Recycling in the US is broken. How do we fix it?

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Credit: USEPA

Recycling in the U.S. is broken. In 1960, Americans generated 2.68 pounds of garbage per day; by 2017, it had grown to an average of 4.51 pounds. And while many Americans dutifully put items into their

recycling bins, much of it does not actually end up being recycled. This post will explain why, and talk about potential solutions.

Why recycling isn't working in the U.S.

Many recyclables become contaminated when items are placed in the wrong bin, or when a dirty food container gets into the recycling bin. Contamination can prevent large batches of material from being recycled. Other materials can't be processed in certain facilities.

Moreover, many items that are collected, such as plastic straws and bags, eating utensils, yogurt and takeout containers often cannot be recycled. They usually end up being incinerated, deposited in landfills or washed into the ocean. While incineration is sometimes used to produce energy, waste-to-energy plants have been associated with toxic emissions in the past.

Landfills emit carbon dioxide, methane, volatile organic compounds and other hazardous pollutants into the air. And our oceans are drowning in plastic waste.

China's ban

For decades, China handled the recycling of almost half of the world's discarded materials, because its manufacturing sector was booming and needed these materials to feed it. In 2016, the U.S. exported 16 million tons of plastic, paper and metals to China. In actuality, 30 percent of these mixed recyclables were ultimately contaminated by non-recyclable material, were never recycled, and ended up polluting China's countryside and oceans. An estimated 1.3 to 1.5 million metric tons of plastic found its way into the ocean off China's coast each year.

In 2018, China's National Sword policy banned the import of most plastics and other materials that were not up to new, more stringent purity standards. The U.S. then sent its plastic waste to other countries, shipping 68,000 containers to Vietnam, Malaysia, and Thailand in 2018. When these countries later instituted bans on imported plastic waste, the U.S. diverted its waste to Cambodia, Bangladesh, Ghana, Laos, Ethiopia, Kenya and Senegal—countries with cheap labor and lax environmental rules. The U.S. still ships over 1 million metric tons a year of plastic waste abroad, often to countries already overwhelmed by it. Experts estimate that 20 to 70 percent of plastic intended for recycling overseas is unusable and is ultimately discarded. One study found that the plastic waste exported to Southeast Asia resulted in contaminated water, crop death, respiratory illnesses due to toxic fumes from incineration, and organized crime.

When the market disappeared

Without the Chinese market for plastic—as well as for some types of cardboard, paper, and glass—the U.S. recycling industry was upended.

"The economics are challenging," said Nilda Mesa, director of the Urban Sustainability and Equity Planning Program at the Earth Institute's Center for Sustainable Urban Development. "If there is not a market for the recycled material, then the numbers do not work for these facilities as well as cities, as they need to sell the materials to recoup their costs of collection and transportation, and even then it's typically only a portion of the costs."

As a result, U.S. processing facilities and municipalities have either had to pay more to recycle or simply discard the waste. In 2017, Stamford, CT made $95,000 by selling recyclables; in 2018, it had to pay $700,000 to have them removed. Bakersfield, CA used to earn $65 a ton from its recyclables; after 2018, it had to pay $25 a ton to get rid of them.

Franklin, NH had been able to sell its recyclables for $6 a ton; now the transfer station charges $125 a ton to recycle the material or $68 a ton to incinerate it.

Municipalities that couldn't afford to pay more have cut back on their recycling programs. Over 70 ended curbside recycling (though several have been reinstituted after public protests), and many drop-off sites closed; some programs increased costs to residents while others limited what materials they would accept.

The state of U.S. recycling today

Because U.S. recycling was dependent on China for so many years, our domestic recycling infrastructure was never developed, so there was no economical or efficient way to handle recycling when the market disappeared.

"The way the system is configured right now, recycling is a service that competes—and unsurprisingly often loses—for local funding that is also needed for schools, policing, et cetera," said Stephanie Kersten-Johnston, an adjunct professor in Columbia University's Sustainability Management Master's Program and director of circular ventures at The Recycling Partnership. "Without dedicated investment, recycling infrastructure won't be sufficient. In addition, we need to resolve the simple math equation that currently exists—when it's cheap to landfill, recycling will not be 'worthwhile' so we need to start to recognize what landfill really is: a waste of waste!"

Making the situation more complicated—the U.S. does not have a federal recycling program. "Recycling decision-making is currently in the hands of 20,000 communities in the U.S., all of which make their own choices about whether and what to recycle," said Kersten-Johnston. "Many stakeholders with many different interests converge around this

topic and we need to find common ground and goals to avoid working against one another. That means companies coming together with communities, recyclers, haulers, manufacturers and consumers to try to make progress together."

What actually gets recycled?

According to the EPA, of the 267.8 million tons of municipal solid waste generated by Americans in 2017, only 94.2 million tons were recycled or composted.

Sixty-six percent of discarded paper and cardboard was recycled, 27 percent of glass, and 8 percent of plastics were recycled. Glass and metal can be recycled indefinitely; paper can be recycled five to seven times before it's too degraded to be made into "new" paper; plastic can only be recycled once or twice—and usually not into a food container—since the polymers break down in the recycling process.

Single-stream recycling, where all recyclables are placed into the same bin, has made recycling easier for consumers, but results in about one-quarter of the material being contaminated.

Plastic recycling presents the biggest challenge because the plastic is often contaminated by other materials and consumer goods companies are reluctant to buy recycled plastic unless it is as pure as virgin plastic.

Although companies that make and sell plastic push the idea that recycling is the answer to the plastic pollution problem, six times more plastic waste is incinerated than is recycled. The CEO of Recology, a company that collects and processes municipal solid waste, wrote in a 2018 op-ed, "The simple fact is, there is just too much plastic—and too many different types of plastics being produced; and there exist few, if any, viable end markets for the material." Moreover, because of the glut

of natural gas and the resulting boom in U.S. petrochemical production, virgin plastic is now cheaper than recycled plastic.

A recent Greenpeace report found that some PET (#1) and HDPE (#2) plastic bottles are the only types of plastic that are truly recyclable in the U.S. today; and yet only 29 percent of PET bottles are collected for recycling, and of this, only 21 percent of the bottles are actually made into recycled materials due to contamination. China used to accept plastics #3 through #7, which were mostly burned for fuel. Today #3 – #7 plastics may be collected in the U.S., but they are not actually recycled; they usually end up incinerated, buried in landfills or exported. In fact Greenpeace is asking companies such as Nestle, Walmart, Proctor & Gamble and Unilever that label their products made with #3 -#7 plastics as "recyclable" to stop or it will file a complaint with the Federal Trade Commission for mislabeling.

Textiles are another large source of waste. Only 15.2 percent of textiles were recycled in the U.S. in 2017. And while the fashion industry is trying to refashion old clothing and vintage items are now chic, this movement is not big enough to solve the problem.

Food waste is by tonnage the most significant source of waste, according to Mesa. "Some cities and countries in northern Europe have had success with using organic waste as a source of energy. And while waste to energy facilities exist in the U.S., there is a history of some of these facilities in the past being sited near vulnerable populations," she said. "While the technology (including air pollution measures) has advanced, it still raises questions. As technology advances and as the search for green energy ramps up in U.S. cities, however, this may become a more appealing option for cities and regions in the future."

What are the solutions?

The global market for high quality recycled materials is actually growing. Global demand for paper and cardboard is expected to grow by 1.2 percent a year, mainly due to the growth in e-commerce and the need for packaging; recycled paper will be essential to meeting this demand.

And the global plastic recycling market is projected to grow by $14.74 billion between now and 2024. As a result, companies are trying to enhance the quality of recycled plastic as well as incorporate it into the plastic products they produce. Plastic waste, especially PET and HDPE, is being recycled into packaging, building and constructions, electronics, automotive, furniture, textiles and more.

The key to fixing recycling in the U.S. is developing the domestic market. This means improving the technology for sorting and recovering materials, incorporating more recycled material into products, getting these products into the marketplace and creating demand for them.

"What has worked," said Mesa, "is where institutions and cities require a percentage of recycled content for their purchasing, for example, requiring 100 percent recycled paper, or recycled materials in building materials…A growth in demand for recycled content, or reused content can be driven by changes in regulations and purchasing commitments, and their enforcement." Another effective measure, she added, is for institutions or governments to limit the disposal of construction and demolition debris, to encourage recycling instead. "These both set up a stable system that then allows for the growth of markets for reused and recycled materials, as well as the facilities that can process them," said Mesa.

If recycling processors have a market where they can sell their material, they will be motivated to invest in better equipment that can sort materials to minimize contamination, and it will make economic sense to expand recycling programs.

Recycling in Harbin, China. Credit: GabrieleBattaglia

Best practices

Here are some places where recycling is working relatively well.

San Francisco, which has set a zero waste goal for 2020, keeps 80 percent of its waste out of landfills. The city requires residents and companies to separate their waste into three streams, employing blue bins for recyclables, green for compostables (the city diverts 80 percent of its food waste) and black for material intended for the landfill. Food vendors have to use compostable or recyclable containers, and every event in San Francisco must offer recycling and composting. Starting July 1, stores will charge 25 cents for checkout bags, including bags for takeout and delivery.

Los Angeles recycles almost 80 percent of its waste, with a goal to recycle 90 percent by 2025. Restaurants are required to compost their food waste, and companies get a break on their taxes based on how much they recycle. In addition, an initiative called "Rethink LA" helps

residents understand the importance of recycling and composting.

In Austin, TX, which is aiming to divert 75 percent of its waste by this year, all properties must provide recycling and composting to their tenants and employees. Large construction projects must reuse or recycle at least half of their debris.

Germany recycles 56 percent of its trash by providing different colored bins for different colored glass and other items. The country uses the Green Dot recycling system: When a green dot is placed on packaging material, it indicates that the manufacturer contributes to the cost of collection and recycling. These manufacturers pay a license fee to a waste collection company that is calculated on weight in order to get their packaging picked up, sorted and recycled.

South Korea recycles about 54 percent of its trash, including 95 percent of its food waste. The country dramatically cut food waste by providing bins for organic waste that are weighed—the more they weigh, the more residents are charged. Recyclables are picked up for free, but there is a charge for disposal of other trash, determined by its weight.

Other countries with good recycling rates are Wales, Switzerland, Austria, Japan and Taiwan. Japan requires residents to wash items, remove labels, and fold cartons, and waste must be labeled so that individuals are held accountable. Residents of the tiny village of Kamikatsu sort their trash into 34 categories, with the goal to achieve zero waste this year.

Taiwan recycles 55 percent of its residential and commercial trash, and 77 percent of its industrial waste. Yellow trucks go through neighborhoods playing music to let residents know it's time to dump their trash; white trucks follow behind carrying 13 different bins into which residents sort their recyclables. Recyclables are then sent to

companies like Miniwiz that transform them into building materials. In addition, smart recycling booths accept bottles and cans in exchange for added value to transit cards.

Strategies that work

Education

Minimizing contamination of recyclables and the flow of recyclable items to landfills requires consumer awareness. Community events, campaigns, and brochures are necessary to educate residents about the importance of reusing, recycling and composting, as well as how to properly recycle in their particular community. They need to understand which items are actually recyclable and which are not.

Incentives and penalties

These can be used to promote recycling and waste reduction. For example, residents and companies can be incentivized to reduce waste if they have to pay more for discarding more. Additional payments or a contract extension can encourage waste contractors to divert more waste.

Legislation

In 2020, more than 37 states are considering over 250 bills to deal with plastic pollution and recycling, according to the National Caucus of Environmental Legislators. These include bans on single-use plastic and food ware, single-use bag and polystyrene bans; bottle bills; holding producers responsible for product disposal; and other recycling laws.

Credit: Purecycle

Senator Tom Udall (D-New Mexico) and Congressman Alan Lowenthal (D-Long Beach) recently introduced the Break Free From Plastic Act into Congress. The bill includes bans on single-use plastic bags and polystyrene; requirements for companies that make packaging or food ware to be responsible for their waste collection; a national container deposit system that would charge a refundable deposit on all single-use beverage bottles; standardized labeling on recycling bins; and a suspension on permits for the building of new plastic-producing plants.

Eight states have bans on single-use plastic bags. Jennie Romer, founder of PlasticBagLaws.org, says that hybrid bans that ban thin plastic carryout bags and also impose a charge for paper or any other bags are the most effective. Chicago's hybrid ban cut plastic bag use in half; and in San Jose, the hybrid ban with a 10-cent charge for paper bags led to an increase in reusable bag use from 4 percent to 62 percent. On March

1, NYC instituted a plastic bag ban that charges 5 cents for taking a paper carry out bag.

Extended producer responsibility (EPR) requires companies that make products to be responsible—financially or physically—for their management and disposal at the end of their lives. Companies can do this through recycling or reusing products, buying them back, or they may hire a third party to deal with their waste management. EPR shifts the financial burden from local governments to manufacturers, which also motivates companies to design and produce more sustainable products. The EU has had an EPR program on packaging since 1994.

Container deposit laws or "bottle bills" which charge a refundable deposit on all single-use beverage bottles, whether plastic, metal or glass, "are the single most effective means of boosting recycling," according to the Sierra Club. Ten states already have bottle bills, and six more are considering them.

Innovation

Many companies are trying to come up with better ways of dealing with waste, from chemical recycling, which uses chemicals or high heat to turn plastic into its original components for reuse, to new ways to make recycling simpler.

Oregon-based Agilyx breaks down hard-to-recycle and contaminated plastics to their molecular level; it can then be made into high-grade synthetic oils, chemicals and other plastics. The company says all the recycled plastic can be reused an infinite number of times.

A Seattle recycling service called Ridwell collects hard-to-discard items such as plastic wrap and bags, light bulbs and electronics, which Seattle no longer collects. For a fee of $10 to $14 a month, customers get a bi-

weekly pickup of these items. Ridwell then distributes the items to other places for recycling, reuse or destruction. In 2019, the company diverted 170,000 pounds of waste from the landfill.

PureCycle Technologies has patented a process to remove the color, odor and contaminants from polypropylene plastic (used for bottle caps) and turn it into a "virgin-like resin."

Until now, only one percent of polypropylene has been recycled, even though it is the second most common plastic in the world. It has mostly been recycled into black or gray products, such as benches or car parts, but once purified, it has the potential for many more applications.

Loop creates reusable and returnable packaging for consumer products. Items in the Loop store are shipped to buyers in containers for which they pay a deposit; when the containers are returned to Loop in the reusable shipping box, buyers receive a full refund. Carrefour grocery stores are using Loop in France, and Kroger's and Walgreen's in the U.S. will soon sign on.

What you can do

"It will only ever make economic sense to recycle a small subset of materials, which means we will have to look beyond recycling alone to solve for our broader waste," said Kersten-Johnson. "We need to tap into new business models that allow us to reduce our consumption in the first place, and re-use materials where we can. This can include things like rental or service models. But while we work to scale these types of solutions, we can't take our eyes off recycling."

- Learn which recycling symbols correspond to which types of plastic so you know what is recyclable
- Understand what items and materials your community recycles

- Keep a recycling bin handy
- Rinse out bottles, cans and food containers before recycling
- Buy recycled products or items incorporating recycled material
- Buy and store products in jars, not plastic containers
- Buy the biggest size possible and apportion it out at home
- Shop farmers' markets and bulk food aisles
- Store produce in reusable produce bags
- Don't buy single-use items
- Urge your representatives to introduce waste-reducing legislation

Here are more tips from the Natural Resources Defense Council .

China's decision to stop accepting the world's contaminated materials may ultimately prove to be a boon to the U.S. recycling industry. In a CNBC report, Ron Gonen, CEO of Closed Loop Partners, said, "Long term, it's going to be a major benefit because it's going to force the industry to be much much more efficient, and produce a much higher quality product that will actually be able to be used in domestic manufacturing supply chains." According to the report, the U.S. has invested over $4.4 billion in new and retooled facilities that recover materials; these improvements include advanced technologies such as robotics and optical sorting to deal with the material from mixed streams. Gonen said, "It's forcing everybody to focus on efficiency, product design, and reuse of material."

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