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CASE STUDY: MARINE PLASTIC DEBRIS AND SOLID WASTE MANAGEMENT IN PERU

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Introduction

The negative impact of plastic debris on marine ecosystems and species is a global challenge. While the causes vary by region, most scientists agree that poor solid waste management is a leading factor. This is particularly true in the developing world, where infrastructure has not kept pace with economic growth. For the past several years, a range of public and private sector partners in Peru have worked to improve solid waste management—for human well-being and to reduce threats to marine ecosystems. Their work offers insight into effective strategies while also illuminating gaps in key data on the impact of plastic pollution on marine biodiversity. This case study includes a look at the challenges facing Peru, the strategies undertaken to date, and the types of additional data and interventions required to address this global issue at the local and national level.

The Global Challenge

Plastic debris is a persistent and ubiquitous global issue threatening marine life throughout the world's oceans (Thevenon, Carroll and Sousa 2014; Jambeck, et al. 2015; Boucher and Friot 2017; The CADMUS Group 2018). Global plastic production has increased significantly, with more than 300 million metric tons of plastics currently produced annually, compared to 1.5 million metric tons in 1950 (Boucher and Friot 2017). As plastic consumption increases, so does solid waste and, ultimately, marine debris. Currently, plastic debris can be found in a wide range of sizes: from nanoplastics and microplastics, such as the ones used in synthetic textiles and tires (Ibid), to macroplastics, such as plastic bags.

A significant portion of marine plastic pollution is generated inland and transported to the coastal areas through rivers (Lebreton et al. 2017) and runoff (Boucher and Friot 2017). Industrial fisheries also contribute to marine plastic debris (Luna-Jorquera et al. 2019). On a global scale, the most significant polluting rivers are located in Asia (Lebreton, et al. 2019). Rivers in South America account for an estimated 4.8 percent of the river mass plastic input to the oceans (Ibid).

Most plastic debris remains near coastal areas for years, degrading ecosystems key to economic and human health. Over time, debris can be degraded and transported by ocean currents to open waters and gyres, where



particles accumulate and create “garbage patches” (Lebreton, Egger, and Slat 2019; Thiel, et al. 2018). Plastics in the South Pacific Subtropical Gyre (SPSG) largely originate from debris in the coastal waters of the Humboldt Current, spanning across the coast of Chile and Peru (Thiel, et al. 2018). Marine protected areas located near the five oceanic gyres and garbage accumulation points are at risk of receiving large amounts of marine plastic debris, undermining efforts to protect local wildlife (Luna-Jorquera, et al. 2019).

Plastic debris has negative effects on marine wildlife, including entanglement, ingestion, the transport of invasive species, and toxic pollutants (Thevenon, Carroll, and Sousa 2014). Microplastics have been reported in a wide range of marine taxa, including amphipods living in six of the deepest marine ecosystems on Earth (Thiel et al., 2018; Jamieson, et al. 2019), pointing at the ubiquitous distribution of these particles. However, a nuanced understanding of the impact of plastic on the biology of specific marine species is still poorly understood. The risk of exposure to plastics and microplastics depends on the distribution and abundance of the plastics and the biology of the species (Thiel et al. 2018).

Until scientists collect more data on the impact of marine debris on species and ecosystems, public and private sector institutions are focusing on better solid waste management upstream to reduce the flow of plastic pollution. Of the 6,300 million metric tons of plastic waste produced globally as of 2015, 9 percent has been recycled, 12 percent has been incinerated, and about 79 percent has accumulated in landfills or in the natural environment (Geyer et al. 2017). At the current trend, 12 billion tons of plastic waste will accumulate in landfills and the natural environment by 2050 (Idem).

In many developing countries, the consumption of disposable goods has increased at a higher rate than the development of proper waste management practices and infrastructure (Jambeck, et al. 2015). Developing sustainable waste management systems requires several key strategies, including strengthening the capacity of public waste management authorities; closing the infrastructure gap; partnering with and building the capacity of the private sector and civil society organizations; and implementing adequate laws, regulations, and standards (The Cadmus Group 2018). Countries, including Peru, are increasingly taking bold measures to tackle plastic pollution. With over 3,000 km of coastline and home to some of the most polluted beaches in Latin America, Peru provides a model to better understand the relationship between marine plastic debris and solid waste management, and the types of interventions having a positive impact.

Approach

Marine plastic debris is a growing concern in Peru for both environmental and economic reasons. Coastal areas in Peru support diverse ecosystems, including five Ramsar sites, and economic activities, such as tourism (McKinley, et al. 2019). Furthermore, Peru’s coastal waters are among the most biologically productive in the world, given the cold, nutrient-rich water brought by the Humboldt Current.

From an economic standpoint, Peru is the world leader in fish meal and fish oil production. Industrial and artisanal fisheries are important livelihoods, directly supporting about 95,000 jobs (INEI 2018b). In 2019, Peru exported 1.81 million tons of fish and fish products, valued at \$3.5 billion (PRODUCE 2019). Artisanal fisheries contributed to 24 percent of the exports.



Figure 1. Regions in Peru where USAID has worked to reduce marine debris.



Efforts are underway to generate information on the impacts of plastics and microplastics on Peru's fisheries and coastal ecosystems. Initial studies documented the presence of microplastics in three commercial species off the coast of Peru (De la Torre et al. 2019). Higher concentrations of microplastics were found in the carnivorous species. The authors concluded that bioaccumulation and proximity to a megacity with poor waste management contributed to these findings (Idem). In 2019, Peru's Ministry of Production transferred \$760,000 to the Peruvian Institute of the Sea (IMARPE) to assess the presence of marine debris in areas of extraction of hydrobiological resources along the coast of Peru and Lake Titicaca. These studies will generate information about potential impacts on the quality of Peru's commercial fisheries at a larger scale.

Despite the lack of data, the Government of Peru and the private sector and civil society organizations recognize the critical relationship between solid waste management and the health and productivity of coastal communities and are actively collaborating to reduce plastic debris.

Solid waste management and marine debris in Peru

The majority of Peru's population lives in coastal cities located on the country's 3,000 km coastline, generating concerns about land-based marine debris (INEI 2018). In Peru, 19,000 tons of solid waste are generated each day, of which about 52 percent goes to sanitary landfills, and the rest is disposed of in unpermitted and unmanaged dumps, often located near rivers or in wetlands (OEFA 2014, MINAM 2016). As the economy grows, so does plastic consumption and marine debris.

As the gross domestic product (GDP) rises, per capita plastic waste generally increases. Peru has a GDP per capita of \$6,941 (2018),¹ which is associated with plastic waste production of 0.1–0.2 kg per capita. This is comparable to the per capita plastic waste production of other Latin American countries, such as Colombia, Nicaragua, and Honduras



Photo credit: Maina Martir

Plastic debris tangled in a bed of mussels on the beach in Lima, Peru.

¹ <https://data.worldbank.org/indicator/NY.GDPPCAP.CD?locations=PE>



Per capita plastic waste vs. GDP per capita, 2010

Per capita plastic waste generation rate (measured in kilograms per person per day) versus gross domestic product (GDP) per capita (measured in 2011 international-\$).

Our World
in Data

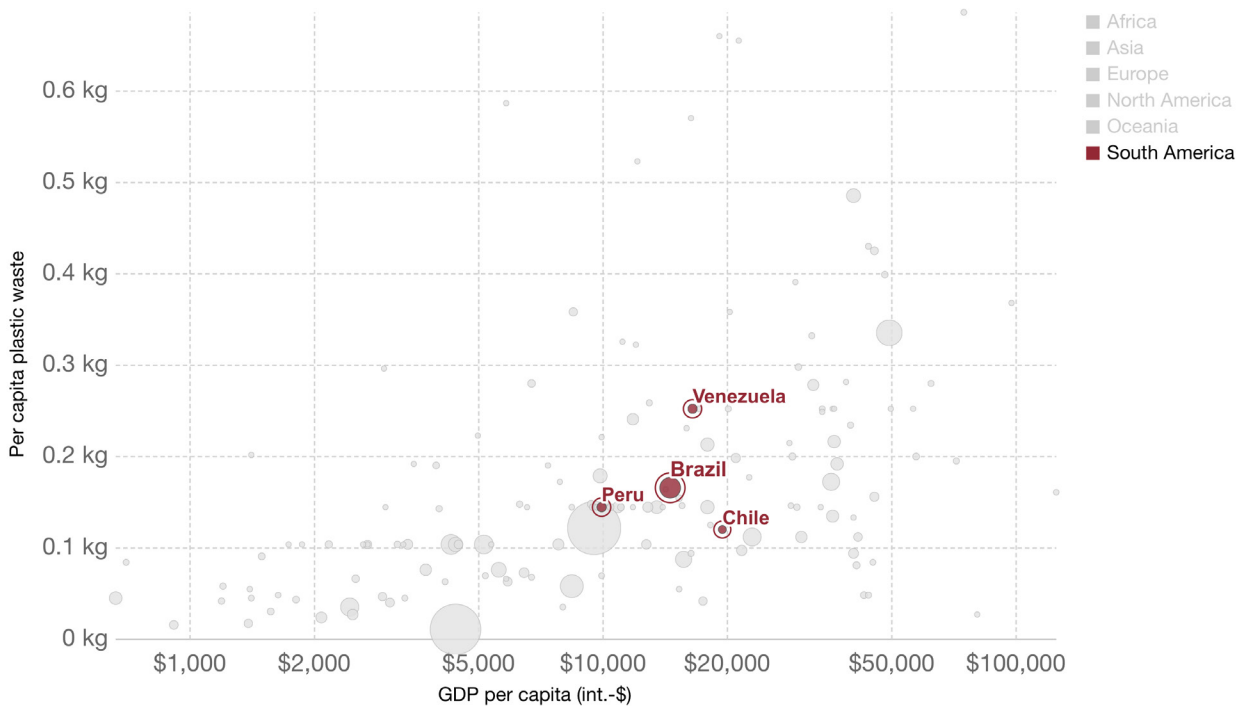


Figure 2.² Per capita plastic waste vs. GDP, 2010. Source: <https://ourworldindata.org/plastic-pollution#determinants-of-mismanaged-waste>

(Figure 2). The positive relationship between GDP and plastic waste is further borne out at the municipal level. Within Lima's greater metropolitan area, the more affluent the area, the greater volume of waste produced (Figure 3) (Durand and Metzger 2009; INEI 2019).

In addition to the increase in waste, mismanagement of waste is of equal concern. Overall, middle-income countries like Peru typically have the highest rates of mismanaged plastic waste because waste management infrastructure has not kept pace with increasing consumption (Figure 4). In 2016, Peru generated 708,000 tons of plastics per year, of which 43.7 percent was inadequately disposed (MINAM 2018). Further, the Ministry of Environment (MINAM) estimates that only about 1.9 percent of the recyclable materials are recycled (MINAM 2018). According to Ciudad Saludable, a non-profit working on waste management in Peru, one of the primary challenges in recycling is ensuring consistent supply and stable prices for recyclable materials. Furthermore, inconsistent behavior and cultural norms around payment for and use of municipal services for waste collection contribute to poor adequate disposal in Peru (ECLAC and OECD 2017).

Poor waste management in major coastal cities like Lima and Callao is also a top concern. These two cities generate half the country's waste, approximately three million tons per year, and informal disposal near rivers transports the debris to the coast (El Comercio 2018). The beaches of Lima, Callao, and La Punta are considered the most negatively affected by litter in Peru (La Republica 2018). Researchers

² GDP per capita based on purchasing power parity (PPP). PPP GDP is gross domestic product converted to international dollars using purchasing power parity rates. An international dollar has the same purchasing power over GDP as the dollar has in the United States. GDP at purchaser's prices is the sum of gross value added by all resident producers in the economy plus any product taxes and minus any subsidies not included in the value of the products. It is calculated without making deductions for depreciation of fabricated assets or for depletion and degradation of natural resources. Data are in constant 2011 international dollars.

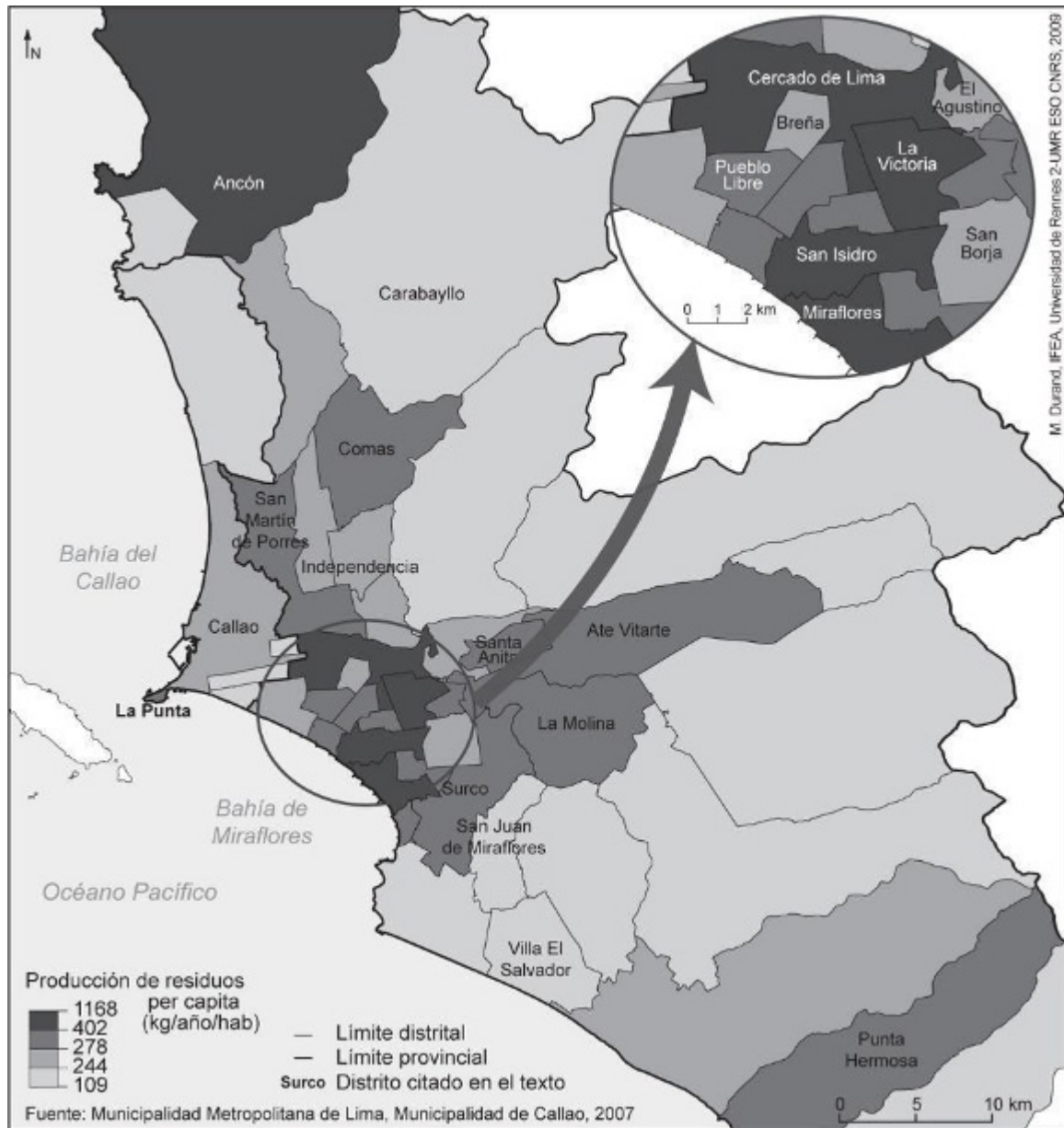


Figure 3. Waste production in Lima, Peru, by zones in 2009. The more affluent areas of San Isidro, Miraflores, and La Victoria produced higher amounts of waste than less affluent areas.

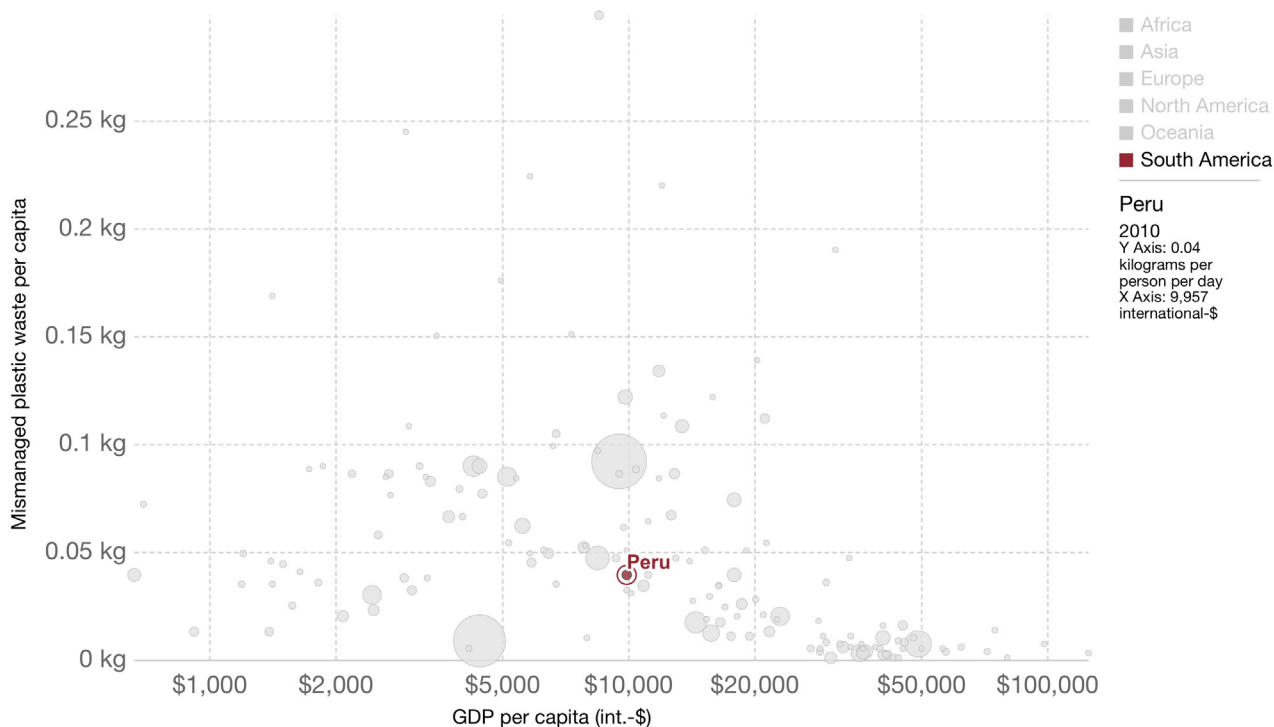
found over 500 microplastic fragments per square meter in some beaches in Lima and Callao (Purca and Henostroza 2017, De la Torre, et al. 2020). While not all beaches sampled had such a high concentration of microplastics, the average amount of microplastic per square meter found in these studies is higher than other reports in the South Pacific Coast (De-la-Torre, et al. 2020).

In addition to land-based debris, mismanagement of sea-based waste is also a threat to biodiversity. However, government-led efforts are in place to better understand and manage solid waste generated by artisanal fisheries, which is typically disposed of into the ocean. A study conducted by researchers from IMARPE found plastics constituted over 30 percent of the residue generated by artisanal fishing vessels (Solano Sare and Buitron Diaz 2019). Further, a survey of plastics found off the coast of Peru and Chile found 50 percent originated from packaging, fishing lines, and lost fishing gear, while bottles and baskets accounted for 25 percent (La Republica 2018a).



Mismanaged plastic waste per capita vs. GDP per capita

Mismanaged waste is waste that is littered or not formally managed, which includes disposal in dumps or uncontrolled/open landfills.



Source: Plastic Waste - Jambeck et al. (2015) and World Bank.

OurWorldInData.org/plastic-pollution • CC BY

Figure 4. Per capita mismanaged plastic waste vs. GDP per capita. In general, middle-income e countries have the highest rates of mismanaged plastic wastes. Peru, Colombia, and Ecuador have similar rates.

Source: <https://ourworldindata.org/plastic-pollution#determinants-of-mismanaged-waste>

Tackling marine debris and solid waste management in Peru

With a circular economy³ at the core of recently enacted legislation on production and solid waste in Peru, private sector and civil society actors are at the forefront of tackling long-standing challenges associated with plastic and solid waste management.

Creating an enabling legal environment

Peru's 2016 Solid Waste Law No. 1278, 2018 Plastics Law (see Box 1), and National Competitiveness and Production Plan (DS 237-2019-EF) prioritize efforts to promote a circular and eco-efficient economy.

In December 2019, following a year of enforcement of the Plastics Law (Law 30884), MINAM reported the consumption of plastic bags decreased by about one billion units. Peru expects further reductions in plastic consumption as a result of the ban on local production of plastic bags and straws, which started on December 20, 2019. Alternative products, such as reusable straws, bamboo plates, and biodegradable bags, are now available in most grocery stores in Lima. By 2020, MINAM expects at least 12,000 tons of solid waste material will be reutilized by industry, and 75 percent of residues will receive adequate final disposal (MINAM 2018a).

³ Circular economy is a regenerative system in which resource input and waste, emission, and energy leakage are minimized by slowing, closing, and narrowing energy and material loops.



Raising public awareness

Public awareness campaigns are an important component of the Government of Peru's efforts to build support for national policies such as the Plastics Law and drive individual behavior change. Coinciding with the enactment of the Plastics Law, MINAM launched the campaign "Menos plastico, mas vida" ("Less plastic, more life") to generate public awareness about alternatives to plastics. In partnership with NGOs, donors, and the private sector, MINAM developed multiple similar awareness campaigns. Among these was "[Gallinazo Avisas](#)" ("Vulture Warnings"), which launched in 2016, with support from USAID. The campaign raised awareness about solid waste issues in Lima by training vultures to fly with small GoPro cameras. In just eight weeks, it reached over four million people, including volunteers who participated in trash pick-up days (MINAM 2016). In 2018, MINAM launched "[No quiero esto en mi ceviche](#)" ("I don't want this in my ceviche")—a campaign to draw attention to microplastics pollution and its impact on marine life and human health (Oceana 2018).

Actions by municipalities and local NGOs, such as Ciudad Saludable, have helped mobilize civil society and the private sector to participate in recycling and beach cleanup efforts. With support from USAID, in 2018, Ciudad Saludable launched the campaign "Menos plastico mas Pacifico" to promote recycling and waste management in the Chincha and Paracas area. Over two thousand people participated in this campaign, helping collect and adequately dispose of about 13 tons of marine litter and 3.5 tons of recyclable materials (Ciudad Saludable 2018).

Enabling legal framework for improving solid waste management and reducing plastic pollution in Peru

The Solid Waste Law (No. 1278) focuses on three pillars of solid waste management: reduction of waste via a focus on a circular economy; efficient use of materials; and alternative, valuable uses for waste. The law re-frames waste as an opportunity and primary material for industries, and values some waste as useful for purposes other than disposal. Importantly, the law also creates a better enabling environment for waste management, including establishing waste management as part of public utilities. This simplifies the process for investment in solid waste infrastructure (e.g., increasing the permit limit on sanitary landfills from one year to five years). The law also created the National Solid Waste Investment Fund to finance solid waste investments in public sanitation, emphasizing public-private partnerships. In May 2020, the Government of Peru amended the Solid Waste Management Law in response to the state of emergency generated by the COVID-19 pandemic. Among the new measures is the mandatory segregation of solid waste at the source of origin and transfer of segregated materials to formal recycling associations.

The Plastics Law regulates single-use plastics, non-reusable plastics, and disposable styrofoam containers. The law is primarily focused on polyethylene bags, which take 500 years to degrade. The law proposes a gradual reduction in the use of plastic bags, with a goal of reducing use by 35 percent in the first year. Plastic bags will be entirely prohibited after a transition period. The new law prohibits the use of small plastic bags and requires supermarkets and other vendors to sell plastic bags, rather than offering them for free. Key milestones of the new law include:

- All plastic bags will be phased out and plastics smaller than 30 cm, such as straws, will be prohibited after one year.
- All plastic bags will be phased out and replaced with reusable bags within three years.
- A tax on plastic bags will be established.



Reducing the infrastructure gap

Peru has approximately 1,800 landfills, but only about 30 are sanitary. To address this, MINAM has prioritized 31 cities as part of its Development Program for Waste Management Systems. The program constructs sanitary landfills, provides machinery for trash collection, and trains municipalities in waste management processes (Andina 2018). Collaboration with municipalities is important to institutionalize reliable trash pick-up and recycling, and support behavior change around trash collection. As of 2019, ten new sanitary landfills started operations, and eight new landfills were in construction, improving waste management across the country.

Mainstreaming recycling

Recycling and reuse of materials are key components of Peru's waste management strategy and are important for reducing the amount of material reaching the ocean. Developing value chains for the reuse of waste materials is also critical (GFI et al. 2018). Research shows that, despite efforts to mainstream recycling, challenges remain. There is still work to be done to overcome barriers to the formalization of recyclers; maintain a reliable supply of recyclable material through adequate segregation of domestic waste; and stabilize prices for recyclable materials, because unstable prices can limit the profitability of the recycling sector (EIU 2017, GFI et al. 2018).

Recyclers are an important part of the waste management system in Peru, where over 100,000 families depend on recycling for their livelihood (Peru 21 2018). In early 2020, MINAM launched the first national recyclers census, which will generate socio-economic data to better understand the challenges recyclers face. Mandating segregation of waste at the source of origin—through amendments to the Plastic Law made by the Government of Peru in response to the COVID-19 pandemic—is expected to benefit formal recycler organizations by generating a more stable supply of recyclable materials. However, it is still too early to assess the effectiveness of this measure.

In Peru, private sector initiatives play an important role in the development of value chains for recycling and reuse of waste materials. MINAM recently launched the “Recycling with Purpose” initiative in alliance with PepsiCo Foundation, Ciudad Saludable, and Ecoins, to use the digital Ecoins platform to generate incentives for recycling. Coca-Cola Peru has also supported multiple initiatives to change behavior around recycling and promote formalization of the recycling value chain, including work with Ciudad Saludable in the city of Arequipa. With the new focus on promoting a circular economy, alliances with the private sector will become increasingly important to strengthen waste management and reduce plastic pollution.

USAID Support

Strengthening the Government of Peru's capacity to finance and implement solid waste management systems is part of USAID's legacy in Peru. From 2007 to 2009, through the Public Investment Project Technical Assistance Program, USAID worked with the Ministries of Environment and Economy and Finance to train government officials at the municipality level on the development of solid waste management public investment projects (PIP) (MINAM 2010). Through these efforts, PIP profiles were developed in about 85 percent of the departments in Peru. Furthermore, through the ProDecentralization activity (2012 to 2017), USAID provided specialized technical assistance to municipalities in the regions of Madre de Dios and Ucayali to improve their integrated solid waste management systems (PGRD 2018).

Recent efforts funded by USAID have focused on raising public awareness about solid waste management and impacts on the environment. Since 2017, working with Ciudad Saludable, USAID has



helped formalize recycling in coastal cities in the department of Ica. Efforts led by Ciudad Saludable are building public awareness about the impacts of debris on coastal ecosystems. In addition, as mentioned above, awareness-raising campaigns funded by USAID, such as “Gallinazo Avisa,” mobilized citizens to engage in the management of solid waste in Lima. Additionally, Peru will be one of two countries in Latin America to participate in a larger global program called Clean Cities, Blue Oceans (CCBO)—USAID’s global initiative to address land-based sources of ocean plastic pollution. With an initial focus on key countries in Asia and Latin America, CCBO will build capacity and commitment for the 3Rs—reducing, reusing, and recycling—and solid waste management in urban and peri-urban settings, particularly in riverine and coastal areas, which are at the heart of the global plastic pollution crisis.

Conclusion

Peru is at the forefront of efforts in Latin America to implement strategies to reduce plastic pollution (UNEP 2018c). Peru’s government, private sector, and non-governmental groups recognize the importance of addressing solid waste management to protect the health of its citizens, economy, and biodiversity. Their commitment is evident in numerous initiatives to address plastic and solid waste management—from new laws to corporate support to NGO-sponsored recycling programs. Closing the gaps in the proper management of plastic and solid waste will require a continuous effort by all sectors of society, including building capacity at the municipal level and providing civil society oversight.

Data gathered through more systematic, standardized research methods on the impacts of macro and microplastics on marine wildlife remains a critical need to inform, prioritize, and target actions by administrative and oversight agencies. While Peruvian agencies recognize this need, inadequate budgets limit their ability to conduct the necessary studies. Catalyzing engagement from citizens, political will, and investment are still needed for the country to achieve its waste management objectives and reduce threats to Peru’s key marine and coastal ecosystems.

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