

Global Plastic Production Rises, Recycling Lags

Gaelle Gourmelon | January 27, 2015

For more than 50 years, global production of plastic has continued to rise.¹ Some 299 million tons of plastics were produced in 2013, representing a 3.9 percent increase over 2012's output.² With a market driven by consumerism and convenience, along with the comparatively low price of plastic materials, demand for plastic is growing.³ Recovery and recycling, however, remain insufficient, and millions of tons of plastics end up in landfills and oceans each year.⁴

Plastics are human-made materials manufactured from polymers, or long chains of repeating molecules.⁵ They are derived from oil, natural gas, and—while still a small portion of overall production—increasingly, from plants like corn and sugarcane.⁶ About 4 percent of the world's petroleum is used to make plastic, and another 4 percent is used to power plastic manufacturing processes.⁷

First invented in the 1860s but developed for industry in the 1920s, plastic production exploded in the 1940s, becoming one of the fastest-growing global industries.⁸ From 1950 to 2012, plastics growth averaged 8.7 percent per year, booming from 1.7 million tons to the nearly 300 million tons of today.⁹ Worldwide production continued to grow between the 1970s and 2012 as plastics gradually replaced materials like glass and metal.¹⁰ Metal, glass, and paper are increasingly replaced by plastic packaging, particularly for foods. By 2009, plastic packaging accounted for 30 percent of packaging sales.¹¹ With the push by U.S. federal mileage standards to reduce the weight of vehicles, the American automobile industry has been a champion of this transition too. Plastics make up about 10 percent by weight (50 percent by volume) of a typical U.S. vehicle today, representing 336 pounds of plastic per vehicle.¹² In 1960, less than 20 pounds of plastic were used in cars.¹³ Plastics now often replace metals in bumpers and door panels as well as in engine components.

The global plastic industry generates revenue of about

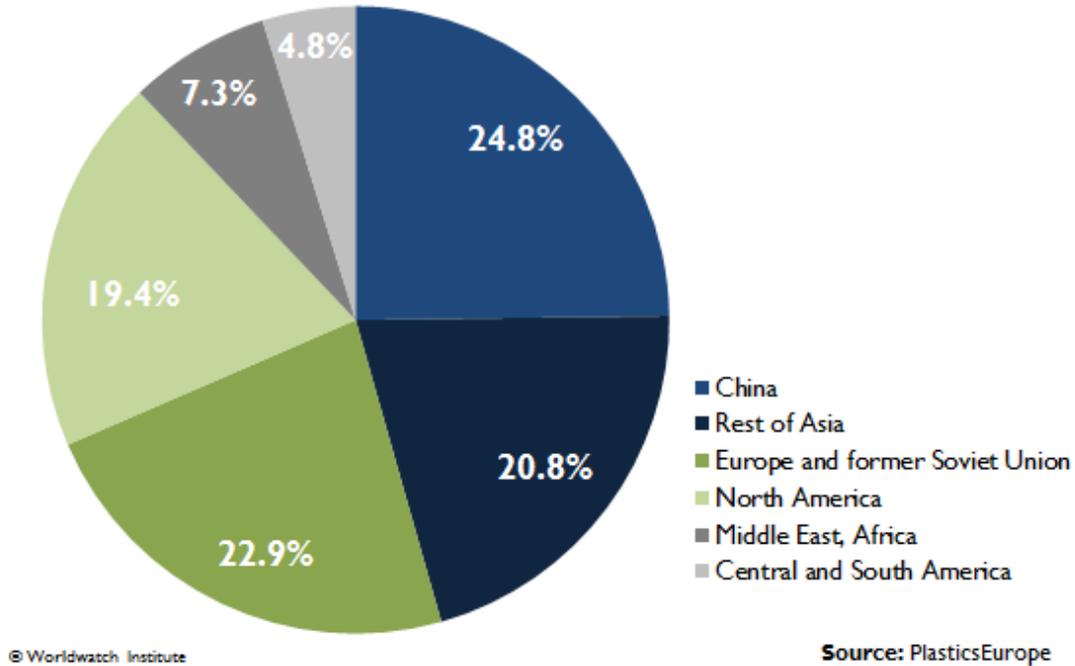
\$600

billion annually

Today the global plastic industry generates revenue of about \$600 billion annually.¹⁴ Plastics are found throughout many sectors and industries, including transportation, construction, health care, food products, telecommunications, and consumer goods.¹⁵ Per capita plastic consumption reached 100 kilograms (kg) in Western Europe and North America.¹⁶ Asia currently uses just 20 kg per person, but this figure is expected to grow rapidly.¹⁷

Plastics production is also shifting toward Asia. The region produced 45.6 percent of global plastics in 2013, with China alone producing nearly a quarter of the world's plastic.¹⁸ (See Figure 1.) China surpassed Europe in plastics production in 2010.¹⁹ India has recently seen strong growth in plastic production due to an increasing population and the growth of manufacturing sectors in the country.²⁰ Today, Europe and the states emerging from the former Soviet Union account for 22.9 percent of global plastic production, with Germany leading European production. North America, led in large part by the United States,

Figure 1. | **World Production of Plastic Materials by Region, 2013**



produces 19.4 percent of global plastic.²¹ The Middle East and Africa (7.3 percent) and Central and South America (4.8 percent) have the smallest global shares of production.²²

Packaging is responsible for the majority of plastic use, representing 40 percent of demand in Europe and 42 percent in the United States.²³ (See Figure 2.) Consumer and household products (like appliances, toys, plastic cutlery, and furniture) account for the next most significant segment, closely followed by the building and construction sector.²⁴ Within the United States, the largest consuming industries are construction (which uses plastic products like pipes, window and door frames, roofing, and siding) and the food and beverage industry (which uses products like plastic bottles, containers, and film).²⁵

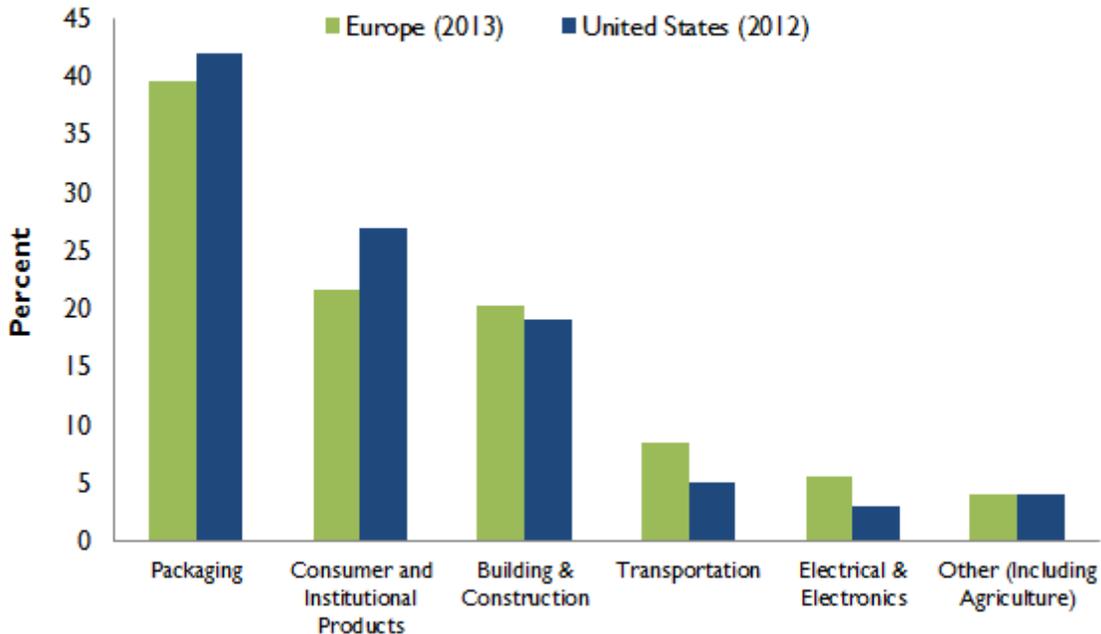
Between 22 and 43 percent of plastic worldwide is disposed of in landfills, where its resources are wasted, it takes up valuable space, and it blights communities.²⁶ Recovering plastic from the waste stream for recycling or for energy has the potential to minimize these problems.²⁷ However, much of the plastics collected for recycling is shipped to countries with lower environmental standards, making the balance between environmental protection, clean material cycles, and resource use unstable. Further, energy recovery from plastics is often inefficient, requires air emissions controls, and produces hazardous ash.²⁸ Actual rates of recovery vary widely across countries.

22-43%

of plastic worldwide is disposed of in landfills

In Europe, 26 percent, or 6.6 million tons, of post-consumer plastic produced in 2012 was recycled, while 36 percent was incinerated for energy recovery.²⁹ This means that 38 percent of post-consumer

Figure 2. | **Plastic Use Sectors in Europe and the United States**



© Worldwatch Institute

Source: PlasticsEurope; American Chemistry Council

plastics in Europe went to landfills.³⁰ This represents a 26 percent decrease in plastics ending up this way compared with 2006, but nearly half of all European countries still send the majority of their plastic waste to landfills.³¹ Nine European countries—Austria, Belgium, Denmark, Germany, Luxembourg, Netherlands, Norway, Sweden, and Switzerland—have enacted landfill bans for plastics.³² While these countries do generally achieve higher recycling rates than countries with no landfill bans, a majority of plastic is disposed of through incineration for energy recovery.³³

In the United States, only

9%

of plastic was recycled in 2012

In the United States, only 9 percent of plastic (2.8 million tons) was recycled in 2012.³⁴ The remaining 32 million tons were discarded, accounting for nearly 13 percent of the nation’s municipal solid waste stream.³⁵ The United States depends mostly on China and Hong Kong to absorb its plastic waste, although some is sent to Canada and Mexico.³⁶

In other parts of the world, recovery of plastics is even lower. The United Nations Environment Programme estimates that 57 percent of plastic in Africa, 40 percent in Asia, and 32 percent in Latin America is not even collected, being instead littered or burned in the open.³⁷

The largest waste plastics exporters are the United States, followed by Japan, Germany, and the United Kingdom.³⁸ Europe exports about half of the plastics it collects for recycling and is the largest global exporter of waste plastic intended for recycling.³⁹

China receives

56%

of waste plastic
imports worldwide

Most plastic scraps from western countries with established collection systems flow to China, which receives 56 percent (by weight) of waste plastic imports worldwide.⁴⁰ What happens to all this imported plastic once it gets there is not well understood, however.⁴¹ The International Solid Waste Association reports that indirect evidence suggests the majority of plastic is still being reprocessed using family-run, low-tech businesses with no environmental protection controls.⁴² There are also concerns that low-quality plastics are not reused but are disposed of or incinerated for energy recovery in plants without air pollution control systems.⁴³ Through its 2010 Green Fence Operation, the Chinese government has started to work to reduce unregulated facilities.⁴⁴

Europe depends on China for 87 percent of its plastic waste exports intended for recycling.⁴⁵ This leaves the global plastics recycling market highly vulnerable to market changes in China, as was shown by recent quality control implementations by China's customs (implementing a "zero tolerance" policy for contamination levels in imports), which resulted in a crash in the price of secondary raw materials.⁴⁶

Approximately 10–20 million tons of plastic end up in the oceans each year.⁴⁷ Including financial losses by fisheries and tourism as well as time spent cleaning beaches, \$13 billion a year is lost in environmental damage by plastics to marine ecosystems.⁴⁸ Marine wildlife is particularly vulnerable to plastic pollution.⁴⁹ Animals such as seabirds, whales, and dolphins can become entangled in plastic matter.⁵⁰ Floating plastics—like discarded nets, docks, and boats—transport microbes, algae, invertebrates, and fish into non-native regions.⁵¹

Approximately

10-20

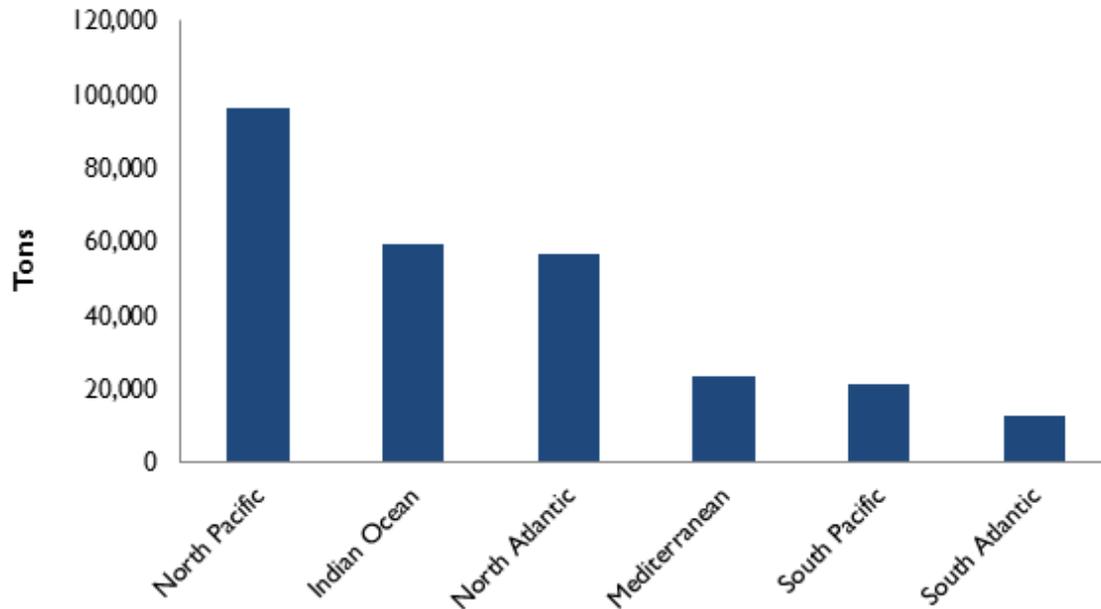
million tons of plastic
ends up in the oceans
each year

Once in the ocean, plastic does not go away. It breaks down into small pieces that are ingested by sea life and transferred up the food chain, carrying chemical pollutants from prey to predator.⁵² A recent study conservatively estimated that 5.25 trillion plastic particles weighing 268,940 tons are currently floating in the world's oceans.⁵³ Because plastics are moved with wind and currents, very few areas in the ocean may have escaped plastic pollution.⁵⁴ The North Pacific gyre contains the most, with nearly 2 trillion pieces of plastic weighing over 96,000 tons.⁵⁵ (See Figure 3.) In the southern hemisphere, the Indian Ocean has more plastic pollution than the South Pacific and South Atlantic combined do.⁵⁶

The environmental and social benefits of plastics must be weighed against the problems that its durability and incredible volume worldwide constitute as a waste stream.⁵⁷ Plastics help to reduce food waste by keeping products fresh longer, allow for the manufacture of health care equipment, reduce packaging mass compared with other materials, improve transportation efficiency, and have large potential for renewable energy technologies.⁵⁸ But plastic litter, gyres of plastics in the oceans, and toxic additives in plastic products—such as colorings, flame retardants, and plasticizers—are raising awareness and strengthening consumer demand for more-sustainable materials.⁵⁹

Along with reducing unnecessary plastic consumption, finding more environmentally friendly packaging alternatives, and improving product and packaging design to use less plastic, many challenges associated with plastics could be addressed by improving management of the material across its lifecycle.⁶⁰ Businesses and consumers could increase their participation in collection in order to move plastic waste toward a recycling or recovery supply chain. Companies could switch to recycled plastics, using joint ventures to ensure supply.⁶¹ They could also investigate options for using bioplastics—plastics that are partly or fully biobased, biodegradable, or both—although the benefits

Figure 3. | **Plastic Pollution in the World's Oceans, 2014**



© Worldwatch Institute

Source: Marcus Eriksen et al., 2014

and impacts of these products are currently unknown.⁶² Governments must regulate the plastic supply chain to encourage recycling, and consortia must coordinate and monitor the supply chain and provide guidelines for plastic waste processing, especially in developing economies.⁶³ As the economy and population grow, global demand for plastic is expected to continue to grow—especially in Africa, Latin America, the Middle East, and China.⁶⁴ Immediate action is needed to handle today's and tomorrow's plastic problem.

Gaëlle Gourmelon is the Communications and Marketing Manager at the Worldwatch Institute.

Vital Signs Online provides business leaders, policymakers, and engaged citizens with the latest data and analysis they need to understand critical global trends. Subscribe now for full access to hard data and research-based insights on the sustainability trends that are shaping our future.

Worldwatch Institute
1400 16th St., NW, Suite 430
Washington, DC 20036
Phone: 202.745.8092
vitalsigns.worldwatch.org

Global Plastic Production Rises, Recycling Lags

¹ PlasticsEurope, *Plastics—The Facts 2014: An Analysis of European Plastics Production, Demand and Waste Data* (Brussels: 2014).

² Ibid.

³ U.N. Environment Programme (UNEP), *Valuing Plastics: The Business Case for Measuring, Managing and Disclosing Plastic Use in the Consumer Goods Industry* (Nairobi: 2014).

⁴ Ibid.

⁵ Germany Trade & Invest, *Industry Overview: The Plastics Industry in Germany* (Berlin: 2014); PlasticsEurope, op. cit. note 1; American Chemistry Council, Economics and Statistics Department, *Plastic Resins in the United States* (Washington, DC: 2013).

⁶ American Chemistry Council, op. cit. note 5.

⁷ The European House—Ambrosetti, *The Excellence of the Plastics Supply Chain in Relaunching Manufacturing in Italy and Europe* (Milan: 2013); UNEP, op. cit. note 3.

⁸ American Chemistry Council, op. cit. note 5.

⁹ PlasticsEurope, op. cit. note 1; European House—Ambrosetti, op. cit. note 7.

¹⁰ American Chemistry Council, op. cit. note 5.

¹¹ World Packaging Organization, *Market Statistics and Future Trends in Global Packaging* (Naperville, IL: 2009).

¹² American Chemistry Council, Economics and Statistics Department, *Plastics and Polymer Composites*

in Light Vehicles (Washington, DC: 2014).

¹³ Ibid.

¹⁴ First Research, *Plastic Resin & Synthetic Fiber Manufacturing Industry Profile* (Austin, TX: 2014).

¹⁵ European House—Ambrosetti, op. cit. note 7.

¹⁶ Germany Trade & Invest, op. cit. note 5.

¹⁷ Ibid.

¹⁸ PlasticsEurope, op. cit. note 1.

¹⁹ European House—Ambrosetti, op. cit. note 7.

²⁰ Ibid.

²¹ PlasticsEurope, op. cit. note 1; American Chemistry Council, op. cit. note 5.

²² PlasticsEurope, op. cit. note 1.

²³ Ibid.; American Chemistry Council, op. cit. note 5.

²⁴ PlasticsEurope, op. cit. note 1; American Chemistry Council, op. cit. note 5.

²⁵ American Chemistry Council, op. cit. note 5.

²⁶ UNEP, op. cit. note 3.

²⁷ Ibid.

²⁸ Ibid.

²⁹ PlasticsEurope, op. cit. note 1.

³⁰ Ibid.

³¹ Ibid.

³² Ibid.

³³ Ibid.

³⁴ U.S. Environmental Protection Agency, *Plastics* (updated 2014), at www.epa.gov/osw/conserves/materials/plastics.htm.

³⁵ Ibid.

³⁶ Costas Velis, *Global Recycling Markets: Plastic Waste; A Story for One Player—China* (Vienna: International Solid Waste Association, 2014).

³⁷ UNEP, op. cit. note 3.

³⁸ Velis, op. cit. note 36.

³⁹ Ibid.

⁴⁰ Ibid.

-
- ⁴¹ Ibid.
- ⁴² Ibid.
- ⁴³ Ibid.
- ⁴⁴ Ibid.
- ⁴⁵ Ibid.
- ⁴⁶ Ibid.
- ⁴⁷ UNEP, op. cit. note 3.
- ⁴⁸ Ibid.
- ⁴⁹ Ibid.
- ⁵⁰ Marcus Eriksen et al., "Plastic Pollution in the World's Oceans: More than 5 Trillion Plastic Pieces Weighing over 250,000 Tons Afloat at Sea," PLOS ONE, 10 December 2014.
- ⁵¹ Ibid.
- ⁵² UNEP, op. cit. note 3.
- ⁵³ Eriksen et al., op. cit. note 50.
- ⁵⁴ UNEP, op. cit. note 3.
- ⁵⁵ Eriksen et al., op. cit. note 50.
- ⁵⁶ Ibid.
- ⁵⁷ UNEP, op. cit. note 3.
- ⁵⁸ Ibid.
- ⁵⁹ Clean Production Action, *Plastics Scorecard v 1.0: Evaluating the Chemical Footprint of Plastics* (Somerville, MA: 2014).
- ⁶⁰ UNEP, op. cit. note 3.
- ⁶¹ Ibid.
- ⁶² Ibid.
- ⁶³ European House–Ambrosetti, op. cit. note 7.
- ⁶⁴ Ibid.