# Closing the plastics loop

Civil society, businesses, governments and academia should unite forces to transform the plastic economy.

On 22 April the world's largest environmental movement — the Earth Day Network (EDN) — celebrated its global annual event, Earth Day, with the theme 'End Plastic Pollution' (https://www.earthday.org). The impacts of plastic waste on the environment have long been recognized by activists: plastic debris accumulates on land and in the ocean with severe global consequences to all forms of life, and academic research has increasingly documented the mechanisms at play. Earth Day Network has been working relentlessly to raise awareness among millions of people about the risks associated with the use and disposal of plastics, in attempts to make them take personal responsibility for plastic pollution. It has also led a movement trying to promote the adoption of a global framework to regulate plastic pollution.

Initiatives have developed along with increasing public awareness about plastic pollution. At the time of writing, we learn for example that in the United Kingdom, more than 40 companies involved in the plastic value chain — including food, drink and non-food brands, manufacturers and retailers, plastic re-processors and packaging suppliers — have joined the government, NGOs and trade associations to form 'The UK Plastics Pact', a deal to cut plastic pollution over the next seven years (http://www.wrap.org.uk/content/the-uk-plastics-pact). The first of a global network of deals, this agreement will be replicated in other countries as part of the New Plastics Economy initiative led by the Ellen MacArthur Foundation (https://newplasticseconomy.org). Ultimately, and in the view of those involved, the pact will create a circular economy for plastics by focusing on innovation to deliver better packaging design and end-of-use systems.

Environmentalists surely will cheer the initiative, but the scale of the transformation required to significantly reduce the risks associated with plastic pollution and create a full circular plastics economy is enormous. According to the Ellen MacArthur Foundation report 'The New Plastics Economy: Rethinking the future of plastics & Catalysing action' (https://go.nature.com/2HGKYtQ), production of plastics is expected to double over the next two decades and it is possible that by 2050 there will be more plastic than fish (by weight) in the ocean.

Credit: Phil Degginger / Alamy Stock Photo

Modern life is all about plastics. On a typical trip to the supermarket shopping for food, a consumer would end up with an almost empty basket if they attempted to avoid products wrapped with plastics. With incredibly desirable characteristics — being light and adaptable — plastics are fairly cheap to produce. Of course, low costs are likely to be misleading as the environmental impacts along the supply chain of plastics are not typically factored in the market value. The reality is simply that plastics are by and large not really sustainable but we can't get easily rid of them. They are mainly obtained from fossil fuels, with all the associated environmental consequences; for the most part they are designed for a single-use, though once released to the environment they stay there for a long time with adverse environmental and health effects. Manufacturing plastics requires energy consumption and can also lead to pollutant discharges to water, air or soil, once again with environmental and health impacts. Alternative plastics, such as for example biodegradable ones, are available but do not yet represent viable substitutes of the conventional ones for most applications.

Efforts have gone into developing recycling approaches to extract value from plastic waste (chemical recycling; *Science* **360**, 380–381; 2018). In some cases, it is possible to recover precious raw materials to be used in the production of new but similar plastics, whereas in others recycling converts plastic waste directly into products with high added value. Either way, this kind of innovation could be the route to close the material loop of the economy, reducing the need for plastics disposal and demand. But chemical recycling is not without limitations. Plastics that can be easily recycled often lack the properties that would make them widely useful. So, will the plastics loop close? It's hard to say, but there is hope. Scientific advances are being made, but we need more and faster. We need much more research to innovate the sourcing, production and recycling of plastics. We need more civic engagement to push governments to regulate plastics use and waste. Finally, we all need to change behaviour — we need to commit to reduce plastic waste by reducing wasteful consumption. Producing more green and reusable plastics, and less plastic overall, could lead to healthier and environmentally savvy societies. ❐

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