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The
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Plastic Pollution



Editor

Allan E. Dittmer

Design/Layout

Nick Dawson
University of Louisville
Design & Printing Services

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Send electronic correspondence to
r.barnett@louisville.edu

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2

Single-use Plastics: A Roadmap for Sustainability
United Nations Environmental Program



23

Plastic Pollution – Preventing an Incurable Disease

Katie Allen



25

Microfibers, Macro Problems: A Resource Guide and Toolkit for Understanding and Tackling the Problem of Plastic Microfiber Pollution in Our Communities

Róisín Magee Altreuter



33

Microplastics in Compost: Environmental Hazards of Plastic-Coated Paper Products

Cyndra Dietz



36

Ditch the Throw-Away Culture and Solve Plastic Pollution

Miriam Gordon
Jamie Rhodes



40

Beyond Bans: Breaking Free From Plastic

Chris Kane



42

The Fate of Plastics at Wastewater Treatment Plants

Alex E. Novak



45

Recycling is Not Enough

GAIA/Zero Waste Europe



52

Plastic Pollution: How YOU can make a BIG difference

Kate Bailey
Kate Nelson

Issue 39 - Fall/Winter 2019

Plastic Pollution

Mounds of plastics at the Thilafushi waste dumping site. Thilafushi is an artificial island created as a municipal landfill situated to the west of Malé, and is located between Kaafu Atoll's Giraavaru and Gulhifalhu of the Maldives.



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Plastic Pollution – Preventing an Incurable Disease

by Katie Allen, Education Director
Algalita Marine Research and Education

By now, many people know that the ocean is filled with plastic debris. A recent study estimates that the amount of plastic waste that washes off land into the ocean each year is approximately 8 million metric tons. Jenna Jambeck, the study's lead author, helps us visualize the magnitude by comparing it to finding five grocery bags full of plastic on every foot of coastline in the 192 countries included in the study.

As someone who lives in a highly urbanized coastal city in California, this estimate didn't shock me. I grew up watching loads of plastic trash spew from river outlets into our ocean. Our beaches are covered with things like plastic bottles, bags, wrappers, and straws – all mostly single-use “disposable” items.

For years, I've watched polluted water flow beneath the bridge at the end of the San Gabriel River, a channel that drains a 713 square mile watershed in Southern California. This bridge is special...it's where my fascination with plastic waste began – **it's where our plastic trash becomes plastic marine debris.**

As Algalita's Education Director, it's my job to help people wrap their heads around the complexities of this issue. Many times, it's the simple questions that require the most in-depth responses. For example: “Why can't we clean up the trash in the ocean?”

I won't say extracting plastic debris from our ocean is impossible; however, I will say most plastic pollution researchers agree that its output is not worth its input. They believe our cleanup efforts are best focused on land and in our rivers. Here's why:

The ocean is imperious and is constantly changing.

The ocean is complex and is influenced by an endless list of processes. It's three-dimensional, interconnected, and unpredictable. It's massive, dynamic, and acts as one giant imperious force. The fact that the ocean is ever-changing makes it impossible to fully understand.

Our experience of the ocean is entirely defined by our interactions with it. Most researchers who have studied plastic marine debris will tell you that, logistically, working in the open ocean is arduous and unpredictable. Some days you are completely powerless against its will.

Waste management ends at the end of the river.

Humans lose the ability to manage plastic trash once it enters the ocean and becomes marine debris. Ocean cleanup is not a form of waste management. It is simply an attempt to extract plastic debris from our complex ocean.

There are different types of plastic marine debris.

Our ocean is filled with all sorts of plastic – from fully intact items like bottles and toothbrushes to plastic fragments, filaments, pellets, film, and resin. Recently, a team of researchers from six countries calculated that an astounding 5.25 trillion pieces of plastic weighing 269,000 tons can be found floating in the global ocean. Most of the 5.25 trillion pieces of plastic are small, between just 1mm and 4.75mm in size.



Each piece of debris is unique, with its own shape, size, and chemical composition. Its structure and buoyancy change as communities of organisms adhere to its surface. Some pieces have been completely transformed into artificial habitats that harbor dozens of species.



Some plastics, like fishing nets, line, and film have a tendency to snag and accumulate other pieces of debris. Imagine a kind of snowball effect as tangled debris rolls around in the ocean's currents. These composite mixtures come in all shapes and sizes, from massive ghost nets to tiny clusters of monofilament fibers invisible to the naked eye.

The heterogeneous nature of the debris poses critical challenges that, if not addressed properly, can have significant negative consequences and potentially jeopardize the health of the ocean.

As you can imagine, ocean cleanup is a controversial issue. Let me try to simplify things – think of ocean plastic pollution as a type of cancer. The **cure** for ocean plastic pollution is **eliminating disposable plastics all together**. I'll be the first to admit that this is never going to happen. So let's see what prevention and treatment look like.

Redesigning plastic products to be valuable and sustainable is our biggest leap toward **prevention**. When designed in cradle-to-cradle systems, plastic products have a much better chance of being recovered and recycled. Also, better product design may ease many of the challenges plastic recyclers face. **Waste reduction** also falls into the **prevention** category as it helps scale down the amount of waste to be managed.

Waste management can be viewed as **treatment** for the disease. This is how we keep things under control.

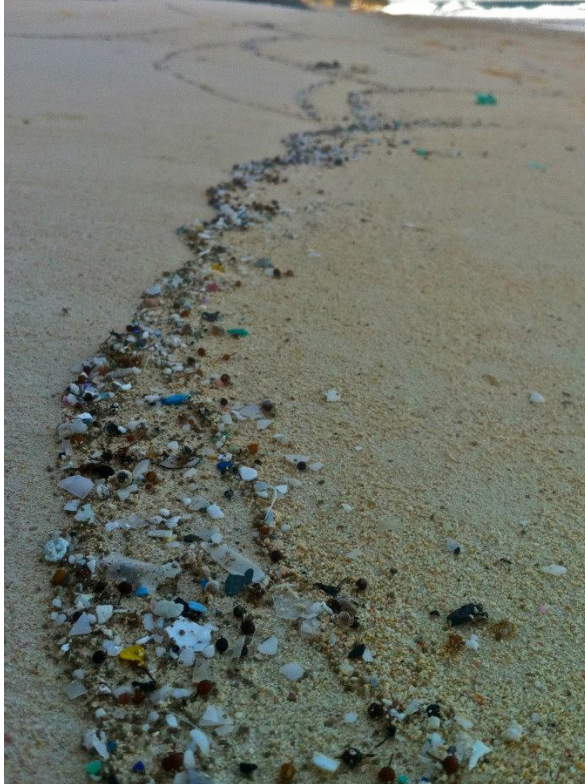
Ocean cleanup is comparable to **invasive surgery** – and that's why it's so controversial.

Most plastic pollution researchers agree that ocean cleanup is a radical approach to the issue. Many will even denounce it as impractical and overly idealistic. However, this engineering challenge should not be ignored completely...just as surgery for a cancer patient is sometimes our last-ditch effort.

Surgery is most successful when done by a specialist with a great deal of experience in the particular procedure. The problem is, ocean plastic pollution is a relatively new disease and therefore, there are no specialists in this type of "procedure"- there are no textbooks, courses, or degrees related to ocean cleanup. Experience starts now.

An understanding of the ocean and this "disease" is best gained through experience. If we are to attempt ocean cleanup, our best approach is to connect the proponents of clean-up schemes with people who understand the complexities of the disease – experienced plastic pollution researchers. And if these plastic pollution experts denounce certain methods of cleanup, we should pay close attention to what they're saying. Those who propose ocean clean up schemes should embrace the critiques of these individuals, as there is immeasurable value in their scrutiny.

For more information, please visit algalita.org.



Microfibers, Macro Problems: A Resource Guide and Toolkit for Understanding and Tackling the Problem of Plastic Microfiber Pollution in Our Communities

by **Róisín Magee Altreuter**
Science Educator at CuriOdyssey
5 Gyres Ambassador

Microfibers are a type of microplastic (defined as plastic pieces less than 5 mm in size), that are threadlike in shape and between 100 μ - 5 mm long (Miller et al., 2017; Moore, 2008). The majority of these tiny threads of plastic are fibers from synthetic fabrics such as fleece and polyester (Browne et al., 2011). These particles enter our environment, especially our waterways, via contaminated wastewater effluent from the laundering of these plastic-based fabrics (Browne et al., 2011).

Microfibers are found aloft in our air, lacing our land, floating in our oceans, and even tainting our food and drinking water (Browne et al., 2011; Kosuth et al., 2017; Le, 2017; Rillig, 2012; Rochman et al., 2015). Microfibers appear to be far more common and problematic than microbeads and recent studies from across the globe suggest that microfibers are in fact the most common type of plastic polluting our oceans today (Anderson et al., 2017; Bagaev et al., 2017; Nel & Froneman, 2015; Peng et al., 2017). The flow of microfibers into our oceans is not currently being managed or regulated, making these invisible and ubiquitous plastics a major environmental and human health concern that requires action in our communities now.

As community activists, we are united by the common mission of protecting our oceans, animals, and communities from plastic pollution. We each bring a unique set of skills, knowledge, and passion that we can share and leverage to achieve this goal. This guide and toolkit was created in collaboration with 5 Gyres and is intended to help empower us to address this issue within our communities through enhanced understanding of microfiber pollution, including the sources, impacts, and possible solutions. Our voices are stronger together and together we can make a positive impact.

The Problem

The basics causal chain.

When we wash plastic-based synthetic fabrics and clothing (like polyester, fleece, nylon, spandex, and more) in washing machines, these items shed tiny plastic fibers. Those tiny pieces of plastic are too small to be caught by conventional filtration systems used within washing machines or by municipal water treatment plants, instead flowing freely out into our environment in great numbers via wastewater effluent. As a result of the widespread use of synthetic fabrics and a lack of adequate filtration, our environment, waterways and food resources are becoming inundated with these invisible plastics.

How many fibers are entering the ocean?

- A single piece of synthetic clothing can shed more than **1900 fibers in one wash** (Browne et al., 2011).
- It is estimated that at least **90 million microplastic pieces** are discharged from wastewater treatment plants into the San Francisco Bay each day, with the majority of those particles being synthetic fibers, likely in large part from the laundering of synthetic fabrics (Sutton et al., 2016).
- A recent Norwegian study suggested that up to **1000 tons (2,204,623 pounds) of microfibers** go down the drain in Norway each year (Sundt et al., 2014).

What parts of the world are affected?

Microfibers from laundering synthetic textiles are the **#1 global source of primary microplastics**. 34.8% of primary microplastic released into the oceans are from the washing of plastic fabrics (Boucher & Friot, 2017). Globally, 60.1% of the clothes we consume are made out of plastic (68% in developing economies, 48.2% in developed economies) (Boucher & Friot, 2017). Emerging research from around the world examining the abundance of microfibers is beginning to be published more frequently. Here is a small sampling from across the globe:



- *Africa*: Microplastics were collected in all 21 sample sites along the southeastern coast of South Africa and 90% of those analyzed were microfibers (Nel & Froneman, 2015).
- *Antarctica*: Microfibers were found abundantly in a sampling study in Admiralty Bay, Antarctica in 2010 - 2011 (Theresinha et al., 2017).
- *Asia (China)*: In the Changjiang Estuary of Shanghai, China, 53 sediment samples were examined and 93% of the microplastics discovered were microfibers (Peng et al., 2017).
- *Asia (Middle East)*: 83% of microplastics found across 5 sites from the Strait of Hormuz (Persian Gulf) were microfibers (Naji et al., 2017).
- *Australia*: Wastewater treatment plants were found to emit approximately 1 microplastic piece per liter of water, with microfibers being the most common type (Browne et al., 2011).
- *Europe*: 63% of water samples collected from the Baltic Sea contained microfibers (Bagaev et al., 2017).
- *North America (Canada)*: Microplastics were found in all samples taken from Lake Winnipeg, Canada and the majority of those were microfibers (Anderson et al., 2017).
- *North America (US)*: An estimated 300 million microfibers flow from the Hudson River Watershed into the Atlantic Ocean each day (Miller et al., 2017).
- *South America*: 83% of fish caught by local fisherman in the Pajeú river crossing in Serra Talhada, Brazil contained plastics, with microfibers being the most commonly observed type (Silva-Cavalcanti et al., 2017).

The Impact

Marine animals are eating microfibers.

Like microplastics, microfibers are a similar size to plankton (Nel & Froneman, 2015). This small size poses a large problem because a wide variety and high number of marine species eat plankton via filter feeding. While targeting plankton, these species appear to frequently consume microplastics as well. In fact, the chemical properties of plastics may even cause some organisms like corals to target microplastics (Allen et al., 2017). Studies have shown that species such as zooplankton, coral, fish, crabs, mussels, whales, and many others ingest microplastics directly (Besseling et al., 2015; Desforges et al., 2015; Hall et al., 2015; Rummel et al., 2015; Watts et al., 2015; Van Cauwenberghe & Janssen, 2015).

We're eating them too.

Research has shown that because human populations rely on the ocean as a major food source, we are consuming microplastics as well. It is estimated that average shellfish consumption could lead an individual to ingest 11,000 microplastic pieces per year (Van Cauwenberghe & Janssen, 2015). In another study, 83% of fish caught by local fisherman in the Pajeú river crossing in Serra Talhada, Brazil contained plastics, with microfibers being the most commonly observed type (Silva-Cavalcanti et al., 2017). Dietary exposure to microplastics is not exclusive to meat, as another study found microplastic contamination present across 15 brands of table salt for sale in China (Yang et al., 2016). Even more shocking is recent research that found 83% of drinking water samples tested around the world to contain microplastics (Kosuth et al., 2017). This truly is a challenge faced by the entire global community.

Microplastics absorb, accumulate, and pass on environmental toxins.

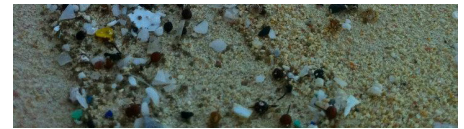
While the full effect of consuming microplastics on animal and human health are only beginning to be understood, microplastics have been shown to absorb, carry, and retain pollutants (Hankett et al., 2016; Hirai et al., 2011) and leach those compounds into the tissue of animals that consume them (Tanaka et al., 2013; Yamashita, 2011). Studies are beginning to emerge that highlight the negative impacts of microplastic ingestion on marine life. For example, microplastic consumption has been linked to liver toxicity in fish, decreased reproductive potential in oysters, and decreased survival and predator aversion ability in beachhoppers (Rochman et al., 2013; Sussarellu et al., 2016; Tosetto et al., 2016). Animals may be affected by the toxins carried by microplastics even without ingesting them, with one study finding that brown mussel larvae were sensitive to being in the mere presence of leachate from plastics (Gandara e Silva et al., 2016). These studies altogether suggest that plastics in the ocean accumulate toxins, pass those chemicals to the tissues of organisms that consume them, and can create a significant health risk to marine animals and potentially humans.

Plastic fashion is made from fossil fuels.

Synthetic fabrics, including polyester, nylon, rayon, fleece, spandex, and more, are made from plastic and plastics are made from oil, which is a fossil fuel. When we purchase these items we are supporting the plastic and fossil fuel industries, which contribute to climate change.

Microfibers are not just a problem for the ocean.

We live in a world of microfibers. Studies have not just found them in waterways and the ocean, but also in the air that we breathe, the dust in our homes, the water we drink, the fields that house our food production and more (Browne et al., 2011; Le, 2017; Kosuth et al., 2017; Rillig, 2012; Rochman et al., 2015). We face this common and widespread challenge together as a global community.



The Solutions

Multiple levels, many possibilities.

The issue of microfiber pollution can be tackled at multiple levels - the companies that produce plastic fabrics, the clothing companies that use and sell products made from synthetics, consumers themselves, washing machine companies, municipal wastewater treatment plants, and more. In some ways, this means that there are many opportunities to collaborate and approach this issue and make a difference. However, this lack of one obvious solution has also led to some confusion and disagreement about the best and most appropriate way to tackle microfiber pollution. In this section, many solutions are presented and negatives and positives of each one are discussed. It is important to keep in mind that since this is such a far reaching issue, a network of solutions that target multiple levels will be required. Consider this chart a list of many things that we should work to incorporate into a complete and collaborative strategy.

Various solutions overviewed. (Table 1, part 1 and part 2.)

Table 1, part1.

Target	Solution	Pros	Cons
Fabric & Clothing Companies	Produce & use fewer synthetic fabrics - switch to alternatives	<ul style="list-style-type: none"> • Holds companies and corporations responsible • Would significantly reduce pollution in the long run • Many alternative natural fibers exist 	<ul style="list-style-type: none"> • Difficult to accomplish since many companies rely on performance fabrics for athletic wear, waterproof clothing, swimsuits, and more. • Synthetic fabrics last a long time so even if we cut production now, people will be washing them for a decades.
Fabric & Clothing Companies	Coat fabrics in something that will cause them to shed fewer fibers or Improve synthetic fabrics to cause them to shed less through tighter weaving, etc.	<ul style="list-style-type: none"> • Holds companies and corporations responsible • Has the potential to significantly reduce pollution in the long run • Allows for the use of synthetic fabrics in waterproof and performance clothing (think raincoats, ski pants, etc.) 	<ul style="list-style-type: none"> • Much research and development needed • Many questions remain with coating, including - how long would the coating last? Is it safe? • Some pollution still occurs
Washing Machine Companies	Add pre-installed filters to all washing machines	<ul style="list-style-type: none"> • Holds companies and corporations responsible • Has the potential to significantly reduce pollution in the long run 	<ul style="list-style-type: none"> • Could affect the functionality of the machine • Would require research and development, which could cause companies to push back, resulting in slow progress • People already own washing machines and they last a long time, so this would be a slow transition.
Municipalities	Mandate any of the above policies (washing machine companies must install filter, etc.)	<ul style="list-style-type: none"> • Has the potential to significantly reduce pollution in the long run • Does not rely on individual action • Community based, big picture solution 	<ul style="list-style-type: none"> • Policy changes tend to take a lot of time to pass and enforce, especially due to lobbying from special interest groups • Could be difficult to enforce
Municipalities	Install finer filtration small enough to catch microfibers in all wastewater treatment plants	<ul style="list-style-type: none"> • Has the potential to significantly reduce pollution in the long run • Does not rely on individual action • Community based, big picture solution 	<ul style="list-style-type: none"> • Would be very expensive • Would take a lot of time for research, development, and installation • Unclear what would be done with the microfiber waste collected in filters.

Take Action

Humans are the Solution.

The good news with this relatively recently recognized source of plastic pollution is that thanks to sound science and dedicated advocacy, we know exactly what the problem is. This clear and identifiable causal chain means that we have the power to take steps to help. Humans may be the source of this problem, but that also means that we can be the solution. Each of us has the power and privilege to take action to fight against plastic microfiber pollution.

In the previous section, many solutions were reviewed. In this section, some of those solutions are expanded upon and digested into actionable suggestions for how each of us can start to make a difference today. This is by no means an exhaustive list. You know your community best - use your knowledge to design solutions that will work where you live.



Table 1, part2.

Individuals	Wash synthetics in a microfiber catching bag (Guppy Friend), with a microfiber catching ball (Cora Ball), or install a filter on your washing machine	<ul style="list-style-type: none"> Allows passionate individuals to start acting right now Reduces flow of microfiber pollution immediately Prevents clogging of sewage systems and septic tanks by catching particles like microfibers and pet hair 	<ul style="list-style-type: none"> Puts responsibility on the individual Requires purchase Requires individual to change their routine. Does not catch all microfibers (Cora Ball is reporting about 35% capture, Guppy Friend Bag is reporting 66% - close to 100%) Needs to be cleaned out and microfibers thrown in landfill. Can give a false sense of security that can lead people to continue purchasing and washing plastic fabrics (like recycling and plastic consumption)
Individuals	Wear and wash synthetic clothing less often	<ul style="list-style-type: none"> Allows passionate individuals to start acting now. Reduces flow of microfiber pollution immediately 	<ul style="list-style-type: none"> Pollution still occurs - it is difficult to get the word out about this issue and get people to take action. Plus, clothing still needs to be washed eventually.
Individuals	Choose to stop wearing and purchasing synthetic clothing	<ul style="list-style-type: none"> Allows passionate individuals to start acting right now. Reduces flow microfiber pollution immediately There are many great alternative natural fabrics 	<ul style="list-style-type: none"> Most people already own synthetic clothing and it is unfair to expect individuals to throw out clothing and pay to purchase a whole new set Some items with functionalities like waterproofness are difficult to replace with natural fibers
Individuals	Advocate and educate in your communities	<ul style="list-style-type: none"> Allows passionate individuals to start acting right now. Raises awareness about the issue and prepares people to take action and accept solutions Spreads knowledge to a wider audience Includes making political phone calls and writing letters, which is a great way to turn an individual action into a community level movement. 	<ul style="list-style-type: none"> Unfortunately, education and awareness does not always equal action, so pollution still occurs
<p style="text-align: center;">Your solution here!</p> <p>There are many ways to tackle this issue - this list is certainly not exhaustive. We will continue to innovate to solve this problem. What ideas do you have?</p>			

Sources consulted and cited: Cora Ball, Environmental Enhancements, Guppyfriend, Mermaids Life + Project, Patagonia, Plastic Pollution Coalition, Stiv Wilson (See "Webs consulted and cited, page 33)

Individual Level Actions.

The choices that we make each day impact the environment. However, as informed citizens, we can chose to make those impacts a good thing by choosing wisely.

You have the (purchasing) power.

The purchasing decisions that we make on a daily basis can help to address this problem. For example, it is best to avoid 'fast fashion' like that found at large inexpensive chains. Those items tend to be lower quality, causing them to have a shorter lifespan and to shed more in the wash (Update on Microfiber, 2017). A surefire way to address this problem is to shift our wardrobes to natural fibers and avoid plastic fashion all together. The great news is that there are many wonderful alternative to synthetic fabrics (A-Z Glossary, 2014). Here are just a few of the many available options to consider –

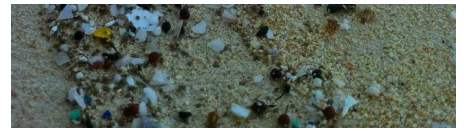
- Linen
- Hemp
- Bamboo
- Banana Fiber (abaca)
- Coconut Fiber (coir)
- Cotton

- Silk
- Wool
- Cork
- Corn Fiber (ingeo)
- Modal
- Pineapple Silk
- Jute
- Kapok

For when you do have to wash your synthetics.

Groups and companies like Patagonia and Mermaids Life+ Project have begun conducting research on the factors that affect how many microfibers a piece of clothing will shed in the wash. So far, the research suggests that individuals might try the following steps to reduce your microfiber footprint when washing synthetics: Wash with –

- A full load
- Liquid laundry detergent
- Cold water
- Low spin speed
- Shorter cycle time
- Fabric softener
- Front loading washing machine
- Always be sure to put dryer lint in the landfill



Community Level Actions

One of the best tools that we have to fight microfiber pollution is our own voice. Each of us has a say in our own community and political system and we can leverage that by asking companies, politicians, and others to do better. It is an unfortunate reality that because of the vast reach of this problem, individual small-scale actions will not be enough. In concert with these personal choices, we must come together to push for large-scale community changes.

The Power of the Pen and Phone: Letters and Calls

One way to express your opinions to any company, group, or person is via letter or phone call. Writing allows you the time to express your opinion in a thoughtful way, to include more information, and to share your ideas with multiple audiences. Phone calls are a great way to quickly make sure your voice is heard.

There is no need to be intimidated by this process - It is great to keep it short and to the point! Just be sure to keep a positive tone; people are more likely to be receptive to your thoughts and ideas if you focus on what the person or organization can do to help rather than what they are doing wrong.

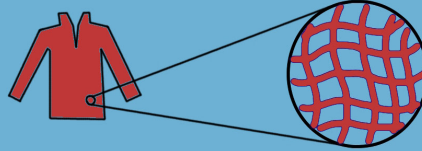
One great way to make this process more fun and impactful is to get more people involved. Consider hosting a letter writing or phone banking party - invite some friends over, have some snacks and spend some time making a difference! Groups are more likely to respond if they receive a larger volume of feedback about microfibers.

Who to Contact

- **Clothing Companies:** All people, animals, and ecosystems are shouldering the burden of microfiber pollution. Yet, the generation of this invisible danger lies largely with companies producing and using plastic fabrics. As consumers, we can demand that they take

Microfibers, Macro Problems

how plastic fashion is polluting our lives and how we have the power to make a change



Globally, 60% of the clothing we wear is made of tiny plastic fibers. This includes materials like polyester, nylon, spandex, fleece, and more.

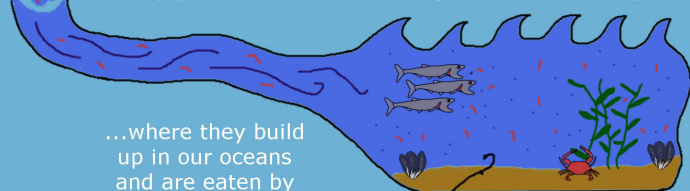
When we wash those clothes, they shed plastic fibers that exit with the wastewater...



...and are too tiny to be caught by wastewater treatment plant filtration systems.



The tiny plastic fibers flow directly into our waterways...



...where they build up in our oceans and are eaten by animals.



We rely on the ocean as a food source, which means that we are eating plastic fibers too.

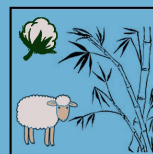
We rely on the ocean and the ocean relies on us.

We have the power to stop microfiber pollution

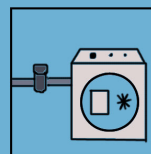
Microplastics are the most common type of plastic pollution in the ocean, and microfibers from washing plastic-based clothing is the #1 source of this problem.



Contact a clothing or washing machine company to let them know you want them to do better.



Wear more natural fibers like cotton, bamboo, and wool.



Wash your clothing using a Guppy Friend, Cora Ball, or washing machine filter.



Let your elected officials know about microfibers and ask them to push for solutions like regulation.



Humans are innovators! What ideas do you have to stop microfiber pollution?

#plasticfree fashion

#5GyresAmbassador

Roisin Magee Altreuter



responsibility for creating this problem. There are many options for who to contact - from outdoor brands that you know want to make a difference like Patagonia to huge fast fashion companies that, as large clothing companies, are some of the major contributors to the problem. Consider contacting a company that you have bought from before and let them know that you are a customer.

- **Washing Machine Companies:** Washing machine companies are in a unique position to help stem the flow of plastic pollution into our environment. If it became standard to integrate microfiber filtration systems into their products, similar to the lint trap on a dryer, this could significantly reduce microfiber pollution over time. Such units are not currently on the market but as consumers we have the ability to ask them to do better.
- **Political Figures:** There are many asks you might make to a local political figure. For example, you may ask for legislation to fund science research on this issue, to require clothing and fabric companies to reduce their dependence on synthetics, to mandate washing machine companies install microfiber filters, or to support the installation of municipal microfiber filtration systems. Contact someone who represents your area and be sure to mention that you are a constituent in that person's district.

Create a pledge.

Asking people to commit to a particular action by signing a pledge can help lead to lasting behavior change (McKenzie-Mohr, 2000). For this reason, you could consider creating a short pledge for people to sign if you are tabling at an event or in your local community. Target an action that makes sense where you live. That might mean asking people to pledge to stop buying plastic fashion, to wash their synthetics less often, to install a microfiber filter on their washing machine. Try looking back at the solutions chart in the previous section and chose an ask that you think is achievable and approachable for your community. If possible, try to record contact information and follow up after a few months to see how the pledge is going.

As a follow-up, try emailing your participants with some words of encouragement and ask how it is going. You could try creating a survey using a free online tool such as Survey Monkey to ask if they have changed their habits, what has been challenging for them, if they've looped any friends in to the pledge, and more.

Create a petition.

Petitions are a great way to not only make a statement about how many people are concerned with a particular issue or making a particular ask, but they are also a great way to spread information about an issue. Simply circulating a petition can help

people to become more aware of an issue and help them feel empowered to use their voice to make a change.

There are many online tools available to help you create a petition. An easy to use version can be found at: <https://www.change.org/start-a-petition>. Here are some tips on how to make your petition a success: <https://savingplaces.org/stories/preservation-tips-tools-9-tips-for-creating-successful-petitions-on-change-org#.WfAPhpOGPMU>

Share what you're up to and set a new social norm.

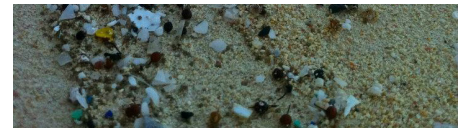
Make sure to always share what you are working on! We do best when we work together and have a flow and exchange of ideas and support. Plus, if we all talk about how we are working on this problem, it will become more usual to refuse to accept the norm of plastic fashion. Social norms are one of the most significant predictors of behavior. If we can share what we are doing, we can help to shift social norms towards a place where making the environmentally responsible choice is easy and widespread. Sharing our ideas and efforts can help to strengthen our network so that we can help the planet move towards #plasticfree fashion #moreoceanlessplastic #5Gyres #5GyresAmbassador.



Wrapping It Up with Hope

Microfiber pollution is a major environmental and human health challenge. In the face of such a broad threat to all environments, wildlife, and human communities, it is easy to feel overwhelmed and despaired. In these moments, it is critical to focus on hope and unity. We are in this together as a global community and through that interconnected network, we can make a real difference.

While it is true that humans are the source of this issue, that fact inherently means that we are also the solution. People are natural innovators - we are constantly using new, creative ideas to make the world a better place from new technologies to new waves of activism. We simply need to harness that energy and intellect toward this problem to protect the future of this planet and the human and animal communities that rely on it.



To be a leader in this challenge will require a great deal of persistence, positivity, and passion. You cannot change the world overnight. You cannot change your community overnight. But, you can keep adapting and fighting for the things important to you. Each of us is just one piece of a large and beautiful puzzle. As you fight on for your piece, in your community, find comfort in the fact that you are a part of a network of changemakers, all contributing to the larger mosaic of the movement to protect our planet. Celebrate your small victories, share your passion, and never give up.

Please check out the full advocacy toolkit at <https://www.5gyres.org/s/Microfibers-Macro-problems.pdf> to learn more and access helpful resources!

Róisín Magee Altreuter is a science educator at CuriOdyssey in San Mateo, CA and an ambassador for The 5 Gyres Institute. She recently received her graduate degree from Project Dragonfly's Global Field Program through Miami University in Oxford, OH. Her research focused on engaging kids and communities in action oriented solutions to plastic pollution and she is particularly interested in microfiber pollution.

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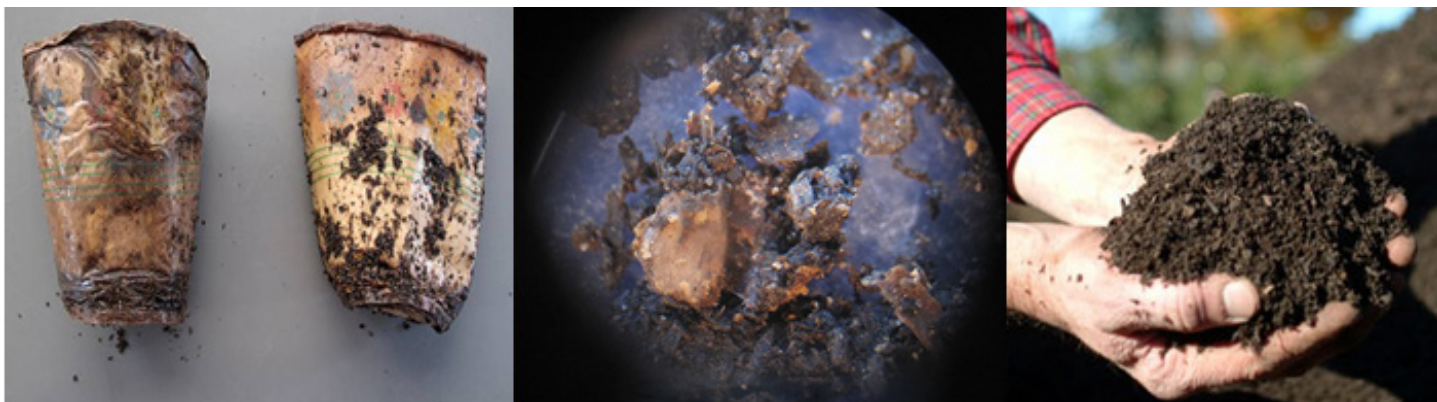
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Microplastics in Compost: Environmental Hazards of Plastic-Coated Paper Products

by Cyndra Dietz, Director,
School Recycling and Environmental
Education Program, Eco-Cycle

AT ISSUE

A growing number of U.S. and Canadian communities are recovering their food scraps through composting to reduce their climate impact, work toward Zero Waste goals, and return valuable nutrients to local soils. A survey of these programs found that nearly half of these programs allow residents and businesses to include plastic-coated paper products for composting in order to increase the convenience of composting and the amount of materials that can be accepted. Plastic-coated paper products include milk and juice cartons, hot and cold paper drinking cups, frozen food containers, plastic-lined paper bags, take-out containers and some paper plates. These products, made predominantly from paper fibers, are traditionally coated with a petroleum-based plastic to prevent liquid absorption or freezer burn, or to otherwise enhance product performance.

The growing epidemic of plastic pollution in the environment has led to concerns about what happens to the plastic coatings on these products during the composting process, since petroleum-based plastic particles break down into smaller fragments but do not biodegrade. Research from Eco-Cycle and Woods End Laboratories demonstrates that microplastics are shed from all plastic-coated paper products during composting. These microplastics may pose a significant risk to our soils, freshwater and marine environments, wildlife, and ultimately, human populations. This potential threat

justifies a ban on non-biodegradable plastic-coated paper products in compost.

RESEARCH

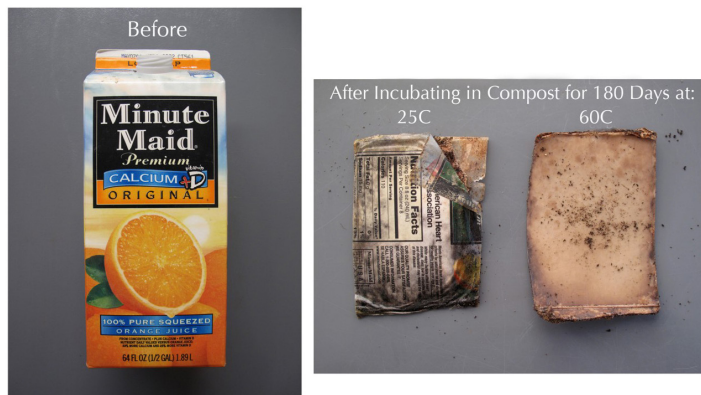
In order to ascertain what actually happens when including plastic-coated paper products in the feedstock of a composting process, Woods End Laboratories, Inc. (Mt. Vernon, ME) and Eco-Cycle, Inc. (Boulder, CO) partnered to test a range of these materials in a controlled biodegradation process:

- milk/juice cartons (double-coated LDPE)
- cups (double-coated LDPE)
- plates (clay with binders)
- paper food boat (clay with binders)
- freezer box (single-coated LDPE)
- oven-able tray (double-coated PET)

The study showed conclusively that micro-plastic fragments were shed from all plastic-coated samples, whether single or double-coated. This means any plastic-coated paper product, even those that are partially screened out during the composting process, is contaminating the finished compost with plastic particles.

Plastic-Coated Paper Products





Micro-plastic particles were released from all plastic-coated paper products such as this paper orange juice carton, shown before and after testing.

In addition to this study done in 2010, a more recent study done in Germany in 2018 (Weithmann et al 2018) tested finished compost made from bio-waste that originated from both households and commercial sources. The study found microplastics present in all samples, including polyethylene and polystyrene, which are frequently used in food packaging. Both of these plastics are known to be highly persistent in the environment. This confirms Woods End and Eco-Cycle's findings that plastic particles are migrating from plastic packaging into finished compost.

CHALLENGES IN COMPOSTING OPERATIONS

Composters generally use a 1/2 inch (12mm) sieve, or 3/8 inch (9mm) sieve under optimal dry conditions, to sift out contaminants including glass, plastics, metal and other unwanted materials, as well as any organic materials that did not completely breakdown during the composting process.

Any plastic particles smaller than this size will remain in the finished compost and will be dispersed into the environment during compost application. Previous research by Woods End found that extremely fine polyethylene (PE) fragments and strands as small as 100 microns are present in composts—that is, impossible to recover or screen out.

Products with a PET or LDPE coating on both sides (double-coated products) showed very little decomposition during the Woods End tests, as the plastic coating on both sides of the paper severely retarded decomposition. The product size, therefore, remained large enough to be screened from the finished compost as a contaminant. This contamination can be very costly to compost facilities.

However, this study is the first to show these products are also shedding microplastics during the biodegradation process, contributing to the contamination of the finished compost (along with the single-coated products tested). Since these smaller particles are not captured during the screening process, in order to eliminate microplastics from finished compost, all plastic-coated paper products should be excluded from the composting process.

POTENTIAL HARM

Most research on the impacts of microplastics to date has focused on marine environments. Plastic fragments and fibers have been shown to accumulate in marine environments and to be ingested by living organisms (see article on p. TBD for more on the effects of plastics in our oceans). The next questions we must ask are:

- 1.) How does this accumulation of plastics affect wildlife?
- 2.) Are the plastic fragments transferred up food chains? and
- 3.) Are there possible consequences for human populations?

The microplastic fragments shed from plastic-coated paper products that are present in finished compost will be disseminated into the environment through the application of compost to soils. These microplastics will eventually migrate into other land and aquatic ecosystems through wind and surface run-off, exacerbating the existing threats to wildlife and ultimately humans. While there needs to be more research on the specific effects of microplastics in all ecosystems, growing evidence on the threats to wildlife and humans from terrestrial, freshwater and marine-based plastic particle pollution are enough to cause serious concern.

Macroplastic particles (>5mm) are a well-known threat to wildlife, causing suffocation, entanglement and starvation. New evidence shows that there is also a growing abundance of microplastics in the soil, rivers and oceans, mirroring the rise

of global plastics production. These particles come from a variety of sources, both land- and ocean-based. Smaller in size, the particles are more likely to be ingested by wildlife such as filter feeders and deposit (bottom) feeders. Microplastics may then move up the food chain when these creatures are eaten by predators such as birds, crabs, starfish and humans. These plastic fragments have also been shown to concentrate persistent organic pollutants

(POPs) such as DDT, PCBs and dioxins, and their movement up the food chain may increase the exposure of wildlife and humans to these dangerous toxins. Prudence and the Precautionary Principle would dictate that any source of plastic fragments, including

***The Precautionary Principle
When an activity raises threats
of harm to human health or the
environment, precautionary measures
should be taken even if some cause
and effect relationships are not fully
established scientifically. (Science and
Environmental Health Network, 1998)***



plastic-coated paper products from composting operations, should be eliminated in order to decrease the impact of the growing problem of plastic pollution in all environments.

CALL TO ACTION

1. Ask your compost facility or local program provider to take the pledge to exclude plastic-coated paper products. Local governments, nonprofits, universities, compost facilities and compost haulers can all pledge to no longer accept these products in their collection programs. Only products that meet ASTM 6400, EN 13432 or BPI standards should be allowed in food waste collection programs. Be clear and say no to these materials on your guidelines and educational materials, and help us keep our soils free of plastic pollution. Take the pledge at www.ecocycle.org.

ALL THESE CARTONS

are recyclable



Carton recycling includes a wide variety of products such as these.

www.ecocycle.org/microplasticsincompost.

2. Recycle milk and juice cartons. Recycling is a much better alternative than composting for milk and juice cartons, and the good news is that carton recycling has nearly tripled over the past decade thanks to industry efforts to expand programs and build processing facilities. Now more than 60% of U.S. households have access to recycle gable-top and aseptic containers used for milk and juice packaging. Visit www.recyclecartons.com to find programs near you or how to get a program started.

3. Avoid plastic-coated paper products. Many of these disposable products can be easily avoided by bringing your own mug or

take-out box. See more tips on how to go plastic-free on p.TBD (reference article on what you can do)

4. Look for the label when buying compostable products. Truly compostable products do not contain petroleum-based plastics, and they break down naturally into healthy soil in commercial composting facilities. However, there's a lot of greenwashing out there and misleading labels, so we put together a simple buying guide to help you buy truly compostable products at home and at your workplace. Check it out at www.ecocycle.org/microplasticsincompost.

5. Hold the packaging industry accountable. Fraudulent or deceptive claims such as "earth-friendly" or "biodegradable" are no longer permitted by the Federal Trade Commission (FTC). Speak out against this greenwashing and support companies and programs that utilize compostable standards.

LEARN MORE

See who's taken the pledge to reduce plastic pollution from composting, read the full research report, and get more information on what you can do at www.ecocycle.org/microplasticsincompost. Further research by Woods End Laboratories on plastic fragment contamination in compost can be found at woodsendsend.com/wp-content/uploads/2016/05/CSU-foreign_matter.pdf.

Cyndra Dietz has been the Director of Eco-Cycle's School Recycling Program since 1990. She has developed and diversified the program, and, under her leadership, the program has become a national model and has won several state and national awards. Cyndra herself was named the 2012 *Boulder Pacesetter* in the Education sector and in 2013 received the Colorado Alliance for Environmental Education's *Enos Mills Lifetime Achievement Award* for long-term outstanding achievements and contributions to environmental education. Cyndra has degrees in Biology and Environmental Science from the University of California, as well as previous environmental education experience with the National Park Service, Denver Museum of Nature and Science, University of Colorado and Denver Public Schools Outdoor Education Program.

Ditch the Throw-Away Culture and Solve Plastic Pollution

by **Miriam Gordon and Jamie Rhodes**
UPSTREAM Solutions



In order to stop the current annual dumping of roughly 9 million metric tons of plastic waste into the ocean¹, we need to recognize the driving force behind the growing plastic pollution crisis: an addiction to the throw-away culture. There is a collective desire to replace the flawed system that, based on current trends, will lead to a doubling, to 17.5 million metric tons, of the amount of plastic reaching our oceans². That's the equivalent of 5 garbage bags filled with plastic going into the ocean along every foot of coastline in the world³, or the dumping of one truckload per minute of trash into the ocean.⁴

The commitment to solving this problem has quickly gained steam among policymakers, but the solutions have missed the mark. Images of ocean life entangled and impaired by single-use plastic items wrenches the heart and focuses the public's attention on the danger of uncontrolled plastic pollution in sacred spaces. Responses that target only the plastic problem while ignoring the single-use aspect simply shifts the environmental burdens. Rather than disposable products ending up in the ocean, we could be supporting clear-cutting of forests or expanding damaging industrial agriculture.

Source reduction -- reducing product and packaging consumption and making products reusable to avoid the generation of waste -- can be the cornerstone of a more colorful and diverse economy allowing for ingenuity and creative problem solving. How do we get all the stuff we want without all the unnecessary waste of the throw-away culture? While the future is still being envisioned, our policies need to reflect the core values we see encapsulated in such mantras as "Reduce, Reuse, Recycle," and "Zero Waste."

Recycling Is Not the Way Out

With all the talk of "Reduce, Reuse, Recycle" there is a shocking lack of commitment to actual reducing and reusing. Too much of the focus has been on recycling. Compounding this failure of vision, there is movement now to demand that disposable foodware be recyclable or compostable. This is greenwashing. Food packaging usually does not get recycled. It

is covered in grease, water, and all those food bits that fell out of your burrito. Put it in your recycling bin all you want, but this dirty material is picked out and landfilled.

Those industries most closely linked to plastic pollution are promoting recycling as the solution. This is the easy way out as they have forced taxpayers to cover the cost of managing their products once they become waste while they protect their markets and profits. Waste generation continues to far exceed the ability of recycling to keep up, and the EPA's data shows that only about 9% of plastics are recycled in the U.S.

And now there's a new challenge. U.S. cities that have had recycling programs have nowhere to send the mixed plastics and contaminated paper that they've been exporting for recycling in China. In March, China's Green Sword policy stopped imports in their tracks. Our "recyclables" have lost their biggest buyer. California for example, which boasted the highest state recycling rates, was sending 44% of its recyclables to China.

Compostable, disposable packaging does not appear to be a magic bullet as industry claims. Many people buy the notion that a bottle made from a plant is a better bottle, or a food container made from paper is better than one made from plastic. In shifting from petroleum to plant based sources, we transfer the environmental burden to the agricultural industry which will now not just feed us but also wrap that same food. The negative impacts of industrial agriculture are wide-ranging, including huge energy and water consumption, fertilizers that contaminate groundwater, toxic runoff and air pollution from pesticides and insecticides, and sedimentation of nearby streams and rivers. The trade-off seems like a pretty bad deal. Much better would be reducing the packaging and avoiding the damage of either the petroleum-based or the agricultural-based products.

Effective Action Commits to Reduction

Currently, 54% of the world's population - 3.8 billion people - live their daily lives with either a ban or fee on plastic bags. San Francisco started the wave in 2007 and it crested with 150+



California cities following suit. These local actions lead to the first statewide plastic bag ban and subsequent adoption by other countries. Now, twenty-eight nations have taken action and we see daily growth in cities and regions worldwide.⁵

In theory, bans are a mandatory reduction in the demand for single-use items. Thereby we avoid the manufacturing of those products and reduce unnecessary consumption. This may seem draconian. However, when current estimates are that there are 5.25 trillion pieces of plastic debris weighing 268,940 tons floating on the surface of the world's oceans⁶, there is a need for drastic action. In those places where such black-and-white lines are hard to draw, there is strong evidence that visible consumer charges are an effective market-based tool to encourage more widespread adoption of reusable bags.⁷ While local results may vary, the international mix of charges and bans have resulted in 60-90% reduction in single use bags and correlated increases in reusable bags.⁸

When attention was focused on the sheer volume of microbeads found in not just the open ocean but also the Great Lakes, U.S. policymakers were able to embrace the mantra of mandatory reduction. In 2015, Illinois enacted the first prohibition on the inclusion of these nettlesome nurdles in our facial scrubs and toothpastes. The U.S. government, in a now too infrequent example of leadership, banned these beads across the entire nation. Austria, Belgium, Canada, France, India, the Netherlands, New Zealand, Sweden, Taiwan, and the U.K. have taken action. If we do not want microbeads in our water, banning their use is the most effective solution.

Other nations, confronted with the prevalence of single-use plastic in their beaches and rivers have targeted other culprits of the throw-away culture. France, in 2016, ended the use of plastic cups and plates. When a stereotypical national experience is coffee and beignets out on the sidewalk, it makes sense to ensure that the presentation of such delicacies does not lead to clogging Parisian storm drains or staining the French Riviera. Belgium, Denmark, and Scotland plan to follow suit and Theresa May thinks ending plastic waste in the U.K. by 2042 is likely more popular than Brexit.

These firm targets for reducing the single-use culture is a testament to the national will to solve a problem. The question is whether to solve the problem by banning only single use plastic or whether going after all disposable products that we use for a matter of minutes is the better choice. An intervention is necessary, and no single nation can save our planet on its own.

An International Fear of Commitment

Since the 1970s we have collectively witnessed the accumulation of plastic as pollution on our coasts, long before Blue Planet II made it a cause celebre. Also, since the 1970s we have been reaching for global solutions to

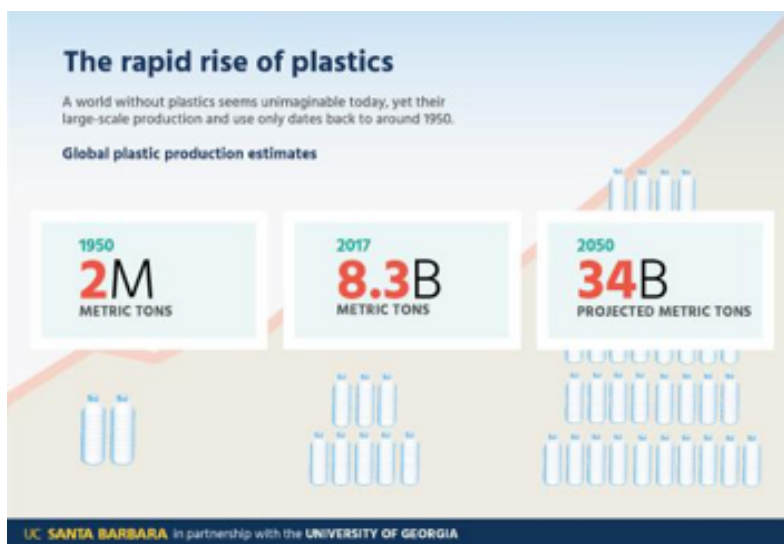
tackle a problem. MARPOL, *The International Convention for the Prevention of Pollution from Ships*, brought us rules on handling ship garbage. Sixteen years later it was updated to include a strict ban on overboard dumping of plastics. This bold statement, sadly, was the high water mark of commitment from the global community.

The United Nations Environment Program, meeting in Washington D.C. in the mid-90s, managed to build up to a declaration of protecting the oceans from the perils of land dwellers.⁹ Like a beach cleanup, this brought attention to the problem and engaged those present, but it did not pump the brakes on the growing catastrophe. Watered down with doses of “where possible...” and “when feasible...” no company or government needed to take responsibility in the absence of targets and timelines.

The agreements, strategies, and action plans that followed are numerous, voluminous, and useless.¹⁰ Not a single actionable target or performance measure is to be found. Now, more than four decades later, the European Union's 2018 *Strategy for Plastics in a Circular Economy*, still talks of increased recycling while merely nodding to the all too obvious need to reduce single-use packaging, continuing the trend of forgetting reduction targets.

Though G7 and G20 nations put the topic on the agenda in their most recent meetings, what emerged were pledges to reduce ocean pollution through an international agreement. While multilateral talks delve into the topic and highlight the problems, a failure of global actors to set timelines for reducing the production and consumption of single-use items means that plastics production and consumption will continue on an unsustainable and awe-inspiring growth trend.

Of course, Japan and the U.S. simply walked away from the problem either despite or because of our headquartering of so much of the global plastics manufacturing capacity.





Focus on Reduce and Reuse - Toss Out the Disposables

What can be learned from the successes of the bans and fees that have accomplished local and tangible reduction in plastic bags, microbeads, plates, and cups? For one, they have proven to reduce the amount of plastic out in individual consumer's lives. It sets the tone for businesses and customers that we can do things differently and use less harmful stuff. What needs to be further investigated is whether this drop in consumption is truly leading to a drop in production, as industry analysts continue to predict dramatic increases in plastics production from 2 million metric tons in 1950 to 8.3 billion in 2017. We are a short hop to 34 billion in 2050.

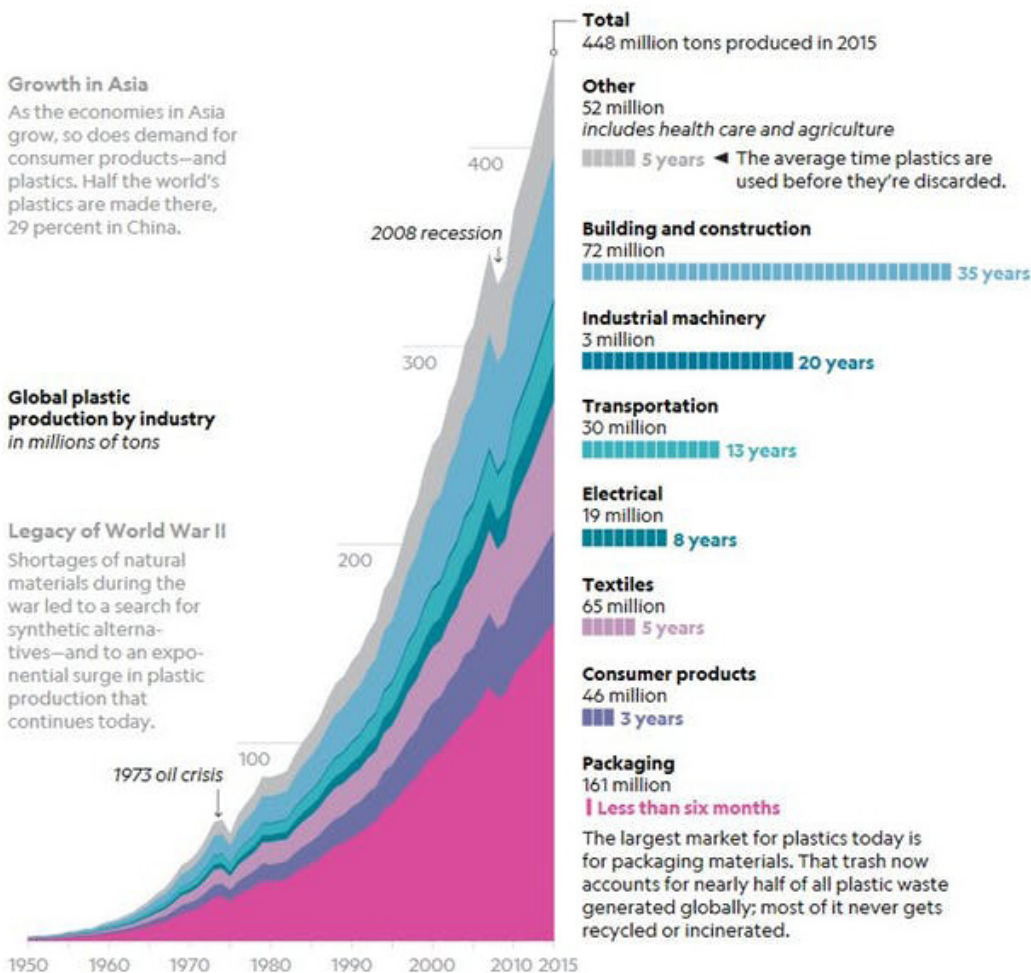
This growth is less shocking when we consider the underlying problem. So long as we are addicted to a culture of "use and toss," plastics reduced here will find a home there. Though there are fewer plastic bags and straws, brands have increased the amount of single-use plastic packages for many products, like baby food, nuts, crackers, diapers, sandwiches, peeled fruit, single vegetables, salad bars, buffalo wings, cheese, water, and on, and on.

Yes, shifting away from all of this packaging will clean-up your beach and save a sea turtle's nose. There is more. Reducing disposable packaging saves businesses money on day-to-day operations and keeps a little something back from the natural gas fracking and pipeline companies who salivate at this unrestrained growth in the sale of plastic. Programs like *ReThink Disposable* work directly with cafes, restaurants, and cafeterias to reduce packaging and embrace reusables. Each business has a success story with measurable reductions in packaging and thousands of dollars saved in the process.

Businesses can deliver products without the unnecessary packaging and embrace refillable and reusable alternatives. While we do not need to return to 1947, when Americans drank ALL of

A LIFETIME OF PLASTIC

The first plastics made from fossil fuels are just over a century old. They came into widespread use after World War II and are found today in everything from cars to medical devices to food packaging. Their useful lifetime varies. Once disposed of, they break down into smaller fragments that linger for centuries.



their soda in refillable bottles and 86% of the beer,¹¹ a return to refillable bottles will reduce the impact of each tasty beverage we consume. When the American beverage industry introduced the single use aluminum can, they bought up all the refillable bottling plants and shuttered them. While investing in the plastic bottle, they have fought every state deposit law that puts them on the financial hook for successful collection and recycling.. Basically, the industry brought us the single-use bottle and has told us that cleaning up the waste and litter should be covered by taxpayers.

Let us bring back and modernize what used to work. While the soda fountains may have gone the way of the triceratops, reusable containers tailored to our daily lives and integrated with our smartphones are just the type of mundane science fiction that can excite the imagination. Today's sticker-covered bottle can be tomorrow's programmable, dishwasher-safe LED display, telling



the world my favorite band, computer brand, and farmstand. Make it fun and convenient and the future brightens with possibilities within our grasp.

Why We Start With Food

There needs to be a starting point. Disposable plastic packaging significantly outpaces the plastics used for consumer goods, textiles, construction, and more. Our local governments are dealing with a massive amount of plastic packaging waste and litter on a daily basis.¹²

Of course this translates into what we find in the oceans, lakes, rivers and streams also being primarily plastic packaging. A full three-quarters of the top 20 products found on the shoreline fit into the category of food and beverage packaging.¹³ With that type of prevalence in our environment, changing how we get and consume food will lead to significant real world impact in reducing the demand for plastics and eliminating it from our environment.

Changing the way we produce, transport, purchase and consume food is more than numbers on a chart and market trends. Food is at the very core of what it means to have a society. Evolution and innovation within our food systems, from the domesticated grain to the first government grain subsidy, have marked changes in our culture. The food we eat and the way in which we serve it is a key indicator in shifting behavior norms and values. It speaks to our tastes, desires, histories, and experiences. We did not get to this place of endless shelves of packaged foods and infinite combinations at the price-per-pound hot food bar accidentally. We are targets of endless marketing campaigns to connect food to brand names and marketable images. Yet, we all recognize that there is a fundamentally different feel at a restaurant that puts all your food in a styrofoam clamshell than one that uses ceramic plates, silverware, and a dishwasher. These are markers of our values.

Imagine a city where every single restaurant, either due to law or consumer demand, has ended its reliance on single-use items. No one will notice when they have a cloth napkin or glass tumbler. It is what will be normal. Progress toward this vision is happening. Scotland and the Irish cities of Cork and Dublin have banned disposable cups within government buildings. California cities such as San Francisco and San Luis Obispo, banned single use plastic water by government. And recently, the City of Berkeley proposed that restaurants use only real plates and cups for on-site dining and charge customers for take-out cups and containers.

There are already companies out there trying to normalize this behavior. The London cafe chain, Boston Tea Party, has stopped serving customers in disposable cups. Recup is servicing cafes in cities all over Germany, while similar reusable cups and containers programs are popping up in places like NY, London, Boulder, Portland, San Francisco.

Beating the throw-away culture can not solely rely on individuals hauling a bag full of heavy containers everywhere. Businesses need to embrace the changing culture and make it more convenient for us to consume without all the waste. The entire throw away culture can shift when people push for upstream solutions and demand better.

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Beyond Bans: Breaking Free From Plastic

**by Chris Kane, Director of Research Resource Development
Adina Spertus-Melhus, Campus Coordinator**

For years plastic has inhabited nearly every aspect of our daily lives; most recently, it's taken center stage in the form of a socio-environmental crisis. Increasingly, we hear statistics on the extent of plastic pollution as it currently exists, and predictions of an aggressive trajectory in the next 30 years. Most visible is the encroachment of plastic debris on marine ecosystems, evidence from the guts of marine life that have ingested bags, balloons, and plastic pellets indiscriminately of their regular food supply.¹ Microplastics, pieces smaller than 5mm across in diameter, are transported up the food chain - along with the carcinogenic toxins that they can harbor - as humans ingest marine life; recent studies have even detected them in the air we breathe.² This problem is only exacerbated by the depressed state of international recycling markets, deep in turmoil after China banned most imports of foreign waste. Still, plastic production rates continue to rise, the volume of plastic in the ocean projected to exceed that of fish by 2050.³

Some advocates call for the expansion of domestic recycling infrastructure, coupled with public facing education and outreach efforts that stress individuals to recycle responsibly. However, this end-of-the-line approach only focuses on the disposal of plastics existing in the system already, failing to address increasing production and high-level consumption rates by larger entities like businesses and corporations. The plastics and beverage industries are notorious supporters of recycling efforts, as they remove the responsibility from the producer to clean up their own pollution (in this case, plastic waste) and excuse the production of "recyclable" plastics that, at the end of the day, are rarely being caught in the actual recycling stream.⁴

At the [Post-Landfill Action Network \(PLAN\)](#), we advocate for holistic solutions to waste, including recycling as one part of a multifaceted approach. We support campuses not only in managing

their waste, but avoiding it to begin with, through programs and initiatives like composting in dining operations, student run thrift stores and repair spaces, and progressive campuswide purchasing policies. Through our work, we highlight waste's place in a larger linear consumption economy, a system that extracts resources like fossil fuels, processes them into materials like plastic, manufacture and distribute that material into single-use products, and disposes them into a landfill or incinerator. Focusing on recycling, and allowing the plastics industry to continue to grow, feeds the linear consumption economy. This makes plastic the "new frontier" for gas and oil companies, estimated to account for 20% of fossil fuel consumption by 2050 (up from 6% in 2014).⁵ This Fall, we've released the ["Break Free From Plastics" Campus Pledge](#), setting a standard for campuses to aspire to in their plastic-free endeavors. This pledge, with an accompanying toolkit of programmatic resources, guides a campus in navigating what plastics are feasible to phase out immediately, while holding space for circumstances that need single-use disposable plastics on hand, at least until a viable alternative for those items exists, and is easily accessible to all.

With the plastic problem so entangled in a larger, flawed economic system, the solutions that we implement to break free from plastic have to be more than just banning them from our supermarket shelves and take-out cafes. Any one solution to plastic pollution, including bans, must be coupled with a myriad of others to address the nuances in people's different life circumstances. Infrastructure must be established around solid alternatives that can serve a variety of needs - whether they be physical ability, time and financial resources, or even legal status - before any one material is banned altogether. Alternative systems might seem challenging to implement for an entire city or municipality, however, we see college and university campuses as (relatively) closed systems - microcosms of society within which solutions can be tested and, eventually, replicated at a larger scale. Campuses also contextualize challenges that could be present at a municipal level, such as financial limitations that system users might have and how that might affect their access to plastic-free alternatives. Take, for example, banning plastic straws. Many students might not be able to afford to buy their own reusable straw to use in a campus cafe or dining facility, not to mention



the importance of accessibility in having flexible straws on hand for people with disabilities who need them to drink. Providing reusable straws in-house, especially those that have the same qualities of malleability of a single-use plastic straw, or providing single-use straws upon request, is an infrastructural decision that more holistically addresses the varying needs of the users in that system.

Reusable to-go container systems are another good example of replicable infrastructure. Instead of taking food out in a disposable polystyrene or other plastic, students can opt into a program that hands them a reusable to-go box as they enter their Dining Hall or on campus cafe. Upon completion of a meal, students drop off their dirty container at collection stations located throughout campus - just as they would with a disposable container in a waste bin. Campus employees gather up the dirty containers, wash them, and stock them in eateries for redistribution.

But how do we peel away from plastics that lack scalable alternatives, like plastic trash bags or food wrap? With our **“Break Free From Plastic” Campus Pledge**, PLAN challenges plastic producers as to why alternatives to these items don’t exist, and in the meantime, formulate a best case scenario of what breaking free from plastics can look like with the solutions that we have here and now. Participants in this pledge will be supported through a variety of materials, including:

- **A Plastic-Free Campus Manual**, with best-practice case studies and steps to raise awareness around alternatives to single-use disposable plastics.
- **A Plastic Audit Template**, to allow campuses to assess their current reliance on plastics, and track their progress moving forward.
- **A Reusable To-Go Container Guide** with step by step instructions to create alternative systems for disposable plastic to-go containers on campus
- **A Student Senate Resolution Toolkit**, a tool that a student or faculty governing body can use as the basis of a petition, urging decision makers on campus to sign the Pledge
- Opportunities to network with campuses across the country to share their challenges, successes, and provide peer to peer support.

We create this pledge recognizing that there is currently no such thing as a “plastic-free campus”, or even a clear definition of what qualifies as such. Ultimately, we aim to create a starting point for campuses to demystify what it means to be plastic-free, what are the goals for breaking free from plastic, and what incremental milestones are needed to get there.

*Want to get involved? Fill out the **“Break Free From Plastics” Campus Pledge**, and contact the Post-Landfill Action Network (PLAN) at info@postlandfill.org, and check out the Break Free From Plastics movement!*

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The Fate of Plastics at Wastewater Treatment Plants

by Alex E. Novak, P.E.
Treatment Facilities Director
MSD



Mr. McGuire: I want to say one word to you. Just one word.

Benjamin: Yes Sir.

Mr. McGuire: Are you listening?

Benjamin: Yes, I am.

Mr. McGuire: Plastics.

Benjamin: Exactly how do you mean?

Mr. McGuire: There's a great future in plastics. Think about it. Will you think about it?

The Graduate, 1967

Background

When the Clean Water Act was rewritten in 1972 it triggered much activity nationwide as communities built new wastewater treatment facilities to meet the requirements that were promulgated for secondary treatment standards. Secondary treatment standards targeted suspended solids, oxygen-demanding components that affected the dissolved oxygen level in receiving streams, and required disinfection for pathogen destruction. While these requirements resulted in an improvement to the nation's waterways, we are now dealing with challenges from sources that didn't necessarily exist or were ignored when the law was enacted, such as cosmetics, pharmaceuticals, and of course plastics. In 1972, store shelves were lined with liquids in glass bottles, bottled water was nowhere on the horizon, and the fast food industry with its plastic lids and plastic straws was not as pervasive as we see it today. Now nearly all containers, packaging and even our clothing contains plastic.

The Morris Forman Water Quality Treatment Center (MFWQTC) in Louisville, Kentucky was one of these original facilities. It was placed into service in 1958 as a primary treatment facility, handling both sanitary and storm flow. It was expanded in 1978 to secondary treatment standards with 120 million gallons per day (mgd) receiving full treatment and up to 350 mgd

receiving primary treatment during storm flow. Any excess flow was discharged directly to the Ohio River untreated. Runoff from the city streets could end up at the wastewater plant, but was also just as likely to be discharged to one of the city's creeks that feeds the Ohio River and ultimately the Gulf of Mexico.

Since the expansion in 1978, the Louisville & Jefferson County Metropolitan Sewer District (MSD) has entered into a Consent Decree that has reduced these untreated overflows from the collection system to the environment. The ability to treat more flow also results in an opportunity to capture more pollutants, such as plastics, and allows us to document our ability to reduce their presence in the environment.

Source Containment

A separate sanitary system is essentially a closed system and should only contain items that were purposely placed there, primarily through a commode, laundry, or other discharges from commercial or industrial customers. While there are possible sources of plastic that enter this way, there is little done to prevent it. Four of the five wastewater treatment facilities in the Louisville MSD are in a separate sanitary system. In a combined system (sanitary and storm flow), every storm drain is a potential source of contaminants. Figures 1 and 2 are photographs of two of the thousands of drains in the Louisville system that enter the combined system. An informal observation of the system indicates that major sources of plastic are cigarette butts, straws and lids with plastic cups and bottles being a secondary source. Many communities have adopted an aggressive street cleaning program, particularly in the central business district and in areas with many bars and restaurants, to prevent the pollutants from entering the collection system.

There are a number of systems available to capture solids and floatables once they have entered the system and before they are discharged. Louisville MSD has implemented a program to add an appropriate method at each combined sewer overflow (CSO) manhole to prevent or reduce discharges to the receiving stream. While these systems are not designed specifically for plastics, they do contribute to the overall reduction. Figures 3 and 4 are photographs of two of the systems currently in use. The screen and



Figure 1. A source of contaminants, a storm drain that feeds into the combined sewer system.



Figure 2. A source of contaminants, a storm drain that feeds into the combined sewer system.

baffle devices are generally located in manholes and have yielded some success, but they are generally located in easements on private property and can be difficult to access and maintain. There are also concerns with odors when capturing this material and not removing it immediately. The method used in Figure 4 allows the material to reach the receiving stream and capture it before it can disperse. This allows better access, but can be subject to failure during periods of high flow.

Wastewater Treatment – Macro-Plastics

Macro-plastics are items that are greater than 5 mm in size. The first line of defense against plastics entering the treatment system is screening. The bar screens at MFWQTC have spacing



Figure 3. A manhole based screen device used to keep larger contaminants out of the system.



Figure 4. A manhole based baffle device used to keep larger contaminants out of the system.

that is 3/8 inches apart, so it will catch larger items, such as plastic bottles, but may allow lids, straws and various personal hygiene products to pass through. Any items that have been captured are placed in a container, referred to as a lugger, and taken to the landfill. Figures 5 and 6 are photographs of typical contents of a lugger from several screening operations associated with MFWQTC. There is no system in place that will allow this material to be segregated and recycled.



Items passing through the bar screens are conveyed to the primary sedimentation basins where they can be removed after settling to the bottom or floating to the top. Whether they are scraped from the bottom or skimmed from the top, solids are pumped to anaerobic digesters. Inert material such as plastics are not easily broken down in the digesters and occupy valuable space and reduce the ability of the digesters to produce energy. The material is only removed when digesters are taken out of service and cleaned. The digesters at MFWQTC are cleaned on a 5-year cycle and typically 25% – 30% of the volume has been displaced by inert material during the 5-year period. Plastics are not the only source of the inert volume, other trash and grit also contribute significantly.

Wastewater Treatment – Micro-Plastics

A more pervasive problem that is generally not directly resolved in the wastewater treatment process is the presence of micro-plastics, material that is less than 5 mm in size. They have gained much notoriety as one of the main constituents in the “Great Pacific Garbage Patch” and have been discovered in the digestive tracts of many marine animals. Micro-plastics can be created from larger plastic items being broken down into smaller pieces until they reach a threshold that is less than 5 mm in size. A greater source of micro-plastics in the wastewater stream likely comes from manufactured sources such as hand and facial cleansers, cosmetics, textiles, and paint. Microbeads are a subset of the cleansers that have been identified and banned in much of Western Europe, Canada, and some states in the United States. The micro-plastics in textiles are actually recycled plastic that are used in the manufacturing of clothing and enter the wastewater system as laundry discharge.

In reviewing the current literature, there are varying opinions on the amount of micro-plastics removed in the treatment process. Treatment systems that include primary settling, such as the MFWQTC, may remove about 75 percent of the material as it is bound in with other settling solids and the floating material is removed in the skimming process. After its capture, the material is sent to the digesters where it will either settle with other inert material and be removed during the periodic cleaning of the digesters or it will continue through the process into the dryer system. The suspended material in the digesters contains valuable nutrients and is used to manufacture a fertilizer at the MFWQTC. If the plastics are processed in the dryers, they will be part of the fertilizer that is produced at the plant and marketed to farmers for



Figure 5. Typical contents of a lugger from screening operations.



Figure 6. Typical contents of a lugger from screening operations.

use on pastureland or crops. The plastics would not break down once distributed and would remain on the land or runoff during a rain event.

Summary

The presence of plastics in the waste streams has been increasing over time and wastewater treatment plants have not historically been designed to target that waste. Larger plastic items are removed by typical mechanical methods, but also can cause plugging of equipment and pipes. Additionally, the plastic items are often difficult to keep contained and add to the general clutter and housekeeping problems around the process areas.

Micro-plastics pose a more difficult challenge. There is ongoing global research looking at treatment methods for their removal and even questioning whether this is an effective use of resources (rate payers money) given the ubiquitous presence of micro-plastics in the environment. Filtration and membrane mechanisms are commonly being tested as possible technologies, but both are expensive to install and can be complicated to operate. At this time there doesn't appear to be the political or economic will to pursue this beyond the realm of research.

The most effective and cost-effective solution is to confront the problem at the source. As stated above, many communities have instituted aggressive street cleaning programs to keep litter from entering the waterways and sewer drains. Additionally, there have been bans of plastic bags, microbeads and other products that can contribute plastic to the environment and there is an ongoing public education effort in many communities that may ultimately result in a reduction of the amount of plastic that we use.

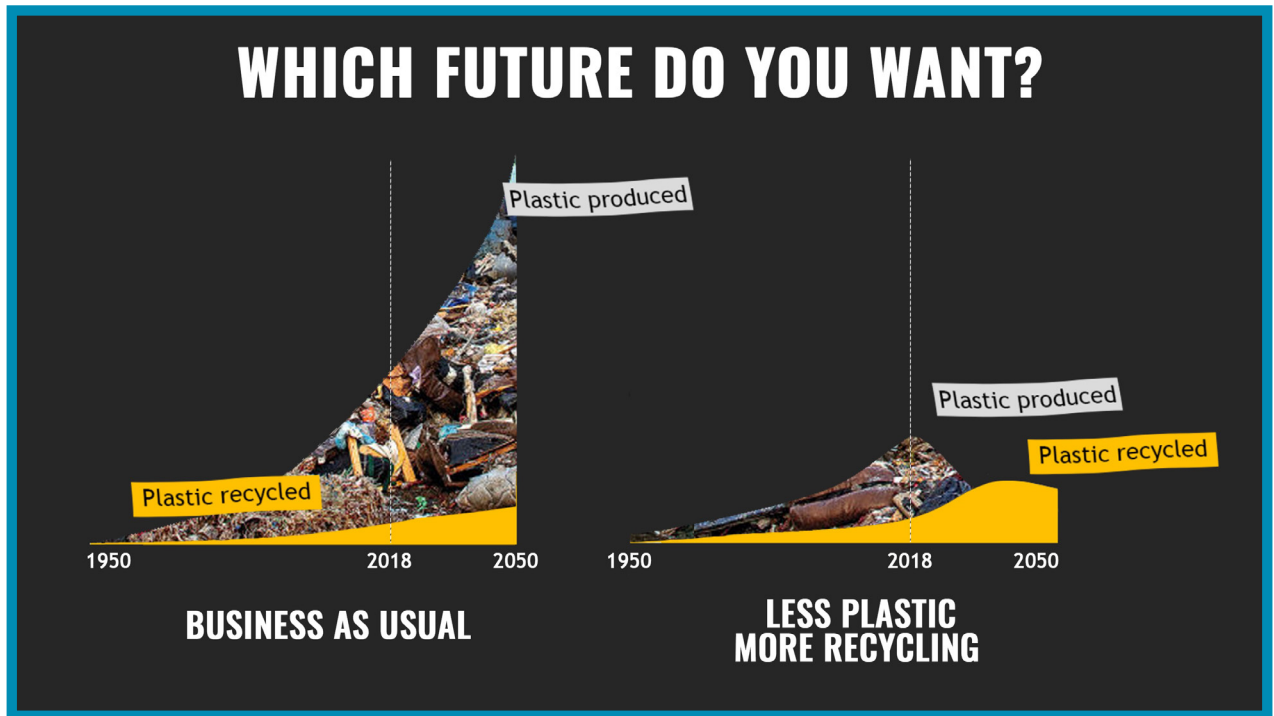
Alex Novak earned his Civil Engineering degree from the University of Missouri and his Masters in Environmental Health Engineering at the University of Texas. He is registered as a professional engineer in the states of Kentucky and Texas as well as a wastewater treatment plant operator in Kentucky. Novak is a member of the Water Environment Federation and National Society of Professional Engineers and has been the Treatment Facilities Director at MSD in Louisville since 2004.

RECYCLING IS NOT ENOUGH

It's time to rethink how to solve the plastic waste crisis

By GAIA/Zero Waste Europe

In collaboration with Break Free From Plastic, Consumers Association of Penang (Malaysia), Friends of the Earth Europe, Ecology Center (U.S.), Story of Stuff (U.S.), BaliFokus, China Zero Waste Alliance

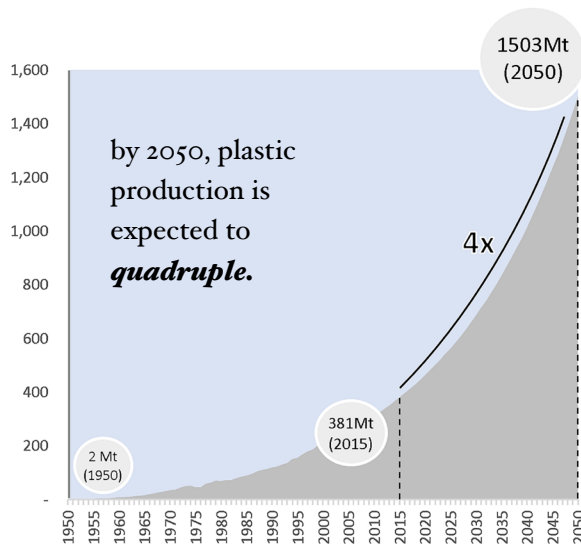


China Says Enough is Enough, Closes its Borders to Foreign Plastic Waste

Until recently, countries in the Global North dealt with their plastic waste problem by shipping significant portions of it to China. But in January of this year China began a new ban on plastic scrap import, shaking local recycling systems worldwide. The ban has exposed global dependence on plastic waste trade for recycling systems. In 2016, 15 million tons of plastic was traded globally. China was the top importer and main consumer worldwide, receiving 51% of all plastic waste traded. Unsurprisingly, the United States is the largest national plastic waste exporter in the world, and the 2nd largest plastics consumer, and the EU is the largest regional exporter.

Already, China's ban is driving efforts to improve recycling quality, build more domestic recycling capacity, and create better standards in the regions that export the most plastic. However, the ban is also sparking negative outcomes: some countries are threatening to increase plastic incineration and the burden of plastic waste processing is shifting to countries in South and Southeast Asia. As a result of extensive research with core partners around the globe, our findings indicate that ultimately, none of these adaptations address the elephant in the room -- the sheer quantity of plastic being produced-- and ignore **the most effective solution: to simply make less of it.** Our oceans, fish supplies, and climate depend on our ability to do so.

Evolution of annual global polymer resin and fiber production



Plastic is the Problem

Plastic, and especially single-use plastic, is an increasing environmental threat worldwide. Though plastic has only been used widely for a relatively short period of time, it has managed to colonize our daily lives and pollute the environment, much of it in the form of packaging. The plastic trend is far from over—in fact, plastics producers are planning on flooding the markets with a massive scale-up over the coming decades.

Plastic Production Explosion

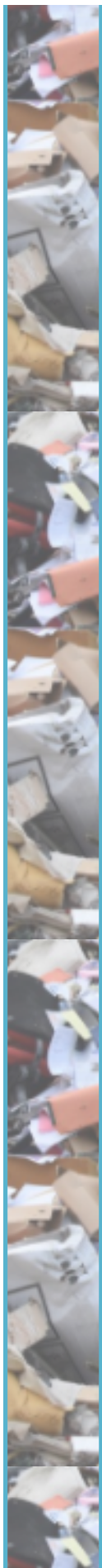
- Global annual production increased from 2 million tons in 1950 to 381 million tons in 2015: 2.5 times the compound annual growth rate of the global gross domestic product for that period.²
- Projections are to further increase the growth rate: by 2050, it is estimated that the total volume of plastic ever produced will reach 34,000 million tons (Mt)—over four times what has been produced so far.

Nearly all plastics are made from fossil fuels, and oil and gas companies see plastics as the new frontier.

- Currently, 6% of total oil production is used by the plastic sector, and it is estimated that it will represent 20% use by 2050. Plastic would represent 15% of global annual carbon budget (up from 1% today).³
- In the US, 264 new plastics-related facilities and expansions are currently planned to use gas from the shale fracking boom.⁴

We Can't Recycle Our Way Out of Plastic Pollution

Recycling is often proposed as the primary solution to the plague of plastic waste. But in reality, recycling will never compensate for the high use of plastic on its own. Recent data shows that **only 9% of all plastic ever discarded since 1950 has been recycled**, and the rest became pollution in landfills, dumpsites, incinerator emissions, or oceans, where it will remain for millennia.⁵ Europe has the highest collection rates of plastics for recycling in the world, at 29.7%; China's rate is 22.8%; while the U.S. only collects 9.5% of post-consumer plastic for recycling.⁶ This means that in the best case scenario over two-thirds of the plastics we discard currently fall out of the so-called Circular Economy, ending up in incinerators, landfills, cement kilns, dumpsites, oceans or the environment. Despite some efforts to curb plastic pollution through mechanisms like bans and fees, overall, governments have been unable to staunch the increasing flow of plastic. Companies are not only designing plastic to be difficult or impossible to recycle, but the overwhelming flood of new plastic into the market thwarts any chance of recycling keeping up.



Limits to Plastic Recycling

- Companies are choosing to use lighter weight plastic, or a combination of materials, colors and additives that are hard to recycle, or are simply not recyclable at all.
- With the best available recycling technology for the current mix of plastics used, the maximum recycling level would only be somewhere between 36% and 53%.⁷
- Even if the global recycling rate were to reach the theoretical best possible rate of 53% by 2050, projections for overall increase in plastic production mean the amount of non-recycled plastic polluting the environment would still double.⁸

New Plastic Kills Recycled Plastic Economy

- Overproduction of virgin plastic leads to low market prices, particularly as prices don't factor in the externalities of plastic production, such as climate impacts and pollution from oil and gas extraction.
- Low virgin plastic prices outcompete recycled plastic, and there are no mechanisms in place to ensure manufacturers will use recycled plastic content in their products.

Bad waste management undermines recycling

- Incineration, "waste-to-energy," and "plastic-to-fuel" methods compete with recycling, and undermine plastic reduction efforts. These forms of waste treatment are a one-way use of fossil fuels and plastic, whereas any recycling that does happen replaces virgin plastic production.

Only 9% of all plastic ever discarded since 1950 has been recycled, and the rest became pollution...

The Human Cost of the Global Plastic Waste Trade

The livelihoods of millions of people worldwide depend on collection and recycling systems. Wealthier societies like the US and Europe tend to recycle more of their own high-quality plastic domestically and export low-worth plastics to Asia, burdening these countries with the occupational and environmental health hazards that arise from processing these materials. In general, recycling operations are challenged by low plastic quality, competition against cheap virgin plastic, and lack of transparency and accountability for exporters and plastic manufacturers.

Toxicity and Environmental Injustice

- Thousands of chemicals are added to plastics to deliver different characteristics, such as stability, flexibility, and so on. Some are known toxics, risking recycling workers' health.
- In some countries, collection and processing of low-grade plastics for recycling is carried out largely by the informal sector (often called wastepickers and recyclers). Such workers often face no labor or environmental protections and usually only have access to poor quality equipment. This leads to pollution and dangerous conditions.



Transparency problems and double standards in shipping waste

- Exporters often do not know the real fate of the materials they ship or have information on the environmental or social performance of reprocessing facilities.
- Although conditions are improving in some importing countries, when the quality of plastic shipped from global north countries to developing nations is low, some imported plastics will end up in dumpsites, landfills or incinerators or “waste-to-energy” plants, or used as fuel in cement kilns and boilers, polluting regions’ air and water.
- Despite this, many global north countries still count exports towards recycling targets, and the lack of transparency in shipping has even led to shipment of mixed waste misrepresented as recyclables.⁹

An Uncertain Future for Plastics Recycling: Opportunities and Threats

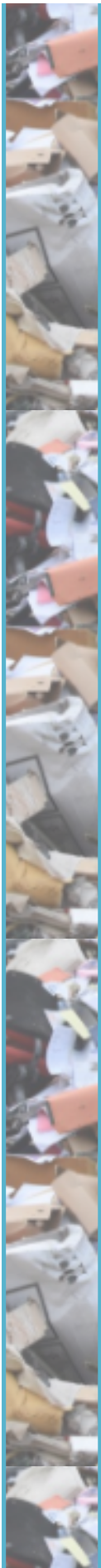
Exporting countries most affected by China’s recent ban are already pursuing alternatives that would create even more plastic pollution, such as burning previously exported plastics in incinerators and cement kilns, shifting recyclables exports to Southeast Asia, and investing in plastic-to-fuel, plastic roads, and

other linear methods. Not only do these approaches pose a danger to human health and the environment, they enable further fossil fuel extraction to produce even more plastics. Underlying all these possibilities is the specter of much more virgin plastic flooding the global marketplace.

Without significant intervention, by 2050 plastic production will represent 15% of the global carbon budget.

Given the scale of the global plastic waste crisis and the immediate issues resulting from China’s ban, bold and innovative thinking is required. We must acknowledge that recycling will never be able to absorb the existing and expanding production of plastics, and while efforts to improve recycling are necessary, the primary emphasis must be on large scale reduction of plastic in the marketplace. The chart on page 5 represents two very different realities: the “best case scenario” which illustrates some of the solutions necessary to prevent plastic pollution, and the worst outcome if we pursue business as usual.





Best Case Scenario	Worst Case Scenario
<p>1. Overall virgin plastic production is greatly reduced</p> <ul style="list-style-type: none"> • Goods in marketplace are accessible to the public and industrial consumers without single use plastic. • All plastic in the marketplace is designed to be nontoxic and reusable, with very limited exceptions. 	<p>1. Virgin plastic production exponentially increases</p> <ul style="list-style-type: none"> • Retailers increase the amount of plastic packaged goods in the marketplace, and consumers have few opportunities to choose products without plastic packaging. • Companies exponentially increase the production of no-value plastic designed with additives, mixed materials, and other components that impede recycling.
<p>2. Significant measures are taken to reduce pollution caused by existing plastic</p> <ul style="list-style-type: none"> • Incineration in any form is discredited as a plastic waste management technique. • Corporate liability policies hold companies accountable for the pollution they have created and the environmental and human health harm they cause. 	<p>2. Lack of accountability and poor waste management worsens pollution</p> <ul style="list-style-type: none"> • There is increased reliance on incineration, plastic-to-fuel, and other false solutions, causing air and land pollution. • Without fear of accountability, companies continue to pollute countries with increasing amounts of single-use, virgin plastic packaging.
<p>3. Any continued plastic recycling meets higher environmental and social standards</p> <ul style="list-style-type: none"> • Wastepickers and informal recyclers have the power to improve materials management, and to integrate into changing systems such as future delivery, with training for new roles. • To prevent countries from being a dumping ground for poorly sorted waste and unrecyclable plastics, plastic waste exports are restricted and ultimately eliminated, and domestic recycling capacity increases. 	<p>3. Burden of plastic recycling processing shifts to countries in Southeast Asia and other regions</p> <ul style="list-style-type: none"> • Companies continue to make low-value materials that fail to support wastepicker livelihoods and expose them to harm. New infrastructure investments displace wastepickers, destroying livelihoods. • Plastic waste exports continue, creating new dumping grounds in other parts of Asia like Vietnam, Cambodia, and Indonesia and exposing those countries to human health impacts and environmental degradation. <p>5</p>

China's Wake-up Call

China's ban could prove to be a turning point in the history of plastics, either for the better if we act wisely, or with devastating consequences if we do not. While the threat that plastic poses to the ocean is well known, the plastic pollution problem is also inexorably bound to the fate of our climate and threatens irreversible contamination of seafood and drinking water (through microplastics), making the crisis an even greater priority. Already, some city governments, policy leaders,

businesses and citizens are finding their own solutions to plastic overproduction, evidenced by the success of bans and fees on plastic bags and styrofoam, the rise of reusable bottles and other items, and innovative redesign of products and packaging. The message that China is sending us is that we can't continue to ship our plastic problem away, committing environmental injustice in the process. By confronting industry's plastic addiction without using recycling as a crutch, we can work towards meaningful plastics reduction.

Explore the map of plastic recycling flows between countries here:

<http://tabsoft.co/2mSiiW3>

For more information, go to no-burn.org.



#breakfreefromplastic

BALIFOKUS



CHINA ZERO WASTE ALLIANCE

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⁸Calculation made taking global plastic production by 2015 and projections for 2050, and comparing with a 18% recycling rate by 2015 and a 53% recycling rate by 2050.

⁹ <https://www.rappler.com/newsbreak/iq/188654-timeline-canada-garbage-philippines>, accessed January 12, 2018.

NOTE FROM THE EDITORS OF SUSTAIN MAGAZINE:

Putting your bottles and paper into your blue recycling bin is just the first step in the recycling process. From there, the materials are then sorted and sold to manufacturing facilities as a feedstock for new products. This is how recycling works as a business: your recycler collects these materials and then sells them to manufacturers. It's both supply and demand.

Plastics are generally recycled at much lower rates than other materials because they are costly to collect and separate, and they are low in value. This means recyclers spend lots of money to collect them and get paid very little, if anything, in return.

For the past decade or more, the U.S has relied on cheap labor in China to recycle plastics at a lower cost, but over the past few years, China has been increasingly ratcheting down on the quantity and quality of materials it accepts from the U.S. In 2017, very strict import restrictions were put in place very quickly that left many U.S. recyclers struggling to find places to recycle their materials and sent prices for recycled materials plummeting.

This market turmoil is due in some part to poor practices by U.S. recyclers and many see it as an overdue course correction. As a result, we are seeing a renewed commitment to build domestic manufacturing plants for recyclable materials and efforts to increase education around what is recyclable in order to reduce contamination and help programs run more effectively.

However, as this issue showcases, the problems with plastics are more complicated and pervasive. This article reflects a larger movement in the recycling and environmental community that's starting to ask some fundamental questions about the future of plastics. Many are saying that we don't have a plastics recycling problem—we have a plastics problem. It's not to say that recycling doesn't work. It's asking whether it's enough, or even the right approach to manage the scale of the issues.

Plastic Pollution: How YOU can make a BIG difference

by Kate Bailey and Kate Nelson, Eco-Cycle



This entire magazine issue is bursting with evidence that the time has come to reinvent our world without disposable, single-use plastics. While this seems like a daunting task, the good news is that there is a full-scale movement underway! Organizations are working at every level—local, regional, national, and global—to empower individuals and policymakers to move toward a future free of plastic pollution, and we’ve heard from many of these leading groups throughout this issue. Now that you’re all fired up, let’s talk about how we can each make a difference, in our own lives and our communities and beyond.

Just by changing a few simple habits as individuals, we can greatly reduce our consumption and disposal of plastics. By starting with our own lives, we raise our personal awareness of when and how we encounter plastics. This is an essential starting point—only when we understand the part we play as individuals in the use and disposal of plastics will we be empowered to change the larger system.

But like many environmental and social movements, change is about a lot more than just individual action. We also need to engage our local communities and implement new widespread policies, programs and infrastructure for a Zero Waste future. This article will cover some top tips for avoiding plastic pollution in your individual life, and then help you amplify your impact as a catalyst for change in your community.

A Place to Start: Reduce, Reuse, Recycle

It’s no surprise that a great place to start is with the 3R’s: Reduce, Reuse, and Recycle. These cornerstones of environmental stewardship have stood the test of time for a reason: they are a simple and effective formula to address unnecessary waste and pollution. But unfortunately, we tend to put most of our efforts on the last step—recycling—and not enough effort into

waste prevention. To really emphasize the importance of waste reduction, we (along with many others) like to add another “R” to the beginning for “Refuse.” Now we have the power to make a choice to reject wasteful products from the start, and that’s where the environmental benefits really start to add up.

Let’s move through these 4R’s and see how you can adopt some simple steps that can quickly become lifelong habits.

Refuse: Make it a habit to refuse single-use plastics and other disposable products.

Going plastic-free can sound daunting, so focus first on the top five disposables to avoid:

Here are some tips for saying “No.”

- Request “no straw” as soon as you order your drinks at a restaurant.
- Let a restaurant know you don’t need a plastic bag, plastic utensils or condiment packets when you order food for take-out.
- Refuse disposable coffee cups by requesting your coffee be served in a mug or glass “for here” or present your reusable mug when you order.
- If plastic polystyrene foam (often called Styrofoam) take-out containers are on the menu, take your business elsewhere (or supply your own containers). And be sure to ask the staff if they’ll consider safer alternatives.



Each of us can amplify our individual impact by reaching out to our friends, family, co-workers, neighbors and more.



TOP 5 THINGS TO REDUCE AND REFUSE



- A travel coffee mug and reusable water bottle
- Reusable shopping totes
- Reusable produce bags

Recycle + Compost: When you can't avoid packaging, look for alternatives to plastic that can be reused and infinitely recycled or composted.

- Get familiar with your community's recycling guidelines to understand which plastics are most recyclable and which to avoid. In general, most programs accept plastic bottles, tubs, jugs and jars. Other shapes and packaging are generally not included.

Reduce: When shopping, look for products that are made to last and have little-to-no packaging

- Eliminate the need for plastic produce bags for loose fruits and vegetables by bringing reusable bags or using no bag at all.
- Buy bulk foods, liquids, cleaners and much more using your own refillable containers. An easy place to start is to swap out your shower gel for soap bars sold without wrappers.
- Make your next party a Zero Waste event with reusable plates and flatware. With a little planning, you can avoid the post-party trash can full of disposable plates, cups, and plastic utensils.
- Say no to fast-fashion. Cheap, flimsy clothing is designed for disposal and usually made from synthetic material that will shed microfibers in the wash (see article p. 25 for more on plastic microfibers). Instead, invest in high-quality clothes and look for natural fibers like wool, linen, and cotton.

Reuse: Compile a Zero Waste "to-go" kit so that you're prepared to avoid single-use plastics.

Include these items in your kit:

- Metal utensils and a cloth napkin
- A food container for take-out

- Choose less toxic and more recyclable plastics such as #1, #2 and #5 plastics. Check out this handy "Pocket Guide to Plastics" at www.ecocycle.org/plastics-recycling.

- Don't participate in "wish-cycling." With the best of intentions, many of us have tossed an item into the recycling bin that we aren't sure is recyclable. When non-recyclable items end up in the recycling bins, it causes contamination, and an overly-contaminated stream can end up in the landfill.
- Do not compost plastic-coated paper products like plates, cups or milk cartons to avoid pollution from microplastics (see article p.33). Learn more about how to recycle milk and juice cartons at www.recyclecartons.com

TOP 5 MUST HAVES FOR REUSE





Most importantly, don't forget that reducing your plastic use is a lifestyle change—it won't always be easy and it doesn't have to happen overnight. Don't lose heart if you forget to bring your reusable bags to the store or find your take-out order surrounded by extra utensils, condiment packets and napkins. The important thing is that you are committed to learning more about the issue and are taking action. Focus on what you CAN do, because our collective efforts really do make a meaningful difference.

Going bigger: Your “Sphere of Influence”

Changing our individual behavior is the first step toward a future free from plastic pollution, but if we focus only on our own lives, we're missing a bigger opportunity. The next step is to amplify your impact through your personal network and community. We're talking about your school, your workplace, your neighborhood, your church, your local restaurants, etc.—all the places you go that make up your community. We call this your “sphere of influence” because you have the power to make change in these places, and it's easier than you think. Here are a few ideas for getting started:

At work:

- Install bulk snack dispensers in the break room instead of individually packaged snacks from vending machines, or stick to low-waste snacks like whole fruit.
- Make sure there is a recycling bin next to every trash can so people can easily choose to do the right thing.

At church:

- Switch to ceramic mugs at the coffee station and ditch the sugar packets for bulk sugar and milk containers.

At school:

- Host a “waste-free lunch” contest that focuses on reusable containers instead of disposable packages. Encourage a friendly competition to see which grade or class can leave the least amount of waste in the cafeteria trash can.

On campus:

- See the article on p. 40 for more on a plastic-free campus



From climate change to plastics in the ocean, there is an urgency to our environmental, social and economic challenges that calls to each of us to move beyond just changing our behavior as individuals and to get more involved with our community decision making. Community groups are the vehicle to push for larger change.

In the community:

- Ask your town to install a water bottle filling stations in public places like the library, recreation center and ball fields to reduce the use of single-use bottled water.
- Talk to your favorite restaurant about instituting an “only by request” policy for straws. Download a toolkit at www.strawlessocean.org.

Most important of all, use the power of your voice whenever you see a solution to reduce waste: Write to companies with wasteful packaging, talk to local businesses and neighbors about the issue, share your concerns over social media, and support non-profit groups working to reduce plastic waste and pollution.

Even bigger: Sparking Change with Community Policies

After you have started a buzz in your sphere of influence, now is the time to engage with fellow citizens and public officials to influence government policies from the ground up. Many cities, and even entire countries, are proving that fundamental policy changes are possible. So how do you go from one person carrying your own reusable bags to banning plastic bags in your town? It's all about the power of community groups, and you're already well on your way.

Three really cool things start to happen when you engage your sphere of influence:

- You are collectively using fewer plastics and really making a larger contribution to a cleaner, healthier environment.



- You are creating success stories about how it can be done at businesses, schools and throughout the community. These real, on the ground experiences help to prove that it's working and more places can come on board.
- You are meeting lots of great folks in your community who care about these issues and want to do more. In fact, you're building a community of concerned citizens that has big ideas to share with others.

Now, all it takes is a bit of strategic organizing to form a group that can initiate policy changes at the local level. Community groups are most effective when they work closely with local government leaders, like the city council, to find solutions that make sense for their individual locale. Here are two great resources to help you take it to the next level:

- Eco-Cycle offers a free **Community Organizing Guide for Zero Waste** that walks concerned citizens step-by-step through the process of organizing and empowering a community group. See ecocyclesolutionshub.org/take-action/community-organizing-for-zero-waste.
- Story of Stuff offers a free online training course called **Your Citizen Muscle Bootcamp**: bootcamp.storyofstuff.org.

While disposable plastic use may feel pervasive right now, you are part of a global movement of people who want change. It starts with individuals taking personal responsibility for their impacts and culminates in local and global communities rewriting our policies to protect our health and our environment. You have an important role to play at every step in the process. Let's do it!

About the authors

Kate Bailey is the Policy and Research Director for Eco-Cycle, based in Boulder, Colorado. Eco-Cycle is one of the largest nonprofit recycling organizations in the world and the organization has more than 40 years of hands-on experience in creating Zero Waste community infrastructure, policies and programs. Kate works directly with local citizens and governments in Colorado and beyond to implement Zero Waste systems, and is a frequent keynote speaker on Zero Waste as a critical climate solution.

Kate Nelson, born and raised in Louisville, KY, first started spreading Zero Waste ideas in high school classrooms as an educator with Eco-Cycle. Now as part of the Eco-Cycle Solutions team, she sees firsthand how the no-waste concepts once considered futuristic are becoming the norm in communities around the world.

Never doubt that a small group of thoughtful, committed citizens can change the world; indeed, it's the only thing that ever has.

— Margaret Mead

