e. informal economy use of non-food grade plastics; or respiratory impacts of open burning).
   - Removing certain plastics may have unintended consequences for food and nutrition security. Member states will need to carefully consider the hazards and potential risks associated with alternatives and substitutes [30,32] to minimize the risk of creating new problems for people and planet today and in the future.
5. **Conflicts of interest.** Food, plastic and petrochemical industries spend large sums of money to influence science and policy, including at the plastics treaty [42-44]. In order for the treaty to protect human health and the environment, INC discussions should be evidence-based and free from commercial interests. Importantly, this extends to any future science-policy interface.

Contributors

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