

INSIGHT OUT

Expert Voices on China's Energy and Environmental Challenges



Closing the Loop ON PLASTIC WASTE IN THE U.S. AND CHINA

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INSIGHTOUT is a China Environment Forum (CEF) publication series that began in 2014. Past issues have covered topics including closing the loop on wastewater in China, the coal-water risk in China, wastewater as a source of clean energy in the United States and China, and how energy efficiency can stem air pollution. In 2020, with support from the Japan Foundation's Center for Global Partnership, CEF partnered with the Institute of Developing Economies (Chiba, Japan) to create the Turning the Tide on Plastic Waste in Asia Project. Under that project in 2021 we published InsightOut issue 7 with 20+ authors answering the question "How can Indonesia close the loop on plastic waste?" This lucky issue 8 of InsightOut also dives into plastic pollution, exploring opportunities for the United States and China to close the loop on plastic waste.

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Since 1997, the Woodrow Wilson Center's China Environment Forum (CEF) has carried out research and exchange projects that bring together American, Chinese, and other Asian experts to explore the most imperative environmental and sustainable development issues both inside China and in the greater Asian region. The networks built and knowledge gathered through meetings, publications, and research activities have established CEF as one of the most reliable sources for information on China/Asian environment trends and bolstered CEF's capability to undertake long-term and specialized projects on topics such as clean energy development in U.S. and China, water-energy confrontations, environmental justice, Japan-China-U.S. clean water networks, water conflict resolution, food safety, and environmental activism and green journalism in China. Our current initiatives:

- **Turning the Tide: Japanese-U.S. Partnerships to Slow Ocean Plastic Pollution in Asia** is a comprehensive two-year research and convening project to examine the sources and causes of plastic waste in China and Southeast Asia and identify possible innovative solutions through cooperation, technology, and policy. The Institute of Developing Economies and China Dialogue are project partners.
- **The Plastic Pipeline: A Serious Game for Plastic Reduction Education** is an educational video game project created in partnership with the Wilson Center's Serious Games Initiative that aims to bring the complex world of plastic policy to the fingertips of people around the world and to spread knowledge about the sources of and solutions to plastic waste leakage.
- **U.S.-China Energy and Climate Action** is an ongoing series of meetings and blogs that keep a finger on the pulse of emerging trends in clean energy and climate action in the world's two largest energy users.
- **Vulnerable Deltas** is a research and convening project in partnership with the East-West Center exploring the climate, pollution and development threats to three deltas in Southeast Asian and two in China.

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INTRODUCTION

United States and China as Plastic Superpowers

By Clare Auld-Brokish, Angela Pan, Yunyi Huang, Tonxin Zhu and Karen Mancil

Over half of the 8.3 billion metric tons of plastics produced from 1950 to 2015 have been manufactured since the year 2000, of which a majority was used in packaging. The current model for plastic packaging is linear: from production and single-use to irretrievable disposal. Promoting recycling is often touted as key for achieving circularity, simply turning plastics into other plastics. However, in 2016, only 21 percent of the plastic produced was economically recyclable, and only 15 percent was actually recycled. The rest ended up in landfills, incinerators, and the natural environment.

As the world's largest consumers and producers of plastics, the United States and China are pivotal for helping to close the loop on global plastic waste. For years the main narrative has been that China, Indonesia, the Philippines, Thailand, and Vietnam are responsible for most of the ocean plastic leakage in the world. However, recent studies, such as the National Academy of Sciences' *Reckoning with the U.S. Role in Global Plastic Waste*, indicate that the United States is the world's largest generator of plastic waste and has one of the lowest recycling rates (9 percent) of any industrialized country.

The Intertwined Plastic Waste Footprint

The United States has a well-functioning waste collection and sorting infrastructure system. However, for decades it has shipped half of its recyclables (plastic, glass, etc.) overseas to China and other countries that too often lacked the infrastructure to recycle them, significantly contributing to the global plastic pollution crisis.

In 2018, China's National Sword Policy banned the import of plastic waste. For nearly 40 years, China had used these imports as industrial feedstock, but the boom in E-commerce and food delivery companies in the early 2010s caused packaging waste to rapidly pile up. As part of the government's war on pollution, Chinese policymakers launched domestic waste management reforms and introduced policies to reduce single-use-plastic.

After 2018, Southeast Asian countries also started to turn away waste exports from the United States and other western countries. Many U.S. cities were subsequently forced to store recyclables in warehouses until they could be incinerated or landfilled. The lack of markets for recyclables led many U.S. cities to cancel or reduce their recycling programs. In response, U.S. policymakers passed or debated more stringent state and federal legislation to reduce plastic and other single-use packaging.



Image courtesy of MycoWorks 06Work, Photo by Laura Gutierrez

Opportunities for U.S.- China Plastic Leadership

If plastics were a country, it would be the 5th largest carbon emitter. Judith Enck, founder of the advocacy group Beyond Plastics, and featured in one of this issue's Closed Loop Innovator boxes, has described plastics as "Plan B for the fossil fuel industry." The International Energy Administration reports that plastics, which are made from petrochemicals, are set to be the largest driver of world oil demand, outpacing demand from trucks, aviation, and shipping. Plastic production is a big business and U.S. and Chinese companies make up the top three producers.

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While the two countries have not established bilateral cooperation around plastic waste, their economies are intertwined in a way that any national waste policy regulating the industry reverberates in both and across the world. The United States and China have signed on to support the Global Plastics Treaty, which could encourage both countries to accelerate their actions to close the loop on plastic waste.

Both the United States and China have announced major commitments to achieve carbon neutrality, but most of their investments and policy actions focus on the energy sector. Presidents Xi and Biden met in November 2022 and announced they would restart bilateral dialogues on climate cooperation. Notably, researchers, activists, and companies in both countries are starting to highlight the growing greenhouse gas footprint of plastics, opening up a potential new avenue for U.S.-China to engage in joint research, dialogues and action.

The authors in this issue highlight similar trends in U.S. and Chinese action on plastic waste. Policymakers in both countries are exploring national standards and practices that incentivize companies to reduce the waste and pollution of plastic packaging. Many of our authors advocate for enhanced producer responsibility laws as the most important policy mechanism for changing the business of waste in both countries.

INFOGRAPHIC 1:

The Plastic Superpowers

(Million Metric Tons, MMT)

TOTAL PLASTIC PRODUCED (2020)

China is the **#1** plastic producer in the world, while the US, together with Mexico and Canada, ranks **#2**

117 MMT

32% of global production



(combined with Mexico and Canada!)

70 MMT

19% of global production



PLASTIC WASTE (ALL TYPES) GENERATION

(Total & Per Capita, 2016)

21 MMT

18 kg per capita



42 MMT

53 kg per capita



Data Compiled by Solange Reppas and Angela Pan

Data Sources: **Plastic Production:** "Plastics - the Facts 2021." Plastics Europe, 2021. <https://plasticseurope.org/wp-content/uploads/2021/12/Plastics-the-Facts-2021-web-final.pdf>
Plastic Waste Total (Committee on the United States Contributions to Global Ocean Plastic Waste, Ocean Studies Board, Division on Earth and Life Studies, and National Academies of Sciences, Engineering, and Medicine. *Reckoning with the U.S. Role in Global Ocean Plastic Waste*. Washington, D.C.: National Academies Press, 2022. <https://doi.org/10.17226/26132>) & Per Capita (World Economic Forum. "Zero-Waste Shopping Comes to Japan." Accessed July 27, 2022. <https://www.weforum.org/agenda/2021/09/zero-waste-shopping-japan/>.)

The Headache of Finding Plastic Stats

—By Angela Pan

Single-use plastics are everywhere in our daily lives and it is difficult to avoid using them. Yet when we were looking for statistics on plastic production and waste in the United States and China, it was a struggle to find recent and comparable data.

After much digging we cobbled together some stats for three infographics (that our fabulous desktop publisher Kerrin Cuison transformed into lovely images) to give a snapshot of where the United States and China stand on plastics from cradle to grave. The two are really the world's plastic superpowers, ranking #1 and #2 on many plastics stats.

The top two plastic producing companies in the world are ExxonMobil and Dow from the United States. China's Sinopec ranks third in the world, but in aggregate China is the largest producer and investor in plastics.

When it comes to waste, the United States generates TWICE as much plastic waste as China. Americans also beat their Chinese counterparts

by generating three times more plastic waste per capita.

The stats in this first infographic captures production and waste of all types of plastic in the two countries. Not only the single-use plastic you see everyday like bags and bottles, but also the plastic used in buildings and highways.

To close out my plastic stat rant, embarrassingly, we could not find comparable data for total U.S. plastic production, rather only numbers that combined plastic production of the United States, Mexico, and Canada. Also, almost all the stats we found were a few years old, but they do give you a sense of trends and surprising comparisons. With the recently passed Save Our Seas 2.0 Act, there is a new push for better research in the United State into plastic waste. The Chinese government is also mandating more transparency in trash, so hopefully soon there will be better data. Data is critical since you can't manage what you can't measure.





Image source: By aslysun / Shutterstock.com

IN THIS ISSUE

As two of the world's most influential countries and the largest producers and consumers of plastic, the United States and China, either together or separately, could play key roles in promoting circularity across the plastic pipeline. This lucky eighth issue of our InsightOut publication gathered 17 authors from China, the United States, and Europe to produce op-eds discussing how these two plastic superpowers can close the loop on plastic waste. Most authors focused on only one country's potential actions, as plastic is not yet a robust area of bilateral cooperation. A common thread among these op-ed pieces is that solving the plastic pollution problem will require continued and coordinated action across three fronts — grassroots advocacy, industry innovation, and government policy.

Authors in section one examine the potential for bottom-up environmental groups and citizens to pressure the business community into action on closing the loop on plastic. **Diane Wilson** and **Angela Pan** share a swashbuckling story of the power grassroots activists can have in fighting industrial pollution from nurdles in Texas and beyond. **Sun Cheng** from Green Hunan shares a similar story of citizens acting as watchdogs to reduce plastic leakage into waterways in China. **Daming Tang** (Greenpeace China) explores the lack of policy and market incentives in China to motivate online retailers to be accountable for their plastic packing.

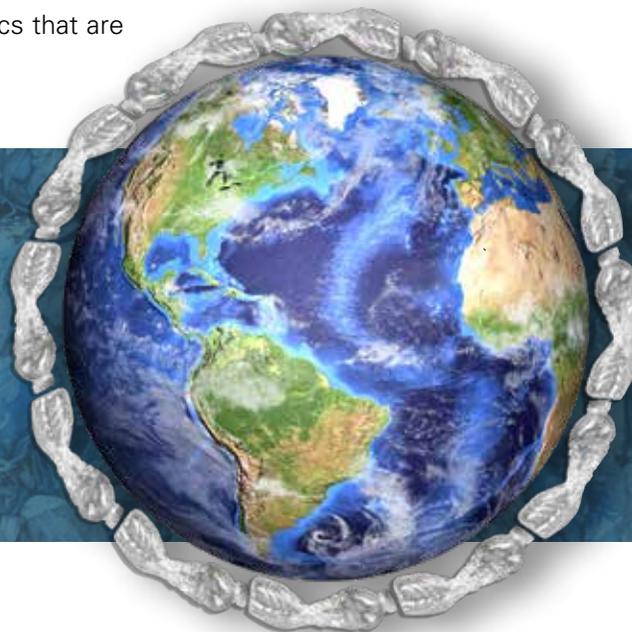
Pieces in the second section delve into promising industry and policy initiatives to create the market incentives for companies to close the loop on plastic waste. **Sydney Harris** and **Scott Cassel** from the Product Stewardship Institute argue that robust enhanced producer responsibility (EPR) legislation should be the centerpiece of the circular economy in the United States and other countries. **Chrissy Adamowicz** (NRC Maine) introduces Maine's recycling reforms that created the country's first EPR legislation to mandate industries reduce packaging waste. **Bea Miñana** (Closed Loop Partners) explains how corporations

can cooperate on packaging innovations to greatly reduce or even eliminate plastic waste. To ensure that mandated and voluntary standards requiring companies to reduce their plastic pollution are implemented well, **Maggie Ka Ka Lee** (formerly Verra) argues that a third-party verified plastic credit system is needed. World Wildlife Fund's **Anthony Tusino** ends this section with an optimistic note on how the Global Plastics Treaty could offer a roadmap for the United States and China to adopt and implement EPR laws.

The op-eds in the final section lay out plastic policy actions. **Kathinka Furst** and **Mengqi Li** (Duke Kunshan University) provide an overview of China's evolving plastic policies and stress that if China does not reign in its plastic production, plastics could be an obstacle that prevents the country from reaching its carbon neutrality goals. In a parallel op-ed, **David Biderman** (SWANA) details how China's green sword program accelerated U.S. policy and corporate action to close the loop on plastic waste. **Nanqing Jiang** (CPRRA) dives into the ups and downs of reforms in China's recycling system, which are critical for the country to reach its waste reduction goals. **Karen Mancl** (The Ohio State University) takes her op-ed discussion down to the farm, highlighting the agricultural plastic waste in the United States and China, an issue where the two countries could collaborate. **Marcus Flury** (Washington State University), **Douglas Hayes** (University of Tennessee), and **Karen Mancl** dig into challenges and opportunities for the United States and China to develop biodegradable plastics to help farmers conserve water and fertilizer and increase yields, while avoiding the toxic pollution from conventional plastic mulch.

Throughout the issue, we feature six U.S. and Chinese women who are innovating in business (**Sophia Wang** and **Stacy Flynn**) and grassroots nonprofits (**Sherry Lu, Zheng Xue, Chen Liwen, and Judith Enck**) to close the loop on plastic. Although the United States and China have not (yet) cooperated extensively on plastic, former China Environment Forum research assistants **Angela Pan** and **Solange Reppas** brought the two countries together in three infographics that are accompanied by short "rant" commentaries.

The combined weight of U.S. and Chinese single-use plastic waste in 2021 equals **1,521 billion plastic water bottles**, which if laid end-to-end could **circle the earth 10,808 times**.



Acknowledgements

By Jennifer L. Turner

First and foremost, I want to extend my deepest thanks to our hardworking contributing authors, who have several combined lifetimes of experience in the plastic waste and environmental protection realms. There is not yet extensive U.S.-China collaboration around plastic waste. However, our authors reveal many areas of synergy and action where governments, NGOs, and researchers in both countries could share insights and join forces to address the global plastic crisis.

As we have not been able to hold any in-person meetings since March 2020, we decided to bring more voices to our work by adding more authors to this and the previous InsightOut issue (“Can Indonesia Close the Loop on Plastic Waste?”). So instead of a sprint with four to six op-ed authors as in the past, these two plastic-themed InsightOut issues have been marathons! Clare Auld-Brokish and Tongxin Zhu were the initial managing editors of this issue in 2020 and 2021 and a team of other research interns have picked up the task since and helped to get it to the finish line. I am grateful to all of them. A special shout out goes to Angela Pan and Solange Reppas who wrestled with spotty data sources to create the three U.S.-China plastic infographics featured in this issue. As always I am in awe of our creative graphic designer Kerrin Cuison, who once again transformed our written words into a beautifully laid out publication.

Last, but never least, I want to thank the Japan Foundation’s Center for Global Partnership for the two years of support for our Turning the Tide on Plastic Waste in Asia project. Their support enabled us to produce two InsightOut publications, as well as many blogs and webinars with our fabulous Japanese partners, Dr. Michikazu Kojima and Dr. Kenji Otsuka, from the Institute of Developing Economies. The Turning the Tide project opened up a new area of programming focused on creating dialogues between experts in the United States and Asia on plastic waste solutions, which we are continuing with great enthusiasm.

OUR AUTHORS



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Dr. Nanqing Jiang is the Secretary-General, Committee of Green Circular and Inclusive Development of the All-China Environment Federation. She also previously headed the China Plastics Reuse and Recycling Association and led the association to join the Global Commitment on a New Plastics Economy in late 2018 as the first sectoral association from China.



Ms. Maggie Lee has been managing market transformative projects to enable sustainable sourcing and consumption in the Asia Pacific. Her most recent role was at Verra where she worked on the plastic credit program. Previously, she was the overall coordinator for the UNEP SEA circular project, a strategist for the WWF Plastic ACTion initiative, the secretariat for Support Asia for Sustainable Palm Oil, and the co-lead for the WWF Responsible Seafood Tool project .



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Ms. Beatrice Miñana is a Communications Associate at Closed Loop Partners, where she works on the branding and communication strategies of the firm, creating messages that engage more people in the transition toward a circular economy.



Ms. Ruoyi (Angela) Pan was a research assistant for the China Environment Forum in spring and summer 2022. Her research interests include U.S. and China plastic issues, international green finance, and the environmental implications of the Belt and Road Initiative. She is on track to complete her BA in Government and China & Asia Pacific Studies at Cornell University and a JD at Cornell Law School.



Mr. Cheng Sun is formerly the Secretary General of Green Hunan and Vice Secretary General of Beijing Watchers Environmental Fund. He received a U.S. National Geographic Society's Exploration Grant in 2014. In 2016, he was an exchange fellow at the Wilson Center's China Environment Forum under the auspices of the National Committee on U.S.-China Relations.



Mr. Damin Tang is a Plastics Campaigner at Greenpeace East Asia. He is leading a project to reduce packaging waste from e-commerce and food delivery, two of China's fastest-growing sectors.



Mr. Anthony Tusino is a senior program officer for plastic policy advocacy at WWF, focusing on pathways to mitigate plastic pollution to increase recycling and better protect communities and environments. He also serves on the steering committee of the U.S. Plastics Pact and leads OneSource Coalition, a convening of corporate, nonprofit and expert partners who advocate for circular economy policies.



Ms. Diane Wilson is a fourth-generation shrimper, boat captain, author, and an environmental, peace, and social justice advocate. During the last 30 years, she has launched legislative campaigns, demonstrations, organized hunger strikes, led citizen scientist groups, and won a citizen lawsuit against Formosa Plastics in her fight to protect her Gulf Coast bay.

Grassroots Action to Reduce Plastic Waste



Image source: By @madicattt, Sustainable Coastlines / Flickr (CC BY-NC 2.0)

From Citizens to Regulators: A Fight Against Nurdles

By Angela Pan and Diane Wilson

How do you fight a problem that regulators have ignored for decades? In the case of combatting plastic nurdle pollution, Diane Wilson and her army of volunteer waterkeepers scored a historic win in a June 2019 lawsuit against Formosa Plastics Corporation in Point Comfort, Texas. This Taiwanese company was manufacturing plastic nurdles that are the building blocks for all plastic products from bottles, bags and utensils to pipelines, car parts, and buildings. Diane has documented how Formosa Plastics has flooded Port Comfort waterways with nurdles for 30 years. In 2019, she presented 2,400 water samples, 110 videos, and 44 photos in federal court that led Formosa Plastic to agree to pay a \$50-million settlement and a zero-discharge pledge.

“Nurdles are as harmful and even more ubiquitous than consumer single-use plastics.”

What are nurdles?

Nurdles are grain-sized microplastic produced from natural gas and oil. Trillions of nurdles are produced and shipped around the world every year. 10 trillion nurdles—weighing in at 200,000 metric tons, the equivalent of more than 1,300 blue whales—enter the ocean every year.¹ These little beads of plastic are an unregulated source of plastic even though they now are the second biggest ocean polluter in the world.² In this regulatory vacuum, nurdles are discharged and disseminated during manufacturing and transit.

“
Around the world, nurdle spills and discharges are happening throughout the entire plastic value chain.”

Compared to consumer packaging plastics, nurdles have largely escaped public scrutiny, but they are just as harmful and even more ubiquitous than consumer single-use plastics. Nurdles are highly persistent pollutants that damage commercial fishery and human health through bioaccumulation in the food chain. Once nurdles enter into the natural environment, they are widely dispersed and too small to be systematically collected and cleaned up. According to the International Spill Control Organization, only 40 to 70 percent of nurdle spills can be recovered.

Nurdle watch dogs

The first Marine Debris Act was passed by Congress in 2006, but nurdles remained largely invisible to regulators and plastic manufactures have categorized them merely as a “nuisance” to evade accountability. Tremendous efforts by grassroots local activists are starting to hold nurdle polluters accountable. In 2016, Point Comfort, a concerned worker of Formosa Plastics took the FBI and state agents on a boat by Formosa’s discharge area in the bay, showing that plastic nurdles had covered an entire small island. However, the illegal discharge continued.

Confronting the mounting nurdle problem, citizens are standing up and filling in where regulators have failed to act. With help from volunteer citizen scientists, Diane Wilson had over 2,000 samples to show that nurdles spills from Formosa Plastic violated the company’s permit to release “trace amounts” of floating solids. Moreover, the company also failed to report any of these violations. With the overwhelming evidence, the court ruled Formosa

plastic was a serial offender, leading to an unprecedented settlement of \$50 million to provide environmental benefits to affected areas. Beyond the settlement, these citizen actions have led to the first-ever “zero discharge” nurdle commitment and a consent decree that allows waterkeepers to monitor Formosa Plastic’s nurdle discharge.

After the lawsuit, a waterkeeper engineer has built and installed a wastewater sampling mechanism which collects samples to test for violations, a creative approach to monitor a large industrial discharge for plastics. Since June of 2021, they have detected 230 violations of discharging plastic nurdles and powders by Formosa, leading to over \$5 million in fines.

From citizen actions to better regulations

The nurdle problem is not limited to Formosa Plastic in Point Comfort. Nurdles are produced around the world from big petrochemical plants to small plastic producers. Nurdle spills and discharges are happening throughout the entire plastic value chain from producers, transporters, and distributors. The world has witnessed nurdle spills for years. The most notorious was the massive 1,680-ton X-Press Pearl spill off the coast of Sri Lanka in 2021 that hurt the country’s coastal environment and economy. Coastal communities in the United States and China are both facing serious spills, such as the 165-ton spill on a Hong Kong beach after Typhoon Vicente in 2012 and Mississippi River’s 2020 “Nurdle Apocalypse.”

And yet, most countries have no specific regulations on plastic nurdle discharge.

Nurdles are not classified as pollutants or hazardous material, although they contaminate ecosystems by absorbing and exuding chemical toxins. Current U.S. federal regulations allow producers to discharge billions of nurdles.

The Point Comfort waterkeeper's historic victory offers a model on how we can use citizen-collected evidence in litigation to hold polluters accountable. The victory is a warning sign for other plastic manufacturers and distributors that they are facing a hefty cost for discharging plastic nurdles.

Beyond environmental litigation, citizens are taking up the fight against nurdles in other ways. For example, Nurdle Patrol, a citizen scientist community, has surveyed and established a database of records and maps of more than 1,000 sites across the Gulf of Mexico. This comprehensive evidence from citizen scientists is being reported to regulatory agencies, spurring regulators to further investigate and establish new legislation.

Citizen actions and lawsuits are highlighting the need for regulating nurdles. Fortunately, in the United States, we are witnessing growing public pressure and

legislative attempts to curb microplastic pollution. In 2021, U.S. Senator Durbin from Illinois introduced the Plastic Pellet Free Waters Act that, if passed, would give authority to the Environmental Protection Agency to regulate nurdles, creating accountability around nurdle spills during transportation and storage.

Fix for larger nurdle puzzle

Curbing nurdles is not only about regulating discharge, but also solving the overall plastic problem through source reduction and pollution classification. For example, the pending U.S. Break Free From Plastic Pollution Act seeks to establish an extended producer responsibility system to mandate plastic producers to reduce production overall.

Citizen lawsuits, patrols, and cleanups can raise awareness of the nurdle problem. However, to put the global brakes on nurdle pollution, big plastic producing countries like the United States and China need to harmonize legislation that not only regulates microplastic discharge, but also updates existing permits and standards for manufacturers, distributors, and transporters.

“To put the global brakes on nurdle pollution, big plastic producing countries like the United States and China need to harmonize legislation to... regulate microplastic discharge.”

Endnotes

1. “Breaking the Plastic Wave: A Comprehensive Assessment of Pathways towards Stopping Ocean Plastic Pollution.” The Pew Charitable Trusts and SYSTEMIQ, 2020. https://www.pewtrusts.org/-/media/assets/2020/07/breakingtheplasticwave_report.pdf.



Who Foots the Plastic Bill for China's Online Retailers?

By Daming Tang

“E-commerce companies are slow to address the environmental externalities of their business model.”

E-commerce is among a few industries in China (and beyond) that COVID-19 did not decimate. Online shopping boomed during the pandemic, with to-door delivery offering a lifeline to consumers and as money went out, purchases came in, and packaging waste piled up.

China's volume of *kuaidi*, or express delivery orders, grew 31 percent year-on-year in 2020, exceeding 80 billion for the year. As the pandemic subsided in 2021, *kuaidi* orders still increased to more than 100 billion that year. *Kuaidi* trends are still on an upward swing in 2022. At the center of this dynamic business network is e-commerce companies, which have forever transformed the lifestyles of Chinese consumers to rely deeply on online shopping. However, those companies are slow to address the environmental externalities of their business model. Among them, packaging waste is one problem that resonates with many online shoppers. Companies can and must do more.

A mountain of packages

In November 2019, Greenpeace East Asia and two other environmental NGOs published a study, estimating that the 50.7 billion packages delivered by Chinese *kuaidi* companies in 2018 generated 9.4 million metric tons of packaging, of which 850,000 metric tons was plastics, equivalent to more than 150 million plastic grocery bags.¹ The study predicted that a business-as-usual scenario would see packaging waste more than quadruple to over 41 million metric tons by 2025.

The plastic packaging waste is particularly worrying. While perforated paper boxes have value in the recycling market, recycling plants do not welcome the plastic bags, wrap-

ping and stuffing from packages. With little market, recyclers and trash pickers reject them. Therefore, most plastic shipping packaging goes into landfills or incinerators, with each option presenting its own set of environmental and social risks.

Some of the disposed plastic packaging also escapes the formal solid waste management system, becoming litter that peppers the landscape and floats in rivers. Scientists around the world have found microplastics—small pieces of plastics that result from the wear and tear of plastic waste—in drinking water, table salt, and recently human blood.² Countless studies are investigating how the absorption of microplastics could be impacting the health of fish, oysters, crops, and people.

Just nibbling at the edges

China's State Post Bureau, which regulates the *kuaidi* sector, has pushed critical regulatory advancements to reign in packaging practices of online retailers and *kuaidi* companies. For example, today most *kuaidi* packages in China are wrapped in narrower tape, and QR codes have universally replaced an old-school system involving multiple layers of carbon paper for the packaging receipts.

But these measures are just nibbling at the edges of the massive problem. To bring packaging waste under control, we need to think about the whole system. Nothing short of an overhaul of the default system of single-use packaging and disposal can answer that call.

It is time to literally think outside of the box and explore possibilities of alterna-

tive logistics schemes. One way to reduce unnecessary shipping packaging and carbon emissions is through order combination services: customers assign a day for their accumulated orders to be delivered together. Single shipments thus eliminate the need to pack each item individually and reduce the number of delivery trucks that burn fossil fuels. Amazon does this for its Prime members in the United States. With their highly sophisticated logistics systems, Chinese e-commerce leaders such as Alibaba and JD.com are equipped to offer this service to their loyalty program members.

Another option that has already gained traction in Chinese e-commerce companies is the reuse system coupled with reverse logistics. Under the reuse scheme, online retailers use durable, reusable packaging boxes or bags to deliver the item. For example, the Finnish company RePack designed a closed-loop system, where reusable packages can be easily mailed back. Such packages can be used for at least 20 cycles, reducing packaging waste by 96 percent. If more e-commerce companies adopt a reuse system, it will save the earth unimaginable loads of plastic trash.

Give teeth to reuse schemes

Major *kuaidi* and e-commerce companies in China have been piloting technology and supply chains for reusable packaging equipment for years, but to this day retrieval of the packaging is still a major obstacle preventing these systems from reaching a critical mass in adoption.

Chinese regulators have increasingly recognized the importance of reusable

“Regulatory advances to reign in packaging practices of online retailers...are just nibbling at the edges of the massive problems”

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Companies can and
must do more.”
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packaging and set goals to expand the reuse system. The State Post Bureau aims to scale up the system to include more than 10 million reusable packages by 2025³ and has started piloting such systems in some cities and popular destinations.⁴

Now, e-commerce companies must up their game to meet this target. Without clear strategies, time-bound action plans,

increased investment or close collaboration with solution providers, these targets will be out of reach. E-commerce giants also need to utilize their technological edge to make innovative shipping doable and scalable. I have little doubt in their ability to achieve this, for these companies have demonstrated many times in the past their power to fundamentally reshape the economy and society.

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Declaring War on River Trash through Grassroots Action

By Sun Cheng

I grew up in Hunan Province, which is located in the middle and lower reaches of the Yangtze River. We are a water-rich province with more than 5,000 rivers and our longest is the Xiang, one of the principal tributaries of the great Yangtze River. Over decades, rapid industrial growth and expanding agriculture have been polluting all of Hunan's rivers.

In 2011, a group of water researchers and concerned citizens established the environmental group Green Hunan and launched the River Watcher Network to involve residents in protecting our rivers. We organized volunteers to help enforce environmental laws and tackle local water pollution through patrolling, whistleblowing, awareness raising, and advocacy.

Within a few years, the River Watcher Network became a national river protection network. Tens of thousands of volunteers joined and became river watchers. Thanks to the network's action, local governments stepped up their actions against polluters, from enforcing fines to shutting down a large number of polluting enterprises. However, while polluted sewage and factory emissions have been significantly reduced, they have been replaced by all kinds of trash, particularly plastic.

Every piece of plastic trash you discard could end up in a river, floating in our drinking water and ultimately flowing into the ocean. Plastic waste breaks into tiny, eventually microplastic, pieces that are ingested by fish and other marine species. Eventually, this plastic returns to our cups and dinner tables, highlighting the old adage "what goes around comes around." Grassroots groups can play a key role in breaking this cycle by opening up more

“Grassroots groups can play a key role in breaking the cycle of plastic waste by opening up more transparency and advocacy to trigger policy, community and business action.”

“The massive amount of trash found in [Chinese] rivers is a clear sign we have lost control of single-use plastic waste.”

transparency and advocacy to trigger policy, community and business action.

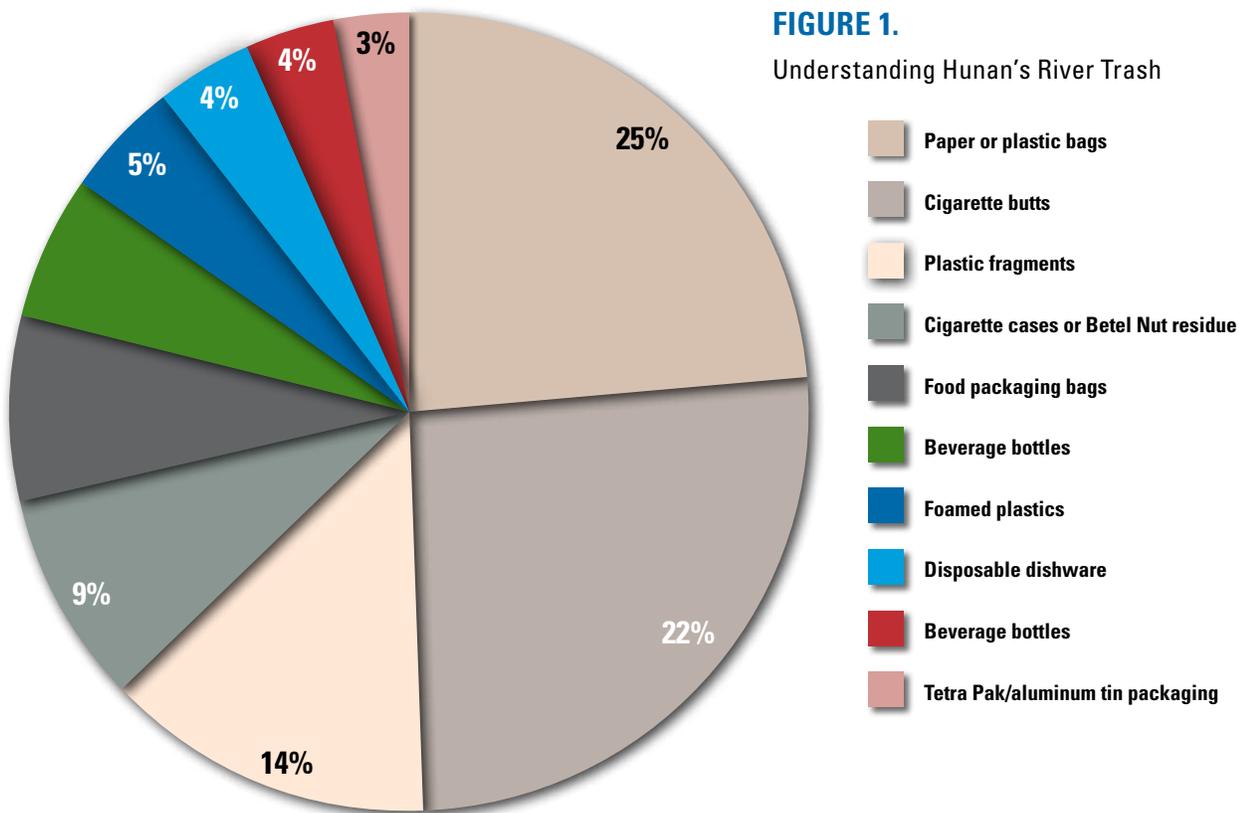
Stepping up the fight against river trash

With the increasing level of urbanization and the tightening of government pollution control, China has made great strides in controlling pollution emissions from traditional industries. However, plastic pollution leaking into rivers has been overlooked for years and has grown into a serious environmental problem. China is the largest producer and consumer of single-use plastics. Each year, China produces more than 100 million tons of plastic raw materials and consumes over 60 million tons of plastic products.¹ River trash has become an

emerging problem because of our obsessive consumption of plastic packaging.

In September 2016, Green Hunan launched the Clean River Bank 100-Square Meters Initiative and developed guidelines and tools for citizen monitors. Through engaging with the public, we launched a series of campaigns to clean up trash along riverbanks. Besides cleaning up trash within 100-square meters from the river bank, participants also audited the trash they collected.

In the first half year, our 5,000 volunteers completed 110 Clean River Bank events along 4 major rivers in Hunan. Nearly 10 miles of river banks were cleaned, and our participants removed more than 16,000 pounds of trash. Through our monitoring efforts, we finally came to understand what





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CHART 1.

Breakdown of Trash of Four Major Rivers in Hunan

Ranking	Type of Trash	Items Collected
1	paper bags or plastic bags	6,329
2	cigarette butts	5,685
3	plastic fragments	3,699
4	cigarette cases or betel nut residue	2,354
5	plastic food packaging	1,953
6	beverage bottles	1,517
7	Styrofoam	1,269
8	disposable dishware	1,050
9	plastic beverage bottles (non-transparent)	918
10	Tetra Pak/aluminum tin packaging	898

kind of trash is plaguing the rivers and shared that information with local policymakers. (See Figure 1 and Chart 1).

Two major findings emerged from our monitoring activities. First, more than 70 percent of the river trash was plastic. Secondly, rural litter was bigger than we expected due to the inadequacy of rural waste collection infrastructure. Rural villagers have no choice but to throw trash on the river bank or burn it on the spot.

To raise awareness about river trash, in 2018, we initiated our largest advocacy campaign. We developed a WeChat mini program called “Xunhebao” (“River Patrol”), which made it easier for the public to join patrols and record their waste collection audits and other insights. We also established close collaborations with the government and enterprises, sharing insights and information from the clean-up campaigns.

CHART 2.

“Xunhebao” mini program 2022 map for river bank cleaning



Courtesy of Green Hunan Public Platform

The Wechat mini program has helped us track participation in our river bank clean-up events well outside Hunan. From 2020 to the present, 42,499 people formed 1,445 teams in 29 provinces and removed 154 tons of trash from the rivers. In addition, hundreds of thousands of people followed our online campaign to clean the rivers. As of now, this mini program has over 220,000 users.

We are not fighting alone

We are moved by the enthusiasm of our volunteers, but there is just too much trash that needs to be picked up. Thus, we at Green Hunan have been reflecting on how

we could do more to prevent plastic waste and other trash leakages. We visited more than 200 rural communities in Hunan and provided reusable cotton bags to encourage villagers to reduce the usage of plastic bags. We also worked with photographers to display photos of river trash at the biggest local shopping centers in Hunan. Compared to our mass consumption of plastics that has become increasingly difficult to manage, these education efforts are too tiny to turn the tide.

Fortunately, we are not the only ones who feel the urgent need to address plastic pollution. Besides other grassroots groups, national and local policymakers have also

taken steps to reduce plastic consumption in China. In 2008, the capital city of Hunan, Changsha, adopted policies that banned hotels from providing single-use plastic items. In 2017, China's Ministry of Housing and Urban and Rural Development launched a pilot program in 46 cities — including Hunan's capital Changsha — to develop more effective waste collection and sorting. In 2020, China amended its Solid Waste Law to help prevent waste leakage and improve recycling. China's National Development Reform Commission issued policies to incentivize e-commerce companies to reduce the use of single-use plastics and a new law banning many

single-use plastics has taken effect in 2022.

The massive amount of trash found in rivers is a clear sign we have lost control of single-use plastic waste. It is clear that we need to do more to reduce the use of plastics. Combining the efforts of new government waste policies and citizen actions, we can move towards system-based solutions that can nip the plastic problem in the bud. We all need to step forward to resolve the issue of plastic waste and declare war on river trash to restore the connection between humans and nature.



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CLOSED-LOOP INNOVATORS

Zheng Xue and Sherry Lu

Plastic Free China is Hitting the Breaks on China's Food Delivery Plastic Waste



Photo courtesy of Sherry

In every Chinese city, an army of motorcycles and mopeds weaves through the traffic jams, and sometimes even venturing on sidewalks, to deliver millions of food and e-commerce orders each day. During 2019 alone the 63.25 billion e-commerce packages delivered a plastic waste punch of 280,000 tons, equal to the weight of about 23 school buses.

With growing grassroots activism around plastic, Plastic Free China was established in 2018 to focus solely on single-use plastic reduction through corporate campaigns to change business practices and consumer behaviors. Led by CEO and co-founder Zheng Xue and project officer Sherry Lu, Plastic Free China has proposed policy changes on express delivery regulation, co-authored reports on e-commerce and food delivery waste with Greenpeace East Asia, and worked with WWF China's No Plastic in Nature Action Network.

The program began with the publication of a report evaluating and ranking the package reduction efforts of express delivery companies to create motivation for packaging reduction. Next they started educating consumers to identify whether the package they receive is over-packaged and engage them to put pressure on companies. Their recent success has

advanced the reduction of single-use plastics in express delivery. They are also trying to inform people about the harm of biodegradable plastic, which will likely go to the incinerator or a landfill.

Plastic Free China also launched online public awareness campaigns to teach consumers on the severity of the single-use cutlery and the take-out food packaging problems. Engaging the public on Weibo, WeChat, and other social media platforms, they promote discussion and education about plastic waste issues. Through these efforts, the Plastic Free China team has played a vital role in sparking citizens and other NGOs to join forces to reduce plastic pollution.



Chen Liwen

Zero Waste Village— a grassroots effort in Rural China

Photo courtesy of Chen Liwen

Growing up in Xicai Village in rural Hebei Province, Chen Liwen spent plenty of her childhood outdoors, where she established a deep connection with nature. This connection eventually led her to pursue an environmental career. Early on, while she was surveying landfills outside Beijing, she discovered “mountains” of putrid waste that were leaking into waterways and sickening nearby residents. That incident sparked her to focus her work on reducing waste and waste pollution. After working on urban waste issues Liwen became concerned that pollution reforms to promote waste sorting and recycling in cities were not extended to rural areas, where 40 percent of China’s population lives.

In 2017, Chen Liwen founded Zero Waste Village, a group that has already helped more than 24 villages and five townships set up waste sorting programs. Laishui County, Hebei Province was their first village. The China Foundation for Poverty Alleviation was building a new rural tourism project in the county and better waste management was important to keep the area attractive for visitors. The first pilot was a complete experiment without much financial support. The Zero Waste Village team even bought trash cans and hardware themselves and spent the first two weeks going door-to-door to teach the villagers how to incorporate waste sorting into their routine.

They learned that their “do it all” training approach was not sustainable. Instead they shifted to training and mobilizing local people to lead this waste work. They found village committees the best leaders because they hold the administrative power in rural areas. Today, Chen is shifting her group’s focus to townships as the local governments can spread good waste practices to surrounding villages in their area. Working more at the township level has helped overcome the limitations with some village committees that often lack a strong systematic governance structure.

“We will continue educating others about rural waste sorting. Each year we hope to build new partnerships”

INDUSTRY INITIATIVES AND EPR TO REDUCE PLASTIC WASTE



Image source: By Iryna Inshyna / Shutterstock.com

Why We Need Extended Producer Responsibility (EPR) for Packaging

By Sydney Harris & Scott Cassel

Recycling in the United States is failing. Only 50 percent of packaging is currently recycled.¹ For plastics (packaging and other items) the rate is lower, only nine percent.² The U.S. packaging recycling rate is far below many other countries and has been stagnant for over a decade because our waste management infrastructure is fragmented, inefficient, and underfunded. Local governments spend millions of taxpayer dollars each year to manage an expanding and increasingly complex array of packaging waste they had no input in designing or creating. U.S. recyclers are struggling with poorly designed packaging that cannot be recycled and adds cost to the recycling system, and brand owners are unable to source the recycled content they need to honor their public sustainability commitments. Under the current system, consumer packaged goods companies have little incentive to change.

Market shifts in the wake of China's National Sword policy and other export restrictions on U.S. recyclables led many municipal recycling programs to stop accepting certain materials or even stop collecting materials altogether as they struggled to deal with budget deficits. The coronavirus pandemic has compounded financial struggles that cities were already facing. These events have highlighted an already unsustainable and inequitable recycling system. Not only are individual taxpayers shouldering the cost to collect and manage packaging waste created by corporations, communities are bearing the brunt of the social and environmental impacts of the waste crisis as plastics refineries, packaging production facilities, incinerators, and landfills are sited overwhelmingly in low-income communities

“It is beyond time for a better system in which producers are required to take responsibility for their packaging to create a circular economy.”

and communities of color. It is beyond time for a better system, in which producers are required to take responsibility for their packaging to create a circular economy.

“ Bans on single-use items and container deposit systems are key, but without EPR these [policy] tools will not be enough to build a circular economy ”

EPR: Centerpiece of the circular economy

Imagine this: On your next trip to the grocery store, you are able to fill up reusable containers with bulk goods like cereals and shampoo. Some items you still purchase in packaging made from post-consumer recycled content. At home, when you've emptied the packaging, you recycle with confidence because you know that the entire state has a standard list of recyclable items—you are no longer confused about what belongs in the recycling bin and what does not. When an online order arrives at your doorstep, it has no excess material—no gratuitous boxes inside of boxes; no inexplicable bubble wrap or plastic pillows—the packaging has been optimized to use as little material as possible while still protecting the products inside. Over time, more and more of your household needs are available package-free or in reusable or recyclable formats. What's more, your friends who live in rural communities now have recycling programs

for the first time—as do your friends in apartment buildings downtown. Your town was able to start up a curbside composting program this year, thanks to newly available funds that were previously spent on recycling. This is a packaging EPR system.

Extended Producer Responsibility (EPR) for packaging will be a game changer for waste reduction and recycling in the United States. When designed well, an EPR program can optimize material collection, weather market challenges, and restore the public's trust in recycling. EPR reduces the unreasonable demands placed on municipalities to manage and pay for recycling programs, leaving local governments with more funding to focus on priorities such as public health. Throughout Europe and Canada, where EPR has been established for decades, these programs have increased packaging recovery and recycling rates, reduced consumer confusion and material contamination, bolstered recycling infrastructure, and cultivated strong domestic markets for recycled materials. Some countries with packaging EPR systems, such as Belgium and the Netherlands, have achieved packaging recycling rates over 80 percent.³

Image courtesy of Shutterstock.com



At a time when brands are facing mounting pressure from citizens who are fed up with ocean plastics and increasingly aware of the global injustices of impacts from waste disposal, EPR can incentivize and reward reuse, recycling, and the production of materials with lighter environmental footprints. Producer funding of EPR systems can support and expand collection and recycling infrastructure, catalyze research and development of new recycling technologies, harmonize recycling systems across an entire state or country, and level the playing field for producers and brand owners by ensuring that all companies contribute to the transition to a circular economy.

Paving the way for complementary waste policies

Voluntary product stewardship efforts and consumer education campaigns have produced small, incremental improvements to the current recycling system. Industry has poured millions of dollars into advanced recycling technologies, recycling infrastructure grant programs, and other voluntary efforts to increase recycling. Nevertheless, local governments continue to struggle with recycling programs that simply cannot keep pace with production, and plastics and packaging continue to flood into the environment. We need a systemic policy approach that creates a comprehensive system and holds all producers accountable. In short: We need EPR for packaging.

Complementary policy tools such as bans on single-use items and container deposit systems are key, but without EPR these

tools will not be enough to build a circular economy. Instead of a waste policy that reacts to problematic materials after the fact, we need an agile system that can adapt to the ever-changing packaging landscape. Unless producers are held accountable for packaging waste, they will continue to have no real incentive to make meaningful change. EPR internalizes the economic externalities in our current linear economy to create a more equitable system for all.

Building momentum, driving change

The world's largest packaging producers operate on a global scale. To drive meaningful change on plastic and packaging waste, economic accountability must be global in scale as well. If large economies such as the United States and China join the EU, Canada, India, and other global powerhouses to implement EPR for packaging, the market pressure on producers will be unavoidable. Our organization—the Product Stewardship Institute (PSI)—offers a model on how this can be done. We bring local and state governments, manufacturers and brands, waste collectors and recyclers, NGOs, and other stakeholders together to forge lasting agreements rooted in producer responsibility and sustainable materials management.

In 2020, we facilitated a dialogue between state and local governments and members of the Flexible Packaging Association to reach a first-of-its-kind agreement⁴ on key elements of EPR for packaging in the United States. Leveraging the deep experience of our global partners, we provide

ongoing educational resources to those seeking real policy change, including an extensive packaging EPR toolkit that highlights policy best practices, original research such as our in-depth report on EPR for Packaging and Paper Products,⁵ and informational webinars. In the United States today, more than a dozen states are actively considering EPR for packaging and many have already introduced legislation using PSI’s model or are working directly with PSI in facilitated dialogues with key stakeholders. The federal Break Free From Plastic Pollution Act, first introduced in early 2020 (reintroduced in 2021), features packaging EPR as its centerpiece and was also informed by PSI’s policy model. In

addition to EPR, this bill includes many complementary policy tools to reduce packaging and plastic waste.

As we look ahead, PSI is hopeful that innovative EPR policies will provide avenues for reducing the production and consumption of single-use materials, increasing domestic reuse and recycling opportunities, and safeguarding public health. We must drastically change the status quo—now is the time to adopt EPR legislation for packaging and paper products in the United States so that we can stabilize and improve our recycling programs and build resilience and flexibility for the material changes and market fluctuations that inevitably lie ahead.

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The Power of Pre-Competitive Collaborations in Addressing Plastic Waste & Scaling the Circular Economy

By **Bea Miñana**

From the eyes of one person looking out upon the mountains of trash in landfills and the plastic swirling in our oceans, the problem of global waste can seem insurmountable. The global plastics crisis is much bigger than any one of us in isolation. It's bigger than any one institution, organization, or country. If we're to tackle this challenge effectively, an unprecedented level of cross-sector collaboration is needed.

At Closed Loop Partners' Center for the Circular Economy, we specialize in convening leading corporations and other diverse stakeholders to solve shared material challenges—the single-use plastic bag that too often ends up in our oceans, the ubiquitous plastic coated to-go paper cup that lands in the landfills, or the compostable piece of packaging that can contaminate recycling facilities but are often not recovered properly. We aim to accelerate the transition to a circular economy in which waste is eliminated and materials are continuously cycled, aligning planetary needs, consumer preferences and business imperatives.

“Business as usual no longer works in the face of systemic challenges like growing waste and climate risks.”

The power in corporate supply chains

The collective power of corporations to enact change is extraordinary. Their supply chains and retail footprints span the globe, and their revenues can be larger than those of some governments—they represent a huge opportunity to scale impact. Compet-

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ing brands experience the same challenges and risks downstream: typically losing sight of products and packaging after point-of-sale. When those materials end up where they shouldn't—landfills or the natural environment—this comes at a cost to people, business, and the planet; all of whom are increasingly clamoring for change.

Business as usual no longer works in the face of systemic challenges like growing waste and climate risks. There is opportunity to create collective value and positive social and environmental impact that outweigh the perceived risks of joining forces with competitors.

In 2018, the Center for the Circular Economy launched the NextGen Consortium, a multi-year collaboration that addresses single-use foodservice packaging waste globally, bringing together Starbucks and McDonald's as Founding Partners. The Coca-Cola Company elevated its commitment in 2021, becoming a Sector Lead Partner, while Yum! Brands, Wendy's and Jacobs Douwe Egberts are Supporting Partners, with the World Wildlife Fund as Advisory

Partner. Together, they all aim to advance the design, commercialization and recovery of sustainable foodservice packaging.

Go-to solutions for the to-go cup

The Consortium's first initiative, NextGen Cup, is advancing recoverable solutions for the fiber, hot and cold, to-go cup system. Every year, more than 250 billion of these single-use cups are produced—and most of this valuable fiber ends up in a landfill or is incinerated. The NextGen Consortium's Cup Challenge, in partnership with the Consortium's Innovation Partner IDEO, launched an international search to identify sustainable cup designs, yielded 12 winning ideas, Eight companies offered innovative cups and cup liners, one a leading material innovation and three put forward reusable cup service models.

The solutions effectively reimagine the current difficult-to-recycle cup, bringing material value across the recovery system and harnessing the technology and design necessary to keep materials in circulation

Image source: By MikeDotta / Shutterstock.com



longer. After identifying the innovations, the Consortium has worked to continuously test, iterate and hone these solutions to set them up for success in the real world. In 2020, the Consortium piloted reusable cup companies across local cafes in the San Francisco Bay Area, increasing our understanding of the unique material, technical and operational changes necessary for a seamless and convenient transition to reusable cups for customers and cafes.

Waste reduction in the bag

In 2020, the Center for the Circular Economy next launched the Consortium to Reinvent the Retail Bag to identify, test and implement innovative design solutions of today's single-use plastic retail bag. It aims to deliver convenience to consumers while striving to lessen the impact on the environment. The Center united Founding Partners CVS Health, Target and Walmart, alongside DICK'S Sporting Goods, Dollar General, Kroger, The TJX Companies, Inc., Ulta Beauty, Ahold Delhaize USA Brands, Albertsons Companies, H-E-B, Hy-Vee, Meijer, Wakefern Food Corporation, and Walgreens, with Conservation International and Ocean Conservancy participating as Environmental Advisory Partners.

In August 2021, the Consortium launched the Beyond the Bag Challenge, inviting entrepreneurs, designers, suppliers and problem solvers to submit solutions that could replace the current plastic retail bag. From 450 challenge submissions from 60 different countries, nine winners were selected. Later in the year, the Consortium launched first-of-a-kind multi-retailer pilots

with select reusable bag winners across CVS Health, Target and Walmart stores. From these pilots, we identified five key insights that can help inform how brands, retailers and startups test and implement potential reusable packaging systems.¹

Building infrastructure to break it down

Most recently, the Center for the Circular Economy formed the Composting Consortium, in collaboration with Founding Partners PepsiCo and the NextGen Consortium, to advance composting infrastructure and recover compostable packaging and food scraps. The Consortium is joined by Supporting Partners Colgate-Palmolive, The Kraft Heinz Company, Mars, Incorporated, and Target Corporation, as well as Industry Partners the Biodegradable Products Institute and the U.S. Plastics Pact. Together with many leading voices in the composting ecosystem in the United States, the Composting Consortium aims to pilot industry-wide solutions and build a roadmap for investment in technologies and infrastructure to deal with the growth in production of compostable food packaging.

Making waves to close the loop

Through all Consortia, we not only bring competitive companies together to solve shared challenges, but also engage stakeholders from across the entire value chain to bring sustainable solutions to fruition, incorporating insights from customers to manufacturers to recycling facilities. Policy-

makers, industry associations and NGOs, among others, also play a critical role in the Consortia, supporting best practices and incentivizing optimal, waste-free systems.

The impact of cross-sector, pre-competitive collaborations is powerful. Corporations working together demonstrate the elevated level of commitment and ambition to truly move the needle on global challenges. The alliance of powerful institutions sends a unified signal to the market, representing volumes that could incentivize manufacturers, recovery infrastructure and technology to adopt more sustainable practices. Pooled resources accelerate innovation and

increase efficiency. And ultimately, these pre-competitive collaborations reframe the issue beyond short-term fixes to long-lasting, systemic solutions—acknowledging the need for collective action to pave a more circular path forward for plastics.

For this momentum to continue, we need more unprecedented partnerships among institutions and organizations that share circular goals. As we approach 2030, a milestone year for many corporate sustainability goals, we encourage more companies to dare to do things differently and recognize the power of collaboration to achieve a more sustainable future.

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More Effective, More Sustainable and More Equitable Recycling Reform For Maine

By Chrissy Adamowicz

Maine people live with a strong conservation ethic — easy to do in such a scenic and wild state where our economy and natural environment are inextricably linked. Part of that ethic includes a deep interest in waste reduction and recycling, especially plastic pollution. When fundamental weaknesses in our recycling programs were revealed as the global recycling market crashed in 2018, Maine people quickly realized that we needed to change the way we plan and pay for recycling.

The Natural Resources Council of Maine (NRCM) is a nonprofit environmental advocacy organization that is passionate about doing what's right for Maine's people and environment. One of our priorities is to help struggling municipalities and push for a proven solution that would save taxpayers money, increase the effectiveness of recycling, and decrease plastic pollution. Shifting more responsibility to large corporations who produce the bulk of wasteful packaging through an Extended Producer Responsibility (EPR) for Packaging law was the clear choice to save Maine's recycling programs from unexpected and rising costs, making them more effective and resilient.

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Fundamental weaknesses in our recycling programs were revealed as the global recycling market crashed in 2018
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Maine is already a national leader in this policy area, having implemented eight existing product stewardship laws, covering products from paint to batteries, that have successfully shifted the burden off taxpayers for managing the waste producers make. EPR for Packaging laws are new to the United States even though they have been successfully used around the world for decades.

EPR for Packaging laws have been proven to increase recycling rates and incentivize eco-friendly designs. In more than 40 countries these policies place the responsibility onto big, multinational corporations to pay for municipal recycling programs, rather than taxpayers. According to an analysis by NRCM, more than 500 brands that can be found on the shelves of Maine grocery stores already pay for Canadian recycling programs. Anyone who sees the list immediately asks the question “if they pay in Canada, why can’t they pay here too?”

Maine’s Department of Environmental Protection (DEP) estimated that Maine’s

municipal waste stream is about 40 percent packaging, and costs taxpayers \$16-\$17.5 million per year to manage. Meanwhile, we have never reached our goal of recycling 50 percent of our waste, and instead have plateaued for years at a low 36 percent (which is presumably falling). Mainers are spending a lot of money to recycle and aren’t getting results.

Despite what the producers of packaging like to say, the problems with recycling aren’t the fault of the consumer or municipalities. The problem starts upstream, with them. Too many packages are not designed with recycling, the environment, or the taxpayer in mind. Countless products on the shelves falsely claim that they are recyclable, are made of materials that look recyclable and mislead consumers into thinking they are recyclable (think plastics that look and feel like paper or foil), are made of complex mixed materials, or are excessive in weight or volume—all of which end up confusing and costing taxpayers. The truth is, a package may be technically recyclable, but it’s not practically recyclable if no collection system or market for that

Image courtesy of czjiri / Shutterstock.com



material is in place. It's time for producers of packaging to help provide support for recycling programs.

Good hearted Maine residents and volunteers work hard to educate their neighbors, schools, and workplaces about Reducing, Reusing, and Recycling, but ultimately those efforts are no substitute for what is really needed: a coordinated approach that involves producers, municipalities, consumers, and waste management companies. That is what an EPR system does, it connects everyone involved in the design, sale, use, and ultimate disposal of a package in a way that our current, fragmented approach simply can't do. Producers need to be held accountable for their contribution to our recycling crisis, and EPR helps them do that in a fair, sustainable way.

For Maine, the EPR for Packaging law is first and foremost about providing support to our municipalities, who want to do the right thing but are struggling to maintain recycling programs due to cost. By the time of the public hearing, over 20 towns representing over 200,000 Mainers had adopted a municipal resolution in support of EPR for Packaging. In addition to municipalities, EPR for Packaging was supported by several of Maine's businesses, nonprofits, religious institutions, recyclers, students, and community groups. Support was overwhelming and

Maine became the first state in the nation to have an EPR for Packaging law voted out of committee. On July 13, 2021 the governor signed into Law 1541, making Maine the first U.S. state to enact an EPR bill for paper and packaging waste.

EPR for Packaging will provide the funding Maine's towns need to make the proper investments in education and infrastructure that are necessary to reach a circular economy. While the setbacks due to the pandemic continue to be difficult to bear for Maine's towns who desperately need help to secure the future of their recycling programs, the support for an EPR law in Maine remains too strong to be ignored.

NRCM, towns, recyclers, the environmental community and local activists are ready to continue fighting for better waste and recycling policies. The road ahead may seem long, but a consensus is growing that producer responsibility laws are the only way forward if we want to systemically fix our waste and recycling problems.

Acknowledgements

NRCM would like to thank the activists and partners who are helping to bring an EPR for Packaging policy to Maine.



“Mainers are spending a lot of money to recycle and aren't getting results.”




**TRACKING THE FIGHT
AGAINST PLASTIC:
A PLASTIC CREDIT SYSTEM**

By Maggie Ka Ka Lee

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**Burt’s Bees, will
leverage Plastic
Credits in their
pledge to be Net
Zero Plastic to
Nature by 2025.**
”

Most people will agree that plastic waste collection and recycling infrastructure world-wide needs to be improved. Recycling rates across the world, especially in the Global South, where there are few mandatory recycling, collection, and deposit return schemes, are low. Only 9 percent of global plastic waste was ultimately recycled in 2019.¹ China’s National Sword policy raised additional international attention to the problems that exist in recycling value chains.

At the same time, companies and brands are being called on to address their plastic pollution and support the shift to a circular economy. Initiatives like the Ellen MacArthur Foundation Plastics Pacts and WWF’s Plastic ACTion Agreement encourage companies to reduce their use of virgin plastic and increase the recyclability of their packaging. These commitments require companies to increase the use of post-consumer recycled plastic and redesign for recyclability within their value chains. Fulfilling these commitments would certainly make a significant impact in addressing the plastic pollution crisis, but only with necessary monitoring and verification mechanisms.

Verra, a global leader in developing and managing standards, is stepping up to provide a credible, third-party verified plastic credit system as an accounting framework. It aims to empower companies and organizations to invest in verifiable plastic reduction projects, and facilitate the transition towards a circular economy.

Building the new plastic standard

In February 2021, Verra launched a new standard to support the collection and sorting infrastructure needed to close the loop on plastic waste. This Plastic Waste Reduction Standard (Plastic Standard) is a crediting mechanism that provides an efficient and powerful means of financing activities to verifiably reduce plastic waste in the environment. The Plastic Standard is used for the consistent accounting and crediting of a variety of plastic collection and recycling activities, which enables independent auditing. It issues Plastic Credits to registered collection and/or recycling projects based on the tons of plastic waste they collect or recycle above baseline rates (i.e., what would have happened in the absence of the project). Plus, this crediting mechanism addresses the social and environmental impacts of waste management activities. By including metrics such as safeguard requirements around fair compensation, working conditions and the greenhouse gas emissions of projects, these projects have an impact beyond just the collecting and recycling of plastic waste.

Companies purchase Plastic Credits to invest in the plastic waste collection and recycling infrastructure outside of their value chain. Through the crediting mechanism, companies can make a verified investment into the infrastructure that will process the plastic they generate and complement the actions they take within their own value chain.

In a robust plastic credit market, a company can purchase credits to offset their own

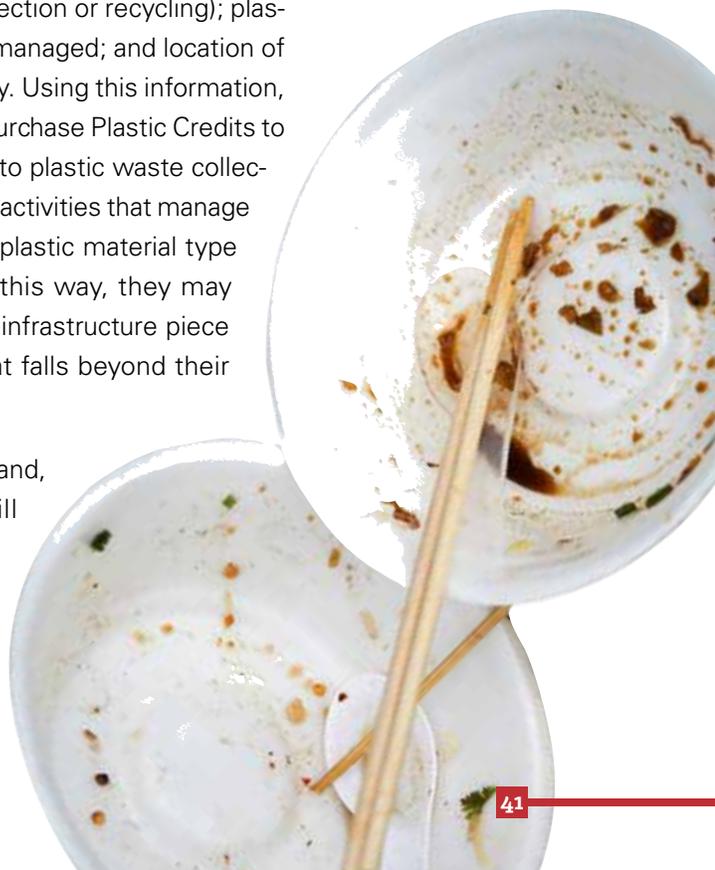
plastic footprint. The *Guidelines for Corporate Plastic Stewardship* were launched in conjunction with the Plastic Standard as one of the outputs of the 3R Initiative (Reduce Recover Recycle), a market-based approach to upscale collection and recycling.² These guidelines, which the World Business Council for Sustainable Development intends to standardize, set out best practices for using Plastic Credits.

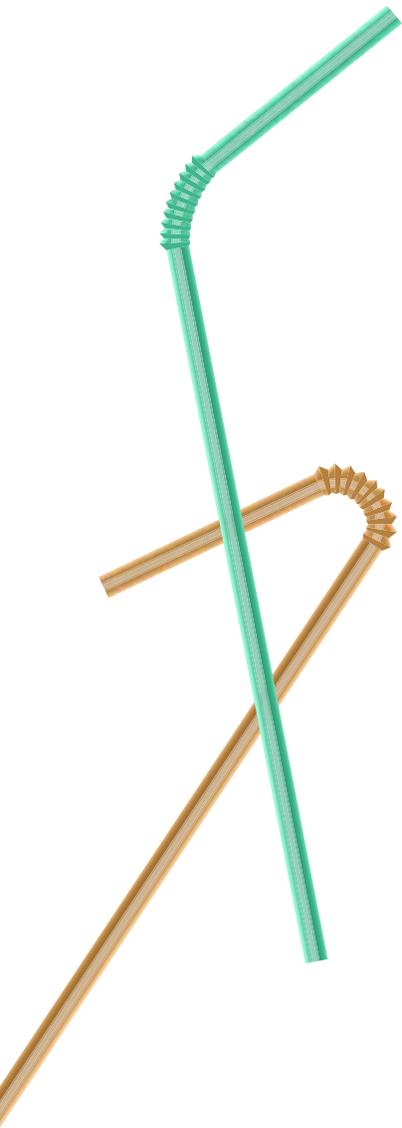
Plastic credit system in action

Let's consider how a Chinese brand may apply these guidelines and invest in Plastic Credits as part of their broader plastic stewardship strategy. The brand should assess their plastic footprint and consider what actions they can take to reduce the plastic footprint and leakage associated with their product lines. Moreover, this brand should also consider how to manage its packaging where its products are sold. Each Plastic Credit issued by Verra has a serial number that includes information such as the activity type (e.g., collection or recycling); plastic material type managed; and location of the project activity. Using this information, the brand could purchase Plastic Credits to drive investment to plastic waste collection and recycling activities that manage their packaging's plastic material type within China. In this way, they may help address the infrastructure piece of "the loop" that falls beyond their value chain.

The U.S.-based brand, Burt's Bees, will leverage Plastic

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The US and China
account for 51
percent of global
plastic production
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Credits in their pledge to be Net Zero Plastic to Nature by 2025. In addition to reducing their reliance on virgin plastic materials and increasing the circular attributes of their packaging, they are supporting global waste management infrastructure through Plastic Credits. Specifically, Burt's Bees are funding projects in India and Ghana developed by rePurpose Global. All of these Burt's Bees and rePurpose Global joint projects must be registered and verified under the Plastic Standard, which provides further credibility to this investment.

In the short term, the Plastic Standard can facilitate investment in the recognized gap in critical waste management infrastructure worldwide, including the United States and China which accounts for 51 percent of global plastic production.³ In the long term, countries passing Extended Producer Responsibility (EPR) policies could use the

Plastic Standard as a standardized accounting framework to quantify the impact (in tons) of investments made by companies in collection and recycling. Credible, third-party verified Plastic Credits may be able to support the development or expansion of these policies, and provide a valuable tool that helps governments and the public to monitor the companies.

Plastic waste collection and recycling infrastructure is complex and every country's needs are different. Yet one thing is clear – we can't close the loop on plastic waste without addressing tracking plastic recovery and recycling. Verra's Plastic Standard and the credits issued under it help to drive investment into this essential infrastructure.

Endnotes

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The Global Treaty on Plastic Pollution Can Catalyze a Roadmap for Circularity in the United States

By Anthony Tusino

In March 2022, 175 nations agreed to begin negotiations on a global treaty that would stem the flow of plastic waste into nature. When implemented, the treaty will equip countries with a roadmap for action and accountability for reducing the environmental impact of plastic waste. By addressing the entire lifecycle of plastics, from production and disposal to the need for better waste management systems, we can create a future where plastic no longer enters nature.

Now for the cold hard reality: the United States, which is the world's biggest producer of the plastic waste, is nowhere near ready to implement the kind of plan required of countries under such a treaty. Our national recycling rates for plastic currently hover around 9 percent, with the rest of it accumulating as waste in landfills, communities and nature, to devastating effect. This dismal statistic is a result of factors including aging infrastructure, spotty access to recycling, the public's widespread confusion over exactly what is recyclable, and the subsidized low cost of virgin materials. Producers of plastic are incentivized to create more, waste more and remain disconnected from the very system they put materials into. We can fix this.



Image source: Chanchai phetdikhai / Shutterstock.com

EPR to change the business of waste

The United States lacks any national standards, practices or plans to reduce waste and pollution. But at the heart of this structural problem lies massive and attainable opportunities to get the country on the right track before a treaty comes into effect in 2024. The solution starts with Extended Producer Responsibility (EPR) for packaging and paper products.¹

EPR is a policy mechanism that would change the business of waste in the United States by making producers and brands financially responsible for the collection and recycling of consumer packaging. By shifting the financial burden away from taxpayers and local governments, the companies that are producing plastic will be incentivized to ensure plastic that goes into the system stays in the system.

Under an EPR framework, producers and brands would shoulder the cost of recycling materials. They would also be penalized for selling hard-to-recycle packaging or for not incorporating recycled content into their packaging portfolio. Collectively, these changes would incentivize producers to

use less plastic, and use it more responsibly. Over time, recycled content would become more available and more cost effective. Collectively, we would be on the path to doing more with less.

In encouraging news, Americans want businesses to act on plastic waste. A recent WWF survey found over 50 percent of respondents believe businesses that produce and sell plastic should be held responsible for collecting and recycling that plastic waste.² It should be noted that more and more businesses want to be responsible for the collection and recycling of the materials they use. While this aligns with what the public wants, it might give an environmentalist pause. Are companies willing to put their reputation, brand and profit on the line? The answer is yes, and we've already seen important progress in this space. For example, Europe and Canada have implemented EPR policies.

As we navigate how we adopt EPR in the United States, we can use these examples to create a system that is sturdy, efficient and drives the right environmental results. Government and public oversight can ensure that those systems are operating in an environmentally sound manner, and demand

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The US, the world's biggest producer of the plastic waste, is nowhere near ready to implement the kind of plan required under [the proposed Plastic] treaty
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changes to stewardship plans if targets aren't being met. At the beginning of June 2022, Colorado signed a bill into law putting the state well on its way to implementing their own EPR system, and several other states have considered similar legislation.³

A game-changing opportunity

It is true that the United States can't just recycle its way out of the global plastic waste crisis. But with waste management set up for success, we can enable the circu-

lar systems needed to fulfill our national obligations under the impending global treaty.

We are standing on the threshold of a seminal moment for private sector accountability—a game-changing opportunity to provide both taxpayers and nature with some much-needed relief. Now we must capitalize on this moment by implementing EPR and transforming our waste management system once and for all. If we prevail, we'll be one giant step closer to freeing the United States and the world from plastic's chokehold.

Endnotes

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Single-Use Plastic Waste: China Versus the US in 2021

CHINA
25.4 MMT TOTAL

UNITED STATES
17.2 MMT TOTAL

18
KG
PER CAPITA
PER YEAR

53
KG
PER CAPITA
PER YEAR



(Million Metric Tons, MMT)

Data Compiled by Solange Reppas and Angela Pan

Data Sources: Charles, Dominic, Laurent Kimman, and Nakul Saran. (2021) "The Plastic Waste Makers Index: Revealing the Source of the Single-Use Plastic Crisis." Minderoo Foundation. <https://www.minderoo.org/plastic-waste-makers-index/>.

A Rant on the Single-use Plastic Boom

—By Angela Pan

Single-use plastics present a growing global environmental crisis. They are made to be thrown away in just minutes, but impose high, often long-term, economic, environmental and health costs. Encouragingly, the United States and China--the world's plastic waste superpowers--both supported the creation of a Global Plastic Treaty to stem the flood of plastic waste that threatens marine ecosystems.

Municipal waste systems in both the United States and China are struggling to manage the boom in single-use plastics. Many single-use plastics are very low-quality and thus hard or economically impractical to recycle. Weak markets for plastic recycling also means mountains of single-use plastic ends up in landfills or incinerators, which can pollute the surrounding environment. Some of the 9-10 percent of plastic waste the United States ships overseas for recycling, ends up leaked into the ocean. As discussed in this issue's introduction, the growth in single-use plastics

is accelerating greenhouse gas emissions. It is encouraging that plastic as a climate threat is starting to get more attention from researchers and activists in the United States and China.

As both the United States and China are starting to prioritize the single-use plastic waste problem, these statistics were easier to find! The data reveals while China generates overall more single-use plastic waste than the United States, per capita the U.S. uses almost three times more single-use plastics than China.

The recent COVID-19 pandemic has led to a new wave of single-use plastic. A new study by Chinese and U.S. researchers calculated that 8+ million tons of pandemic-associated plastic waste, mostly medical waste generated by hospitals, led to a sharp rise in ocean plastic pollution.¹

¹ Peng, Yiming, Peipei Wu, Amina T. Schartup, & Yanxu Zhang. "Plastic Waste Release Caused by COVID-19 and Its Fate in the Global Ocean." *Proceedings of the National Academy of Sciences* 118, no. 47 (November 23, 2021) <https://doi.org/10.1073/pnas.2111530118>.



CLOSED-LOOP INNOVATORS

Sophia Wang: Returning to our Roots for Elegance and Sustainability in Fashion

Photo courtesy of: Sophia Wang, photograph by Carla Tramullas, courtesy of MycoWorks



Fashion is the second most polluting industry behind oil and is responsible for 10 percent of annual global carbon emissions. The carbon-intensive production of animal hide and plastic for synthetic leather (e.g., pleather) and clothing further compound the impact of this industry. Sophie Wang is an artist who creatively combines the nature-based material (Fine Mycelium technology) into sustainable fashion, weaving a plastic-free alternative fashion industry. Now her work has led to the first commercialized plastic-free mushroom leather hat.

When her artistic collaborator, Phil Ross, shared with her the mycelium sculptures he had been finessing for decades, artist Sophia Wang was amazed by the expanse of possibilities in its natural pigments and textures. Mycelium comprises the root structure of mushrooms and like the edible portion of the fungi, possesses textural qualities unlike any of those found in the animal or plant kingdoms. Sophia had never seen anything quite like it and describes the mycelium materials Phil created as “at once rigid and foamy; compact and endlessly expressive.”

The cultivation of mushrooms for consumption is an age-old industry boasting strong production and distribution infrastructure all over the world. Myce-

lium’s abundance and its biodegradable and carbon sequestration properties make it an obvious choice for the sustainable goods of the future. Companies like Ecovative Design and Rhizoform LLC have spent decades developing mycelium as a packaging alternative for fragile consumer goods and fish and have even secured support from Ikea and packaging giant SealedAir, but in fashion nothing has yet been attempted at quite this scale.

Sophia and Phil’s joint project, MycoWorks, is based on their proprietary process for mycelium cultivation called “Fine Mycelium™.” This process uses fungi’s capacity to bind both to itself and carbon-based materials to produce durable three-dimensional structures. The first product they developed with Fine Mycelium is Reishi™, a sustainable option for leather that looks, feels, and acts like the animal-derived version. Following their successful brand launch for Reishi in February 2020 at New York Fashion week, MycoWorks in collaboration with Nick Fouquet has launched its commercial product, a series of plastic-free mushroom leather hats.



Stacy Flynn: Closing the Loop on Fashion Waste

Photo courtesy of: Stacy Flynn, Evrnu

Stacy Flynn is intimately familiar with the ins and outs of fashion's supply chain. She knows how clothes travel the world as they move through the stages of design, textile production, and garment formation before landing in your local retail store. For years, she managed these supply chains for Dupont and Target, making regular visits to suppliers in China. She was shown pristine manufacturing facilities where she examined textile and clothing samples and discussed prices and delivery. But nothing could have prepared her for seeing the staggering pollution these second and third tier suppliers generated when she returned in 2010 with a Seattle-based startup to tour smaller textile and dyeing factories. Her guides told her that during periods of increased textile production, wastewater emissions turn the nearby river into deep unnatural hues and factory exhaust smothered the air outdoors and even indoors for the workers.

Stacy soon began a mental tally of the millions of yards of fabric she had handled throughout her career and their associated environmental cost. The pride she held for her profession quickly soured. At a crossroads, she asked herself, "Is this how the story ends, is this our state or is there another way for the fashion industry?"

The current global fast fashion model encourages the rapid design of inexpensive seasonal clothing. This fast-paced supply chain produces over 92 million tons of waste each year and consumes 79 trillion liters of water. Cheap synthetic fibers that make lightweight

and durable fabrics fuel this industry, but the environmental cost is high and long-lasting. In 2015, the annual greenhouse gas emission from polyester production for textiles reached the equivalent impact of 185 coal-fired power plants. Polyester fabrics are particularly harmful because when being worn or washed they can shed plastic microfibers at an alarming rate. Scientists are still working to see how these microfibers accumulate in our seabeds, national parks, seafood, soil, and homes.

Evrnu is a collaboration between Stacy Flynn and Christopher Stanev to counter the impact of the fashion industry on natural resources by licensing their supply-side innovations to global producers. Evrnu's innovative NuCycl technology strips old garments down to their component fibers to produce a stronger end material capable of reuse. They are modernizing the textiles industry by designing waste out of supply chains and leveraging discarded textiles as resources for the future.

"We've seen the negative environmental impacts and limits to our growth with the current way of doing business. What if we start designing our products with the intent to recycle them in the future? What if waste byproducts of textile products in the future are used to create the supply chain rather than mining raw materials?"

SECTION 3

PLASTIC POLICY ACTION



Image source: By Piyaset / Shutterstock.com

Closing the Loop: China's Multiple Stakeholder Push on Plastics and Carbon

By Kathinka Fürst and Mengqi Li

China reigns as the world's largest plastic producer. From 1978 to 2017, its plastic production volume increased nearly 100 times, whereas global production had risen only sevenfold. In 2020 alone, China produced 76 million tons of plastic, the weight of 5,000 orcas. Yet only 25 percent of China's plastic produced in that year was recycled. And overflowing landfills and weak waste infrastructure have fueled plastic pollution in China's waterways and coastal areas.

In 2008, China took action to strengthen its regulatory frameworks and reduce the leakage of plastic into the environment. This commitment has ushered in more bans to problematic single-use plastics, upgrades to municipal solid waste management infrastructure, and incentives for industries to innovate on packaging alternatives. It is a strong foundation for China's shift towards a circular plastic economy.

Yet China must do more. Its plastic pollution policies should focus more on reining in plastic production—which depends on fossil fuels. Every kilogram of plastic produced releases between 1.7 and 3.5 kilograms of carbon dioxide into the atmosphere. And China incinerates approximately 30 percent of its plastic waste, which also leads to increased CO₂ emissions. Production is a major obstacle to closing the loop on plastic waste, and a challenge for China in reaching its carbon neutrality goals.

“China incinerates approximately 30 percent of its plastic waste, which leads to increased CO₂ emissions.”

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The drumbeat of more regulations has sparked China’s large e-commerce and food delivery companies to innovate and reduce their plastic and waste footprint.”

From bag ban to life cycle

China’s first modest regulation of plastic started in 2008. Bans and fees targeting ultra-thin plastic bags helped reduce bag use and increase recycling. Yet enforcement was weak. Only 17 percent of retailers complied with the voluntary regulations and charged a fee for plastic bags. Fully 78 percent of retailers, especially smaller shops, continued to provide them to customers. Chinese policymakers intensified their efforts in 2016 with a sharp increase in laws, policies, and action plans to tackle the plastic problem.

Today, China boasts a more robust regulatory framework to curb plastic pollution. In 2018, its government took the momentous step of banning imports of most plastic wastes. Then, two years later, it issued a *Guideline for Further Strengthening the Control of Plastic Pollution* that included stringent single-use plastic bans. In 2021, the 14th Five-Year Plan ushered in a series of new high-level targets to reduce plastic production and use at source, promote recycling and disposal, and clean-up pollution in key areas. The new plan also set clear reduction and recycling targets for plastic products and wastes.

China’s targets are not empty gestures. They are built on the 2009 Circular Economy Promotion Law that laid the groundwork of a life-cycle regulatory regime for varied products that covered all aspects of production, consumption and treatment. The nation’s amended *Solid Waste Pollution Law (2020)* also specifically cites the circular economy concept, banning single-use plastics and promotes recycling and alternatives.

One major challenge to achieving circularity is that China’s recycled materials market is still not fully developed, and many cities have lagged behind in plastic collection and sorting. To address this issue, the Ministry of Housing and Urban-Rural Development required 46 cities to carry out pilot programs on mandatory garbage collection and sorting in 2017. A year later, China’s Ministry of Ecological Environment launched the “Zero-waste cities” pilot program in 11 cities, to create models for improved sorting and recycling and increased waste reduction. These pilot programs have reduced plastic pollution as well as other types of waste. China’s policymakers also are creating incentives for voluntary programs in both industries and nonprofit groups.

Business and social entrepreneurship

The drumbeat of more regulations also has sparked China’s large e-commerce and food delivery companies to innovate and reduce their plastic and waste footprint. JD.com, one of China’s leading e-commerce platforms, launched its Green Stream campaign in 2017 to integrate waste reduction throughout its supply chain. The company replaced single-use boxes with green packing boxes made of polypropylene that can be reused at least 50 times. The results are encouraging. These boxes have been reused over 16 million times in more than 30 Chinese cities. And JD has also adopted biodegradable packaging for fresh food delivery services and created recyclable bags to pack food for transport.

A new generation of small manufacturers is also developing new products from recycled plastic. One example is the P.E.T. Plastic Ecological Transformation Company founded in July 2017 by fashion manufacturing veteran Jane Zhao. Perturbed by the state of pollution in China that her children will inherit, Zhao tackled the problem of virgin plastic in fabrics by transforming recycled PET plastic bottles into many types of fabrics.

Chinese NGOs that focus on plastic pollution prevention have multiplied in the last five years. The China Zero Waste Alliance members are creating corporate campaigns to change business practices and consumer behaviors around single-use plastics. In addition, Beijing-based NGO IPE and the Vanke Foundation initiated the Waste Map Project to fill the data gap needed to close the loop on plastic waste. This project's app helps residents find the nearest collection and recycling stations, and enables cities and companies to post information on their waste generation. The data obtained not only guides waste management investments, but strengthens waste markets so more plastics are recycled.

NGOs such as Zhoushan Qiandao and Shanghai Rendu Ocean NPO Development Center are active in beach, coast and underwater clean ups. The Cross-Border Environment Concern Association (CECA) is a nongovernmental think tank focusing on marine and coastal ecological issues in the Pearl River Delta and Bohai Bay. CECA's policy research and advocacy target plastic

and other pollution, development threats, and urban planning, laws and regulations in these key regions.

Hurdles and opportunities on China's path forward

Plastics—and other sorts of waste—are the newest front in the Chinese government's war on pollution. This top-down focus on creating a circular economy around waste has sparked policy, campaigns, and investments to overhaul the country's waste management system. These efforts have also opened up doors for bottom-up efforts to mitigate plastic pollution.

But more can be done. A bolder embrace of multiple stakeholder approaches in plastic governance can offer funding opportunities, new ideas, and leverage stronger alliances between different actors with an interest in mitigating and preventing plastic pollution in China.

Besides addressing the country's plastic pollution problem, reining in plastic waste is also critical to help China reach its "dual carbon" goals: a carbon peak by 2030 and carbon neutrality by 2060. Because each stage of plastics production produces greenhouse gas emissions, China will need to significantly reduce production and address its relatively high incineration rate of plastic waste to achieve its carbon neutrality pledge.

“Plastics—and other sorts of waste—are the newest front in the Chinese government's war on pollution.”



Image courtesy of lensfox / Shutterstock.com

Moves to Close the Loop on Plastic Waste in the United States

By David Biederman

“China’s National Sword shock has prompted new state and company actions in the U.S.”

China’s announcement of its National Sword program in mid-2017 and its implementation beginning in 2018 caused a substantial market disruption to many U.S. municipal recycling programs, particularly for plastic waste. China was by far the largest export market for recyclables and scrap in the world, receiving more than one-third of post-consumer plastic recyclables prior to 2017. China no longer accepts those materials and some U.S. municipalities have been forced to suspend curbside recycling programs. On the positive side, the abrupt cutoff of China’s market sparked local and state governments, private companies, associations such as the Solid Waste Association of North America (SWANA), equipment manufacturers, and other recycling stakeholders to work together to preserve and expand existing recycling programs and operations.

Numerous private sector and government actions have been taken to help close the loop on plastic waste in the United States. New policies and business action are starting to identify gaps and facilitate action in plastic recycling.

Increasing demand for recycled content

In a move to demonstrate sustainability commitments, a growing number of U.S. and other global manufacturers and consumer-centric companies are pledging to use more recycled content in their products. Some of these companies are also signing pledges

with the Ellen MacArthur Foundation, the Alliance to End Plastic Waste, and other multinational organizations.

Many solid waste and recycling experts believe that without increased demand, it will be difficult to recycle more plastic waste. The recent pledges are helping to create a “demand pull” for plastic waste, which has helped support higher prices for recyclers selling High-density polyethylene (HDPE) plastics. SWANA issued a report titled *Energy Recovery Options for Non-Recycled Plastic Discards* in September 2020 that analyzes some of these facilities and technologies in greater detail.¹

China’s National Sword program has eliminated a primary export market for plastic waste from the United States, and following the flow, some other Asian countries are also reducing the volume of such imported waste materials. This shift has encouraged several companies to plan and construct new plastic processing facilities in the United States. In January 2020, the Northeast Recycling Council published a report identifying more than one billion pounds of new processing capacity are expected to come on line in the United States, Canada, and Mexico.

Reducing contamination

One of the key challenges facing U.S. recycling systems is the high rate of non-recyclable materials that Americans place in their recycling bins. Known as “contamination,” these materials are often difficult to remove from the valuable paper, plastic, metal, and glass accepted in most recycling programs. Removing non-recyclables

reduces the efficiency of recycling facilities. One of the catalysts for China’s National Sword program was the high levels of contamination in bales of discarded paper and plastic shipped from the United States.

The increased focus on reducing contamination through better education and increased enforcement of local rules is bearing fruit. According to Waste Management, the largest U.S. recycling company, the contamination rate for materials received at its recycling facilities has declined by about 25 percent over the past few years. A number of local governments and companies have also reported decreased contamination, often with assistance from state or private sector grant programs.

Changing laws and policies

The U.S. recycling rate (including composting) declined from 35 to 32 percent between 2017 and 2018. In 2022 the rate remains stalled at 32 percent. On November 18, 2020, at the America Recycles Summit, the EPA issued an ambitious national recycling goal of fifty percent by 2030. A year later the EPA released and started implementing a National Recycling Strategy with five key objectives to: 1) improve markets for recycled commodities, 2) increase collection and improve recycling infrastructure, 3) reduce contamination of recyclable materials through outreach and education, 4) enhance policies and programs and 5) standardize measurement and data collection. EPA anticipates that



“California’s Plastic Pollution Prevention and Packaging Producer Responsibility Act has catalyzed waves of investment and new technologies to revive the recycling business.”

this 50 percent recycling goal and national strategy will reverse the downward turn of the U.S. recycling rate.

Congress introduced four significant legislative proposals in 2019 and 2020 to improve recycling and address plastic waste problems. Over five years, the Save Our Seas 2.0 Act, S. 1982, provides \$55 million in infrastructure grants annually to states to support local recycling programs. This bill unanimously passed the U.S. Senate in January 2020 and President Trump signed the bipartisan Save Our Seas Act into law on December 20, 2020.

Two other pending bills — the RECOVER Act and the RECYCLE Act — also provide funding for five years to support domestic recycling infrastructure, education, and outreach. The other pending bill, the Break Free From Plastics Act introduced in early 2020, prioritized upstream strategies to reduce waste and promote recycling. The act proposes bans on single use plastics, a national container deposit regime, recycled content requirements, and an extended producer responsibility scheme.

Accelerated business investment for recycling

China’s National Sword shock has prompted new states and company actions. Today state recycling mandates and other policies like California’s Plastic Pollution Prevention and Packaging Producer Responsibility Act, brand commitments have catalyzed waves of investment and new technologies to revive the recycling business.²

The low recovery rate for plastic waste has encouraged some companies to develop additional technologies and processes for diverting materials away from disposal. Many of these processes turn the plastic waste into monomers or polymers that can be used as feedstock for new plastic products. Often referred to as “chemical” or “advanced” recycling, many of these technologies are being implemented or are in the development stage now. They may be particularly useful for recycling mixed post-consumer plastics as the cost of mechanically separating the various types of plastics into saleable commodities exceeds their value. For example, Agilyx, Brightmark Energy, and others are siting and operating facilities in North America that provide a new alternative disposal option for some discarded plastics.

A variety of actions are being taken by recycling stakeholders to help close the loop on plastic waste in the United States. Although reducing the amount of plastic waste would be preferable, it is unlikely that Americans will stop purchasing products and containers that contain plastic. However, the actions being taken, combined with growing awareness associated with the environmental impacts of improperly disposed plastic, EPA’s recent actions, and the possibility of federal legislation supporting education and infrastructure, give some reasons for cautious optimism about the future of plastic recycling in the United States.

TABLE 1.**Recent U.S. Plastic and Recycling Policies**

Name and Year	Content
[S. 1982] Save Our Seas 2.0 Act, signed into law Dec 2020	<ul style="list-style-type: none"> • Strengthen domestic marine debris response with Marine Debris Foundation, prize for innovation, and scientific research • Enhance global engagement through formalizing U.S. international cooperation policy, federal outreach, and new international agreement • Improve domestic infra (through waste management and mitigation)
[S. 984] Break Free From Plastic Pollution Act of 2021, referred to COF March 2021	<ul style="list-style-type: none"> • Require producers to design, manage, and finance waste and recycling programs. • National beverage container refund program • Banning non-recyclable single-use plastic products and adding bag fees to others • Prohibit overseas shipping of plastic waste • Place a temporary pause on new plastic facilities and create regulations on them
[H.R. 3764] Ocean-based Climate Solutions Act, Introduced June 2021	<ul style="list-style-type: none"> • Put 5 percent per pound excise tax on virgin plastic used on single-use products • Ask the Biden Admin to reduce virgin plastic production to 10% of 2010 levels by 2050
[H.R. 2821] Plastic Waste Reduction and Recycling Act, introduced April 2021	<ul style="list-style-type: none"> • \$85 million funding for plastics recycling programs in 2022 • Direct the Office of Science and Technology Policy to establish a plastic waste reduction program, and research recycling techs and plastic waste reduction strategies
[SB 54] Plastic Pollution Prevention and Packaging Producer Responsibility Act, California, passed in June 2022	<ul style="list-style-type: none"> • All packaging in the state to be recyclable or compostable by 2032 • A 25% reduction of plastics in single-use products by 2032 • 30% Recycling, reuse, or composting rate of single-use by 2028 • Plastic manufacturers must pay \$5 billion into a fund over the next 10 years that would mitigate the effects of plastic pollution
In November 2019, the U.S. EPA published a National Framework for Advancing the U.S. Recycling System	Identified some of the major challenges facing recycling systems and programs
[AB 1276] Single-Use Food Ware Accessories and Standard Condiments	Retail food industry only provides single-use accessories to take-out consumers upon request

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Building a Circular Economy for Plastics in China

By Nanqing Jiang

Translated from Chinese by Angela Pan and Karen Mancl

“China...is the largest plastic producer in the world, accounting for one-third of the global output.”

The scale of single-use plastics from cups and plates to packaging and tape is astronomical and growing. One eye-opening stat: in 2018 alone, China consumed enough plastic packing tape to circle the earth more than 1,000 times.

Globally, the plastic economy is a linear, one-way system from production to use and disposal. Despite decades of efforts to encourage recycling, 80 percent of plastic packaging ends up landfilled, incinerated or leaked. Thus, some 95 percent of plastic packaging material value (\$80-120 billion) is lost to the economy after a single use. We are wasting a valuable resource and polluting the oceans, reducing the productivity of fisheries, threatening soil and biodiversity health, and creating more greenhouse gas emissions. These environmental costs amount to some \$40 billion per year, far exceeding the plastic packaging industry profits.

China plays a central role in the plastic economy. It is the largest plastic producer in the world, accounting for one-third of the world's output. Domestically, plastic packaging for food, beverage, household products, bulk chemicals, and agricultural sheeting accounts for nearly 50 percent of China's total plastic production. And yet less than 20 percent of plastic is ever recycled in China. The convenience that plastic brings to people's lives has a dark side — it is overwhelming China's municipal waste systems and creating pollution.

For China to confront the plastic problem, the country will need to build a circular plastic economy with strong market incentives, innovative technologies, and new norms for public behavior around waste. Encouragingly, policy changes to strengthen recycling are laying the groundwork for China to close the loop on plastics.

An evolving plastic recycling system

By 2020, China's municipal solid waste reached 210 million tons. Currently, China's waste classification system is still under construction and the plastic recycling rate is low, so plastic waste mostly goes into landfills or incinerators. The foundation for China's recycling system started in 2007 with Administrative Measures for the Recovery of Renewable Resources and a short-lived national ban on plastic bags. China's plastic policies have become more comprehensive and stringent (see Table 1.), but much more is needed to create a circular economy.

From foreign imports to domestic sources

In recent decades, the price industries paid for recycled plastics rose above virgin plastic. The rise in price stemmed from growing environmental protection requirements on the recycling industry and continuous drops in crude oil prices for virgin plastics.

For nearly fifty years, China's plastic recycling value chain was managed by small and medium-sized private businesses with an army of independent scavengers who collected plastic waste and directed it to

private recyclers. The system relied on recycling from foreign imports to make a profit. China's waste plastics processing and technology industries thrived because of their flexibility and efficiency. However, today without foreign imports, the old system is now collapsing. Recycling enterprises now face the challenge of collecting raw materials from domestic sources. The immature waste collection system in China leads to higher sorting and collecting costs of plastic wastes, making the recycling industry less profitable. At present, Polyethylene terephthalate (PET) and Polyethylene (PE) plastics are mainly recycled, but other types are not.

Consumers bear the burden of recycling

China currently does not have an independent and robust plastic sorting and collection system. To improve the recycling rate of plastic waste, consumers need to separate plastics and put them into different containers. The design of plastic packaging is also a key issue limiting the recycling rate. Many products are not designed with backend recycling requirements in mind, leading to complex sorting, cleaning, and treatment processes and driving up recycling costs.

In terms of policy, China is developing a national standard for recycled plastic material, but testing standards for recycled plastic are still needed. The recycling industry lacks the ability to identify, classify, and process the full array of plastic packaging. The industry also needs an information platform for recycling markets. To achieve plastic circularity, we need more recyclable product designs and interconnected tech-

“Plastic packaging and recycling still lack a sufficiently robust legal and regulatory basis in China.”

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nology to encourage individual consumers to participate in the recycling system. To renew China’s recycling system, we need innovative policies, business practices, and engagement with consumers.

Challenges of realizing a circular economy for plastics

Plastic packaging and recycling still lack a sufficiently robust legal and regulatory basis in China. China has yet to issue large-scale regulations on extended producer responsibility (EPR) similar to the EU waste framework directive and packaging and packaging waste directive. The Chinese government has amended the Solid Waste Law and established a series of policies and plans for plastic packaging and renewable resource recycling. An EPR system has been implemented on a small scale targeting agricultural plastic film and the electronic industry waste, but it lacks standards and data collection for the whole plastic economy.

International brands are now committed to using PCR plastic products, but they encounter problems in China due to the lack of laws and regulations. At present, however, it is difficult for China’s predominantly small and medium-sized recycling enterprises to meet the demand for high-quality products.

In addition, recycled products entering the market bring new regulatory chal-

lenges. For example, food-contact-grade recycled materials are not permitted by existing regulations on food safety.

Nevertheless, China’s recycling continues to increase and the country has formed the world’s largest post-consumer plastic recycling market. Yet it still lacks statistics and industry standards in an informal industry dominated by small and medium-sized enterprises. Science, technology and financial policies are needed to encourage application of innovative technologies to develop the industry.

A consumer-side recycling system is needed to allow more families to participate in the plastic waste recycling chain. For example, the Ant Forest platform developed by Alibaba gives consumers “green credits” when logging their recycling streak. By guiding consumers’ consumption and recycling behavior, it can effectively increase socially responsible consumption, and provide solutions for reducing and eliminating plastic pollution.

To fire up China’s new recycling system, the country needs innovative policies, business practices, and engagement with consumers. Specifically, for plastic circularity, China needs a one-two punch of policies to require more recyclable product designs from businesses and greater interconnected technologies to encourage individual consumers to participate in the recycling system.



TABLE 1.**Evolution of Policies to Strengthen Recycling in China**

Year	Regulations/Policy Actions	Significance for Recycling
2007	Administrative Measures for the Recovery of Renewable Resources / Notice on Restricting the Production and Sale of Plastic Shopping Bags	Foundation for China's recycling system and China's first attempt at banning single-use plastic packaging
2011	Opinions on the Establishment of a Complete and Advanced Recycling System for Waste Goods	Signal to enhance China's recycling system
2015	Medium- to Long-term Plan for Construction of Renewable Resources Recycling System (2015-2020)	Established a funding system for the recycling and treatment of electronic waste, but lacked requirements for other types of waste
2016	Guiding Opinions on Accelerating the Transformation and Development of China's Packaging Industry	Proposed creation of a packaging waste recycling system by 2020
2017	Initiative to Guide the Shift toward Circular Development	Set targets that by 2020, the rate of plastic recycling to increase by 15% compared with 2015, and recycling rate of other wastes by 54.6%
2017	Municipal Waste Collection and Sorting Pilots	46 cities mandated to carry out household waste collection and classification pilots to promote more recycling
2017	Implementation Plan for Prohibiting Entry of Foreign Garbage and Advancing Reform of the Solid Waste Import Administration System	Required stricter regulation of foreign garbage imports, paving the way for the 2018 National Sword Policy, a game changer for global plastic recycling
2018	National Sword Policy	In January 2018 China banned the import of most plastics that previously had gone to the nation's recycling processors
2019	Ratified the Basel Convention Amendment to include waste plastics in regulation of cross-border waste trade	China ratified this amendment in 2001 and brought into force in 2019
2019	Zero-Waste City Pilots (Led by Ministry of Ecology and Environment)	Standards for cities to adopt measures to drastically reduce waste production and promote reuse
2020	Opinions on Further Strengthening Control of Plastic Pollution	By the end of 2020, 31 provinces and cities released their 2020-2025 targets for plastic bans, restriction and alternative targets
2020	Amendment of China's Solid Waste Law	Added household waste sorting system into the regulation system

Sources used in text: Statistics Department of China Packaging Federation; Jin Yaning et al., 2008; UNEP; World Economic Forum; Ministry of Ecology and Environment; World Wide Fund; De Marchi et al., 2020; Yu Yang Yao & Lin Lusuo, 2019; Citizens' Ecological Environment Behavior



The Invisible Plastic Problem: Agricultural Plastic in the China and the United States

Image courtesy of mayk.75 / Shutterstock.com

By Karen Mancl

“
Every year, U.S.
farmers generate
almost a half million
tons of plastic waste
[such as] plastic
irrigation tubing,
feed bags, and
greenhouse plastic.
”

The plastic clam shells of yummy berries in the grocery store can cause us to pause, as they are one of the plastic food containers that are not being recycled. The process to make clam shells is different from the one for plastic bottles, resulting in a more challenging recycling process. Another greater, yet nearly invisible, amount of plastic waste is being generated to bring foods to market. This expanding plastic waste problem in agricultural production and food distribution has evaded public and policy attention in both the United States and China. It is a common challenge that both could work on together.

Plastic offers many advantages for food production. Plastic mulch reduces pesticide use, conserves water, and warms the soil to extend the growing season, leading to an average 30 percent yield increase. Plastic covered greenhouses provide fresh produce in the winter months and plastic drip irrigation tubing supports food production in dry areas. Plastic is clean and lightweight and thus protects fragile and perishable food items during storage and shipment to maintain quality and reduce food waste. Unfortunately, without careful collection and recycling, agricultural plastic is washed into the ocean and contaminates the soil.

U.S. farmers depend on plastic

Every year, U.S. farmers generate almost a half million tons of plastic waste. Plastic irrigation tubing, feed bags, and greenhouse plastic all contribute to the waste stream. U.S. farmers use 57 thousand tons of plastic mulch and 191 thousand tons of plastic containers.¹

About one-third of the total U.S. agricultural plastic is used in Florida to grow the fresh fruits and vegetables we enjoy in the winter. Plastic is also used extensively in agri-

cultural fields in California. A recent study conducted by the Monterey Bay National Marine Sanctuary found that each year over 9,000 tons of plastic are used to grow everything from artichokes to strawberries in Monterey County alone.²

Chinese farmers are the biggest plastic users

China is the world's largest user of plastic film mulch, a practice that started in the 1980s. Every year in China, farmers need to dispose of an estimated 1.4 million tons of plastic mulch and another 1 million tons of greenhouse plastic. In addition, tons of plastic irrigation tubing, plastic pots and pesticide containers, Styrofoam aquaculture floats and plastic covers for livestock feed storage all require collection and disposal. In 2012, about 13 percent of China's cropland was mulched.³ Currently, plastic is covering 200,000 square kilometers on Chinese agricultural fields, like covering every inch of Nebraska with plastic mulch.

The plastic mulch used in China for more than 30 years is as thin as plastic wrap, only 4 to 8 microns,⁴ whereas a zip lock bag is 38 microns. The thin plastic easily tears, so it is only used for one growing season and is almost impossible to pick up. Flakes of plastic end up in soil, waterways and even in animal feed that are ingested by livestock.

Impact of plastic in the soil is unclear

All the plastic left in the soil is starting to affect crop yield by changing the soil environment. At first, the leftover pieces of

plastic in the soil in Chinese fields were a nuisance, clogging farm equipment, blowing in the wind, getting caught on fencing and washing into ditches. More than 30 years of plastic building up in the soil has started to interfere with roots and water movement, canceling out the benefits of the plastic mulch.

The impact of all this plastic left in the soil is poorly understood and is not yet a policy priority.⁵ Researchers have just started to look at how plastic residues change the structure of the soil, which is critical for the movement of water and air to support plant growth. Questions also remain on how plastic impacts soil chemistry, the cycling of nutrients and possible toxic effects. Moreover, given that plastic has negatively impacted marine organisms, plastic could also affect soil organisms. Scientists in both China and the United States are just starting to look at the impacts on soil organisms, especially earthworms that are so important for healthy soil.

Recycling is difficult

Very little agricultural plastic in the United States and China is recycled. Half of the plastic's weight can be dirt that damages recycling equipment. Thus, much of the collected plastic is either burned in the field or taken to a landfill. Research shows when farmers collect plastic mulch, about 10 percent stays in the soil because the plastic breaks and tears during recovery.

According to Dr. Changrong Yan, Chinese Academy of Agricultural Sciences, about 80 percent of plastic mulch used in Chinese fields is removed, sent to landfills

“Plastic is covering 200,000 square kilometers on Chinese agricultural fields, like covering every inch of Nebraska with plastic mulch.”

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or burned. To reduce the volume of plastic, the one film for 2 years (PM2) program was tested in the dry areas of western China.⁶ This novel “in the field” program to reuse plastic mulch at least once showed no significant loss of crop yield while saving time, energy and money. Based on this program’s success, systems to use film for multiple years may be feasible but will require more research on the agricultural and ecological impacts.

Research is underway to evaluate biodegradable agricultural products.⁷ The Ohio State University, for example, is developing plant-based plastics that degrade in 45 days. Chinese scientists are also developing and testing biodegradable plastics. Although it seems promising, right now they are still too expensive for widespread use.

Emerging plastic policy

Scientists have been researching the threat of plastic waste, but this ‘White Pollution’ in food production has received little attention from policymakers, business innovators, or the public in any country. The United States is not regulating agricultural plastic at the national level, although some state and

local governments restrict on-farm plastic burning to control air pollution.⁸

China is leading the efforts to regulate agricultural plastic. In December 2019, the Chinese Ministry of Ecology and Environment and the National Development and Reform Commission (NDRC) proposed new regulations to reduce the agricultural plastic problem, which requires the use of higher quality, thicker mulch that can be reused, collected and recycled. This new plastic order ban forbids the production and sale of the traditional thin mulch film of less than 10 microns. The ban goes on to promote the use of biodegradable mulch and enhance recycling. NDRC is also supporting pilot demonstrations on the recycling and treatment of agricultural plastic waste.

The next big task is cleaning up the agricultural plastic residue already in the soil. We need research and development of equipment and systems to gather the plastic left in the ground for the past decades. In addition, the climate footprint of the plastic in food production and distribution is yet to be explored in research or policy agenda. This is a great opportunity for Chinese and U.S. researchers to join forces and tackle the global problem of invisible plastic.



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Biodegradable Plastics—A Potential Solution for Agricultural Mulch?

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**By Markus Flury,
Douglas Hayes, and Karen Mancil**

Plastic can transport toxic chemicals through soil to groundwater, into waterways, and into the atmosphere, exposing other plants and animals.

”

A new kind of plastic emerges to solve a problem. Great news for the planet, right?

But we have been here before. Think of how the innovative plastic microbeads used in cosmetics and health care products were touted as a big advance to improve these products' effectiveness. Sadly, the environmental consequences were not thoroughly investigated until these beads found their way to the ocean and caused harm to the environment. That discovery sparked the U.S. government to pass the Microbead-Free Waters Act of 2015 and ban their usage. China passed a similar ban in 2020.

Plastic mulch is another material of concern, despite its clear utility. Agriculture—especially in China—has grown tremendously and benefited from this innovative material. Plastic mulches enhance sustainable agriculture in a number of ways: warming the soil and reducing weeds, conserving water, fertilizer, and other inputs, reducing soil erosion, and preventing soil splashing on fruits or vegetables. These benefits translate into reduced pesticide use, early planting in spring, water conservation, and increased crop yield and quality. Plastic mulch films are widely used to grow vegetables and other specialty crops and have an annual global market worth \$4.1 billion.

Yet used plastic mulch is difficult, laborious, and expensive to retrieve and recycle, primarily because it is heavily soiled and weakened through environmental weathering. As a result, plastic mulch films, which are typically made of polyethylene, are often piled

up as waste on farms or illegally burned. Sometimes the plastic is just left in the field resulting in contamination of the soil with residual plastic fragments.

The lack of disposal options and the danger of soil contamination that result from use of polyethylene mulch sheeting has encouraged the development of biodegradable mulch film as a promising alternative. Yet not all biodegradable plastics are created equal. More science—and more work with farmers and policymakers—is needed to determine the safest path forward on the use of biodegradable mulches.

Promise and potential harm

Biodegradable plastic mulch films have been designed to be tilled into the ground after harvest or use, eliminating costly removal and disposal. Biodegradable plastics will also decompose when composted. The latter process also can produce biogas that can be captured and used to produce fuel for cooking and lighting on farms.

To be a competitive alternative to polyethylene mulch, biodegradable plastic mulch must (a) maintain a conducive microclimate for plant growth, (b) be flexible and strong enough to allow mechanical installation, (c) undergo complete biodegradation after soil incorporation or composting, and (d) have no adverse short- or long-term impact on the environment. Most of all, farmers will only adopt biodegradable mulch if it makes economic sense.

When biodegradable plastic mulch was introduced in the 1980s, its low actual biodegradation in soils hindered its wide

spread acceptance by farmers. Of particular concern are so-called “oxodegradables.” While this sort of mulch is composed of conventional polyethylene and components that promote partial degradation of polyethylene when exposed to sunlight, these “oxodegradables” actually disintegrate into tiny microplastics that do not fully degrade. To address the misleading nature of these products, several corporations and nongovernment organizations have signed a petition to ban “oxodegradables” from the marketplace.

Fortunately, new formulations for biodegradable plastics look more promising. The current international standards for biodegradable plastics (EN 17033, ISO 17088, and ASTM D6400) specify that at least 90 percent of the plastic’s carbon be converted to CO₂ by soil microorganisms in two years under controlled laboratory conditions.

Yet biodegradable plastic mulches may still pose some environmental harms. During degradation, any non-biodegradable additives, like pigments and plasticizers, may be released into the soil. Smaller than the size of a pencil eraser, microplastics form as bioplastics degrade. Before they are fully degraded, such microplastics can be consumed by soil organisms or be blown or washed away. Also, biodegradation is often much slower in the aquatic environment than in the soil. Microplastics can carry adsorbed pesticides or microbes, spreading contamination in water and soil ecosystems.

Research findings so far are inconclusive, but point to no harmful effects of biodegradable mulches. Some studies indicate no negative impacts of biodegradable mulches on soil health after two or four

“ Biodegradable plastic mulches are a promising alternative to the current polyethylene-based mulches, but rigorous testing is needed to ensure their use is environmentally safe. ”

years of continuous use. Other studies have reported impacts on the microbial community structure, but whether these impacts are harmful remains to be shown.

Fitting into the food production landscape

Arriving at a solution to the global plastic problem requires a multifaceted strategy including prevention, reuse, recycling, recovery, and disposal. Within this strategy, biodegradable plastics are an important and essential component. The most practical applications of biodegradable plastics are in food packaging, single-use plastics (like bags, plates, and utensils), and agricultural mulch films. These plastics are often contaminated with food residues or soil at the end of their service life, limiting reuse and recycling.

Proper labeling of biodegradable plastics is needed to ensure they are diverted from landfills and properly composted, digested, or incorporated into the soil. Ecolabels, such as 'OK Biodegradable SOIL' (TÜV Austria Belgium), assure farmers and other stakeholders of the long-term safety of biodegradable mulch films in soil through certification. The reach of ecolabels

for biodegradable mulches should be expanded beyond Europe—particularly in China, which is the world's largest user of agricultural mulch.

Another key element in the integration of biodegradable plastic mulches into food production is that they must be thoroughly investigated to ensure safe and sustainable use in agricultural systems. If biodegradable plastic mulches are to be tilled into the soil after use, their complete breakdown within a reasonable period of time needs to be ensured and verified as effective in the wide variety of soils and environments where they may be applied.

Biodegradable plastic mulches are a promising alternative to the currently used polyethylene-based mulches, but rigorous testing of these materials throughout all life stages is needed to ensure their use and disposal are environmentally safe. Long-term studies are needed to ensure that repeated use of biodegradable plastic mulch does not cause harm to the agroecosystem. In-field testing of biodegradation under different soil and climatic conditions for a variety of cropping systems, with particular attention to release of microplastics and additives, will show their degradation in



soils and their effects on soil quality. Our own research has already focused on field studies in Tennessee, Texas, Washington, and several locations in China.

Global use of plastic mulch is high and increasing—and the market for biodegradable plastic mulches is growing as well. Yet the incomplete breakdown of biodegradable plastic could lead to an accumulation of plastic fragments and particulates in soils. As we learn more about the effects of biodegradable plastics in soil, it already has been shown that plastic microparticles from conventional plastics can be toxic to organisms in both aquatic and terrestrial ecosystems. Microplastics from biodegradable plastics will degrade over time when properly handled and disposed. Thus microplastics from biodegradable plastics should be less hazardous than those from conventional plastics.

Pesticides pose another challenge. Agricultural systems are heavy users of pesticides that can absorb onto residual plastics from mulches. Plastic can transport toxic chemicals through soil to groundwater, into waterways, and into the atmosphere, exposing other plants and animals.

The aim of future studies of biodegradable mulches should be to provide farmers better methods, best practices, and predictive capabilities on their storage, use and disposal. While we currently have some unanswered concerns about the environmental fate and impact of biodegradable plastics, they are a promising alternative to conventional plastics in agriculture. Doing the proper research can ensure success in long-term environmental health and agricultural productivity.



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Final (Often Polluting) Resting Place for U.S. and Chinese Plastics*

CHINA

China is accelerating recycling and planning to incinerate 50% of its waste.

32%
LANDFILLED



31%
INCINERATED



30%
RECYCLED



UNITED STATES

75%
LANDFILLED



15.3%
INCINERATED



5%
RECYCLED



The U.S. plastic recycling rate is sinking and in many states incineration is rising.

* Landfill and incineration percentages 2018, recycling data 2021

Data Compiled by Solange Reppas and Angela Pan

Data Sources: The Guardian, U.S. EPA, Science Advances, Reuters, Beyond Plastics, Smithsonian Magazine.

The Recycling Rant

—By Angela Pan

Sadly, recycling is not looking so good in recent years. Instead of improving, we seem to be backsliding. Since the United States had to stop exporting its plastic waste to China in 2017, the U.S. recycling rate for plastic has dropped from 8-9% in 2017 to less than 5% in 2021. Plastic recovery rate is doing even worse. From 2019 to 2020, the United States saw a decrease of 5.7% of how much plastic is recovered for recycling.

As the world's plastic superpowers, it is not surprising that the plastic recycling rate between the United States and China is interconnected. The U.S. recycling rate has long been calculated as the sum of its plastic waste exports plus domestically recycled materials. Before 2018, China was the largest importer of U.S. plastic waste, but China's (then) low recycling

rates and high waste mismanagement meant an overblown recycling rate calculation for U.S. plastic waste. On the production side, the United States remains the largest market for Chinese produced plastics. It just goes to show that we are facing a plastic crisis that is flowing between the two giants.

Recycling in China also faces challenges. Not surprisingly, all Chinese cities and regions report they are recycling 30 percent of their waste, which exactly matches the targets in China's 14th Five-Year Plan. Data on plastic waste collection and recycling has many gaps in China. Moreover, Chinese statistics do not always distinguish between different types of plastic, so it is hard for the government and companies to know the true recycling rates of single-use plastics.



CLOSED-LOOP INNOVATORS

Judith Enck

**Championing
Ecological Health
and Environmental
Justice in Plastic Action**



Photo courtesy of Judith Enck

Judith Enck discovered her interest in environmental activism when she interned in college for the New York Public Interest Research Group (NYPIRG) and was asked to lobby for the Returnable Container Act (also known as the Bottle Bill), which had stalled for 10 years. The difficulty she faced in lobbying for this relatively simple bill motivated her to return for a second internship. After graduation, she abandoned plans for social work or law school to return to environmental advocacy, and quickly became the executive director of Environmental Advocates NY. The bill eventually became a New York State law in 1982 and has since prevented the unnecessary export or landfilling of billions of plastic bottles. Judith learned important lessons from that victory and has been making her mark on America's waste policies ever since.

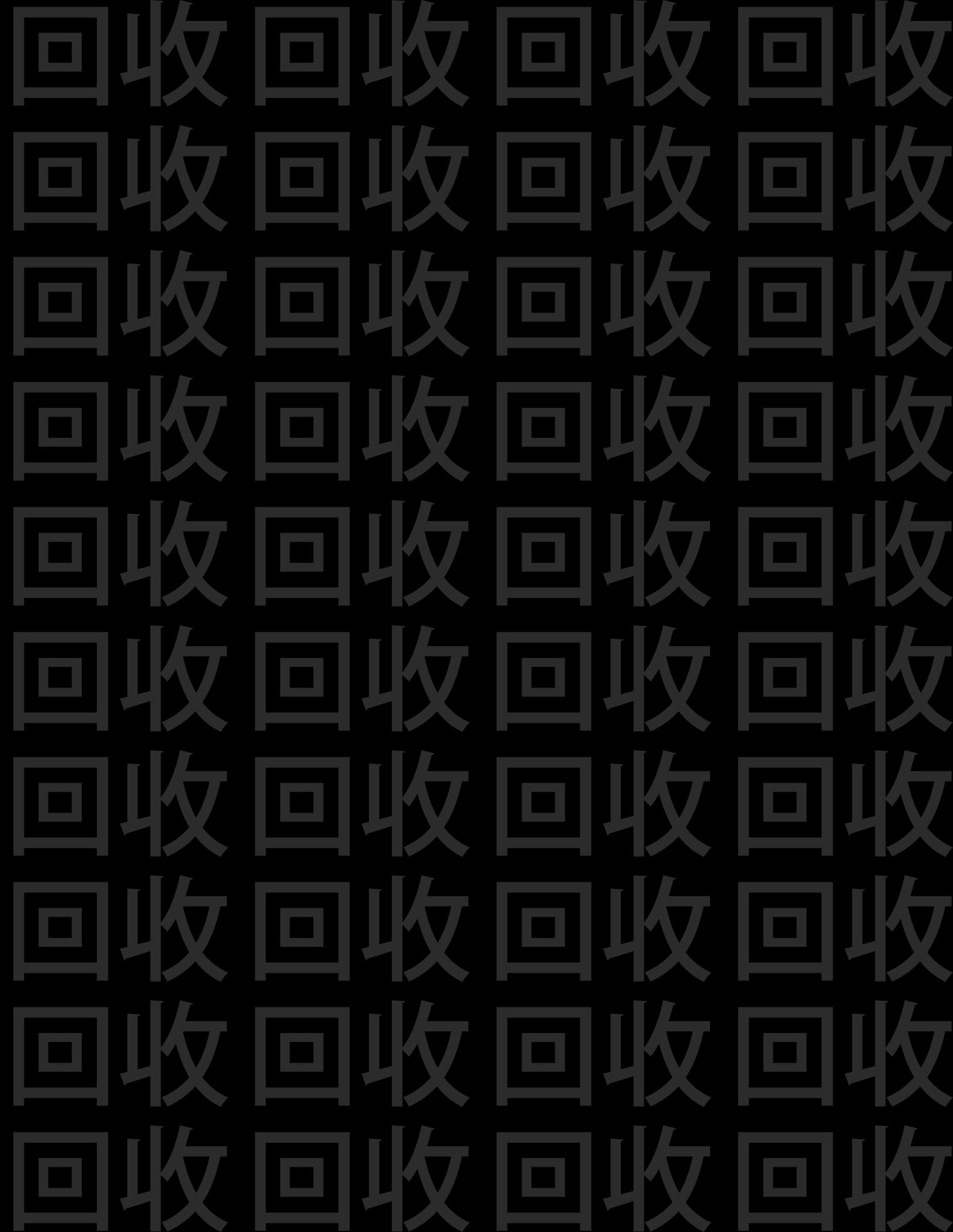
With whirlwind development in packaging technology over the last few decades, the world has come to expect the convenience and versatility that plastic can further bring. Yet, the production of plastic and its disposal are both contributing to health and environmental effects that disproportionately affect those least equipped to handle them. Judith was galvanized to work on these issues because she saw how the global community had turned a blind eye to the consequences of our reliance on plastic and how "polluted landfills and incinerators are almost always sited in low-income communities and communities of color."

A self-described "solid waste gal," Judith views waste issues from an equity perspective. From her first bottle bill and her campaign for banning medical waste incinerators, to her appointment as U.S. EPA Regional Administrator in the Obama Administration and Congressional testimony in support of the Break Free From Plastic Act of 2020, waste activism is the thread that runs through her career.

After her tenure with the Obama Administration ended in 2009, Judith decided to use her decades of public policy expertise to support grassroots advocacy and bring more people into the plastics movement. She is currently a professor at Bennington College in Vermont and founder and president of the organization, Beyond Plastics.

Beyond Plastics has been producing reports on the climate and plastic linkage and toolkits to help guide dry cleaners, restaurants and other industries onto a path to reduce plastic. Judith sees plastics as a systems-scale crisis that demands holistic solutions that connect the fields of climate change, public health, and environmental justice.

"I'm optimistic because there are some 450 local plastic waste laws in the books. But there are 12,000 U.S. local governments, so we still have a long, long way to go."





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