

How Recycling Works

by Ed Grabianowski

Introduction to How Recycling Works

Recycling is a pretty simple concept: take something that isn't useful anymore and make it into something new instead of just throwing it away. It can be anything from recycling old paper into new paper, to making an old hubcap into a decorative birdbath. In reality, recycling can get pretty complex -- how it interacts with our environment, our politics, our economy and even our own human behavior patterns will play a major role in the future of our planet. In this article, we'll look at what recycling is, why and how it works and some criticisms of the practice. **What is Recycling?**

Recycling can take many forms. On a small scale, any time you find a new use for something old, you're recycling. One example is making old cereal boxes into magazine holders.

-Recycling becomes more important on larger scales. At this level, used consumer goods are collected, converted back into raw materials and remade into new consumer products. Aluminum cans, office paper, steel from old buildings and plastic containers are all examples of materials commonly recycled in large quantities, often through municipal programs encouraging bulk household collections.

1. What is recycling, and what are some materials that are commonly recycled? (at least 2 sentences)

It's rare for a recycled product to be exactly the same as the original material from which it was recycled. Recycled paper, for example, contains ink residue and has shorter fibers than virgin paper (paper made from wood pulp). Because of this, it may be less desirable for some purposes, such as paper used in a copy machine. When a recycled good is cheaper or weaker than the original product, it's known as **down-cycling** (or downstream recycling). Eventually, goods move so far down the recycling stream it isn't feasible to recycle them any further. After being recycled a few times, paper is no longer usable. In some cases, goods can be **up-cycled** -- made into something more valuable than the original product. An example of this is a company making upscale, artistic furniture pieces out of old newspapers and aluminum cans.

2. What is down-cycling?

3. What is up-cycling?

Recycling History

Although recycling may seem like a modern concept introduced with the environmental movement of the 1970s, it's actually been around for thousands of years. Prior to the industrial age, you couldn't make goods quickly and cheaply, so virtually everyone practiced recycling in some form. However, large-scale recycling programs were very rare -- households predominantly practiced recycling.

The mass production of the industrial age is, in many ways, the very reason we need to worry about large-scale recycling. When products can be produced (and purchased) very cheaply, it often makes more economic sense to simply throw away old items and purchase brand new ones. However, this culture of "disposable" goods created a number of environmental problems, which we'll discuss in detail in the next section.

In the 1930s and 40s, conservation and recycling became important in American society and in many other parts of the world. Economic depressions made recycling a necessity for many people to survive, as they couldn't afford new goods. In the 1940s, goods such as nylon, rubber and many metals were rationed and recycled to help support the war effort. However, the economic boom of the postwar years caused conservationism to fade from the American consciousness. It wasn't until the environmental movement of the 1960s and 70s, heralded by the first Earth Day in 1970, that recycling once again became a mainstream idea. Though recycling suffered some lean years -- due to public acceptance and the market for recycled goods not growing -- it has generally increased from year to year. The success of recycling traces to wide public acceptance, the improved economics of recycling and laws requiring recycling collections or enforcing recycled content in certain manufacturing processes.

4. Summarize the history of recycling (at least 3 sentences)

Benefits of Recycling

Most of the reasons we recycle are environmental, although some are economic. These include:

Too Much Garbage

One of the main reasons for recycling is to reduce the amount of garbage sent to landfills. Landfill usage peaked in the 1980s, when Americans sent almost 150 million tons (136.08 million metric tons) of garbage to landfills each year. Today, we still dump more than 100 million tons (90.719 million metric tons) of trash into landfills annually. Even though modern sanitary landfills are safer and less of a nuisance than the open dumps of the past, no one likes having a landfill around. In heavily populated areas, landfill space is scarce. Where space is plentiful, filling it with garbage isn't a very good solution to the problem. Today, recycling efforts in the United States divert 32 percent of waste away from landfills. That prevents more than 60 million tons (54.432 million metric tons) of garbage from ending up in landfills every year.

Pollution from Landfill Leachate

Landfills cause another problem in addition to taking up lots of space. The assortment of chemicals thrown into landfills, plus the chemicals that result when garbage breaks down and blends into a toxic soup known as **leachate**, creates huge amounts of pollution. Leachate can drain out of the landfill and contaminate groundwater supplies. Today, impermeable clay caps and plastic sheeting prevent much of this run off, making the landfills much safer than they were just a few decades ago. Still, any leachate is too much if it's draining into your neighborhood.

New Goods Use Up Resources

Making a brand-new product without any recycled material causes natural resources to deplete in the manufacturing process. Paper uses wood pulp from trees, while the manufacture of plastics requires the use of fossil fuels like oil and natural gas. Making something from recycled materials means using fewer natural resources.

Recycling (Sometimes) Uses Less Energy

There's room for debate on this aspect of recycling, but many recycling processes require less energy than it would take to manufacture the same item brand-new. Manufacturing plastic is very inexpensive, and some plastic goods can be difficult to recycle efficiently. In those cases, the recycling process probably takes more energy. It can also be difficult to weigh all the energy costs along the entire chain of production. Recycling steel certainly uses less energy than the entire process of mining iron ore, refining it and forging new steel. Some contend that the fleet of recycling trucks collecting plastic and paper door to door every week in cities across the United States tips the balance of energy out of recycling's favor. Energy use is a factor weighed on a case-by-case basis.

Money

Recycling has a variety of economic impacts. For the companies that buy used goods, recycle them and resell new products, recycling is the source of all their income. For cities in densely populated areas that have to pay by the ton for their landfill usage, recycling can shave millions of dollars off municipal budgets. The recycling industry can have an even broader impact. Economic analysis shows that recycling can generate three times as much revenue per ton as landfill disposal and almost six times as many jobs. In the St. Louis area, recycling generates an estimated 16,000 jobs and well more than \$4 billion in annual revenue.

5. What are the benefits of recycling (at least 3 sentences)?

Recycling Criticisms

Recycling is gaining increased acceptance worldwide, but not everyone agrees that it's the best way to deal with the environmental problems of garbage. There are several criticisms of recycling.

Recycling Causes Increased Environmental Problems

The process of recycling an old product into something reusable uses energy and creates pollution. Critics claim that recycling is simply a zero-sum game, where the pollutants and waste from making new goods shift into the recycling industry. For some types of recycling, this may be true -- the trade-off between new products and some forms of recycled plastic, for example, are questionable. Nevertheless, there are at least as many ways to recycle that offer clear benefits in terms of energy used, natural resources consumed, pollutants released and landfill space used.

There Isn't Really a Garbage Problem

Some claim that there's no "garbage crisis." They say there's plenty of landfill space -- landfills are a safe and simple way to store as much garbage as we need to put there. It's true that there's technically plenty of space in the United States and other countries in which to store our garbage, but the thought of filling valleys and fields with garbage doesn't appeal to many people, and certainly not those who live near those valleys and fields.

Recycling Gives Us a False Sense of Security

This criticism closely ties to the problem of recycling causing its own environmental impact. Because of this impact, recycling only represents a minor improvement over landfills or incineration of garbage. Yet, it makes people feel like they've accomplished something important in protecting the environment. Recycling can also enable an attitude of entitled consumerism -- people feel that it's OK to purchase and use environmentally harmful products like bottled water or plastic diapers because they make up for it by recycling. These views point to the ultimate solution: buy less stuff. Purchasing reusable goods or simply buying fewer things we don't need is the best way to stop the garbage stream at the source.

6. What are some of the criticisms of recycling? (at least 3 sentences)

Why is the world's biggest landfill in the Pacific Ocean?

by Jacob Silverman

Why is the world's biggest landfill in the Pacific Ocean?

In the broad expanse of the northern [Pacific Ocean](#), there exists the North Pacific Subtropical Gyre, a slowly moving, clockwise spiral of currents created by a high-pressure system of air currents. The area is an **oceanic desert**, filled with tiny phytoplankton but few big fish or mammals. Due to its lack of large fish and gentle breezes, fishermen and sailors rarely travel through the gyre. But the area is filled with something besides plankton: trash, millions of pounds of it, most of it plastic. It's the largest **landfill** in the world, and it floats in the middle of the ocean.

The gyre has actually given birth to two large masses of ever-accumulating trash, known as the **Western and Eastern Pacific Garbage Patches**, sometimes collectively called the **Great Pacific Garbage Patch**. The Eastern Garbage Patch floats between [Hawaii](#) and [California](#); scientists estimate its size as two times bigger than [Texas](#) [source: [LA Times](#)]. The Western Garbage Patch forms east of [Japan](#) and west of Hawaii. Each swirling mass of refuse is massive and collects trash from all over the world. The patches are connected by a thin 6,000-mile long current called the **Subtropical Convergence Zone**. Research flights showed that significant amounts of trash also accumulate in the Convergence Zone.

7. What is the Western Pacific Garbage Patch, and where is it located?

The garbage patches present numerous hazards to marine life, fishing and tourism. But before we discuss those, it's important to look at the role of plastic. Plastic constitutes 90 percent of all trash floating in the world's oceans [source: [LA Times](#)]. The United Nations Environment Program estimated in 2006 that every square mile of ocean hosts 46,000 pieces of floating plastic [source: [UN Environment Program](#)]. In some areas, the amount of plastic outweighs the amount of plankton by a ratio of six to one. Of the more than 200 billion pounds of plastic the world produces each year, about 10 percent ends up in the ocean. Seventy percent of that eventually sinks, damaging life on the ocean floor. The rest floats; much of it ends up in gyres and the massive garbage patches that form there, with some plastic eventually washing up on a distant shore.

The Problem with Plastic

The main problem with plastic -- besides there being so much of it -- is that it doesn't **biodegrade**. No natural process can break it down. (Experts point out -that the durability that makes plastic so useful to humans also makes it quite harmful to nature.) Instead, plastic **photodegrades**. A plastic [cigarette](#) lighter cast out to sea will fragment into smaller and smaller pieces of plastic without breaking into simpler compounds, which scientists estimate could take hundreds of years. The small bits of plastic produced by photodegradation are called **mermaid tears** or **nurdles**.

These tiny plastic particles can get sucked up by filter feeders and damage their bodies. Other marine animals eat the plastic, which can poison them or lead to deadly blockages. Nurdles also have the insidious property of soaking up toxic chemicals. Over time, even chemicals or poisons that are widely diffused in water can become highly concentrated as they're mopped up by nurdles. These poison-filled masses threaten the entire [food chain](#), especially when eaten by filter feeders that are then consumed by large creatures. Plastic has acutely affected [albatrosses](#), which roam -a wide swath of the northern Pacific Ocean. Albatrosses frequently grab food wherever they can find it, which leads to many of the birds ingesting -- and dying from -- plastic and other trash. On [Midway Island](#), which comes into contact with parts of the Eastern Garbage Patch, albatrosses give birth to 500,000 chicks every year. Two hundred thousand of them die, many of them by consuming plastic fed to them by their parents, who confuse it for food [source: [LA Times](#)]. In total, more than a million birds and marine animals die each year from consuming or becoming caught in plastic and other debris.

8. What is the main problem with plastic? Explain by summarizing the section above.

Effects of Plastic and the Great Pacific Garbage Patch

Besides killing wildlife, plastic and other debris damage boat and [submarine](#) equipment, litter beaches, discourage swimming and harm commercial and local fisheries. The problem of plastic and other accumulated trash affects beaches and oceans all over the world, including at both poles. Land masses that end up in the path of the rotating gyres receive particularly large amounts of trash. The 19 islands of the Hawaiian [archipelago](#), including Midway, receive massive quantities of trash shot out from the gyres. Some of the trash is decades old. Some beaches are buried under five to 10 feet of trash, while other beaches are riddled with "plastic sand," millions of grain-like pieces of plastic that are practically impossible to clean up. Most of this trash doesn't come from seafaring vessels dumping junk -- 80 percent of ocean trash originates on land [source: [LA Times](#)]. The rest comes from private and commercial ships, fishing equipment, [oil platforms](#) and spilled shipping containers (the contents of which frequently wash up on faraway shores years later).

Some efforts can help to stem the tide of refuse. International treaties prohibiting dumping at sea must be enforced. Untreated [sewage](#) shouldn't be allowed to flow into the ocean. Many communities and even some small island nations have eliminated the use of plastic bags. These bags are generally recyclable, but billions of them are thrown away every year. On the Hawaiian Islands, cleanup programs bring volunteers to the beaches to pick up trash, but some beaches, even those subjected to regular cleanings, are still

covered in layers of trash several feet thick.

Scientists who have studied the issue say that trawling the ocean for all of its trash is simply impossible and would harm plankton and other marine life. In some areas, big fragments can be collected, but it's simply not possible to thoroughly clean a section of ocean that spans the area of a continent and extends 100 feet below the surface [source: [UN Environment Program](#)].

Nearly all experts who speak about the subject raise the same point: It comes down to managing waste on land, where most of the trash originates. They recommend lobbying companies to find alternatives to plastic, especially environmentally safe, reusable packaging. Recycling programs should be expanded to accommodate more types of plastic, and the public must be educated about their value.

9. What are the effects of the plastic and the great garbage patch?

10. What efforts can/can't be made to help address this problem?

In October 2006, the U.S. government established the Northwestern Hawaiian Islands Marine Monument. This long string of islands, located northwest of Hawaii, frequently comes into contact with the Eastern Garbage Patch. After the creation of the monument, Congress passed legislation to increase funding for cleanup efforts and ordered several government agencies to expand their cleanup work. It may be an important step, especially if it leads to more government attention to a problem that, while dire, has only received serious scientific attention since the early 1990s.

Growing Problem Of E-Waste: Bringing Harmony To Electronic Waste Disposal

ScienceDaily (Sep. 4, 2009)

— Disposal and recycling standards for old computer equipment and other electronic waste must be harmonized for this rapidly growing problem to be dealt with effectively across national borders. An analysis of the current rules and regulations is reported in the latest issue of the International Journal of Environmental Engineering.

Sunil Herat, a senior lecturer in waste management at Griffith University, Queensland, Australia, explains that different policies are being developed worldwide to deal with e-waste. This, he says, could lead to new problems as the waste stream grows as any unscrupulous companies charged with recycling or disposing of electronic goods exploit loopholes in regional legislation. The European Union's Directives on Waste Electrical and Electronic Waste (WEEE) and Restriction of Hazardous Substances (RoHS) have paved the way for controls while China, Japan, Korea, and some US states have adopted similar laws. The United Nations through the Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal adopted the Nairobi declaration on e-waste in 2006, but there are still countless issues to be addressed.

Used electronic equipment, including computers, cell phones, and TVs has become one of the fastest growing waste streams across the globe. There is even evidence that developing nations are increasingly reluctant to accept electronic equipment that is considered obsolete in the West. This is not surprising given the complex mix of often toxic materials from which modern electronic devices are made and the rapid descent into total obsolescence for most devices.

Indeed, Herat explains, 20 to 50 million tons of e-waste are generated across the globe each year bringing with it significant risks to human health and the environment. It is estimated that a billion computers could be deemed obsolete each decade from now on and that number may grow as technology advances and more devices are developed.

The disparate policies that are being implemented on a state, national, and federal basis relating to the management of e-waste will, to some extent, help to combat the problem. However, worldwide there remains an urgency to deal with e-waste so that regions do not become dumping grounds for what is essentially a toxic and potentially intractable waste stream.

Herat has reviewed the various legal frameworks being established in different parts of the world and now emphasizes that the only way forward is to find a way to harmonize and unify these different approaches and to ensure that the Basel Convention is enforced and extended.

11. What is e-waste
12. How much e-waste is generated in the world each year?
13. How is e-waste harmful or dangerous?