West Africa Circular Economy:

Realizing the Potential of Plastics

CIRCULARITY

WORLD BANK GROUP

NDF Nordic Development Fund

PROBLUE

WACA West Africa Coastal Areas Management Program

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ABOUT THIS REPORT

This regional gap analysis was carried out under the remit of the West Africa Coastal Areas Management Program (WACA), which addresses coastal degradation—including from plastic pollution—in 17 West and Central coastal African countries and island states spanning from Mauritania to Gabon (referred to as WACA region in this report). It includes insights from an analysis of the plastic landscape across the WACA region; an investigation of the plastic market conditions in three sectors (plastic packaging, construction, and fisheries); and extensive stakeholder engagements with professionals from the plastic value chain in West Africa.

The study seeks to address key gaps in knowledge and data relating to the plastic pollution problem in the region. It also aims to contribute to regional governments' and institutions' agendas on marine litter.

This report is part of a series that includes:

Plastic Pollution in Coastal West Africa: Synthesis paper

The Economics of Plastic Use and Cleanup Priorities for West African Coastal Countries

Producer Responsibility Organisation to manage Polyethylene Terephtalate bottles in Senegal

WACA Plastic E-book

KEY MESSAGES

Countries in the WACA region are **highly dependent on imported virgin plastic resins** and plastic products.

In about half the countries in the WACA region, plastic enters **primarily in indirect forms** (embedded, wrapping). These amount to 57 percent of the total import. By comparison, direct forms (resin and production) represent 43 percent of the total import.

As the region's largest economy and sole producer of virgin plastic resins, **Nigeria is the largest plastic consumer, representing 45 to 63 percent of total plastic consumption** (5 million tons). It is followed by Côte d'Ivoire and Ghana.

In 2021, **three economic sectors** in the WACA region (construction, plastic packaging, and fisheries) represented **78 percent of total plastic consumption**.

By 2026, the three sectors' business-as-usual plastic consumption is expected to reach 9.5 million tons, with **plastic waste generation per year per person growing** from 12.5 kilograms (kg) to 17.3 kg.

Only about **10 percent of total plastic waste is recycled** in the WACA region (0.5 million tons).

The WACA region's production of plastic goods is **dominated by imported virgin plastic resin**.

There is **minimal material substitution using recovered plastics** due to concerns over security of supply and the quality of such recycled products.

A circular economy model offers strong potential for reducing plastic waste. If countries introduce a pragmatic circular economy scenario, it is estimated that 40 to 50 percent less plastic—amounting to 2.5 to 4.6 million tons of plastic waste—will end up as waste in the environment by 2026.

Since virgin plastic products are cheaper than recycled plastics, **transformative policy support** may be required to increase the viability of a regional or local circular plastics economy.

A lack of consumer sensitization on circular approaches to plastic consumption still remains a major obstacle to plastic waste prevention in the WACA region.

Data quality for the plastics value chain in the WACA region is considered **average to poor**. As a result, the quantitative results should be regarded as mostly directional—providing orders of magnitude rather than robust estimates.

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ABBREVIATIONS & DEFINITIONS

ACEA	African Circular Economy Alliance
AfDB	African Development Bank
BAU	business as usual
C&D	construction and demolition
CE	circular economy
CO_2	carbon dioxide
EPR	extended producer responsibility
GDP	Gross Domestic Product
HDPE	High-density Polyethylene
kg	kilogram
km	kilometer
km^2	square kilometer
kt	kiloton
LDPE	Low-density Polyethylene
LEM	linear economy model
MFA	material flow analysis
mn	million
NGO	Nongovernmental organization
PE	Polyethylene
PET	Polyethylene terephthalate
PP	Polypropylene
PPP	Public-private partnership
PS	Polystyrene
PVC	Polyvinyl chloride
R&D	Research and Development
R1	refuse, rethink, and reduce initiatives
R2	reuse, repair, refurbish, remanufacture, and repurpose initiatives
R3	recycle and recover initiatives
rPET	recovered polyethylene terephthalate
SMEs	small and medium enterprises
UN	United Nations
WACA	West Africa Coastal Areas Management Program (www.wacaprogram.org)
WACA Region	The 17 coastal and island states covered by the WACA program: Benin, Cabo Verde, Cameroon, Côte d'Ivoire, Equatorial Guinea, Gabon, The Gambia, Ghana, Guinea, Guinea-Bissau, Liberia, Mauritania, São Tomé and Príncipe, Senegal, Sierra Leone, and Togo


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EXECUTIVE SUMMARY

The circular economy has become a priority in recent decades as policy makers seek to facilitate a transition from linear production systems to closed systems that reuse resources, reduce energy consumption and avoid the exploitation of nonrenewable resources.

This regional gap analysis reveals several important trends. Key among them is a rapid rate of increase. Plastic consumption in the WACA region was estimated at 7.9 million tons in 2021; at current growth rates, this could increase to 12 million tons by 2026.

The WACA region relies heavily on imported plastic-related goods from sources outside the region, such as Asia. Nigeria was found to be both the largest producer of plastic products and the biggest importer of plastic parts and products, in addition to being the WACA region's only producer of virgin plastic resin. Other notable major producers of plastics in the WACA region include Ghana and Côte d'Ivoire.

The plastic landscape investigation included a spatial analysis of plastic waste generation across the WACA region. This revealed varying rates of national annual plastic generation. The spatial analysis work also led to the identification of 71 plastic waste generation hotspots across the WACA region, with a concentration in Nigeria.

The plastic market analysis revealed that the three industry sectors (construction, plastic packaging, and fisheries) represented 78 percent of total plastic consumption in 2021. By 2026, the three sectors' business-as-usual plastic consumption is expected to reach 9.5 million tons, with per capita plastic waste growing from 12.5 kilograms (kg) to 17.3 kg.

The largest plastics consumer of the three sectors is plastic packaging, followed by construction. The plastic packaging sector could focus on new, circular economy business models over the next five years. In this sector, plastic waste recovery and avoidance/reuse/recycling of between 2.2 and 4 million tons of plastic in a "pragmatic"[1] circular scenario would reduce CO_2 emissions between 41 and 53 percent (3.6–6.7 million tons CO_2 emissions).

In the construction industry, in a pragmatic circular scenario plastic avoidance would reduce CO_2 emissions between 0.1 and 0.3 million tons, and plastic waste recovery would reduce CO_2 emissions between 0.1 and 0.2 million tons.

Finally, in the fisheries sector, plastic avoidance under the pragmatic circular scenario would reduce CO_2 emissions between 0.03 and 0.05 million tons, and plastic waste recovery would reduce CO_2 emissions between 0.04 and 0.07 million tons.

New circular business models can motivate these three sectors to reuse and extend the life span of plastic materials.

Recommendations for government include:

- Banning sales of new plastic equipment and nets
- Ending single-use plastics for water, food containers, and plastic pipes
- Incentivizing the use of biodegradable fishing gear (by taxing new plastic gear and implementing tax rebates on purchasing secondhand equipment)
- Strategically installing local recycling plants in urban centers
- Banning single-use plastics in the restaurant and tourism industries

Recommendations for the private sector include:

- Adopting new business models, such as a green construction approach (including the use of metals, bamboo, and composites)
- Increasing use of bio-based plastics and investment in production technology (packaging)
- Employing new geo-tags technology on fishing nets to reduce fishing ghost gear and to renew the inventory of commercial shipping nets
- Extending the lifetime of plastic products, including through reuse and producing materials with higher recycled content
- Implementing policies that encourage the use of mono-color PET bottles
- Developing biodegradable seaweed- or algae-based plastic for use in the fishing industry.

The stakeholder engagement exercise highlighted similar trends across the plastic value chain within the West Africa region. Notably, plastic industry stakeholders identified that countries are struggling to secure funding for recycling infrastructure. The main reason for this is the relatively low profitability linked to low levels of suitable recyclable plastic. While regions that lack solid waste management infrastructure tend to have a significant informal workforce, informal collectors use rudimentary collection methods, and the majority of plastic retrieved from waste is contaminated and not suitable for recycling.

Likewise, many West African countries have weak policy frameworks for promoting circularity in plastics management. Consumer consciousness on circular approaches for managing plastics was also identified as largely lacking across the region.

1 A pragmatic circular economy scenario represents the resource loss output in 2026 following a practical and measured approach to circular economy.

Nonetheless, the professionals interviewed as part of the stakeholder engagement exercise described several interventions for promoting circularity within coastal West Africa's plastics value chain, including:

- Establishing policies that target circularity and plastic waste prevention
- Fostering stronger collaboration between public, private, informal, and development stakeholders in the plastics industry
- Providing research and development resources for innovations, alternative products and materials, and pilot projects
- Increasing intraregional trade in recovered plastics.

Call to action

There is a strong need to establish new national policies geared towards a circular economy; plastic waste prevention and reuse, and promotion of bio-based feedstock. Policy makers in the WACA region can stimulate acceptance of circular-economy-related products by:

- **Passing regional-level legislation that focuses on product import standards**, specifying, for example, content percentages of recycled plastics within an imported plastic-based product
- Implementing taxes, and subsidies and rebates, **in fiscal policy initiatives**
- Making available **research and development (R&D) funds for project design innovations**
- Increasing **intraregional trade in recovered plastics** to reduce the plastic waste burden on smaller economies in the WACA region, taking advantage of the concentration of plastics conversion/recycling capacity in countries such as Côte d'Ivoire, Ghana, and Nigeria
- Involving **informal waste reclaimers**, recognized as an important part of developing solutions.

The WACA region should prioritize engagement by:

- Engaging development banks and bilateral donors to **access technical and financial support** for the development of circular economy solutions
- Promoting **closer collaboration** between public, private, informal, and development stakeholders, thereby **harnessing the individual strengths** of each in addressing challenges in the region's plastics sector.

Countries participating in the WACA Program should also maximize efforts to **improve the completeness and accuracy of plastic-value-chain data**.

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1.

INTRODUCTION
Why Circularity is Critical in West Africa

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What is the Circular Economy?

The circular economy has been present since civilization first began, but has become a priority for policy makers only in the past couple of decades. How to best leverage its principles is still under debate. Some say there is a need to focus on the sustainability dimensions of impacts—whether environmental, economic, or social. Others emphasize the need for new business models to facilitate a transition from linear production systems to closed systems that reuse resources and reduce energy consumption. These differences aside, to embrace circular economy is to move away from linear and open models of production, consumption, and the final disposal of products toward more circular and sustainable models. Such models optimize the use and reuse of materials, thus avoiding the exploitation of nonrenewable resources.

A globally accepted definition of circular economy is still elusive, pushing academic research to analyze a wide range of related concepts and methods. In order to have a reference framework, the World Bank team settled on a definition formulated by Kirchherr, Reike, and Hekkert (2017);[2] Garcés-Ayerbe et al. (2019);[3] and the Ellen MacArthur Foundation: "A circular economy describes an economic productive system that is based on business models which replace the 'end-of-life' concept with reducing, alternatively reusing, repairing, remanufacturing, recycling and recovering materials in production, distribution and consumption processes, to return into a technical or biological cycle."

The circular economy model operates at the micro (products, companies, consumers), meso (eco-industrial parks), and macro (city, region, nation, and beyond) levels, with the aim of economic sustainability. This implies creating economic prosperity through gross domestic product (GDP) growth, social progress (employment generation), and environmental innovation (renewable energy, urban mining).[4]

2 Julian Kirchherr, Denise Reike, and Marko Hekkert, "Conceptualizing the Circular Economy: An Analysis of 114 Definitions," Resources, Conservation and Recycling 127 (December 2017): 221–32, https://doi.org/10.1016/j.resconrec.2017.09.005.

3 Concepción Garcés-Ayerbe, Pilar Rivera-Torres, Inés Suárez-Perales, and Dante I. Leyva-de la Hiz, "Is It Possible to Change from a Linear to a Circular Economy? An Overview of Opportunities and Barriers for European Small and Medium-Sized Enterprise Companies," International Journal of Environmental Research and Public Health 16, no. 5 (2019): 851, https://doi: 10.3390/ijerph16050851.

4 Urban mining comprises the activities or technologies designed for recovering resources from waste or products at the end of their lifetime. Utilizing these secondary raw materials promotes environmental savings, resource benefits, and economic benefits. Urban mining often focuses on the dominant urban waste streams such as electronic waste (e-waste), energy-efficient lighting, end-of-life vehicles, and construction and demolition waste. Both the formal and informal sectors play a role. Rachna Arora, Katharina Pateroka, Abhijit Banerjee, and Manjeet Singh Saluja, "Potential and Relevance of Urban Mining in the Context of Sustainable Cities," IIMB Management Review 29, no. 3 (2017): 210–24, https://doi.org/10.1016/j.iimb.2017.06.001; Lúcia Helena Xavier, Ellen Cristine Giese, Ana Cristina Ribeiro-Duthie, and Fernando Antonio Freitas Lins, "Sustainability and the Circular Economy: A Theoretical Approach Focused on E-Waste Urban Mining," Resources Policy 74 (2019), https://doi.org/10.1016/j.resourpol.2019.101467.

The economic, environmental, and social opportunities of circularity for West Africa

Circularity—that is, the reuse of products and recycling of materials in the economy—is one of three key pollution prevention strategies, the other two being substitution and dematerialization. Its environmental potential comes from the fact that collecting products, packaging waste, and reprocessing waste into secondary products and materials typically have lower environmental impact than making these products and materials from virgin resources.

Using secondary alternatives instead of virgin products and materials not only reduces environmental impact all along the supply chain but also reduces end-of-life waste and the environmental pollution it generates. Reducing the amount of waste disposal through increased circularity is especially valuable in regions like West and Central Africa, where the solid waste infrastructure is still immature and incomplete, and solid waste is thus at higher risk of ending up in marine and terrestrial environments.

The overall impact reduction potential of reuse typically exceeds that of recycling, and both are preferable to disposal. For example, reusing plastic containers has greater environmental benefits than recycling them. This, in turn, is preferable to landfill disposal or incineration. However, the potential environmental benefits of reuse and recycling are realized only if secondary products and materials are used instead of new products and materials, not in addition to them. If secondary resources do not reduce the use of primary resources, waste disposal is merely delayed rather than truly avoided.

While the economics of circularity is challenging for plastics, its economic potential is significant, in particular in low- and medium-income regions such as West and Central Africa. One reason for this is that the processes involved—such as collection, inspection, cleaning, and sorting—tend to be labor intensive. The availability and cost of labor are therefore major determinants of the economic feasibility of plastic reuse and recycling. Another reason is that many technologies required for plastic reuse and recycling are inexpensive and readily available. A third reason is the fact that few countries in the West and Central African regions have large virgin plastic production and conversion industries, which means that they depend on imports and are thus not part of the value chain of virgin plastics. Switching from imported virgin plastics to domestic secondary plastics creates the opportunity to build domestic value chains and increase domestic employment.

Since virgin plastic products are very low cost, robust policy support may be required to increase the viability of a domestic or regional circular plastics economy. Such policies should be aimed, not only at bolstering a domestic or regional supply of secondary products and materials, but also at increasing demand for domestically or regionally produced secondary products and materials. There are various policy instruments available to do this, including traditional and emerging extended producer responsibility (EPR) measures.

The creation of new circular supply chains, or loops, should be implemented in a socially equitable and just way. Regions with immature or incomplete solid waste management infrastructure tend to have a significant informal workforce that has developed to fill the gaps, from informal waste collectors and sorters to informal recycling industries and markets. A heavy-handed approach could risk the creation of new formal circular supply chains and infrastructure at the expense of existing informal ones, thus reducing economic and employment benefits, and increasing rather than reducing social inequities. Potential avenues to avoid these are either to formalize the informal workforce or to make sure that the new circular supply chains complement, rather than substitute, the informal ones.

While today's interest in reuse and recycling initiatives should be welcomed, one needs to avoid naïve enthusiasm regarding their potential and feasibility. This is particularly true for plastic waste, for which even highly developed economies such as Canada and the United States have achieved recycling rates of only about nine percent. Circular supply chains for plastic waste are operationally challenging, and the costs of the necessary operations and processes can quickly exceed the achievable revenues. The true economic potential and viability of plastic reuse and recycling require detailed knowledge of local costs and conditions, and are likely to vary across locations and types of plastic waste.

Study overview

As part of the World Bank's West Africa Coastal Areas Management Program (WACA),[5] and with a view to informing decision-making on marine plastics pollution in West and Central Africa, research was conducted into West Africa's regional response to marine plastics. The analysis covered 17 coastal and island states: Benin, Cabo Verde, Cameroon, Côte d'Ivoire, Equatorial Guinea, Gabon, The Gambia, Ghana, Guinea, Guinea-Bissau, Liberia, Mauritania, Nigeria, São Tomé and Príncipe, Senegal, Sierra Leone, and Togo.

This study seeks to address key gaps in knowledge and data relating to the plastic pollution problem in the WACA countries. It also aims to contribute to regional governments' and institutions' agendas on marine litter.

To achieve these overarching goals, a World Bank team:

- Conducted a stakeholder engagement exercise
- Performed an analysis of the plastic value chain
- Assessed three priority industries: packaging, fisheries, and construction.

5 The WACA program also includes countries considered to be Central African.

2.

The Plastics Landscape

A material flow analysis (MFA) of the WACA region's plastic value chain was conducted using data pertaining to plastic trade, domestic industrial production, and waste generation. Appendix A highlights the assumptions and processes applied in carrying out the MFA. Significantly, the material flow analysis was fraught with data quality challenges. There were inconsistencies in trade statistics between exporters and importers, as well as uncertainties over the data pertaining to solid waste generation and respective plastic content. It was necessary to perform a data reconciliation exercise to facilitate the execution of the MFA. With the exception of the intraregional scrap trade analysis—based on raw data from the UN Comrade statistics for 2018—the qualitative analysis in this section of the report should be regarded as primarily directional, providing orders of magnitudes rather than robust estimates.

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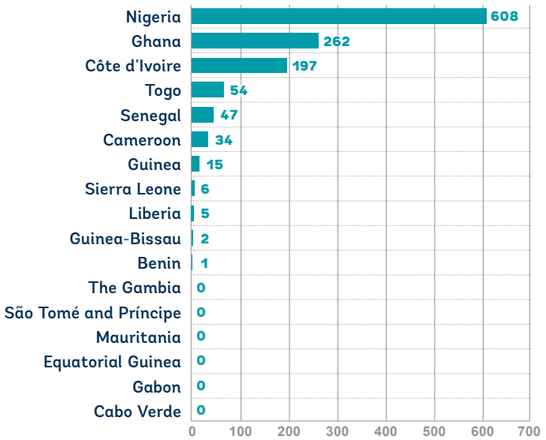
Domestic production of plastic resins in the WACA region

The WACA region has a well-established upstream petroleum sector, with most production centered offshore in the Gulf of Guinea. Nigeria is the largest producer in the region, producing 1,844 million barrels per day in 2019.[6] Other notable oil producers include Ghana, Cameroon, Côte d'Ivoire, Equatorial Guinea, and Gabon.[7] Domestic production of virgin plastic resins in the WACA region is limited, however. According to data from Wood Mackenzie,[8] Nigeria is the only nation in the WACA region engaging in the production of virgin plastic resins, generating 486 kilotons (kt) in 2018.

Imports and conversion of plastic resins in the WACA region

Because domestic production is sparse, countries in the WACA region are highly dependent on imported plastic resins, mainly polyethylene (PE), polypropylene (PP), and polyvinyl chloride (PVC). Regional net resin imports in 2018 were 1,231 kt. Though Nigeria was the region's only producer of virgin plastic resin, it was also the largest net importer, accounting for 49 percent of the region's total, or 608 kt (Figure 1). The other major net importers—Ghana, Côte d'Ivoire, Togo, and Senegal—accounted for 45 percent of the total.

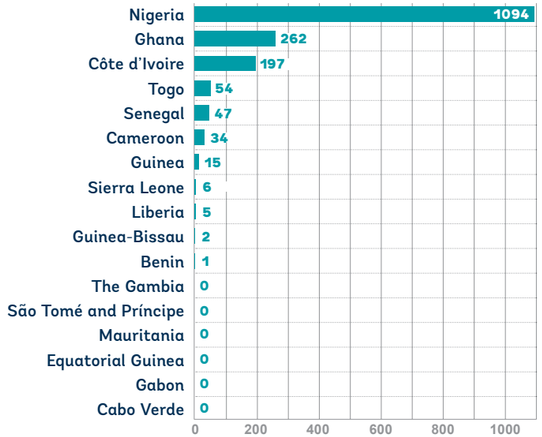
Figure 1. *Net Resin Imports (kt) into WACA Region Countries, 2018*



Note: Data included in appendix E — WACA Plastic Landscape

In 2018, the total resin conversion rate in the WACA region was 1,717 kt. Nigeria's rate was the single largest, at 1,094 kt or 64 percent. Other countries with significant shares included Ghana (262 kt) and Côte d'Ivoire (197 kt), according to the United Nations' Comtrade database (Figure 2). Net imports are calculated as imports minus exports. Conversion processes (like molding and thermoforming) turn resins into plastic parts and products. The sum of domestic production and net import of resins should be equal to all resin conversion. This equation is a good measure of the consistency of the datasets used, which turn out to be in agreement.

Figure 2. *Plastic Resin Conversion (kt) in WACA Region Countries, 2018*



Note: Data included in appendix E — WACA Plastic Landscape

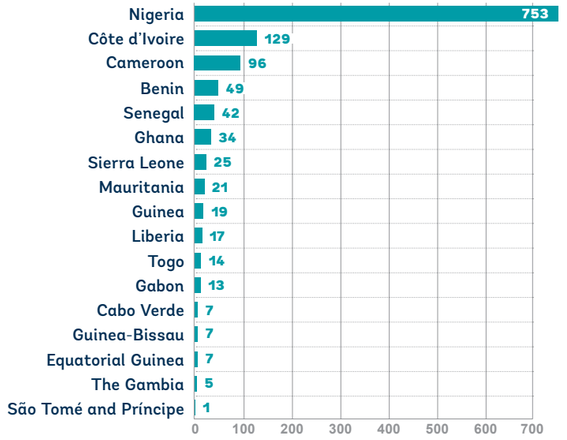
Nigeria and Ghana were identified as the largest net importers of plastic waste and scrap in 2018, at 14 kt and 6 kt, respectively.[9] Mauritania, Benin, Côte d'Ivoire, and Senegal were identified as net exporters of plastic waste and scrap, ranging between 1 kt and 2 kt. Their export markets were in Asia, Europe, and North America, with a small proportion of plastic waste and scrap exported to a few West African countries (Burkina Faso, Togo, and Senegal).[10]

Import of plastic parts and products, and plastics in imported final goods

Because the WACA region manufacturing sector is unable to meet demand, three-quarters of the plastic consumed within the region is imported, mostly from Asia.

The analysis showed a total net import of 1,238 kt of plastic parts and products into the WACA region in 2018 kt. Nigeria (753 kt), Côte d'Ivoire (129 kt), and Cameroon (96 kt) were the three largest net importers of plastic parts (for example, pipes and floor coverings) and plastic products such as household articles and disposable utensils (Figure 3).

Figure 3. *Net finished plastic product imports (kt) in WACA countries, 2018*

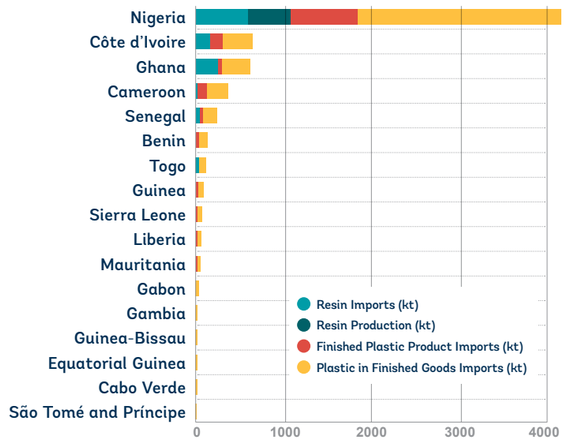


Note: Data included in appendix E — WACA Plastic Landscape

With regard to plastics in imported final goods, our analysis highlights the following estimates. The WACA region accounted for 3,793 kt of net imports of plastics embedded in imported goods in 2018. Of these imports, 78 percent of were accounted for by Nigeria (2,287 kt), Côte d'Ivoire (338 kt), and Ghana (333 kt).

All trade data was extracted from the United Nations' Comtrade database. Plastic parts and products are assumed to be entirely made of plastic, while the reported masses of imported and exported final goods are multiplied by their estimated plastic content. In summary, about 25 percent of the 6,767 kt of plastic estimated to have entered use in the WACA region in 2018 was from domestic converters; 18 percent was imported plastic parts and products; and 56 percent was contained in imported final goods, either as parts or packaging.

Figure 4. *Plastic entering use (imports and resin production) in WACA countries, 2018*



Note: Data included in appendix E — WACA Plastic Landscape

6 US Energy Information Administration, "Total Petroleum and Other Liquids Production Annual," 2021, https://www.eia.gov/international/data/world/petroleum-and-other-liquids/annual-petroleum-and-other-liquids-production.

7 EIA, "Total Petroleum and Other Liquids Production Annual."

8 Resin production and conversion data obtained from Wood Mackenzie Chemicals.

9 Both countries import most of their plastic waste and scrap from Asia. Nigeria's top five sources were China, Saudi Arabia, the United States, the Republic of Korea, and South Africa. Ghana's top five sources were Saudi Arabia, the United States, Korea, Thailand, and Belgium.

10 The complete list of export markets for plastic waste and scrap from the WACA region (2018) include: Australia, Belgium, Burkina Faso, Canada, China, France, Germany, India, Japan, Senegal, Spain, Togo, and the United States.

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Intraregional plastic waste and scrap trade

Raw data from the UN Comtrade statistics for 2018 shows that 10 WACA countries reported receiving imports of plastic waste and scrap from across the globe, including West Africa. The three largest importers were Nigeria, Ghana, and Senegal, with significant proportions of their imports sourced from Asia, Europe, and North America. West Africa is shown as a minor source of plastic waste and scrap imports. Ghana happens to be the region's only major importer.

The 10 countries combined imported approximately 38,400 tons of plastic waste and scrap in 2018. Table 1 highlights the trade values and associated weights of plastic waste and scrap imports from West Africa, the rest of Africa, Europe, Asia, North America, and Oceania into the WACA region, according to the UN Comtrade database.

Table 1. *Trade value and weight of plastic waste and scrap imports into the WACA region*

	West Africa		Rest of Africa		Europe		Asia		North America		Oceania	
	Trade Value ($)	*Weight (tons)*	*Trade Value ($)*	*Weight (tons)*	*Trade Value ($)*	*Weight (tons)*	*Trade Value ($)*	*Weight (tons)*	*Trade Value ($)*	*Weight (tons)*	*Trade Value ($)*	*Weight (tons)*
Benin	**1,478**	**2.71**	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Cabo Verde	n/a	n/a	n/a	n/a	**1,745**	**0.63**	**247**	**0.13**	**656**	**0.51**	n/a	n/a
Gambia, The	**2,214**	**6.39**	n/a	n/a	**3,847**	**11.83**	**119,929**	**69**	**90**	**1.96**	n/a	n/a
Ghana	**112,204**	**3,398.55**	n/a	n/a	**460,240**	**1,601.59**	**314,476**	**891.71**	**189,352**	**543.72**	**31,965**	**107.94**
Mauritania	**11,336**	**138.89**	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Nigeria	n/a	n/a	**83,061**	**106.99**	**128,548**	**81.55**	**14,821,190**	**17,050.73**	**995,239**	**1,072.37**	n/a	n/a
São Tomé and Príncipe	n/a	n/a	n/a	n/a	**4,222**	**1.15**	n/a	n/a	n/a	n/a	n/a	n/a
Senegal	n/a	n/a	n/a	n/a	1,704,119	**2,142.04**	**28,357**	**34.91**	n/a	n/a	n/a	n/a
Sierra Leone	**467**	**0.29**	**38,212**	**37.23**	**513,740**	**328.44**	**781,296**	**470.72**	**9,452**	**20.94**	**889**	**0.65**
Togo	**7,221**	**55.74**	n/a	n/a	**710,826**	**969.88**	**626,518**	**954.86**	n/a	n/a	n/a	n/a

Based on the details in Table 1, Asia ($17 million), Europe ($4 million), and North America ($1 million) are the largest sources of plastic waste and scrap imports for the reported ten countries in the WACA region in 2018. By contrast, only $134,920 of plastic waste and scrap was imported from West African sources.

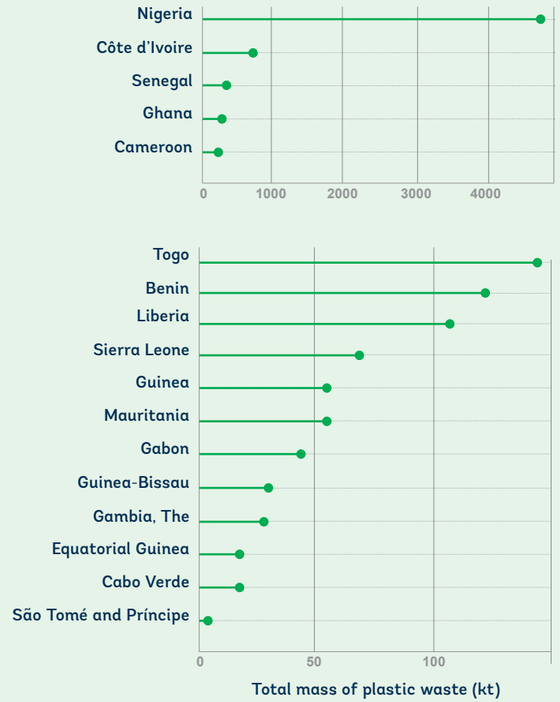
This differential highlights the potential opportunities for greater sourcing of plastic waste and scrap from within the WACA region itself. Greater levels of investment in plastic waste recovery infrastructure would facilitate these opportunities.

End-of-Life management of plastics and plastic waste hotspots in the WACA region

A spatial analysis of plastic waste generation was performed to help identify its geographic distribution. Without high-granularity data pertaining directly to waste generation, an estimate was calculated for each square kilometer (km2) of a given country. This was done by multiplying the population of that area by the national municipal solid waste (MSW) generation per capita (What a Waste 2.0), and the proportion of plastic present in the MSW of that country.[11] While this method does not capture plastic waste generated by industry, it does reveal the spatial distribution of plastic waste from commerce and households. A statistical analysis of the resulting plastic waste generation grid was conducted to identify hotspots—or areas that have significantly higher values than those surrounding them—normalized to the national mean value. Addressing issues around the management of plastic waste requires an understanding of this spatial distribution and the factors that cause locales of greater waste generation. This, in turn, helps to identify opportunities to redirect that waste into a circular economy.

Across the WACA region, annual plastic waste generation varies widely (Figure 4 and Table 2). An area of two square kilometers in the heart of Lagos, Nigeria, generates the most plastic waste in the analysis area, at 3.4 kt annually. By contrast, the lowest-producing square kilometer in Nigeria produces just over half a kilogram (kg) of plastic waste per year, while the lowest-producing square kilometer in the region, located in the desert northeast of Mauritania, produces less than three grams per year (Figure 5).

Figure 4. *Plastic waste generated (kt) in the WACA region, by country, 2018*

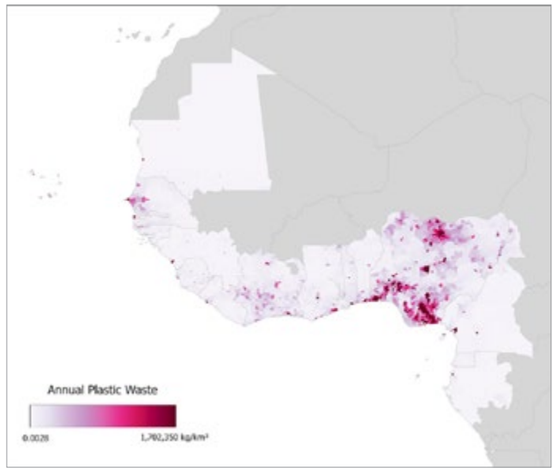


11 Jenna R. Jambeck, Roland Geyer, Chris Wilcox, Theodore R. Siegler, Miriam Perryman, Anthony Andrady, Ramani Narayan, and Kara Lavender Law, "Plastic Waste Inputs from Land into the Ocean," 2015, https://jambeck.engr.uga.edu/landplasticinput.

Table 2. *Annual plastic waste generation, 2018* [12]

Country	Annual Plastic Waste Generation (kt)		
	Total	Within 15 km of Coast	Within 30 km of Coast
Benin	120.95	21.29	34.89
Cabo Verde	16.78	16.78	16.78
Cameroon	225.08	24.01	36.74
Côte d'Ivoire'	699.90	128.36	169.03
Equatorial Guinea	17.03	6.78	8.72
Gabon	43.04	14.86	16.61
Gambia, The	26.93	20.11	21.52
Ghana	271.35	59.78	82.29
Guinea	54.01	11.16	14.59
Guinea-Bissau	29.04	15.83	19.98
Liberia	106.07	44.03	52.44
Mauritania	53.36	18.01	18.29
Nigeria	4,719.86	430.41	640.71
São Tomé and Príncipe	3.42	3.42	3.42
Senegal	341.67	120.64	161.78
Sierra Leone	67.85	19.08	23.36
Togo	133.76	35.66	49.87
TOTAL	**6,930.10**	**990.23**	**1,371.02**
Percentage of WACA Total (%)		**14.3**	**19.8**

Figure 5. *Regional plastic waste generation per square kilometer, 2018*



Note: *Annual plastic waste was first calculated for each country.*

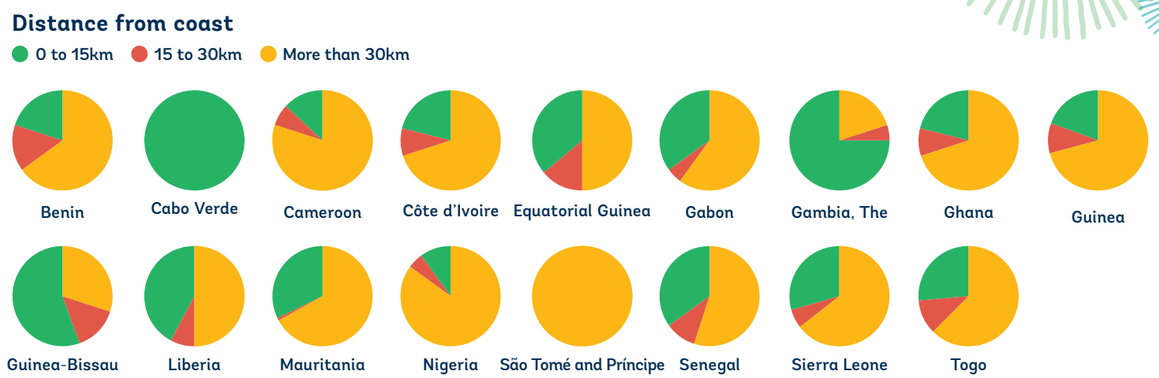
The regional maximum and minimum are consistent with the overall trend of plastic waste distribution. Higher generation occurs in densely populated cities located on the coast, or along trade routes associated with roads or rivers; lower generation occurs in less populated areas in the Sahara, on preserved lands, or inland.

Of the 6,930 kt of plastic waste generated across the analysis area in a year, 14.3 percent is produced within 15 km of the coast and 19.8 percent is produced within 30 km of the coast. The proportion of each country's plastic waste generated closer or further from the coast varies widely. The geographical totality of the island nations of Cabo Verde and São Tomé and Príncipe is within 15 km of the coast, and thus 100 percent of their waste is generated close to the ocean. By contrast, countries with larger inland populations connected to trade via rivers and roads, generate a majority of waste more than 30 km from the coast. The proximity of plastic waste generation to the coast suggests a greater likelihood that mismanaged plastic waste will enter the ocean. (Major waterways also pose an opportunity for waste to be transferred to marine environments but were not within the scope of this analysis.)

Both Cabo Verde and São Tomé and Príncipe produce the least plastic waste of the WACA countries (3.4 and 16.8 kt per year, respectively), amounting to only 5 percent of Nigeria's plastic waste generation within 15 km of the coast—a total of 430.4 kt per year (Figure 6).

12 The reported annual plastic waste generation values were based on estimates for 2018 arrived at through a data reconciliation exercise explained in Appendix A: Methods or Material Flow Analysis. These values should be considered as highlighting the differences in measures of magnitude for annual plastic waste generation between the WACA countries.

Figure 6. *Distance of plastic waste generation from the coast, by country, 2018*



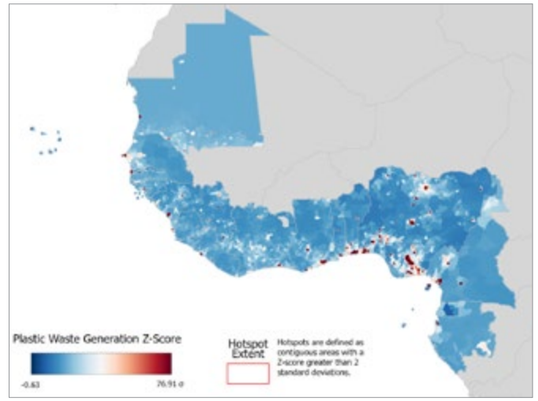
The most populous countries are not necessarily the greatest producers of plastic waste. Nigeria has the largest population and the greatest annual generation of plastic waste at 4,719 kt per year. However, the next most populous country, Cameroon, has the fifth-highest mass of plastic waste produced in a year, at 225 kt. Côte d'Ivoire produces 699 kt of plastic waste per year, earning second place in plastic waste production, but is the fourth-most-populous country in the region. Thus, regional plastic waste generation does not simply mirror population distribution.

In addition to calculating plastic waste generation per square kilometer, the study identified areas with generation rates significantly higher than the national mean as plastic waste "hotspots." Since plastic waste generation per square kilometer was calculated using waste generation rates countrywide, and large variation in population size and density can mask insights in less populous or densely populated areas when compared across countries, each country was analyzed for hotspots separately. The combined national analyses are displayed in Figure 7, while maps and tables of each nation's hotspots can be found under Country Briefs (Appendix C).[13]

The analysis revealed a total of 71 individual hotspots (listed in Appendix D) with a Z-score greater than or equal to a threshold of two standard deviations (Figure 7). Each hotspot was associated with the nearest named locale from the ESRI Africa cities dataset and cross-referenced against OpenStreetMap to increase accuracy in nine cases where multiple hotspots were assigned to a single locale.

Hotspots are largely determined based on the difference between the national mean plastic waste generated per square kilometer and the neighborhood mean. Some areas that may be expected to be hotspots are not, since their neighborhood mean is not significantly different from the national mean, as in the case of St. Louis, Senegal. Likewise, where the national mean is remarkably low, areas that may not be expected to be hotspots are identified as significant, as in the case of small cities in southern Mauritania

Figure 7. *Plastic Waste Generation Hotspots, 2018*



Note: *Hotspots were calculated for each country individually, then merged for visualization.*

Of the 71 hotspots, 32 were in Nigeria, accounting for 45 percent of total hotspots. However, these hotspots produce a total of just over 840 kt of plastic waste annually, which contributes 17.8 percent of the total national mass of plastic waste per year. Only Côte d'Ivoire's hotspots contribute less, with 16.1 percent of plastic waste coming from the country's single hotspot, Abidjan. Yet Nigeria has the greatest total mass of plastic waste from hotspots, followed by Côte d'Ivoire. In The Gambia, 49.2 percent of plastic waste comes from hotspots, followed by Mauritania (34.5 percent) and Cabo Verde (33.1 percent). The variation in the contribution of hotspots to total national plastic waste can be linked to how the population of the country is distributed and the overall generation of plastic waste. Countries where hotspots play an outsized role have high population density in cities and very low population density in rural areas. This is combined with less plastic waste generated overall each year. Countries whose hotspots contribute relatively less have comparably higher population density in rural areas, resulting in greater plastic waste generation outside urban hotspot and overall national plastic generation, increasing the threshold for an area to be deemed a hotspot.

13 For this analysis, very granular geospatial plastic waste generation data was smoothed by calculating the mean for a 10 x 10 km neighborhood surrounding each 1 km^2 cell for the entire country. The Z-score for each smoothed 1 km^2 data point was then calculated with the equation: (neighborhood mean of the 1 km^2 cell - national mean)/national standard deviation.

3.

Assessment of Plastics in Three Key Sectors: Construction, Fisheries, and Packaging

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The in-depth analysis of circular economy opportunities in the WACA region focuses on construction, fisheries, and packaging. This is because of their relative importance to the economies of the WACA region and their identification by the African Development Bank (AfDB) as industries with significant opportunities for the incorporation of circular economy solutions.[14]

For the WACA region, 2021 plastic consumption in a linear economy model (LEM) is estimated at 7.9 million tons of plastic, growing to 12 million tons by 2026.[15] This represents 78 percent[16] of the total across the three sectors under study. Of this 78 percent, 4.7 million tons are "lost resources" (originating from unused products or waste), and 3.3 million tons of these "lost resources" enter the marine area. By 2026 the three sectors' plastic LEM consumption is expected to reach 9.5 million tons, growing at a compound annual growth rate of 9 percent, with per capita plastic waste growing from 12.5 kg to 17.3 kg (7 percent growth).

Plastic in the region comes from a variety of sources:

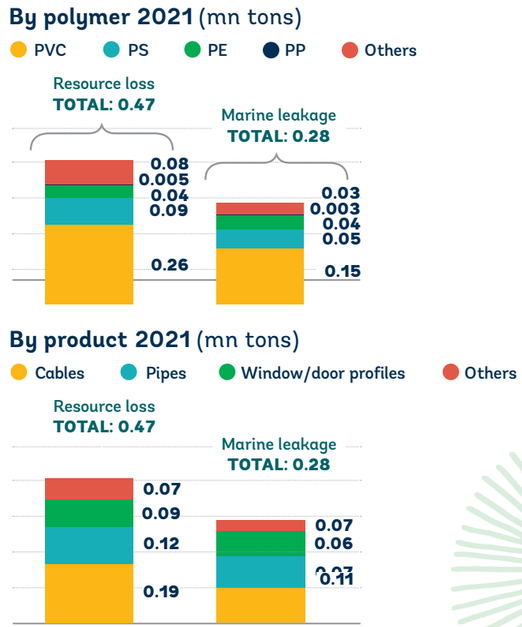
- Only Nigeria has domestic plastic resin production, estimated at 541 kt in 2021.
- Ninety-three percent of plastics is imported into the WACA region. Of this:
  - Most plastics are imported as multimaterial goods (46 to 50 percent of total plastic use in the region in 2021).
  - Imported resin (which is then converted domestically) and plastic products represented 16 percent of total plastic use in 2021.
  - Plastics used as packaging and wrapping of other imported goods (such as protective covers on electronics; plastic bags for chemical products, for example, big bags; plastic wrap around pallets; and so on) represented 0.8 million tons of imported plastics (10 percent of the 2021 total).
- Plastic is imported as resin and converted domestically, or imported as plastic products. Both made up around 16 percent of total plastic use in the region in 2021.
- Plastic also enters the region as part of imported multimaterial goods. In 2021, plastics embedded in these goods was around 46 to 50 percent[17] of total plastics used in the region.

Construction

Environmental and economic opportunities for circularity in plastics

The key products analyzed in this investigation were: cables; ceiling panels; cladding and profiles (windows and doors); floor coverings; insulation; pipes; seals; and gaskets. Figure 8 presents the contribution in million tons (by polymer and product)[18] of plastic waste and leakage into the marine environment. Construction and demolition (C&D) waste is not properly segregated. It is often mixed with other solid waste and sent to landfills or illegally dumped. Additionally, C&D waste can contain various kinds of plastics—including acrylic, polycarbonate, polypropylene (PP), and polyvinyl chloride (PVC) products, polymer-based paints, and adhesives.[19] These plastics can leak into the natural environment or into water streams, eventually entering the ocean, or they can be deposited directly into the ocean during floods.

Figure 8. *Contribution (million tons of plastic) of the construction sector to plastic waste and marine litter, 2021, by polymer and product*



14 Dalberg, African Circular Economy Alliance, African Development Bank, and World Economic Forum, Five Big Bets for the Circular Economy in Africa (Geneva: World Economic Forum, 2021), https://www.afdb.org/en/documents/five-big-bets-circular-economy-africa.

15 The selection of the three key industries—packaging, fisheries, and construction—was based on their relative dominance across the WACA region.

16 According to Geyer, Jambeck, and Law (2017), the estimated waste contribution of the three sectors to total waste is around 60 percent (Roland Geyer, Jenna R. Jambeck, and Kara Lavender Law, "Production, Use, and Fate of All Plastics Ever Made," Science Advances 3, no. 7 [2017]: e1700782). Plastic Europe (2018) estimates that in Europe more than 60 percent of plastic waste can be attributed to plastic packaging alone. The present analysis uses the latter data point as a benchmark for WACA, resulting in a higher-end range of 78 percent.

17 The 50 percent estimate is from the plastic landscape analysis of the previous section. The slightly lower estimate of 46 percent is from Martin Heller, Michael Mazor, and Gregory Keoleian, "Plastics in the US: Toward a Material Flow Characterization of Production, Markets and End of Life," Environmental Research Letters 15, no. 9 (2020): 094034.

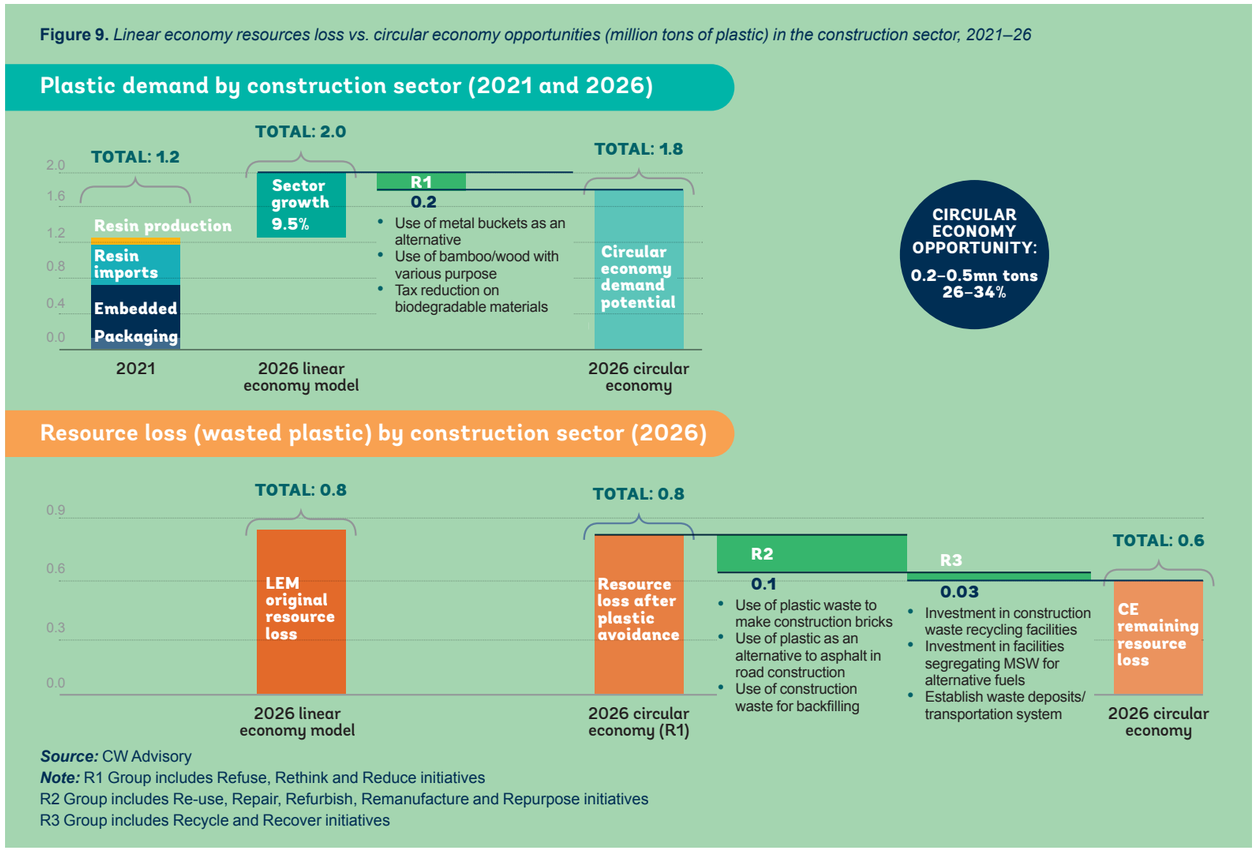
18 CO_2e/CO_2 emissions sourced from Daniel Posen, Paulina Jaramillo, Amy E. Landis, and W. Michael Griffin, "Greenhouse Gas Mitigation for U.S. Plastics Production: Energy First, Feedstocks Later," Environmental Research Letters 12, no. 3 (2017): 034024. Polymer-based coefficients—$kgCO_2$ emission per kg of plastic: PE (lower end: 1.1/higher end: 2.1/average: 1.6); PP (1.1/2.0/1.6); PS (2.8/3.5/3.2); PVC (1.9/2.5/2.2); others (1.7/2.4/2.0).

19 Based on data from http://www.circulareconomy.earth.

The regulatory and institutional framework includes solid waste management legislation in the WACA countries, but does not uniformly address C&D waste. While some countries have introduced legislation that specifically targets waste in the C&D sector—including Nigeria, which introduced such legislation in 2011—the WACA region in general shows a paucity of legislation focused on the growing volume of C&D waste and plastic use. WACA countries urgently need to formulate legislation that addresses use of plastic alternatives in the construction sector.

Currently, there are no specific circular economy initiatives within the WACA region's construction sector. Some circular initiatives in the industry (including the reuse of formwork and scaffolding)[20] have been adopted without a regulatory mandate. Nigeria is a case in point. However, there have been no such initiatives concerning plastics. With "refuse, rethink, and reduce" initiatives (R1)[21], circular economy opportunities in plastics in the construction sector will be between 26 and 34 percent (0.2 to 0.5 million tons) by 2026. Some of these circular strategies could be: use of metal buckets as an alternative to plastic buckets; use of bamboo/wood for construction proposes; and tax reductions on biodegradable materials. Preventing resource loss after plastic avoidance in construction by 2026 includes circular economy opportunities such as: the use of plastic waste to make construction bricks or for backfilling (R2); investment in construction waste recycling facilities; or the establishment of waste deposits and transportation systems (R3) (Figure 9).

Figure 9. *Linear economy resources loss vs. circular economy opportunities (million tons of plastic) in the construction sector, 2021–26*



Source: CW Advisory
Note: R1 Group includes Refuse, Rethink and Reduce initiatives
R2 Group includes Re-use, Repair, Refurbish, Remanufacture and Repurpose initiatives
R3 Group includes Recycle and Recover initiatives

In construction, polyethylene (PE) is used primarily in roofing; vapor retarders; window films; and flooring and countertop protection. Polypropylene (PP) is used in insulation for building wraps and in carpets. Analysis of the CO_2 emissions mitigation (million tons CO_2) for a linear/business-as-usual model and a circular economy model by the year 2026 shows that CO_2 emissions can be reduced between 20 and 40 percent (0.2 to 0.5 million tons), by applying the circular economy alternatives previously explained (Figure 10). In the case of other polymers, Table 3 shows the percentage range of the CO_2 emissions mitigation.

20 Olabode Emmanuel Ogunmakinde 2019, "Developing a Circular-Economy-Based Construction Waste Minimization Framework for Nigeria," doctoral thesis, Bond University, https://research.bond.edu.au/en/publications/developing-a-circular-economy-based-construction-waste-minimisati.

21 The R1 Group includes refuse, rethink, and reduce initiatives; the R2 Group includes reuse, repair, refurbish, remanufacture, and repurpose initiatives; and the R3 Group includes recycle and recover initiatives.

Figure 10. *CO_2 Reduction of PE and PP Resource Loss to Drive CO_2 Emissions in the Construction Industry (million tons CO_2 emissions)*

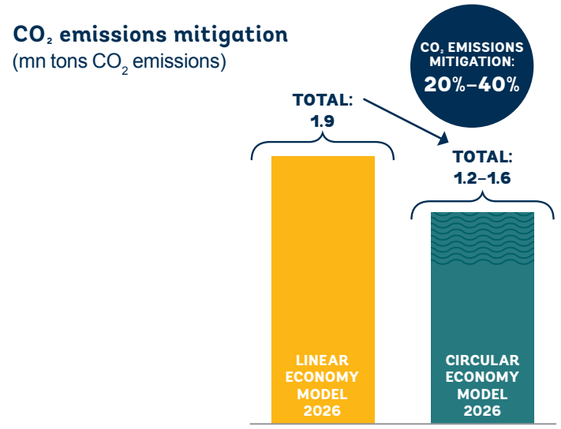


Table 3: *CO_2 Emissions Mitigation by Polymer (% range)*

Polyethylene	8%–52%
Polypropylene	10%–50%
Polystyrene	22%–38%
Polyvinyl chloride	22%–38%
Others	17%–43%

Environmental and economic action items to promote circularity in plastics

Based on the findings of this report, the following action items are recommended across all WACA countries.

Policy and regulation

- Implement specific regulations that address C&D waste—including recycled concrete, recycled aggregates, and plastics.
- Introduce legislation requiring a minimum percentage offset of plastics for other materials (including aluminum, steel, and timber) during the building design phase.
- Create an incentive structure (punitive or financial) that encourages implementation through a combination of tax increases for the use of unrecyclable/unrecycled plastics and tax rebates for circular initiatives in construction.
- Develop a building material roadmap for ongoing and future construction activities.

Public-private partnerships (PPPs)

- Introduce a "materials passport"[22] that stores information on building materials, ranging from bricks to fixtures. This could be useful during the renovation or demolition phases.
- Encourage PPPs that are:
  - Involved in build-operate-transfer contracts; waste incineration; waste treatment; recycling; and energy-from-waste projects.[23]
  - Focused on strengthening basic recycling infrastructure, including recycling infrastructure designed specifically for plastics.
  - Mandating the use of recycled materials (including plastics) in low-income housing and general building norms.
  - Providing finance to companies and individuals who agree to a minimum percentage use of recycled materials in public housing projects.

Research and development (R&D) opportunities

- Try out new products, such as "Agrocrete".[24] This is made from agricultural residue and has strength equivalent to a conventional red brick from a kiln. It is a low-carbon replacement for Portland cement (made from industrial by-products of steel, paper, and power industries).
- Conduct further research on "eco-bricks,"[25] which consist of 80 percent plastic waste from melting and extruding low-density polyethylene (LDPE) and polyethylene terephthalate (PET) plastics, and 20 percent sand.
- Investigate the possibility of using shredded plastic waste in concrete, so reducing the percentage of sand without compromising strength.[26]
- Partner with leading global universities to research utilizing plastic waste—including nonrecyclable plastics—to make roads.

Industry actions

- Promote reuse of plastic products—including doors, window frames, and electrical fittings removed during renovation or demolition.
- Develop a building sector roadmap that promotes nascent technologies to reduce plastics in public housing projects.
- Use cement kilns to recover energy by burning plastic waste, including nonrecyclable PVC.

22 A materials passport is an electronic document that enables the shift to a circular building sector. It describes defined characteristics of materials in products that give them value for recovery and reuse. The passport aims to: (i) increase the value or keep the value of materials, products, and components over time; (ii) create incentives for suppliers to produce healthy, sustainable, and circular materials/building products; (iii) support material choices in reversible building design projects; (iv) make it easier for developers, managers, and renovators to choose healthy, sustainable, and circular building materials; and (v) facilitate reversed logistics and take-back of products, materials, and components. Based on data from BAMB (Building as Material Banks), "Enabling Circular Building Industry," https://www.bamb2020.eu/.

23 Based on data from the PPP Knowledge Lab: https://pppknowledgelab.org/countries; https://pppknowledgelab.org/countries/ghana.

24 Based on data from GreenJams, "Carbon Negative Building Materials," https://www.greenjams.org/.

25 Based on "Circular Economy in Africa" from the Let's Do It Foundation, https://letsdoitfoundation.org/2021/01/28/circular-economy-in-africa/.

26 Based on a study by Vikas Khandelwal, "Replacement of Sand with Shredded Plastic in Cement Concrete," International Journal of Engineering Research and Technology (IJERT) 8, no. 6 (June 2019), https://www.ijert.org/replacement-of-sand-with-shredded-plastic-in-cement-concrete#:~:text=CONCLUSIONS%3A,28%20days%20of%20proper%20curing.

Potential tangible opportunities and stakeholders

The opportunities found in the various WACA countries were divided by clusters, or tiers. The clustering was driven by two primary metrics—plastic waste generation and a set of development indices[27] —and set as follows:

- Tier 1: Sierra Leone, Guinea, Liberia, Benin, Guinea-Bissau, Mauritania, and Togo
- Tier 2: Equatorial Guinea, Cameroon, Nigeria, Côte d'Ivoire, and Ghana
- Tier 3: The Gambia, Senegal, São Tomé and Príncipe, Gabon, and Cabo Verde

Tangible opportunities were focused on the reduction of plastic components used in the construction sector during the design phase through use of biodegradable materials, including bamboo; metals (steel and aluminum); and bio-based paints. The R's[28] percentage reduction for Tier 2 countries is estimated at 3–6 percent, while it is 1–3 percent for Tier 1 and 2–4 percent for Tier 3 countries. To maximize these opportunities, it will be necessary to engage the following stakeholders: government departments (environmental, industry, and trade); nongovernmental organizations (NGOs); industry associations; building material producers; the metal industry; and developers (architects and engineers).

Refurbishment using materials such as steel and timber, can be an important tool for reducing utilization of plastics in construction. The R percentage reduction is estimated between 4 and 5 percent for Tier 3 countries and 2 and 4 percent for Tier 1 and 2 countries. Key stakeholders include: government departments (environment and industry); industry associations; developers (architects and engineers); building material providers, municipal solid waste (MSW) departments; and metal recyclers.

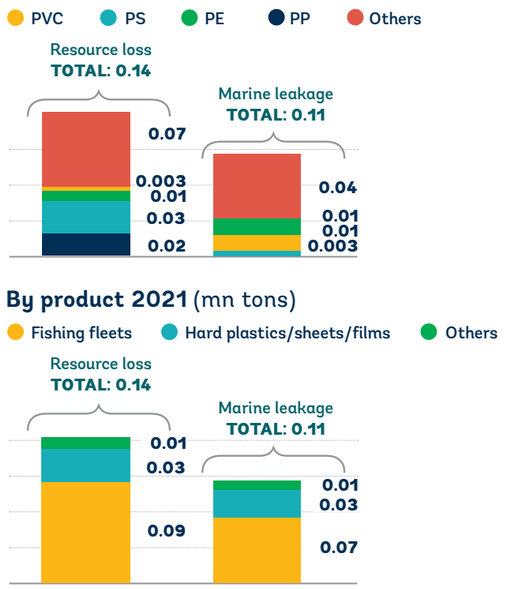
Utilization of C&D waste—including bricks and shredded plastic—for backfilling at new construction sites, is expected to have an impact of 3–5 percent for Tier 2 and Tier 3 countries, and 1–3 percent in Tier 1 countries. Relevant stakeholders include government departments (environment and industry); industry associations; MSW departments; plastic waste segregators and processor; concrete producers; and developers (architects and engineers).

Fisheries

Environmental and economic opportunities for circularity in plastics

The critical products in this sector are fishing nets; crates; plastic lines; ropes; feed bags; plastic embedded in fishing boats; buoys; and fish boxes. Figure 11 presents the sector's contribution—in million tons of plastics (by polymer and product)[29]—to plastic waste and leakage into the marine environment.

Figure 11. *Contribution (million tons of plastic) of the fisheries sector to plastic waste and marine litter, 2021, by polymer and product*



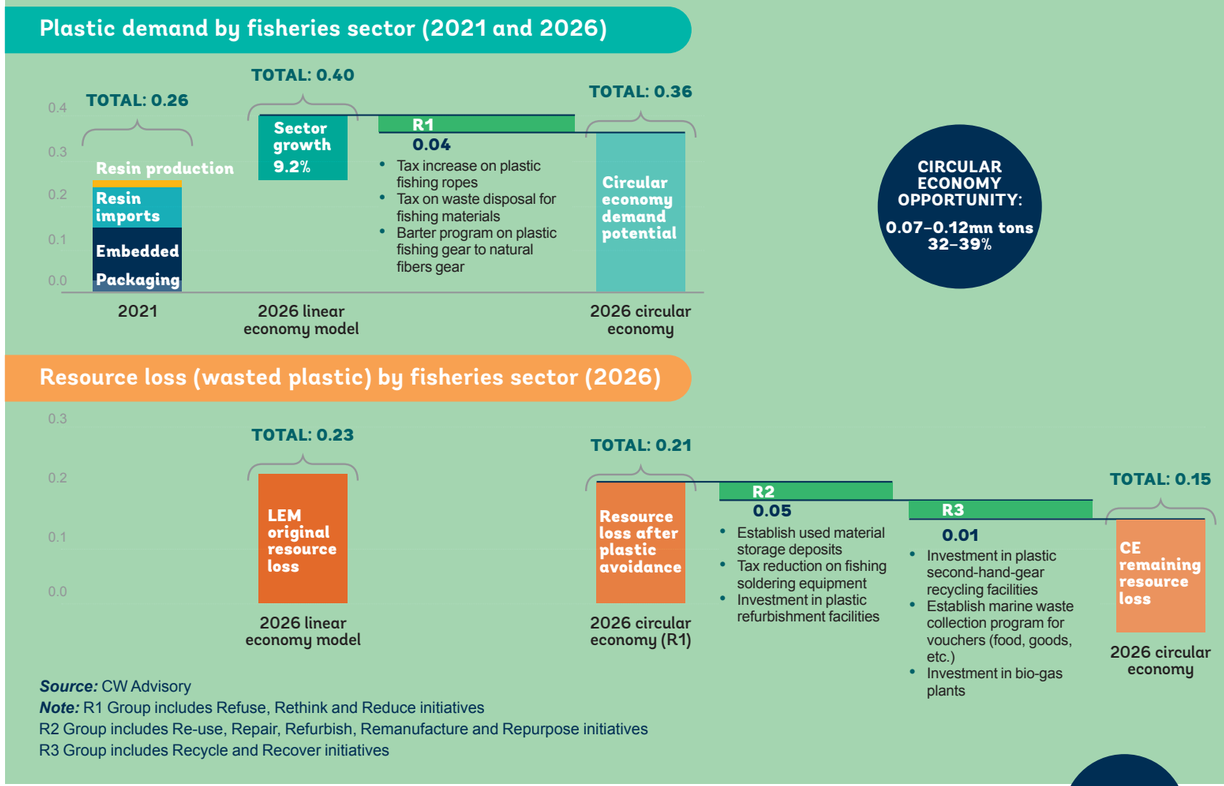
Plastic fishing nets ("ghost gear")[30] and nets dumped into the ocean (broken or lost during storms) are associated with key environmental risks and impacts. Most obviously, they lead to loss of marine life due to entanglement; but they also add to the growing marine plastic waste from the fishing industry, in the form of polyethylene (PE), polyvinyl chloride (PVC), and microplastics. "Ghost gear" disintegrates into microplastics, which are difficult to catch and recycle due to their minuscule size, leading to their consumption by marine life—and eventually humans.

The WACA countries lack specific regulations for the fisheries sector, aside from general mandates regarding the Blue Economy sectors.[31] For example, there are no regulatory measures for reducing plastic content in fishing gear and using alternative packaging materials. Similarly, there is inadequate enforcement of the few existing laws and regulations regarding this sector.

Some of the WACA countries have circular economy initiatives that apply to fisheries management. Certain of the countries, for example, address the protection and restoration of coral reefs.[32]

But existing circular economy initiatives regarding the reduction of plastics in the region are not directly associated with fisheries. Circular economy opportunities could reduce plastics resource loss from the sector by between 32 and 39 percent by 2026. Some of these initiatives are shown in Figure 12: a tax increase on plastic fishing ropes; a tax on the disposal of fishing materials; barter programs for plastic fishing gear and those made of natural fibers; storage deposits for used materials; a tax reduction on fishing soldering equipment; and recycling facilities for plastic secondhand gear, among others.

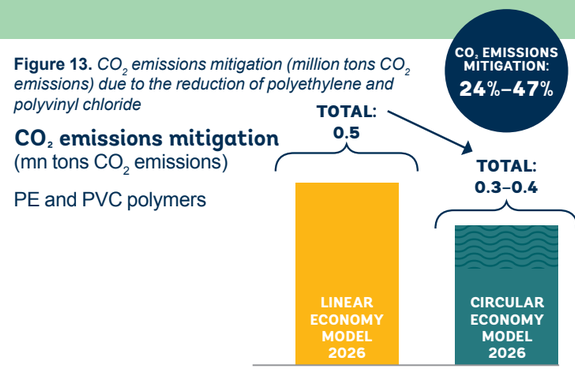
Figure 12. *Linear economy resources loss vs. circular economy opportunities (million tons of plastic) in the fisheries sector, 2021–2026*



Source: CW Advisory
Note: R1 Group includes Refuse, Rethink and Reduce initiatives
R2 Group includes Re-use, Repair, Refurbish, Remanufacture and Repurpose initiatives
R3 Group includes Recycle and Recover initiatives

Fishing-line manufacturers have been using PE increasingly in their products. In addition, nets and floats are normally made from PE and PVC, while PVC pipes and containers are used for the flotation of cage structures. An analysis of CO_2 emissions mitigation (million tons CO_2) by reducing PE and PVC in the fisheries sector—moving from a business-as-usual or linear model to a circular economy model by the year 2026—shows that CO_2 emissions will be reduced by between 24 percent and 47 percent (Figure 13). In the case of other polymers, Table 4 shows the percentage range of CO_2 emissions mitigation.

Figure 13. *CO_2 emissions mitigation (million tons CO_2 emissions) due to the reduction of polyethylene and polyvinyl chloride*



27 Plastic waste generation was calculated based on World Bank data until 2018, using GDP growth rates forecasted by the International Monetary Fund for 2021–26, whereas the set of development indices comprised of the Africa Infrastructure Development Index 2020 and the Environmental Performance Index 2020. See Appendix B.

28 R frameworks have been used in academia and by practitioners for decades, who view the various R frameworks as the "how-to" of CE and thus a core principle of it. The 3R framework, the most prominent R framework, is "reduce, reuse, and recycle." However, the European Union (EU) Waste Framework Directive introduced "recover" as the fourth R. Scholars have proposed R frameworks beyond the 4R framework, such as the 6Rs or even 9Rs: R0: refuse; R1: rethink; R2: reduce; R3: reuse; R4: repair; R5: refurbish; R6: remanufacture; R7: repurpose; R8: recycle; R9: recover (Kirchherr, Reike, and Hekkert, "Conceptualizing the Circular Economy").

29 CO_2e/CO_2 emissions sourced from Posen et al., "Greenhouse Gas Mitigation for U.S. Plastics Production." Polymer-based coefficients—kgCO_2 emission per kg of plastic: PE (lower end: 1.1/higher end: 2.1/average: 1.6); PP (1.1/2.0/1.6); PS (2.8/3.5/3.2); PVC (1.9/2.5/2.2); others (1.7/2.4/2.0).

30 World Wildlife Fund, "Stopping Ghost Gear," https://www.worldwildlife.org/projects/stopping-ghost-gear.

31 The Blue Economy centers on the sustainable use of ocean resources for economic growth, improved livelihoods, and jobs, while preserving the health of the ocean ecosystem, (https://www.worldbank.org/en/programs/problue).

32 Mialy Andriamahefazafy and Pierre Failler 2021, "Towards a Circular Economy for African Islands: An Analysis of Existing Baselines and Strategies," Circular Economy and Sustainability, https://link.springer.com/article/10.1007/s43615-021-00059-4.

Table 4. *CO_2 emissions mitigation by polymer (percentage range)*

Polyethylene	15%–56%
Polypropylene	17%–54%
Polystyrene	28%–42%
Polyvinyl chloride	26%–44%
Others	23%–47%

Environmental and economic action items for circularity in plastics

Policy and regulation

Governments in the WACA region should consider the following:

- Replace policies that allow purchase of new fishing nets and ropes made with plastic, with policies that mandate the purchase of nets and ropes made of natural fibers (including cotton, jute, or coconut fiber).
- Introduce policies that:
  - › Ensure installation of RFID[33] tags on the fishing nets of large commercial fishing vessels, to more effectively monitor existing inventory and losses.
  - › Incentivize fishermen/vessels to bring back any marine plastic litter they find, in exchange for tax credits.
  - › Offer tax subsidies on the purchase of second-hand fishing gear.

Public-private partnerships

Governments in the WACA region should partner with private sector providers to:

- Establish cold chains near main fishing wharfs and jetties, thereby reducing the need for plastic containers when transporting fish over long distances.
- Support production of local fishing equipment—using biodegradable materials—via a joint venture approach.
- Conduct compliance, surveillance, and regulations enforcement, on a service contract PPP model.

R&D opportunities

Opportunities exist to expand the knowledge base in the following ways:

- Conduct research on ways to replace plastic produce bags—including bait bags—with starch-based biodegradable bags.[34]
- Investigate the potential for using fish-oil-based plastics[35] to create cling wrap for food, rather than using plastic packaging made from PVC film.
- Develop existing research on the use of packaging made from algae as a replacement for plastic packaging.
- Partner with leading global universities to develop alternative biopolymers for packaging.

Industry actions

Industry could constructively consider the following activities:

- Form a circular economy forum with government agencies, leading industry associations, NGOs, and major corporate players to establish policies that have requisite buy-in from all stakeholders.
- Encourage all major sector companies to participate in corporate social responsibility activities, including provision of subsidized fishing gear (natural fiber nets) to local communities.
- Promote the avoidance of single-use plastic packaging across the value chain in the fishing industry, through the endorsement of recognized alternatives.

Potential tangible opportunities and stakeholders

Reuse of old fishing gear can significantly reduce the amount of new plastic entering the marine ecosystem. Reuse can be promoted through tax reductions on secondhand fishing gear as well as through investment in old gear. This R impact can range from an estimated 8 to 10 percent in Tier 2 countries to 2 to 6 percent in Tier 1 and Tier 3 countries. It will be necessary to engage the following stakeholders: government departments (environment, fisheries); fishing industry associations; fishing equipment manufacturers; and fishermen associations.

Repair of plastic crates (used in the transport of a catch between the various stages of the value chain) is another important means of reducing the quantity of new plastic entering the ocean. This would also help curb a tendency to dump broken crates into the ocean. The regular repair of crates can be encouraged via a combination of tax reduction measures for fishing soldering equipment and an investment in fishing-gear soldering facilities, among other measures. This R impact is estimated at 5 to 7 percent across all tiers. Relevant stakeholders include: government departments (environment, industry); industry associations; plastic producers/convertors; main plastic packaging users; MSW departments; plastic waste segregators; and resin producers.

Remanufacturing of old fishing gear (especially plastic fishing nets) to produce new ones would help to limit the entry of new plastic into the fishing industry. This can be encouraged by a combination of deposits for damaged gear and increased taxation on illegal waste disposal of old gear. This R impact is estimated at 3 to 4 percent for Tier 3 and 2 to 3 percent for Tier 1 and Tier 2 countries.

33 Michal Grabia, Tomasz Markowski, and Piotr Gruszka, Report: Development of a Fishing Gear Marking System Based on Passive RFID Technology (Sweden: MARELITT Baltic, 2019), https://www.academia.edu/41700173/Development_of_a_fishing_gear_marking_system_based_on_passive_RFID_technology.

34 The goal of preventing plastic from entering the marine food chain and maiming ocean wildlife is driving efforts to reduce, reuse, and recycle.

35 Shaena Montanari 2021, "Old Fish Bones Could Make the Eco-Friendly Plastic We Have Been Waiting For," Popular Science, April 8, https://www.msn.com/en-us/news/technology/old-fish-bones-could-make-the-eco-friendly-plastic-weve-been-waiting-for/ar-BB1freA3.

Key stakeholders include government departments (environment, marine); fishing industry associations; the textile industry; fishing equipment manufacturers; and fishermen associations.

Packaging

Environmental and economic opportunity for circularity in plastics

The key products analyzed in this sector were bubble wrap; disposable plates and cups; food containers and jars; medicine, shampoo, detergent and drink bottles; flexible packaging; stretch/cling film for food and packaging; and water sachets. The packaging sector contributes the most to plastic waste and marine litter (2.9 million tons of plastic) in comparison with the construction (0.28 million tons) and fisheries (0.11 million tons) sectors, which present under 0.3 million tons of plastics. Figure 14 presents the contribution of the packaging sector to plastic waste and leakage into the marine environment, in million tons of plastic (by polymer and by product).[36]

Figure 14: *Contribution (million tons of plastic) of the packaging sector to plastic waste and marine litter, 2021, by polymer and product*

Some of these goods presented key risks and impacts. Because of photodegradation and other weathering processes, plastic packaging leaked into the marine environment in the form of microplastics and nanoplastics.[37] These harmful products are often ingested by marine life, potentially leading to deaths and an associated decrease in fish stocks. Additionally, harmful endocrine-disrupting chemicals are found in plastic marine litter which, when ingested by humans, can cause various diseases and cancers, necessitating medical care. This places an economic burden on healthcare systems.Eleven of seventeen WACA countries have existing circular economy initiatives. Seven of these countries have put in place extended producer responsibility (EPR) legislation and instituted bans on single-use plastic bags, with various levels of enforcement and success. For example, Nigeria—the region's sole producer of plastics and its largest consumer—instituted a ban on plastic bags in 2014, and in 2019 strengthened the legislation by instituting a N500,000 fine or a three-year jail sentence.[38] (Ten countries in the WACA region are yet to establish EPR legislation with regard to plastics.[39]) Despite plastic bans, enforcement remains a point of concern. This is because there is inadequate municipal infrastructure to address waste management requirements and drinking water challenges, so driving ongoing dependence on SUP water sachets. There is a need for clear regulations regarding plastic packaging content in products and possible plastic replacements, especially for products produced within the region.

By improving circular economy initiatives like "refuse, rethink, and reduce," circular economy opportunities in the packaging sector for the year 2026 will be between 41 and 53 percent (2.2–4 million tons of plastic). Examples include tax reductions on imported bio-based plastic; trading programs to exchange used plastic bottles for durable alternatives; and the banning of plastic straws (Figure 15).

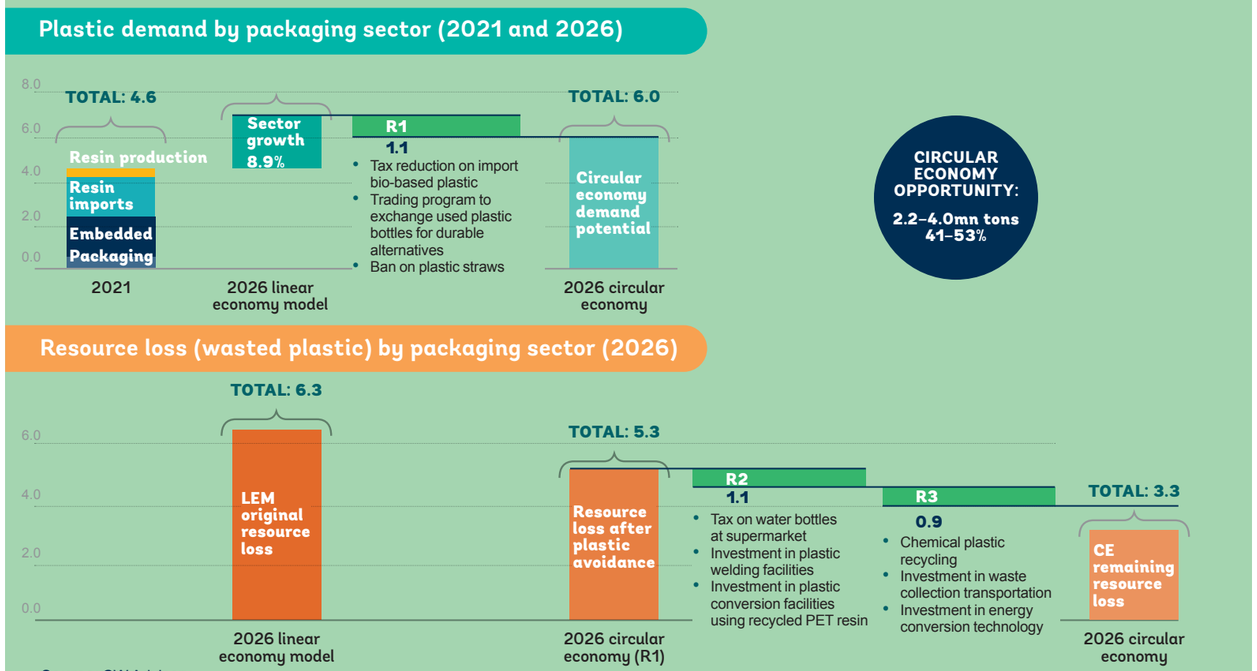
36 CO_2e/CO_2 emissions sourced from Posen et al., "Greenhouse Gas Mitigation for U.S. Plastics Production." Polymer-based coefficients—kgCO_2 emission per kg of plastic: PE (lower end: 1.1/higher end: 2.1/average: 1.6); PP (1.1/2.0/1.6); PS (2.8/3.5/3.2); PVC (1.9/2.5/2.2); others (1.7/2.4/2.0).

37 Frederic Gallo, Cristina Fossi, Roland Weber, David Santillo, Joao Sousa, Imogen Ingram, Angel Nadal, and Dolores Romano. 2018. "Marine Litter Plastics and Microplastics and Their Toxic Chemicals Components: The Need for Urgent Preventive Measures," Environmental Science Europe 30, no. 1 (2018): 1–14.

38 Greenpeace Africa. 2020. "34 Plastic Bans in Africa: A Reality Check," May 19, 2020, https://www.greenpeace.org/africa/en/blogs/11156/34-plastic-bans-in-africa/.

39 Chatham House: http://www.circulareconomy.earth.

Figure 15. *Linear economy resource loss vs. circular economy opportunities (million tons of plastic) in the packaging sector, 2021–26*



Source: CW Advisory
Note: R1 Group includes Refuse, Rethink and Reduce initiatives
R2 Group includes Re-use, Repair, Refurbish, Remanufacture and Repurpose initiatives
R3 Group includes Recycle and Recover initiatives

In the packaging sector, PE can be used in a variety of applications— including crates, trays, bottles for milk and fruit juices, and caps for food packaging. In addition, polypropylene (chemical resistance) can be used in containers for yogurt, margarine, and medicine bottles. An analysis of CO_2 emissions mitigation (million tons CO_2) if a business-as-usual or linear model progresses to a circular economy model by the year 2026, shows that CO_2 emissions will be reduced between 33 percent and 62 percent (Figure 16). In the case of other polymers, Table 5 shows the percentage range of CO_2 emissions mitigation.

Figure 16. *Reduction of PE and PP resource loss to drive CO_2 emissions in the packaging industry (million tons CO_2 emissions)*

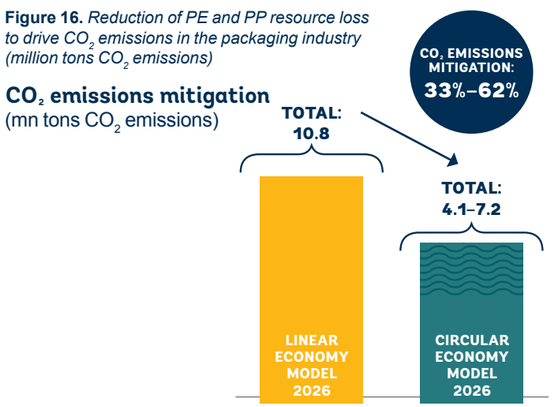


Table 5. *CO_2 emissions mitigation by polymer (percentage range)*

Polyethylene	31%–64%
Polypropylene	32%–63%
Polystyrene	42%–53%
Polyvinyl chloride	40%–55%
Others	38%–57%

Environmental and economic action items for circularity in plastics

Policy and regulation

- Introduce additional regulations, beyond banning single-use plastics and instituting EPR requirements (existing in only 7 of 17 countries[40]).
- As existing legislation does not sufficiently address various types of plastics (including PS and PVC) that are difficult to recycle and have harmful effects on humans, there is a need for important policies that:
  - mandate a defined percentage of recycled plastic in all PET bottles.
  - offer fiscal incentives for the production of bioplastics.
  - set import standards for plastic packaging content (to be formulated on a regional basis to carry weight with importers).

Public-private partnerships

- Support PPPs for PET bottle recycling programs with users (major soft drink/water bottlers) in each country.
- Support production of local PET recycling plants in major cities, through a PPP / joint venture approach.
- Establish PPPs at a local level that promote the use of alternative materials to plastic packaging (including paper and cardboard, bioplastics, and glass).
- Ensure that PPPs focus on financing projects that agree to utilize a majority percentage of recycled plastic to make plastic packaging.
- Implement PPPs that incentivize establishment of recycling centers for the segregation of plastic wastes by type.

R&D opportunities

- Partner with leading global universities in research on new and innovative packaging materials made from sustainable sources.
- Promote research in the field of polymers, including precision packaging resin; this will help reduce overall plastic use and perhaps encourage scientific development of new resins, including bio-polyethylene for packaging.[41]
- Research opportunities in flexible packaging based on starch and bio-based materials.
- Research the redesign of existing packaging containers to reduce resin use.

Industry actions

- Ensure that WACA countries support and collaborate with the newly formed Global Alliance for Circular Economy and Resource Efficiency to enact circular economy initiatives at the national and regional level.[42]
- Join the "African Plastics Recycling Alliance," initiated by a group of international consumer goods companies, to focus on creating small-scale recycling projects.
- Ensure that industry associations work with governments and international stakeholders to mandate a fixed percentage of recycled plastic in all new products.
- Promote mandatory corporate social responsibility policies to establish waste collection/segregation and small-scale plastic resin recycling plants.
- Lobby for effective EPR legislation, as this will help protect the industry.

Potential tangible opportunities and stakeholders

To achieve a reduction in use of plastic packaging, WACA countries need to focus on bio-based (including starch) materials as an alternative. Advances can be promoted via a combination of tax reductions on both the import and production of such materials. The R impact percentage ranges from an estimated 7–10 percent in Tier 2 countries to 5–7 percent for Tier 1 and Tier 3 countries. It will be necessary to engage the following stakeholders: government departments (environment, industry); industry associations; plastic producers/convertors; the major plastic packaging users (PET bottle and high-density polyethylene [HDPE] water sachet manufacturers); MSW departments; plastic waste segregators; and resin producers.

Recycled PET bottle flakes may be used as a raw material to produce high-quality PET recycled pellets to make new products. This can be promoted through a combination of waste deposit initiatives and tax rebates for plastic recyclers. The R impact percentage is an estimated 5–7 percent for Tier 3 countries and 5–6 percent for Tier 1 and Tier 2 countries. Relevant stakeholders include: government departments (environment, industry); industry associations; plastic producers/convertors; main plastic packaging users; MSW departments; plastic waste segregators; and resin producers.

Recycling of plastic packaging continues to promise the biggest circular economy impact. The R impact percentage ranges from an estimated 9–12 percent for Tier 2 countries to 3–7 percent for Tier 1 and Tier 3 countries. Key stakeholders include: government departments (environment, industry); industry associations; MSW departments; plastic waste segregators and processors; and resin producers.

Education campaigns, initiated through closer collaboration between public, private, and civil society groups, can be a useful tool for inculcating proper methods of disposing packaging waste. A joint effort at sensitization will facilitate the provision of consistent messaging, allow for more efficient resource allocation, and enable careful selection of target communities for sensitization campaigns.

40 Data from http://www.circulareconomy.earth.

41 Maughon, B, and Jones, M. 2019. "R&D Efforts to Make Plastic More Sustainable." R&D World, January 29, 2019, https://www.rdworldonline.com/rd-efforts-to-make-plastic-more-sustainable/.

42 Afrik21. 2021. "Africa: The New GACERE Alliance for the Adoption of the Circular Economy," February 24, 2021, https://www.afrik21.africa/en/africa-the-new-gacere-alliance-for-the-adoption-of-the-circular-economy/.

4.

Stakeholder Engagement

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A stakeholder engagement exercise was conducted as part of efforts to address key gaps in knowledge about the plastic value chain in the WACA region. The exercise aimed to highlight insights pertaining to:

- ***Plastic production***—to understand the dynamics behind primary plastic production by industrial manufacturers and the current and/or potential role of circular economy principles in their operations.
- ***Plastic consumption***—to understand the dynamics behind the plastic product consumption of businesses and consumers.
- ***Plastic end of life***—to understand plastic waste management dynamics.
- ***Enabling conditions***—to shed light on the policy, finance, and technology changes required to facilitate a transition to a circular future for plastics.

A total of 29 organizations and industry experts, representing 9 of the 17 WACA countries,[43] were interviewed by a team of consultants. To ensure diversity in opinions, the team engaged with government ministries and agencies; private businesses; industry associations; and civil society organizations. Table 6 highlights the diverse backgrounds of the stakeholders interviewed.

Table 6: *Breakdown of interviewed stakeholders*

Stakeholder Classification	No. of Stakeholders Engaged (contacted and interviewed)
Government	9
Private sector – industry association	4
Private sector – recyclers	7
Nongovernmental/civil society organizations	4
Private sector – plastic-related businesses	2
International organization	1
World Bank Group	1
Academia	1

Commentary on Plastics Management Challenges

Sourcing recovered plastics for plastic production

Plastic manufacturing in the WACA region is still overwhelmingly dominated by the use of virgin plastic resin. In expert interviews, private stakeholders in Ghana and Nigeria highlighted that this dominance is partly driven by concerns that recovered plastics obtained by informal operators from nonsegregated sources such as landfills, are polluted and therefore not suitable for recycling. Since recovered plastics fail to meet cleanliness and quality threshold requirements, their use in the manufacture of new plastic products (especially for food and beverage packaging) is limited.

In addition, the plastic recyclers interviewed noted inconsistency in the supply of recovered plastics (from both formal and informal waste collection operators) as a factor responsible for low demand. They also expressed their concerns regarding local plastic manufacturers with lower quality thresholds. Hence, even though there are regional manufacturers—including manufacturers of fast-moving consumer goods—who would like to use recycled plastics in the production of packaging, they have legitimate concerns about predictability of supply and contamination of raw products. These challenges eventually stifle attempts by manufacturers to pursue plastic-packaging-related recycling and sustainability targets.

State of industrialization in the WACA region

There is a direct relationship between plastic manufacturing infrastructure and plastics circularity in the WACA region. Amid the region's low level of plastic manufacturing infrastructure, there are limited opportunities for the incorporation of upstream circular economy initiatives for plastics—such as designing reusable and easily recyclable products. For example, interviews with public sector stakeholders in Liberia revealed that, like many economies in the WACA region, Liberia has a minuscule plastics manufacturing sector and subsequently relies heavily on imports of manufactured plastic products.

Policy landscape for plastics production

Another important hindrance highlighted by private sector interviewees in Nigeria and Ghana is the prevailing weakness of the policy landscape regarding promotion of circularity in plastics production. Absence of recycled content standards and of clear legal frameworks mandating or encouraging the incorporation of recovered plastics in the production of plastic products, disincentivizes the plastics manufacturing sector in the WACA countries. Many countries in the WACA region (with the exception of Nigeria, which as of 2016 introduced food-grade standards for recovered plastics) currently lack clear policy frameworks to incentivize or mandate the incorporation of circularity in plastics production. This has deterred investors and private enterprises from venturing into more circular approaches to plastic product manufacturing. Hence, many manufacturers continue to rely on virgin plastic resin and produce single-use plastic products. Similarly, few policies or certification programs are designed specifically to incentivize local manufacturers in the production of reusable or recyclable plastic products.

43 Cameroon, Cabo Verde, Côte d'Ivoire, Ghana, Liberia, Nigeria, São Tomé and Príncipe, Senegal, and Togo.

Consumption

Consumer awareness and consumption patterns

Many consumers in the WACA region lack critical awareness of the importance of circular approaches to plastic consumption, thereby exacerbating the region's plastic management challenge. As indicated by public and private sector interviewees from Ghana and Liberia (and alluded to by similar stakeholders in Nigeria) many consumers, especially in urban areas, tend to prefer single-use plastic products such as plastic film, carrier bags, and PET bottles. For example, according to a prominent private sector recycler in Ghana, Ghanaians have a high preference for single-use plastics, largely due to their convenience and relative affordability, with limited or no consideration given to sustainable consumption.

Consumers across the region are unaware of the importance of properly managing plastic and plastic waste. Similarly, commercial and industrial establishments are not sensitized to circular economy business models and practices. According to private sector stakeholders interviewed in Ghana, major obstacles to the promotion of plastic waste prevention and at-source segregation by households and businesses are i) limited sensitization efforts by public stakeholders and ii) a scarcity of incentives to access and improve waste collection services and infrastructure. Similarly, private industries do not prioritize consumer education on plastic products and packaging, for example through waste prevention campaigns or adequate labeling information on appropriate final disposal and recycling. This contributes to the elevated levels of contamination of potentially recoverable plastics. This challenge is further heightened by the ease with which citizens can engage in improper waste disposal, as indicated by public and private sector interviewees in Liberia and Nigeria, respectively. Many Nigerian citizens have grown accustomed to illicit waste disposal activities, such as burning and burying plastic waste, in a climate of weak enforcement.

According to private sector recyclers in Ghana and Nigeria, the adoption of water sachets is a notable consumption trend in the WACA region over the last three decades. The challenges faced in the provision of potable water, even in urban areas with piped networks, have contributed to the proliferation of single-use, plastic film drinking-water-sachets across the WACA countries, especially among low-income households. Another reason for increased consumption of plastic film single-use water sachets is their potential to provide a hygienic source of water.[44] A 2021 econometric analysis based on demographic and Health Survey data for Ghana and Nigeria[45] showed a correlation between single use plastics container use across and within years, and notable declines in the median predicted rate of child mortality (42 percent and 20 percent) and incidence of diarrhea (21 percent and 10 percent) for all children (0 to five years of age).

A representative of the National Public Health Institute of Liberia indicated that an increasing number of companies were actively involved in the production of high-density polyethylene (HDPE) plastic-film water sachets in Liberia. Exacerbated by the prevailing low levels of plastic waste segregation and recovery, as well as an increasing population in the WACA region, this trend contributes significantly to the proportion of used plastics ending up in the environment.

Effectiveness of consumption-related policies

Government efforts to improve plastics management through influencing plastic consumption trends, have to date had little impact in WACA countries. As highlighted by several private sector stakeholders, attempts to ban the use of plastic products, notably in Nigeria and Ghana, have proven futile. In many WACA countries (such as Côte d'Ivoire, Cameroon, and Mauritania), several iterations of plastic ban policies have not produced the expected outcomes. This can be attributed to the absence of strong enforcement mechanisms and easily accessible and affordable alternatives. Weak enforcement has also had direct implications for the implementation of extended producer responsibility (EPR) schemes—most notably in Nigeria, the sole WACA country with a national EPR system. Other WACA countries have limited ability to introduce viable EPR schemes, owing to the absence of effective monitoring systems to track formal and informal plastic product flows. This was highlighted as a major challenge by public sector stakeholders in Liberia and Ghana.

End of Use

Weak market dynamics for recovered plastics

Though every WACA country has unique market features, the plastics waste streams in many WACA countries lack reliable indigenous market demand—a major disincentive to efficient collection of plastic waste. For example, Liberia's low plastic recovery performance is driven significantly by a lack of investment in related infrastructure. Because of its prevalence as a form of food packaging (particularly by street-food vendors) used plastic film is susceptible to organic contamination. Furthermore, many WACA countries do not generate enough recovered plastics to feed large-scale recycling facilities. The challenge pertaining to economies of scale has limited the prospects of capital-intensive investments in large-scale material recovery and recycling facilities.

44 Stoler, J. 2017. "From curiosity to commodity: a review of the evolution of sachet drinking water in West Africa: Sachet drinking water in West Africa", WIREs WATER, https://doi.org/10.1002/wat2.1206,

45 Dasgupta S., Roy S., Sarraf M., and Wheeler D. 2022 (under review). *The Economics of Plastic Use and Cleanup Priorities for West African Coastal Countries*. Washington D.C. : The World Bank.

Private recyclers in Ghana indicated that PET plastic recovery in the WACA region was not as profitable as other plastic waste recovery streams, because of the lack of infrastructure for PET plastic waste pelletization. Recycling businesses cannot afford the prohibitive cost of this infrastructure without financing support. Also, because informal operators are compensated on the basis of the weight of recovered plastics, and PET-based products are lighter than HDPE (that is, nonfilm) and PP plastic products, informal operators find PET plastics such as water and beverage bottles unattractive. Because PET plastics have this low value, they constitute a considerable proportion of the plastic waste found on land and in marine environments.

According to public and private stakeholders, owing to logistical challenges many formal waste collection operators are unable to engage in segregated plastic waste collection. This further contributes to the disposal of plastic waste at landfills. These waste collection firms are unable to afford dedicated recyclable waste collection vehicles, as well as the associated waste transfer stations required to accommodate multiple waste streams. Limited space for collaboration with informal operators, and slow government efforts to formalize informal operations, have contributed to the common mixing of waste collection from residential and commercial sources.

Private sector stakeholders in Ghana and Nigeria highlighted the general absence of high-quality data on plastic products and waste flows in the WACA region, particularly regarding the activities of informal operators. This hampers efforts to promote effective national strategies for plastic waste recovery.

Commentary on Potential Solutions for Plastic Management

Production

Introduction of policy incentives for virgin plastic substitutes

Governments in the WACA countries must work toward introducing policies that incentivize reusable product production as well as use of recovered plastics as a substitute for virgin plastics in the production of plastic products. Standards for the use of recovered plastics can attract more investment into the market. For example, the recent introduction of standards for food-grade applications of recovered polyethylene terephthalate (rPET) in Nigeria has contributed to both increased interest from private investors and the expansion of potential off-takers of recyclable plastic materials. Also, to address the supply risks of manufacturers, governments must consider appropriate incentive schemes for greater collaboration between formal and informal waste operators. This will increase the volume and quality of recovered plastics, thereby increasing domestic and regional demand.

Instituting circular packaging standards

Industry associations, particularly those connected to manufacturers and importers of fast-moving consumer goods, must actively promote the introduction of packaging standards that promote circularity—particularly through reuse and recycling. Working in collaboration with state agencies and local and regional recycling stakeholders, manufacturing associations in major WACA economies, such as the Association of Ghana Industries, can explore the introduction of voluntary mandates on circular packaging and alternatives to plastic packaging.

Consumption

Strategies for promoting sustainable consumption

A blanket switch from single-use plastics to alternatives is likely to be impractical in the WACA region. This is because of cost barriers and health and safety concerns—especially relating to packaging for food and beverages—and the absence of packaging quality standards. Hence, it is encouraging that several important stakeholders, most notably AfDB, are providing much-needed funding for regional R&D into viable alternatives to single-use plastics. Also, at the national level, research institutes (such as Ghana's Council for Scientific and Industrial Research) as well as technology and innovation centers, could be supported with grants or tax breaks to incentivize research into alternatives to plastic packaging, especially using waste/materials from the agricultural sector. Additionally, governments should be leading efforts to promote market-based solutions to plastics management.

The WACA region would likewise benefit from stronger collaboration between NGO stakeholders and public, private, and civil society, with regard to plastic management sensitization. Educational programs, particularly those that emphasize the negative environmental implications of improper plastic waste disposal and highlight practical approaches to behavioral change and sustainable consumption, are vital to strengthen the foundation for circularity in WACA countries.

Regarding informal uses of plastic packaging, WACA country governments and private stakeholders should reassess the use of biodegradable food packaging. For example, with appropriate planning, Katemfe leaves (Thaumatococcus daniellii) and Cassava-based packaging (Manihot esculenta) could be an affordable alternative to plastic packaging such as low-density polyethylene (LDPE) plastic bags and expanded polystyrene foam packs, especially in low-income and rural communities. However, efforts to promote biodegradable alternatives must also assess the associated risks pertaining to interference with food supply.

End of life

Exploration of intraregional trade of recovered plastics

Increased intraregional collaboration on plastic waste management among the WACA countries, and intraregional trade in recovered plastics, could help achieve economies of scale in smaller markets such as those of Liberia, Sierra Leone, and The Gambia. It is essential to assess and develop political solutions to the implications of such trade in relation to the Basel Convention. Intraregional collaboration could also benefit these smaller economies in the areas of knowledge and technology transfer, and awareness-creation on circular economy and plastics.

Introduction of EPR schemes and favorable fiscal policies

The introduction of mandatory EPR schemes is also pivotal to entrenching circular economy solutions in the WACA region. The expert interviews conducted for this study revealed that these schemes must include all businesses involved in the introduction of plastic and plastic-based products into consumer markets. This will require an effective system of identifying and tracking the activities of the relevant stakeholders, particularly water-sachet producers and importers of finished plastic products. Also, the funds raised through the scheme should be ring-fenced and managed transparently to engender continued participation from all stakeholders. Additionally, mandatory EPR schemes should be linked to effective systems for plastic waste recovery—including deposit-return schemes and a network of buyback centers. Though the EPR policies would be beneficial in facilitating effective collection of plastic waste, governments in the WACA region must be cautious of replicating the EPR systems that have been developed in advanced economies. These are unlikely to be appropriate for the African context, particularly due to the predominance of informal waste collectors and low-income consumption of plastics.

Likewise, governments in the WACA region can explore the introduction of fiscal policies and price-based systems (such as tax breaks, levies, and deposit-refund schemes) as tools for promoting plastic alternatives and circular economy approaches to plastics recovery. Examples of fiscal policy initiatives that could be explored are the removal of import tariffs for plastic recycling equipment, and the introduction of tax breaks for local manufacturers of alternatives to single-use plastic packaging. To determine the most appropriate approach to take, governments would do well to prioritize consultation with manufacturers and other relevant stakeholders on the design of fiscal policies. The establishment of such fiscal initiatives can lay the foundation for the development of a viable EPR scheme. Furthermore, networks of satellite plastic buy-back centers would directly incentivize plastics consumers and waste collectors to increase the capture of recovered plastics, and support a cleaner and more reliable supply of recovered plastics. Governments in the WACA region must also facilitate the development of effective traceability and duty-of-care systems for tracking the flow of products across the plastic value chain.

Promotion of circular innovations and associated research and development

According to private recyclers and civil society stakeholders in Nigeria, entrepreneurs pursuing circular economy initiatives would benefit from the harmonization of standards for recovered plastics. Similarly, they would benefit from governmental adoption of green procurement initiatives to stimulate demand. State agencies responsible for public works and other critical infrastructural investments can consider introducing mandates for contractors to incorporate construction inputs that are entirely or partially made from recovered plastics. Road construction works are a particularly advantageous context for application of such initiatives. Backed by the relevant policy framework, such green procurement policies can facilitate the creation of a stable demand market.

Governments can also stimulate market acceptance of circular-economy-related products. In terms of product design, further R&D is needed to balance health and safety considerations with the need to reduce waste. For example, bottles for malt drinks are usually dark in color to prevent fermentation; however, dark plastics have low value and are not recyclable. Thus, it is vital to harness the capacity of local research institutions to support the growth potential of entrepreneurial circular economy business models.

A major challenge of the circular economy approach is that, in many instances (especially with regard to recovered LDPE plastics) many of the new products generated are single-use items. In Ghana, for example, recovered plastic sachets (made from LDPE) tend to be used for producing single-use black plastic bags with low reuse and recycling value. Hence, it is important for governments in the WACA region to consider promoting a hierarchy of uses for recovered plastics based on their inherent circularity. This can be achieved through enacting standards and offering technical guidance on approved uses of recovered plastics that lead to the production of reusable and recyclable end products.

Another innovation highlighted by private recyclers in Ghana is the introduction of plastic credit systems. As plastic waste recovery in the WACA region is driven by the informal sector, the introduction of credible plastic credit schemes has the potential to contribute toward safeguarding the livelihood of—often poorly paid—informal waste operators. The plastic credit system aims to enable companies with plastic footprints to pay for plastic waste recovery equivalent in volume to their plastic production.[46] According to a waste management company with operations in Ghana and Côte d'Ivoire (Coliba) the incorporation of plastic credits in its operations helped subsidize waste purchases from the informal waste sector. In addition, plastic credits provided an earnings buffer for informal operators during episodes of oil price falls, and the associated decline in the demand for recovered plastics.

46 World Wildlife Fund, "WWF Position: Plastic Crediting and Plastic Neutrality," 2021, https://www.worldwildlife.org/publications/wwf-position-plastic-crediting-and-plastic-neutrality.

Given the critical importance of financial incentives for informal operators, and since many informal operators lack access to bank accounts, mobile money technology offers a means of facilitating access to financial services. Commercialization of circular economy business models within a smaller production environment is a challenge faced by stakeholders in the largest economies of the WACA countries. However, this hurdle can be minimized by using well-established tools—such as mobile technology—to significantly improve the efficiency of value chain transactions.

Working in collaboration with the private sector and academic institutions, governments across the WACA region must introduce opportunities for circular-economy-based skills transfer for stakeholders across the plastic value chain. The expert interviews conducted for this study highlighted the importance of providing accessible and affordable sensitization and skills programs for small- and medium-size enterprises (SMEs) and start-ups in the region. For example, local entrepreneurs could benefit from sensitization and skills programs for SMEs and start-ups, on an array of circular-economy-related topics. These could include the development and commercialization of non-plastic packaging alternatives, as well as the design of reusable and recyclable plastic packaging. Technical training on the reusability and recyclability of plastic packaging and alternatives should prioritize provision of insights pertaining to important considerations such as hygiene, cost, and convenience. Additionally, training should facilitate the use of mobile payment platforms, particularly by informal operators.

Collaboration with development partners

Engagements with a representative of the African Development Bank also highlighted the important contributory role development partners can play in supporting the growth of circular economy solutions for plastics management. As an example, the AfDB addresses the challenge SMEs face in securing private sector financing, by providing de-risking financial instruments for small, private entities like start-ups and SMEs. These include grants and credit guarantees given directly to credit unions and regional commercial banks, such as Ecobank. Additionally, the AfDB aims to operationalize a financing vehicle—the African Circular Economy Facility—to facilitate the disbursement of funds for investment in circular-economy-based solutions.

As a member of the Technical Committee of the African Circular Economy Alliance (ACEA), the AfDB cooperates with international partners (such as the World Economic Forum, Global Environment Facility, African Circular Economy Network, Government of Finland, the Finnish Innovation Fund – SITRA), to support governments in developing conducive policy environments for the growth of circular-economy-based initiatives. This includes identifying policy gaps and offering support on ways to improve enforcement. ACEA aims to empower African governments to incorporate circular economy approaches into overarching efforts to facilitate economic growth and strengthen climate and disaster risk resilience. The ACEA considers the African Free Trade Agreement as a tool for promoting circular economy in the management of plastics, especially when it comes to the harmonization of regulations and standards for plastics recycling. To realize this agreement's potential to increase intra-African trade, it is important to develop standards that regulate the reuse, recycling, and disposal of plastics. Hence, AfDB collaborates with the World Economic Forum and African Standardization Organization to provide technical assistance for the development of harmonized, continental standards for PET plastics and to enable greater levels of trade in plastic polymers.

Engagement with informal stakeholders to achieve circularity

Governments in the WACA region must facilitate the incorporation of informal operators into the resource management regime. The experts interviewed for this study highlighted the need for ensuring informal sector participation in the decision-making process for circular-economy-related policies. Also, greater collaboration between formal and informal waste operators can aid in expanding the introduction of segregated plastic collection, especially for households that cannot benefit from door-to-door collection. Hence, it is important for formal waste operators, with support from government, to invest in training opportunities for informal operators to enhance the efficiency of their operations and the supply of recovered plastics.

As the South Africa-based Sustainable Seas Trust pointed out during the stakeholder engagement, though the financing of plastics recovery should be primarily driven by market dynamics—aided by governments creating a conducive business environment—governments can also encourage plastic collection by allocating small amounts of capital to informal waste operators. However, to maximize the benefits accrued, it is important to ensure that such investments are allocated to the appropriate recipients. Hence, government decision-makers need to have the capacity to identify the most effective informal operations requiring financial support.

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5.

Conclusions

This report described both the current status of plastics management in the WACA countries, and the potential for key industrial sectors in the region to leverage circularity in the plastic value chain. By facilitating collaboration geographically—across sectors, subsectors, and value chains—the WACA program and its network of regional partners can play a critical role: sharing lessons learned and identifying actions needed in order to move forward. The network of organizations associated with WACA include the regional economic commissions (WAEMU, ECOWAS, CEEAC), the Abidjan Convention Secretariat (ABC), the Center for Ecological Monitoring (CSE), and the International Union for Conservation of Nature (IUCN).

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Plastic enters the region in direct (resin and production) and indirect (embedded, wrapping) forms, which compose 43 percent and 57 percent of the total, respectively. The economics of circularity are challenging under current circumstances. Switching from imported, virgin plastics to domestic, secondary plastics creates the opportunity to build domestic value chains and increase employment.

The WACA countries have a well-established upstream petroleum sector, with most production centered offshore in the Gulf of Guinea. Since local output is limited, the countries are highly dependent on imported plastic resins. In 2018, net resin imports for the WACA region amounted to 1,231 kt. Nigeria is the only nation producing virgin plastic resins, generating 486 kt in 2018. Nigeria and Ghana were identified as the largest net importers of plastic waste and scrap in 2018, at 14 kt and 6 kt, respectively. However, Mauritania, Côte d'Ivoire, and Senegal were identified as net exporters of plastic waste and scrap, ranging between 1 kt and 2 kt.

Since virgin plastic products are still often cheaper than recycled plastic products, transformative policy support may be required to increase the viability of a local or regional circular plastics economy. Such policies should bolster the domestic or regional supply of secondary products and materials, as well as the growing demand for domestically or regionally produced secondary products and materials. To this end, a variety of policy instruments are available, including traditional and emerging extended producer responsibility targets (EPR measures).

There are numerous ways to improve the downstream of the plastic value chain and mitigate environmental risks, while increasing competitiveness of local industries producing green or alternative plastic products. For example, a green product taxonomy (green certification/standardization) and newly designed incentives (such as tax credits/exemptions) could support the creation of domestic markets for more sustainable products. Circular economy opportunities provide potential solutions by extending the life of plastic products and fostering cross-sectoral use. However, consumer-driven solutions require capacity-building and knowledge-sharing activities by governments to generate virtuous circular loops and reduce direct and indirect environmental costs (among others, the impacts of plastic waste on the tourism industry).

It is estimated that in 2021 plastic consumption generated environmental impacts between 7.9 and 11.1 million tons CO_2, growing between 12 to 16.9 million tons by 2026 if the linear business model does not progress to a circular economy model. Based on a linear economy model, the three economic sectors covered in this study (construction, fisheries, and packaging4) represent a resource loss scenario of 13.2 million tons CO_2 by 2026. However, in a pragmatic circular economy model, resource loss by 2026 will be between 5.5 and 9.2 million tons CO_2. Depending on different price scenarios and their underlying drivers, if the WACA region moves towards a circular economy pragmatic model, it will potentially generate carbon credits[47] valued between $30 and $57.75 million by 2026.[48] Savings in a business-as-usual model are estimated at 13.2 million tons CO_2 compared to 5.5 to 9.2 million tons CO_2 in a pragmatic circular scenario.

Policy Framework for Circularity in the WACA Region

To effectively incorporate circularity across the plastics value chain in the WACA region, critical policy framework changes are required at both the national and regional level. Targeted plastic product bans can be explored for scenarios where affordable, regionally sourced alternatives are available. The quest for viable alternatives in the WACA region must be contingent on support for R&D partnerships with research institutions testing potential plastic substitutes. Nonetheless, in the short- to medium-term, it is very likely that the WACA region will still be a largely import-based market for plastic products and other goods with embedded plastic. Hence, governments in the WACA region will need to introduce circular-economy-based specifications for plastic-related imports, such as setting a minimum recycled plastic content percentage in any imported plastic-based product. Additionally, EPR policies can be introduced to address funding gaps in the recovery of plastic waste.

Governments (working in close partnership with local manufacturing stakeholders) would benefit industrial sectors across the WACA region by developing clearly defined and enforced industry product content standards relating to plastic products. Furthermore, well-thought-out systems of taxes, rebates, and other fiscal policy measures can be used to shape manufacturing sector market trends, such as increasing the competitiveness of plastic-packaging alternatives. These measures can also influence consumer behavior in relation to consumption and plastic waste disposal.

Likewise, across the WACA region, governments must develop targeted waste management policies geared toward maximizing plastic waste prevention, plastic product reuse, and plastic recyclate extraction. Both government and private sector stakeholders will need to facilitate the development of data collection systems that track the flow of plastics across the value chain. These efforts should ideally be complemented by investments in awareness and sensitization programs on plastics management, led by government, and private or NGO stakeholders.

47 Carbon credits (often referred to as "offsets") have an important dual role to play in the battle against climate change. They enable companies to support decarbonization beyond their own carbon footprint, thus accelerating the broader transition to a lower-carbon future. They also help finance projects for removal of carbon dioxide from the atmosphere—delivering negative emissions, which will be needed to neutralize residual emissions that will persist even under the most optimistic scenarios for decarbonization (McKinsey Sustainability, 2020).

48 According to Oil Price Information Service (OPIS), the average price of voluntary carbon credits—frequently sold, premier forestry offsets—is about USD7.50 per ton CO_2 over the last 12 months in 2022 (IHS Markit Energy Expert, 2022)

Material Flow Analysis

While plastic value chain data is available for the WACA region, overall data quality is considered to be average to poor. As a result, the quantitative results from the material flow analysis should be regarded as mostly directional, providing orders of magnitude rather than robust estimates. For example, UN Comtrade data on trade usually disagrees significantly with the data provided by exporters and importers. Likewise, estimates for both solid waste generation and plastic content of solid waste are highly uncertain. Plastic-waste-generation estimates (that is, the amount of plastic exiting use) also typically differ from estimates for the total amount of plastic entering use, again highlighting pervasive data quality issues.

Despite poor data quality and data gaps, there is nevertheless consensus on directional trends and order of magnitude. In sum:

- There is insignificant trade in plastic waste and scrap between WACA countries.
- A few countries have significant conversion industries—by far the largest being Nigeria, Ghana, and Côte d'Ivoire.
- Ghana and Côte d'Ivoire are also significant exporters of new plastic products.
- Though approximately half of WACA countries report significant imports of plastic products, the majority of plastic enters the region as plastic contained in finished goods (multimaterial products).
- Estimates for the amount of plastic entering and exiting use in the WACA region in 2018 (in other words, plastic entering or produced for local consumption, and plastic waste, respectively) are of the same order of magnitude for 13 of 17 countries.
- Data disagreements are smaller than the uncertainty bounds of the input parameters.
- Across the WACA region, there is a rising awareness of the magnitude of the problems caused by marine plastics.
- The largest plastics consumer of the three sectors investigated is the plastic-packaging sector, followed by the construction sector.
- Most recycling (87 percent of all plastic) in the WACA region today takes place in the plastic- packaging sector.
- Nigeria (the region's largest economy) represents 45 to 63 percent of total plastic consumption (5 million tons), followed by Côte d'Ivoire and Ghana.

Assessment of Three Key Sectors

There is currently no established national or regional framework for implementing a circular economy across industries in the WACA region; the current regulatory focus is on recycling. Plastics recycling in the region is limited: an estimated 10 percent (0.5 million tons) of total plastics are recycled, which is roughly 1 percent higher than the recycling rates in the United States and Canada, respectively. Bans on single-use plastics—and, in some countries, EPR policies— have been enacted as a circular economy initiative. Finally, an absence of economically feasible alternatives to plastics, and lack of access to the required technology, hinders regional governments' adoption of circular economy policies.

Countries from Tier 2 (Côte d'Ivoire, Ghana, Nigeria, Cameroon, and Equatorial Guinea) represented around 87 percent of the region's resource loss (6.2 to 6.7 million tons in 2021), driven to a large extent by regional heavyweights, Nigeria and Ghana (Figure 17). Resource loss of countries from Tier 1 was between 0.5 and 0.6 million tons in 2021, representing 88.2 percent from the packaging sector; 8.7 percent from construction; and 3.1 percent from fisheries. In the case of Tier 3, the resource loss was between 0.2 and 0.4 million tons in 2021. Per capita, estimated plastic waste generation was between 12 and 30 kg during the year.

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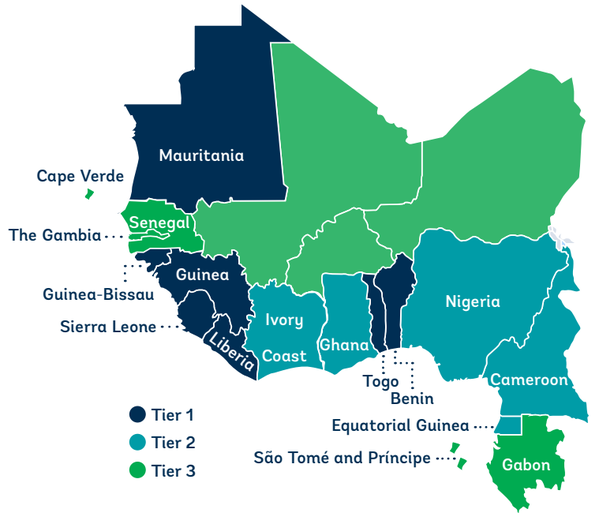
Figure 17: *Resource loss (wasted plastic) in the three key sectors of the WACA countries (2021)*

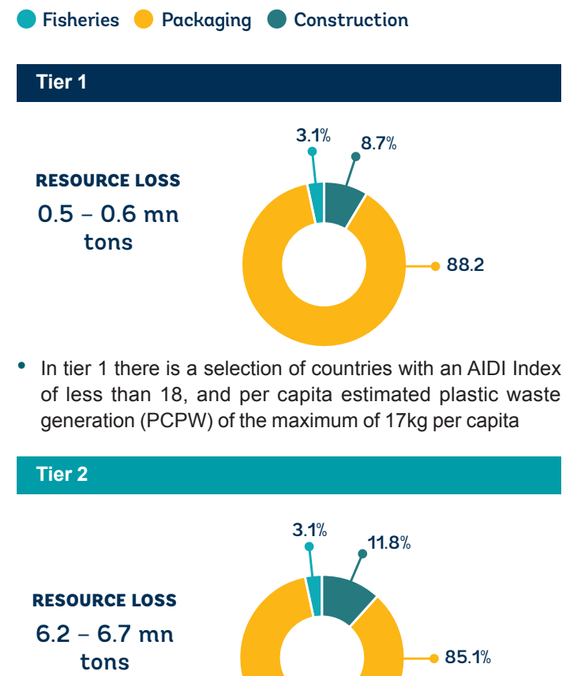


The 17 WACA countries were segmented into three tiers, according to two types of profiles. These were: a) Infrastructure: based on the 2020 Africa Infrastruc-ture Development Index (AIDI), and b) Plastic consumption: based on plastic-waste-generation intensity (on a per capita basis to indicate the relative intensity) also gauged against total plastic waste generation in the WACA countries.

Tier 1: Sierra Leone, Guinea, Liberia, Benin, Guinea-Bissau, Mauritania, and Togo

Tier 2: Equatorial Guinea, Cameroon, Nigeria, Côte d'Ivoire, and Ghana

Tier 3: The Gambia, Senegal, São Tomé and Príncipe, Gabon, and Cabo Verde



- In tier 1 there is a selection of countries with an AIDI Index of less than 18, and per capita estimated plastic waste generation (PCPW) of the maximum of 17kg per capita
- Ghana is considered an outlier, Ghana and Nigeria were grouped in the same tier due to their economic weight and level of industrialization
- Generally, in tier 2 the AIDI is in between 19-25 and PCPW between 15-27kg per capita
- In tier 3 there is a selection of countries with an AIDI Index of more than 28, and per capita estimated plastic waste generation (PCPW) is in between 12-30kg per capita

National policies in the WACA region (including defined waste-management regulations by sector; promotion of bioplastics; advocating use of glass and metals such as aluminum and steel; and increased recycling) need to be legislated, implemented, and enforced to enable circular economy models.

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Construction

Most construction in the WACA countries is informal, but large domestic and regional material groups play a key role. The formal construction sector, on the other hand, contributes materially to local economies. This is especially so in the case of the larger economies (for instance, from 3 percent of GDP in Liberia to about 7 percent of GDP in Nigeria and Ghana). Across the region, the construction sector is expected to grow from 3 to 6 percent per annum through 2026.

Plastic packaging

Almost the entire WACA region is dependent on plastic imports. Nigeria, which has its own production, is a notable exception. With a circular economy model, the plastics industry in Nigeria is expected to grow at a rate of about 10 percent from 2021 to 2026, and packaging is estimated to grow between 1.5 and 2 times as fast as the economy.

Important initiatives are taking place in the WACA region. These include: investment in plastic waste management facilities/deposits/transportation; implementation of trading programs where used plastic bottles can be exchanged for durable alternatives (for example, bottles made of aluminum, bamboo, and glass); and investments in new technologies for plastic repair and welding.

Fisheries

Fisheries in the WACA region compose a fragmented sector. The industry is dominated by artisanal fishing, with a combination of licensed and unlicensed vessels (from other regions). Nevertheless, overfishing has led to increased government involvement and improvements in regulatory enforcement. This sector is expected to expand at a compound annual growth rate of about 2.5 percent through 2026, representing 3 to 5 percent of GDP in the region.

Some important circular economy initiatives are taking place in this sector. These include: investment in the repair and use of secondhand fishing gear; promotion of natural fibers rather than plastics in new fishing nets; and provision of funding to fishers collecting marine litter.

Stakeholder Engagement

The WACA region's production of plastic goods is dominated by imported virgin plastic resin. There is minimal material substitution with recovered plastics, owing to concerns over quality and security of supply. Low levels of industrialization in the region also account for the lack of local demand for recovered plastics. Another factor is the region's limited capacity to absorb potentially recyclable plastics such as PET packaging. Insufficient generation of plastic waste in many WACA countries also hinders investment in recycling infrastructure. These challenges contribute to low plastic recovery performance across the WACA region. Likewise, they disincentivize investments in waste segregation infrastructure to enhance plastic waste recovery.

Plastic consumption trends also directly influence the plastic-waste-management challenge in the WACA region. For example, consumption trends play a significant role in reducing the market value of recovered plastics. Plastic film waste, a ubiquitous component of plastic waste in the WACA region, usually has a high level of contamination.

There is also a relatively weak policy framework for promoting circularity in plastics management in the WACA region. With the exception of recent regulatory developments in Nigeria, there is generally an absence of policies that incentivize virgin plastic resin substitution. Policies introduced to promote circular consumption patterns have likewise struggled to find a footing. For example, attempts at introducing laws banning plastic have mostly proven unsuccessful, as there are weak enforcement mechanisms. With strong enforcement and monitoring mechanisms still lacking in many WACA countries, the viability of future policy innovations and structural changes to plastic waste recovery remains uncertain. Additionally, effective policy development is hampered by a lack of systems for accurately tracking plastic flows, especially in informal settings.

Likewise, sensitization of consumers on circular approaches to plastic consumption remains a major obstacle to plastic-waste prevention in the WACA region, particularly with regard to the consumption of single-use plastics. This is further compounded by concerns over the affordability of alternatives to plastics. Across the WACA region, policies incentivizing circular consumption patterns are largely nonexistent.

6.

Recommendations

Plastics are versatile materials that have many applications and economic advantages over other materials. But the environmental impacts of plastic production, use, and end of life, are becoming unsustainable. Owing to the low residual value of this waste, and lack of economical and sustainable disposal solutions, there are numerous downstream impacts associated with the end of life of plastic products. One of the most effective solutions is to incentivize transition to alternative materials and recycling in a fully circular manner, identifying potential cross-sectoral use of plastic waste.

The cost of virgin plastic is a significant factor in the identification of viable alternative plastic materials/products. Plastic is inexpensive, holding very low marginal value at the end of life. At the same time, its environmental costs could be extremely high, affecting production costs as a whole if an Extended Producer Responsibility (EPR) policy was in place. Deposit Return Schemes are a particularly effective means to add value at end of life, and could be expanded to most plastic items. One of the main aims of governments is to identify opportunities to reduce or eliminate the indirect cost of the environmental management of plastic products' end of life. Sustained investment in innovation, infrastructure, and logistics is required to create a circular economy based on refilling, use of alternative materials (including bioplastics), and recycling. With a view to reducing the contribution of plastics to climate change and improving the economic impacts of downstream solutions, overall recommendations include:

- Develop and innovate in bio-based feedstocks, via green procurement by governments.
- Standardize packaging to create low-emission refill and reuse.
- Recognize and involve informal waste reclaimers as part of the solution.
- Factor GHG emissions into the cost of plastic throughout the value chain, via taxation.
- Finance infrastructure for waste management and impose a total ban on waste exports—plastic pollution from one country affects the entire planet.
- Provide education and clear labelling.
- Press upon manufacturers that they have sole responsibility to move away from damaging practices and products, and to supply environmentally sound alternatives.

Materials Flow Analysis

The materials flow analysis task highlighted three key recommendations for policy makers and relevant stakeholders in the WACA region:

- Since there is overreliance on imports from foreign markets to meet plastic demand in the WACA countries, any attempts to incorporate circular-economy-based solutions to plastic management will benefit from engaging with the countries and companies that export plastic products and plastic-containing goods into the region.
- Governments in the WACA countries (with support from bilateral and multilateral partners) should take the lead in investing in research on the circularity potential of the large volumes of plastic waste generated. As the circularity potential is largely unclear, this approach would facilitate better assessment of the commercial value of proposed circular economy business models in the region.
- Governments in the WACA region, working closely with the private sector and informal stakeholders, need to invest in increasing the completeness and accuracy of plastic value chain data in the region.

Assessment of Three Key Sectors

Several initiatives across the three sectors are recommended by this study (Table 7). These include, to:

- Adopt new business models, such as a green construction approach (including the use of metals, bamboo, and composites).
- Increase use of bio-based plastics and invest in production technology (packaging).
- Use new geo-tags technology on nets to reduce fishing ghost gear and renew the inventory of commercial shipping nets.
- Extend the lifetime of products, including through their reuse and the production of materials with higher recycled content.
- Introduce policies that encourage the use of mono-color PET bottles and develop biodegradable seaweed- or algae-based plastic for use in the fishing industry. Instead of mono-color PET, we can use clear or transparent PET bottles.

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Table 7: *Recommendations for initiatives across three sectors in the WACA region*

	Across sectors	Construction	Packaging plastics	Fisheries
New business models	• Regulatory initiatives including bans, EPR policies • R&D partnerships with research institutions to develop alternatives to plastic • Propose regulations that promote imports of products containing a set minimum % of recycled plastics	• Adoption of green construction approach including use of metals, bamboo and composites • Adopt use of similar Building Information modeling (BIM) technology currently used in Europe by Sanda Hus to reduce plastics use in the industry	• Support increased use of bio-based plastics through import subsidies and investment in production technology • Support research and implementation new bio-material mycelium-based packaging as compostable alternative to plastics • Institute and encourage like for like exchange programs especially for replacing PET bottles for glass/wood/metal alternatives	• Mandate and promote in coordination with industry associations the use of natural fibers for fishing nets and plastic lines • Use technology including RFID tags to create inventory of commercial shipping nets in the region to reduce new ghost gear
Extend lifespan	• Regulatory policies defining industry product content standards • Employ fiscal policy measures including spending, taxes and rebates to shape industry and consumer behaviour	• Select reused or higher recycled content products and materials (e.g., plastic recycled content blocks, reclaimed bricks, locally recycled aggregates) • Modify the specification for building elements (e.g., lower- weight roof design, water pipe material	• Invest in plastic repair/welding technology as a means of prolonging use of existing plastics • Promote transfer/installation technology. For example, Notpla company helped address a biodegradable solution to plastic packaging for water sachets • Enact policies that encourage mono-color use of PET bottles (white) for enhancing recycled PET resin availability	• Promote policies encouraging use of second-hand/discarded fishing equipment especially nets, ropes and crates • Work with research institutions to develop seaweed/algae based and commercially viable plastic for use in fishing industry
Use materials	• Development of targeted waste management policies • Awareness and participation campaigns from govt, private sectors and NGO's	• In coordination with industry associations, mandate use of non-plastic material for packaging of building materials • Support public entities in developing tender requirements for affordable housing and infrastructure • Industry associations and waste management bodies to align with cement industry to ensure MSW stream for alternative fuels	• In coordination with industry associations and research institutions evaluate increased possibilities of chemical recycling • Promote segregation and collection of plastics by type including bottle deposit schemes • Invest in plastic waste recycling technology similar to TECO which transforms waste into usable roofs, furniture and school benches • Invest in collection centers in urban centers as most plastic waste is concentrated in cities vs. rural areas	• Support policies that encourage collection of marine plastic waste + ghost gear by fishermen by providing rebates on purchase of new gear • Enact policies in coordination with industry associations that provide subsidies and or tax breaks for exchange of plastic fishing equipment for other materials • Support programs enable exchange of lost fishing gear for vouchers for food or school supplies

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Fisheries

Over the next five years, new circular business models can motivate the fisheries sector to extend the life span of plastic products and reuse plastic materials. Resource loss mitigation in 2026 assumes an optimistic and radical approach to circular economy. For the fisheries sector, this "ideal" scenario of plastic avoidance would mean the reduction of CO_2 emissions of between 0.04 and 0.06 million tons, and waste recovery, between 0.07 and 0.08 million tons. Subsequently, the potential variation between original resource loss in a liner economy model and in the circular economy scenario, represents a 40 to 52 percent circular economy opportunity. Recommended next steps for the sector are as follows:

- Ban new models of plastic nets (for example, improve servitization, whereby fishers pay for the net service rather than buying the equipment) and incentivize the use of biodegradable fishing gear.
- Increase patrolling of WACA countries' sea limits to enforce marine littering laws.
- Incentivize marine litter collection through fishing industry associations, in exchange for vouchers for weight of litter collected.
- Implement additional taxes on new plastic fishing gear and offer tax rebates on purchase of secondhand and biodegradable fishing gear.
- Invest in local manufacturers of natural fibers for use in nets and support fishing equipment manufacturers using metal and wood.
- Ensure stringent enforcement of plastic ban laws and recycling initiatives.
- Mandate a customs duty increase for fishing gear with a high plastic content.

Plastic packaging

The plastic packaging sector can focus on new circular business models to extend the life span and reuse of plastic materials over the next five years (through 2026). Resource loss mitigation in 2026 is premised on a radical and optimistic approach to a circular economy. For the packaging sector, this "ideal" scenario of plastic avoidance would reduce CO_2 emissions between 0.6 and 0.9 million tons, and waste recovery, between one and 1.8 million tons. Consequently, the potential variation between original resource loss in the linear economy model and in the circular economy scenario represents a 56 to 75 percent circular economy opportunity. Recommended next steps for this sector are as follows:

- End the use of single-use plastics in water and food containers.
- Install strategically located recycling plants in urban centers.
- Engage national/local authorities to analyze the feasibility of a minimum percentage use of alternative packaging material.
- Ban single-use plastics in the tourism sector and restaurant business.
- Subsidize bioplastics and cardboard manufacturers to enable plastic substitution.
- Invest in glass/aluminum container manufacturers; and support drinking water/beverages providers.
- Collaborate with plant nurseries in cities.[49]
- Ensure stringent enforcement of plastic ban laws and recycling initiatives, and mandate maximum allowable plastics content requirements for imported products.
- Mandate customs duty reductions for products having minimum recycled plastic percentages.

49 Plant nurseries have been identified as a good choice for native plant conservation, increase pollination in green cities and part of houses and buildings to maintain a cool temperature in the infrastructure.

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Construction

New business models in the construction sector can focus on life-span extension and reuse of materials for trial pilots over the next five years. Resource loss mitigation in 2026 assumes radical and optimistic circular economy interventions. For the construction sector, this "ideal scenario" of plastic avoidance will reduce CO_2 emissions between 0.2 and 0.3 million tons, and waste recovery between 0.1 and 0.2 million tons. Therefore, the potential variation between original resource loss in the linear economy model and in the circular economy scenario represents a 36 to 50 percent circular economy opportunity. Recommended next steps for this sector are as follows:

- Ban plastic pipes and fittings in new construction projects[50].
- Introduce conditional financing for the use of green construction techniques that focus on reducing and avoiding plastics on mega projects.
- Invest in steel/metal manufacturers and providers supplying the construction industry; mandate architects and engineers to adopt green construction techniques; and subsidize circular economy researchers.
- Ensure stringent enforcement of a ban on plastic pipes and fittings in new construction projects; and establish regional building codes.
- Accept the International Green Construction Code and foster partnerships between renowned universities and local R&D centers.

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50 Plastic pipes can be replaced with galvanized steel, aluminum, copper, or cast iron.

Stakeholder Engagement

According to stakeholders in the WACA region, a number of opportunities can be explored to incorporate circular economy strategies within the region's plastics value chain:

- Governments in the WACA region can significantly reduce the amount of plastic waste ending up in the environment by establishing new policies geared toward circularity and plastic waste prevention. In practice, this means critically considering regulations on packaging standards; green procurement initiatives; EPR schemes; and fiscal policies that incentivize plastic waste prevention, reuse, and recycling. Additionally, countries in the region with economies of scale, such as Ghana, would benefit from increased investment in industrial recycling infrastructure.
- By harnessing their respective strengths, closer collaboration between public, private, informal, and development stakeholders would help address challenges in the region's plastics sector. For example, strategic engagements with the informal sector would expand WACA countries' efforts towards increased access to segregated plastic waste collection. Likewise, closer collaboration could facilitate effective behavioral change campaigns.
- Policy makers in the WACA region can stimulate the acceptance of circular-economy-related products by making available R&D funds for project design innovations. With funding for extensive research, WACA countries can, for example, explore the potential of biodegradable packaging as an alternative to single-use plastic packaging.
- The concentration of plastics recycling capacity in just a few WACA countries—namely Nigeria, Ghana, and Côte d'Ivoire—presents a strong case for increasing intraregional trade in recovered plastics to reduce the plastic waste burden on smaller economies in the region.
- Development of circular economy solutions in the region requires technical and financial support from bilateral donors and development banks such as the World Bank, the African Development Bank and the Islamic Development Bank, among others.

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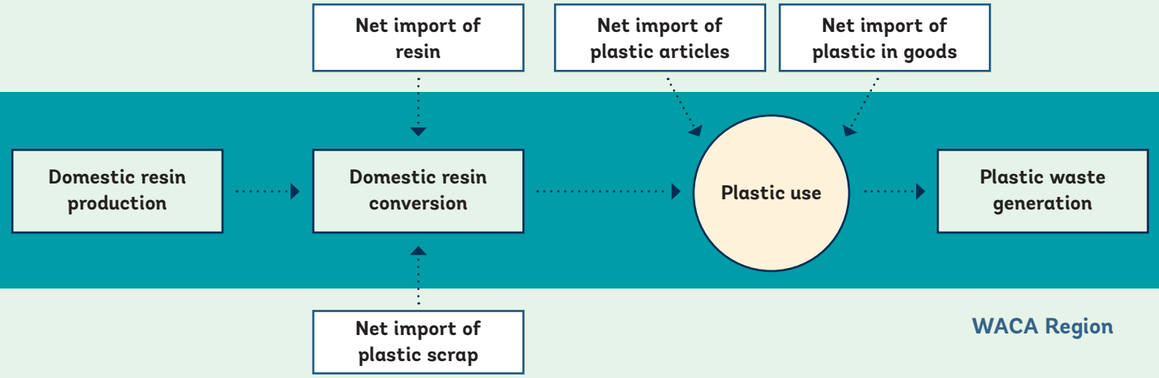
Appendices

Appendix A. Methods for Material Flow Analysis

Figure A.1 shows a process flow diagram of the material flow analysis (MFA) conducted for the West Africa Coastal Areas (WACA) Management Program. One of the objectives of the plastic MFA is to estimate the amount, origin, and composition of the plastic waste generated in the WACA countries. The methodology is applied separately to each of the 17 countries that make up the WACA region. All MFA data are for the year 2018.[51]

Figure A.1. *Process flow diagram of the WACA plastic MFA*



The supply chain of plastic begins with the production of plastic resin. The WACA plastic MFA accounts for domestic production of resin and resin trade. The next step in the supply chain is the conversion of resin in plastic products through processes such as injection molding and thermoforming. The total amount of primary, or virgin, resin consumed by the domestic conversion industry is the sum of domestic production and net import. Net import is defined as imports minus exports. Trade and domestic production, and conversion data, are available by country and by polymer type. A third source of plastic for the domestic conversion industry is plastic waste, or scrap. Net import of plastic waste and scrap is therefore also included for each country. The polymer composition of this plastic waste and scrap is not available.

The amount of plastic that enters the use phase is calculated as apparent consumption, defined as domestic production plus imports minus exports. The trade data account for net imports of plastic products and net imports of plastic contained in final goods. It is assumed that plastic products are entirely made of polymer, while only a fraction of the final goods is plastic. The polymer composition of net imports of plastic products and plastic in final goods is not available. Rough estimates can be made by applying typical polymer compositions of product categories or sectors. Modeling trade in this way in the WACA plastic MFA accounts for not only the fact that a large fraction of the used plastic comes from outside the WACA region, but also for trade within the region.

Plastic waste generation is calculated by combining data on per capita solid-waste generation with estimates of its plastic content and population data. The calculation can be done per country—or in a more spatially explicit way—using geographic information systems and data layers of population density. In the latter case, heat maps of plastic waste generation can be generated for the entire WACA region and each country. The polymer composition of plastic waste generation is not available. Rough estimates can be made by applying available waste characterization studies from other countries or regions.

In principle, the amount of plastic leaving the use phase and the amount of plastic waste generation should be identical, even though they are estimated using different data and methods. However, all used data are subject to concerns about completeness and accuracy. As a result, the data should not be expected to match. The following data reconciliation procedure is used to generate a matching and internally consistent dataset for each country: i) adjust net imports of resins to match domestic conversion minus production; ii) adjust the given plastic content of solid-waste generation to match the country's gross national income per capita; and iii) adjust the net imports of plastic products and plastic in goods to match the value of plastic waste generation minus resin conversion.

51 Here is a quick summary of the data sources used for the WACA plastic MFA: Resin production and conversion data by country and by polymer are from Wood Mackenzie. All trade data have been sourced from the UN Comtrade database. Solid waste generation data are from the 2018 World Bank report, "What a Waste 2.0." Data on the plastic content of solid waste are sourced from "What a Waste 2.0" and also Jambeck et al. (2015). Population data are from the World Bank Database. The spatially explicit population data used are from the fourth version of the Gridded Population of the World collection from the National Aeronautics and Space Administration and Columbia University.

Appendix B. Methods for Plastic Waste Reduction through Circular Economy Models in the WACA Countries

The WACA region spans 17 countries from Mauritania to Nigeria, and includes Cabo Verde and São Tomé and Príncipe. Chapter two of this flagship report aims to provide an overview and analysis of the potential for reducing—in particular marine—plastic waste in the region, through a circular economy model. The analysis focuses on three sectors: construction, plastic packaging, and agriculture (oriented around the fisheries subsector). All numbers and references herein refer to only these three sectors.

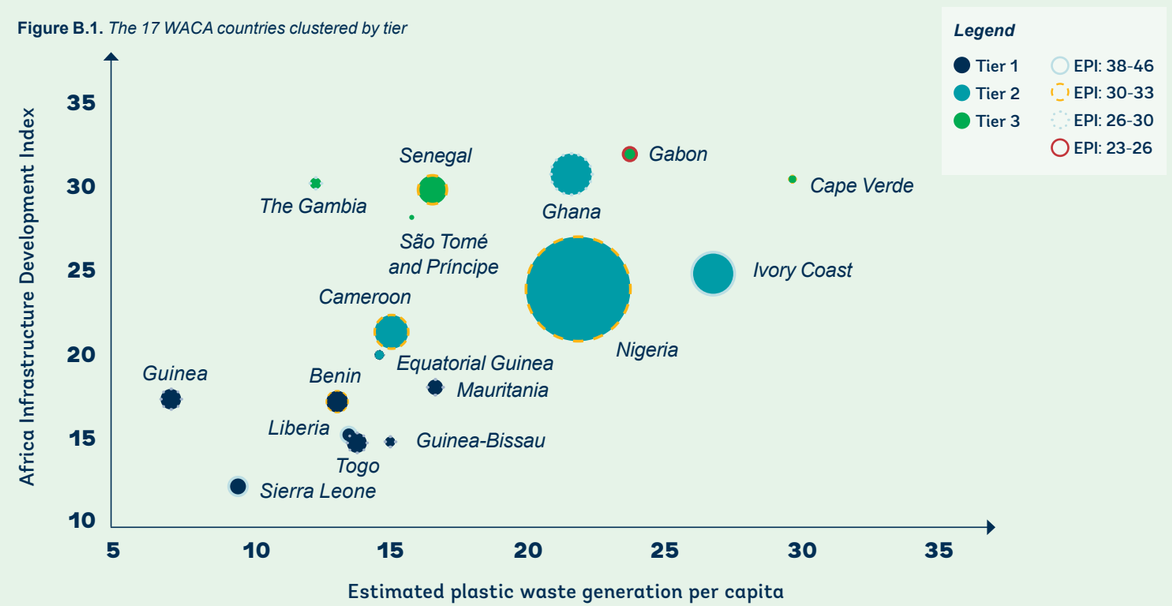
Using plastic-waste data, the World Bank conducted a material flow analysis (MFA) in the region. Adjusting the data for various factors, and estimating it for 2021 and beyond, the MFA quantified the marine plastic pollution problem in the WACA countries.

The 17 countries were segmented into three tiers using two types of profiles:

- ***Infrastructure:*** This is an indication of the ability of the existing asset base and institutions to handle and process plastic waste (Africa Infrastructure Development Index 2020).
- ***Plastic consumption:*** This refers to plastic-waste-generation intensity for the countries, analyzed on a per capita basis to indicate relative intensity, and also gauged against total plastic waste generation.

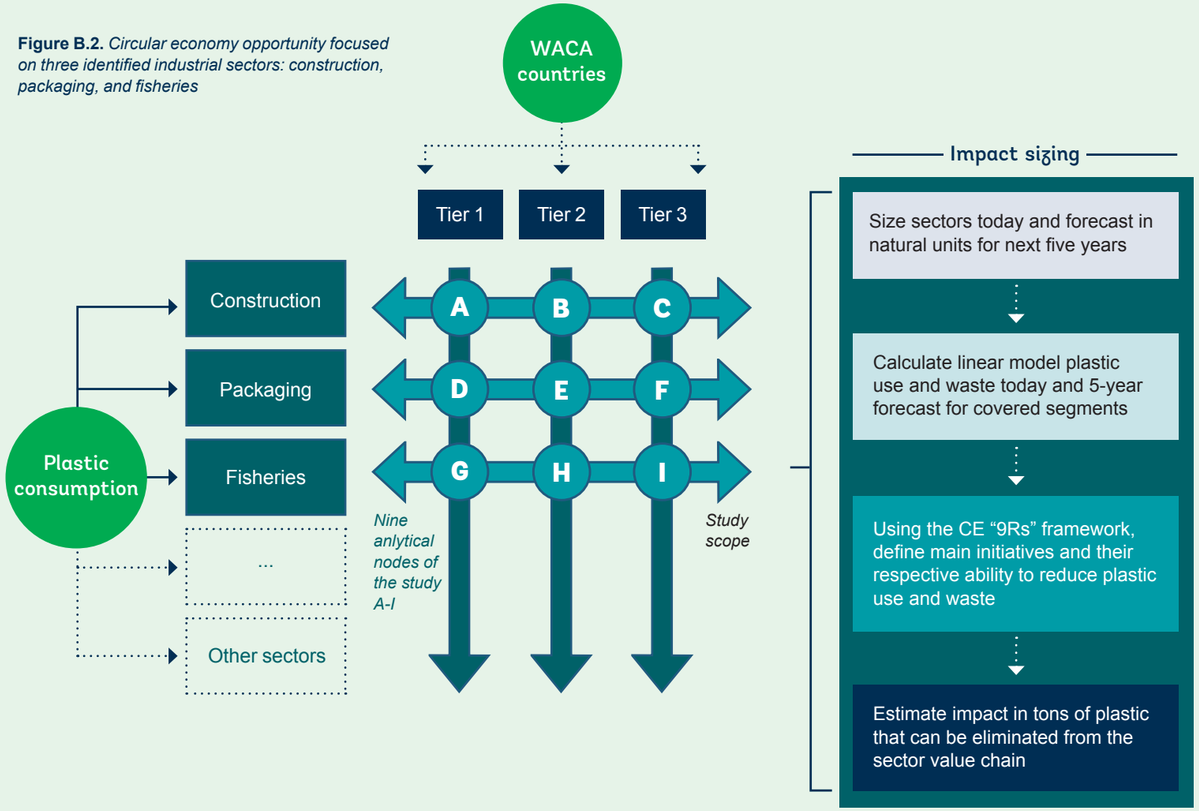
The clustering was driven by the two primary metrics: plastic waste generation and the infrastructure development index (Figure B.1). Plastic waste generation per capita was calculated based on World Bank data (MFA) until 2018, using gross domestic product (GDP) growth rates forecasted by the International Monetary Fund's April 2021 update for 2021–26. A total of four factors (including the African Infrastructure Development Index, the Environmental Performance Index, total plastic-waste-generation, and plastic waste generation per capita) were assessed. However, only two were actually utilized to help map the list of countries.[15]

Figure B.1. *The 17 WACA countries clustered by tier*



Plastic consumption is allocated to the three sectors covered in this study and analyzed across the WACA countries. Figure B.2 presents the circular economy opportunity in the three identified industrial sectors: construction, plastic packaging, and fisheries. As Figure B.2 shows, the 17 WACA countries were organized and analyzed by tiers. The tiering is based on plastic waste per capita and environmental infrastructure (initiatives for circular economy opportunities in the next five years, per tier). The impact sizing of these tiers was determined on the basis of i) the size of the sectors (today to five years' hence); ii) plastic use and waste with a linear economy model (today to five years' hence); iii) definition of the main initiatives to reduce plastic use and waste based on the "9Rs" framework; and iv) estimated impact of plastic that can be eliminated from the value-chain sectors.

Figure B.2. *Circular economy opportunity focused on three identified industrial sectors: construction, packaging, and fisheries*



- *Plastics consumption* is calculated from the resin imported for domestic manufacturing, plus the import of other plastic goods. It also considers packaging from wrapping containers and packing elements, and domestic generation (manufacturing resin, recycling, and recovery). The total sector use of plastic for circular economy opportunity is a combination of reducing plastic intensity (use) and stranded material (waste). Resource loss is calculated on application of the "9Rs" framework on the linear economy model 2021–26 consumption (Figure B.3).
- *Circular economy* potential opportunity: A multistep quantification methodology was developed and employed to size the circular economy potential of the three sectors. This is defined as the sum of plastic avoidance (the application of R Group 1 to linear economy model consumption in 2026) and waste recovery (the application of R Groups 2 and 3 to resultant reduced demand after plastic avoidance in 2026). This is demonstrated in Figure B.4.

Figure B.3. *Circular economy opportunity from a linear/LEM to a circular/CE economic model, applying the "9Rs" framework, 2021–26*

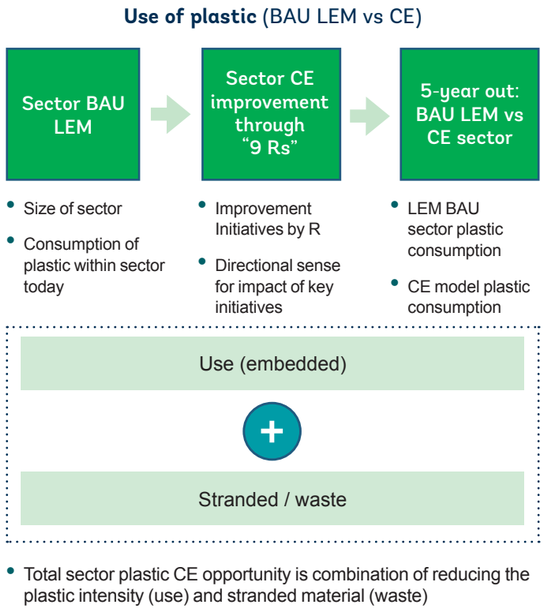
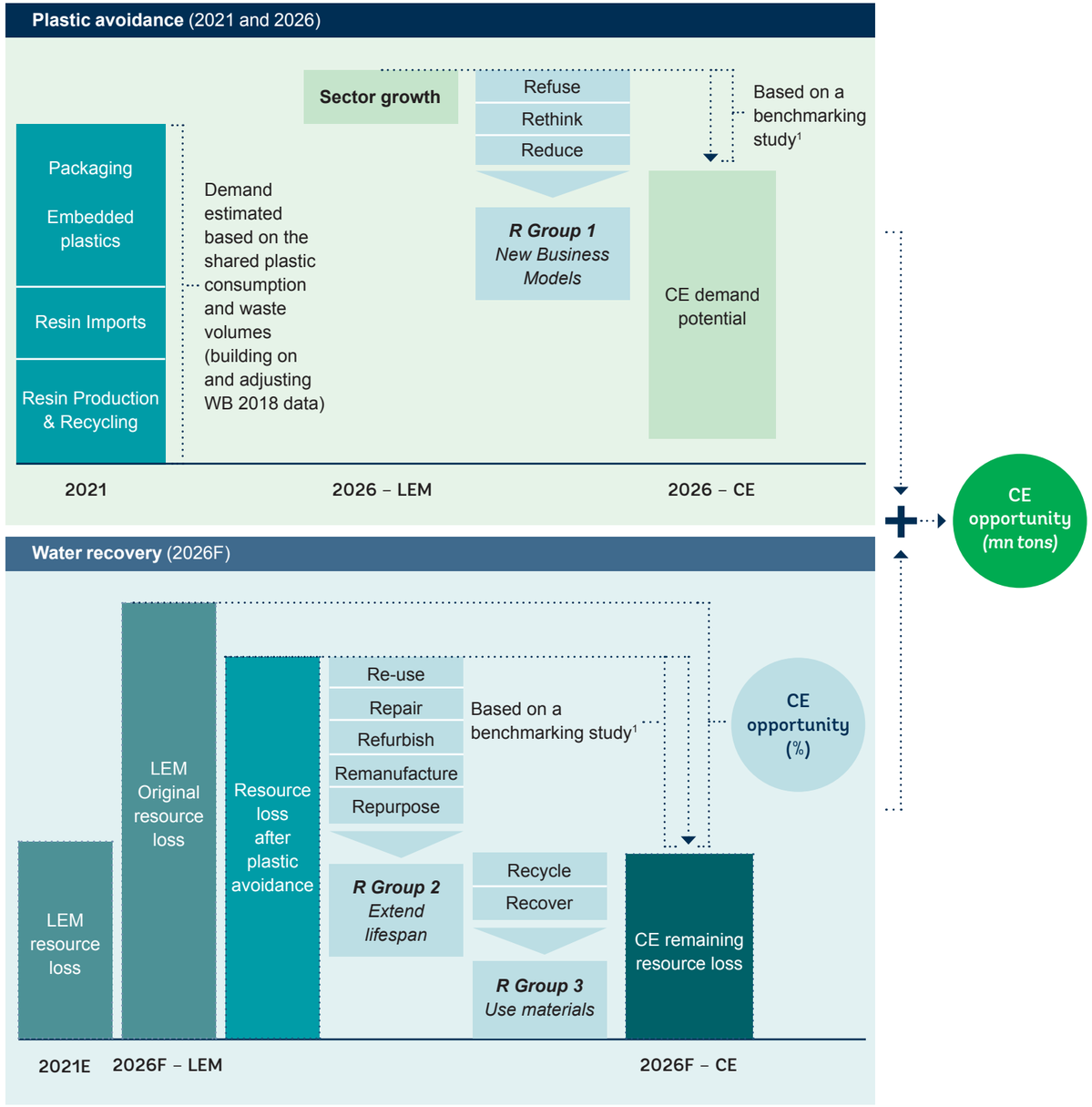
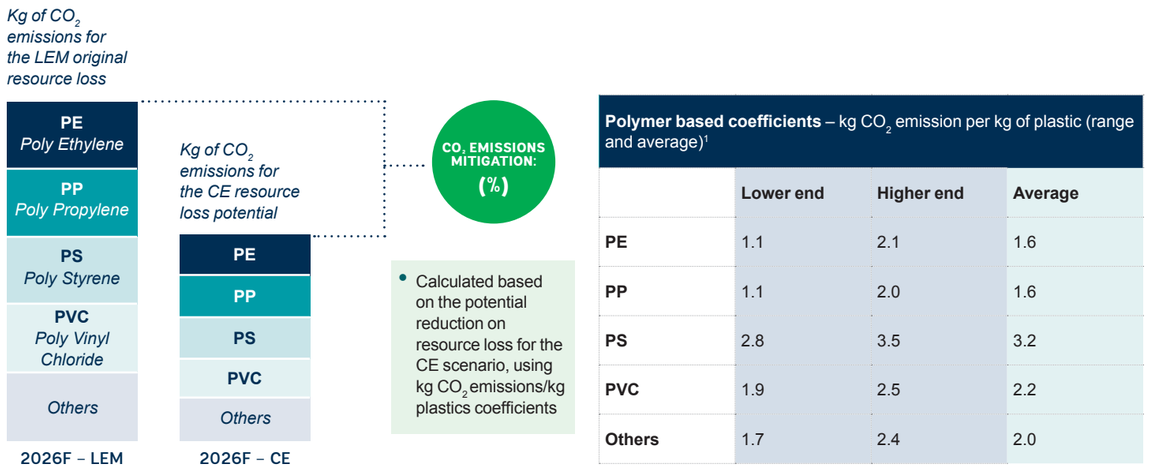


Figure B.4 *A multistep quantification to size the circular economy potential opportunity (million tons of plastic)*



Carbon dioxide (CO_2) emissions mitigation: This calculation is based on the potential reduction in resource loss for the circular economy scenario, using kilogram (kg) of CO_2 emissions/kg plastics coefficients. It compares kg of CO_2 emissions for linear economy model original resource loss (2021–26) and kg of CO_2 emissions for circular economy resource loss potential (2021–26). This is demonstrated in Figure B.5.

Figure B.5. *CO_2 emissions mitigation based on resource loss (linear economy model/LEM vs. circular economy/CE model)*



Polymer based coefficients – kg CO_2 emission per kg of plastic (range and average)[1]			
	Lower end	**Higher end**	**Average**
PE	1.1	2.1	1.6
PP	1.1	2.0	1.6
PS	2.8	3.5	3.2
PVC	1.9	2.5	2.2
Others	1.7	2.4	2.0

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Appendix C. Country Briefs

Country briefs were prepared for the 17 WACA countries, highlighting details relating to socioeconomics; plastic industry; solid-waste-management trends relating to plastics; and plastic-related legislation. Table C.1 lists the different types of plastics-related legislation across the WACA region.

Table C.1: *Plastics-related legislation across the WACA region (Source:* https://circulareconomy.earth/*)*

	WACA Countries	Legislations/Regulations	description
Waste management policies	Benin	Interministerial Order No. 136 / DHAB, 1995	This order regulates the activities of collection, treatment, and disposal of solid waste in Benin.
		Law No. 98-030, 1999	This law sets the legal framework for waste management in Benin. It prioritizes the polluter pays principle for waste management.
		Law No. 98-005, 1999	Article 93 of this law mandates municipal governments as responsible for the collection and treatment of solid waste other than industrial waste.
	Cabo Verde	Decree-Law No. 56/2015 establishing the general regime for prevention, production, and management of waste, 2015	This law establishes the general regime for prevention, production and management of waste. This general regime on waste establishes the principles for waste management and extended responsibilities of the producer. It regulates the prevention, planning and waste management, including the technical standards of waste management operations, the legal regime of licensing and concession of waste management operations, the functioning of Waste Information System (SIRES) and the Animal Carcasses Collec-tion System (SIRCA) and packaging waste, including reusable and non-reusable packaging and the essential requirements for the composition of packaging.
		Strategic National Plan for the Prevention and Management of WastDecree-Law No. 26/2020 for urban waste management services, 2020 (PENGeR) Decree–Law No. 32/2016, 2016	This Decree-Law approves the National Strategic Plan for Waste Management (PENGeR) for the period 2015-2030. PENGeR is especially focused on the production, management and prevention of municipal waste, but also covers other types of waste, equally relevant at national level, such as those associated with the business sector (industry, commerce and services) and health care (hospital waste), treatment and appropriate final destination of solid waste (organic and inorganic), listing as specific goals the increased management capacity of municipalities to assume responsibilities in this area and the management of waste in order to control and reduce pollution.
		Decree-Law No. 26/2020 for urban waste management services, 2020	With this ordinance, it is intended, in addition to complying with the legal provisions, to provide managing entities with a tool to facilitate and standardize the preparation of regulations for waste management services, which are approved by the municipal waste services, thus improving the organization of the sector and protecting users as to the minimum information to which they should have access, within the scope of entering into a contractual relationship with one of the managing entities of these sectors.

	WACA Countries	Legislations/Regulations	description
Waste management policies	Cameroon	Environmental law 96/12, 1996	This law outlines the overarching legal framework for environmental management in Cameroon. Amongst its policy foci, it regulates the handling of waste in Cameroon and includes requirements for recycling. It also has provisions that encourage the reuse of materials through recycling and public awareness.
		National Strategy for Waste Management, 2007	This strategy outlines the body of rules broadly dealing with waste. It also lays out guiding principles for waste management in Cameroon: sustainable develop-ment, the polluter pays principle, the principle of equity, and the right to information of the dangers of dealing with waste.
		Decree No. 2012/2809, 2012	This decree lays down the conditions for sorting, collecting, storing, transporting, recovering, recycling, treating, and disposing of waste.
	Côte d'Ivoire	Framework Act 96-766 under the Environmen-tal Code, 1996	This law provides fundamental provisions concerning the protection of natural and human environments. It provides a legal framework for the management of human and natural environments, including provisions on waste collection and management.
		National Environmental Policy, 2011	The policy looks at different aspects of waste: domestic waste, industrial and medical waste, technological waste.
	Gabon	Decree No. 000541/PR/MEFEPEPN regulating waste disposal, 2005	This decree regulates waste disposal to prevent or reduce the production of waste.
	Gambia, The	National Environmental Management Act, 1994	
		Waste Management Bill, 2007	This bill complements the National Environmental Management Act by filling the enforcement gaps in the existing environmental legislation in waste management, and thereby ensuring that NEMA environmental protection principles are complied with in respect of international principles and standards on waste management.
		Anti-Littering Regulation, 2008	This regulation considers indiscriminate littering as a public offence. It also introduced a nationwide monthly cleansing exercise, locally known as "Set-Setal", to promote proper environmental sanitation and hygienic practices among the population.
	Ghana	Environmental Sanitation Policy, 2009	This policy establishes a clear, nationally accepted vision of environmental sanitation in Ghana. It advocates for awareness drives relating to waste management and alternative uses of wastes through Reduction, Reuse, Recycling and Recovery. The policy was originally published in 1999 and revised in 2009
		National Environmental Sanitation Strategy and Action Plan, 2010	Provides strategies and related action planning elements that cover all aspects of environmental sanitation including solid waste.
	Guinea	Environmental Code, 2019	The Environmental Code includes articles (Title V, Articles 103-119) concerning safe and environmentally sound disposal of waste, waste management and reduction as well as hazardous waste. The responsibility to organize household waste collection sits with local authorities.

	WACA Countries	Legislations/Regulations	description
Waste management policies	Liberia	Environment Protection and Management Law of Liberia, 2002	This law ensures the sustainable use of Liberia's natural resources in pursuance of social and economic development without undermining the ecosystem renewal and re-supply process. It regulates disposal at the national level (solid waste/ litter regulation). It sets out standards for solid waste management, as well as hazardous waste management and sets out prohibitions for water and solid waste pollution.
	Mauritania	Law No. 2000-045	This law lays down the general principles of the national policy on environmental management for the sake of sustainable socioeconomic development. Waste management is broadly covered in this law.
	Nigeria	National Policy on solid waste management, 2020	The policy promotes a clean and healthy environment for sustainable socio-economic development of the country. It provides a framework for a comprehensive integrated solid waste management.
		National Environmental Regulations (Sanitations and wastes control), 2009	This regulation makes adequate provisions for waste control and environmental sanitation including punishments in cases of malfeasances.
	São Tomé and Príncipe	Environmental Law No. 10/99, 1999	This law provides the basic legislation on environmental protection and sustainable development. It affirms the right to environment and lists the basic principles such as prevention and precaution, ecosystems carrying capacity, adequate management and use, participation and access-to-information, user-pays and polluter-pays. The Law defines objectives and measures to be implemented in the environmental policy. It advocates for the reuse of waste.
	Senegal	Environmental Code 2001 (Law No. 2001-01), 2001	States that all kinds of wastes should be disposed of or recycled in an environmentally sound way, such as to remove their harmful effects on human health, natural resources, flora and fauna, and the quality of environment.
		Decentralization Law (Acte III de la Décentralisa-tion) and the Local Governments Law (Code des Collectivités Territoriales).	These laws give local governments the responsibility to provide waste management services.
	Sierra Leone	National Environmental Health and Sanitation Strategy	This plan provides the framework that will guide the efforts of the Ministry of Health and Sanitation (MoHS) and its partners over the next five years in attaining the health related MDGs. It reflects the Minis-try's fundamental belief that waste management and sanitation is a measure of human health and poverty.
	Togo	Framework Law on the Environment 2008-005, 2008	The law includes section on waste (Section 8: Waste, Articles 101-111) concerning safe and environmentally sound disposal of urban and rural household waste, industrial waste as well as hazardous waste.
National circular economy policies	Nigeria	National Policy on Plastic Waste Management, 2020	The policy promotes the sustainable use of plastics in Nigeria and encourage the development of a Circular Economy around plastic waste.
	Gabon	Gabon Green Operation Plan	The plan sets the green strategy for Ga-bon, with the 'aim to increase the level of wealth produced while controlling the footprint ecological effects of human ac-tivities'. It specifically mentions the appli-cation of circular economy principles in the plan and the promotion of waste recy-cling channels.
	Ghana	National Plastic Management Policy	

	WACA Countries	Legislations/Regulations	description
Extended producer responsibility	Cabo Verde	Decree-Law No. 32/2016 Strategic National Plan for the Prevention and Management of Waste (PENGeR), 2016	One of the components of PENGeR is environmental education in the field of waste management as a shared responsibility between management and waste producers. The importance of shared responsibility among the islands is also noted given the size and dispersion of the islands in Cape Verde. The plan considers it important to construct Transfer Stations on some islands, and subsequent transport of the accumulated waste within the same island, to a centralized unit, or between different islands, assuming a shared solution.
	Côte d'Ivoire	Extended producer responsibility regarding plastic bags - Decree No. 2013-327, 2013	The Decree on prohibition of plastic bags includes Extended Producer Responsibility as part of the regulations.
	Gambia, The	EPR included in the Plastic Bag Ban, 2015	The Gambia requires importers to return plastic or recycle it at own costs, and manufacturers to be responsible for recycling.
	Ghana	Extended Producer Responsibility (Hazardous and Electronic Waste Control and Management Act 217), 2016	This legal framework requires producers and private importers to register with Ghana's Environmental Protection Agency (EPA) and pay an advance ecolevy for imported electronic goods and tires. Collected funds are used to facilitate implementation, monitoring and enforcement of the legal framework and support the formalization of informal actors as well as provide finance for the management of electrical and electronic waste and reduce the impact of e-waste on humans and the environment.
		National Plastics Management Policy, 2020	This policy includes the establishment of an Extended Producer Responsibility Scheme: 1. Develop a comprehensive EPR scheme, taking into consideration the already existing Plastic Waste Recycling Fund. 2. Create the enabling environment for the Private sector participation through the development of an appropriate Legislative Instrument for the EPR scheme. 3. Undertake Cost-Benefit-Analysis (CBA) of options identified under the EPR scheme. 4. Support the Private Sector to set-up take-back, collection centers.
	Nigeria	National Environmental Regulations, 2009 and 2011 (introduce EPR requirements for selected industries: food, beverages, tobacco, pharma-ceuticals, soap and detergent, electricals and electronics, and plastics)	All manufacturers or importers shall subscribe to an Extended Producer Responsibility Program including the Buy Back Program. NESREA will work with the sector to achieve the Buy Back Program within three years from the commencement of the regulations.
		Extended Producer Responsibility Program, 2016	The Extended Producer Responsibility (EPR) program is a framework of action for a collaborative and partnership approach between Government, Business, and the larger society towards achieving a zero-waste society in the near future. The overall objective of the EPR program is to ensure a decreased in the total environmental impact from a product including its packaging.

	WACA Countries	Legislations/Regulations	description
Extended producer responsibility	São Tomé and Príncipe	Decree-Law No. 64/2013 on Extended Producer Responsibility, 2013	This Decree-Law introduces the principle of the extended responsibility of the producer of goods to the production of waste as a cornerstone for the proper man-agement of urban solid waste and the protection of the environment. This Decree-Law is applicable to a set of products and articles placed on the market, which by their nature are considered priorities in terms of waste management. Art. 5 establishes the Environmental Impact Fee (called TIA), to be paid by all economic agents importing packaging, products and articles included in the attached list. The list of products attached to this law, defined according to its impact on the environment and on waste management, should be the subject of a revision proposal in accordance with article 8, which will be under the Direction of Customs.
	Senegal	Single Use Plastics Prohibition Law—Law No. 2020-04	The Single Use Plastics Prohibition Law 2020-04 includes the Extended Producer Responsibility on plastics producers; it imposes the responsibility of plastic waste collection and processing on the producers of the products covered by the law.
Product policies/ plastic bans	Benin	Plastic Ban Law No. 2017/39, 2017	This law prohibits the manufacture, import, use and sale of non-biodegradable plastic bags in Benin. Article 15 of this law specifies fines for breaching the law, ranging from five thousand (5000) CFA francs to one hundred thousand (100 000) CFA francs.
	Cabo Verde	Law 99/VIII/2015 - Ban of Non-Reusable Plastic Bags for Wholesale and Retail Trade, 2015	The law establishes the prohibition of production, import, marketing and use of plastic bags for packaging, including goods, which are not reusable, provided in the wholesale or retail trade. It also regulates the introduction of protecting measures aimed to reduce progressively plastic bags in the environment or replacing them by degradable and or biodegradable bags and compostable, which are consistent with minimizing the generation and disposal of waste. Offences and penalties are specified in the text.
	Cameroon	Plastic Bag Ban, 2014	The Cameroonian government introduced a ban on non-biodegradable plastic bags.
	Côte d'Ivoire	Decree No. 2013-327 on the ban of the use of plastic bags, 2013	This Decree is to prohibit the production, import, marketing, possession and use of non-biodegradable plastic bags light-weight polyethylene derivatives or similar plastic with a thickness less than 50 microns.
	Gabon	Order No. 1489 / MECIT prohibiting the import and marketing of non-recyclable plastic bags, 2010	The purpose of this decree is to ban the importation and marketing in Gabon of non-recyclable plastic bags.
	Gambia, The	Regulation 4 – Ban on Plastic Bags Order, 2015	The Gambian Government introduced a ban on the sale, importation and use of plastic bags. A fine applied to persons in breach of the regulation.
	Guinea-Bissau	Decree Law 16/2013 – Plastic bag ban, 2013	Prohibits the use, manufacture, import, sale and distribution of plastic bags and sacks.
	Mauritania	Decree No. 2012-157, 2012	The Mauritanian Government introduced a ban on the manufacture, use and importation of plastic bags. This intervention was noted to aid in reducing the estimated 70 percent of cattle and sheep deaths attributed to plastic bag ingestion.

	WACA Countries	Legislations/Regulations	description
Product policies/ plastic bans	Nigeria	Plastic bag prohibition bill, 2019	Act to prohibit the use, manufacture, and importation of all plastic bags used for commercial and household packaging in order to address harmful impacts to oceans, rivers, lakes, forests, environment as well as human beings and also to relieve pressure on landfills and waste management and for other related matters. The bill further states that a retailer should offer a paper bag to customers at the point of sale.
	Senegal	Single Use Plastics Prohibition Law—Law No. 2020-04, 2020	The aim of the law is to prevent and reduce environmental impact of plastic products by prohibiting single-use plastic products such as cups, lids, pipettes and all sachets intended to be used to condi-tion water or any other drink. The law came into force on April 20, 2020 and repeals and replaces the 2015 Act
	Togo	Decree No. 2011-003-PR setting the manage-ment methods for plastic bags and packaging, 2011	The decree establishes the modalities for the management of the production, importation, distribution, marketing, use, collection and recycling of plastic bags and packaging in Togo banning the produc-tion, import and marketing of non-biodegradable plastic bags. It also authorizes the production, import, marketing, use, collection and recycling of biode-gradable plastic bags and packaging; sa-chets for medical and pharmaceutical use; bags used in agricultural activities; non-toxic food bags. In addition, it governs the prevention and reduction of the volume of plastic waste and its harmfulness through setting up a national committee responsible for monitoring and evaluation of the management of the bags and packaging, biodegradable or not.
		Order No.11/13/MIZFIT/CAB setting out the management procedures for biodegradable plastic bags and packaging in Togo, 2013	This decree sets out how biodegradable plastic bags and packaging are managed in Togo. These biodegradable plastic bags and packaging (defined under Decree No. 2011-03/PR of 05 January 2011) include bags, plastic bags and packaging used for the packaging of food, beverages, drinking water and other food products.

	WACA Countries	Legislations/Regulations	description
Fiscal policies	Benin	Interministerial Decree No. 2004 N ° 077 / ME-HU / MFE / DC / SG / DE / SLRCCAME / DLRE / SA, 2004	This decree authorizes the collection of environmental taxes and fines for pollution caused by disposable plastic packaging.
	Cabo Verde	Law No. 86/IV/93 establishing the environmen-tal policy, 1993	This Act sets forth the bases of environmental policy in Cape Verde. It advocates for the application of fiscal and financial instruments that encourage recycling and reuse of waste.
	Ghana	Customs and Excise (Duties and Other Taxes) (Amendment) Act, 2013	A 10 percent tax is applied on imported plastics and plastic products, with at least half of the revenue accrued meant to be directed toward the funding of plastics recycling and the production of plastic waste bins and bags and biodegradable plastics. However, the funds generated from the tax have yet to be disbursed to the local plastics recycling sector due to the absence of an approved fund management authority.
		Eco-levy on imported electric and electrical goods and tires (Hazardous and Electronic Waste Control and Management Act 917), 2016	This legal framework requires producers and private importers to register with Ghana's Environmental Protection Agency (EPA) and pay an advance eco-levy for imported electronic goods and tires. Collected funds are used to facilitate implementation, monitoring and enforcement of the legal framework and support the formalization of informal actors as well as provide finance for the management of electrical and electronic waste and reduce the impact of e-waste on humans and the environment
	Guinea	Ecotax on Electrical Equipment and Electronics and Tires, 2019	The State of the Republic of Guinea, acting through the Ministry of the Environment, Water and Forests, implements in the country of origin, the verification, collection, and receipt of the Ecotax on Electrical and Electronic Equipment and (EEE) new or second hand, as well as tires which are exported to the Republic of Guinea.

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Benin

Map of African continent

Indicator	Data
Population, 2019 (no.)	11,801,151
Population density, 2018 (people per sq. km of land area)	101.85
Coastal population, 2014 (no.)[52]	3,235,418
Share of people living in urban areas, 2019 (%)	47.9
Total MSW generated, 2016 (tons/year)[53]	685,936

Socioeconomic profile

Benin is a lower-middle-income country in West Africa, bordered by Nigeria, Togo, Niger, and Burkina Faso. Its economy is highly dependent on the informal re-export and transit trade with Nigeria, as well as the export of cotton.[54] The country comprises 12 regional départements and runs a unitary presidential republic system, with a parliament.

In 2019, Benin recorded an overall GDP (purchasing power parity) just below $39 billion and a GDP (purchasing power parity) per capita of $3,287.[56,57] With an area of 112,622 square kilometers (km^2), it has a population of 11,801,151 (2019) and a population density of 101.85 people per km^2 (2018).[58] Though urbanization has increased in recent decades, the majority of Benin's population still resides in rural areas (52.1 percent in 2019[59]) Benin's coastline measures 171 kilometers (km) but over a quarter of its population (over three million in 2014[60]) reside in coastal areas, including the important port city of Cotonou.

Plastic industry and ecosystem

In 2018 and 2019, Benin had no domestic resin production. Its conversion industry processed 1 kiloton (kt) of polyethylene terephthalate (PET) in both years. Similar to other West African countries, Benin is a net importer of plastics. In 2019, 6.7 million kg of plastics were imported into the country, with polyvinyl chloride (PVC) and polyethylene (PE) accounting for about 89 percent of the imports.[61] Only 45,380 kg of plastics were exported from Benin that same year, 70 percent of which was classified as scrap plastics.[62]

Solid waste management

Benin generates 0.34 kg of municipal solid waste (MSW) per capita per day and this amounts to an overall daily MSW generation of 1.9 million kg.[63] However, the West African nation has struggled to effectively manage its waste arisings—about 3 percent of MSW generated in Benin is inadequately managed.[64] The Government of Benin increasingly cites plastic waste management as a pressing environmental issue for the nation. Plastic waste accounts for just below 8 percent of MSW arisings,[65] with a daily generation rate of about 331,000 kg.

Legislation, policies, and other initiatives

Benin's government has assigned responsibility for guidance on waste management legislation to four state agencies[66]:

- The Ministry of Living Conditions and Sustainable Development (responsible for Urban Planning, Housing and Environment
- The Ministry of Public Health
- The Ministry of the Interior and Public Security
- The Ministry of Decentralization and Local Governance.

In 2018 it created the *Société de Gestion des Déchets Solides du Grand Nokoué* (SGDS-GN) to provide waste management services in municipalities of Grand-Nokoué.

52 Jambeck et al., "Plastic Waste Inputs from Land into the Ocean."

53 Kaza, Silpa, Lisa Yao, Perinaz Bhada-Tata, and Frank Van Woerden. 2018. *What a Waste 2.0: A Global Snapshot of Solid Waste Management to 2050.* Urban Development Series. Washington, DC: World Bank.

54 World Bank Group, "Benin—Overview," 2021, https://www.worldbank.org/en/country/benin/overview#1.

55 Statoids, "Departments of Benin," 2019, http://www.statoids.com/ubj.html.

56 GDP, PPP (constant 2017 international dollars) and GDP per capita, PPP (constant 2017 international dollars).

57 World Bank Group, "World Development Indicators" 2020, https://datacatalog.worldbank.org/dataset/world-development-indicators.

58 World Bank Group, "World Development Indicators" 2020.

59 World Bank Group, "World Development Indicators" 2020.

60 Jambeck et al., "Plastic Waste Inputs from Land into the Ocean."

61 UN Comtrade, 2018, "UN Comtrade Database," https://comtrade.un.org/.

62 UN Comtrade, 2018, "UN Comtrade Database," https://comtrade.un.org/.

63 Kaza, Silpa, Lisa Yao, Perinaz Bhada-Tata, and Frank Van Woerden. 2018. What a Waste 2.0: A Global Snapshot of Solid Waste Management to 2050. Urban Development Series. Washington, DC: World Bank.

64 Jambeck et al., "Plastic Waste Inputs from Land into the Ocean."

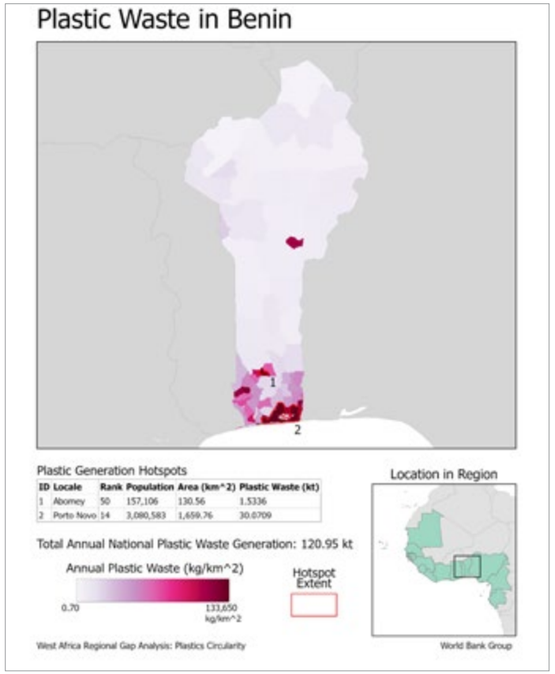
65 Jambeck et al., "Plastic Waste Inputs from Land into the Ocean."

66 Climate & Clean Air Coalition, "Solid Waste Management City Profile: Porto Novo, Benin" 2017, https://www.waste.ccacoalition.org/sites/default/files/files/city_profile_porto-novo_english_vf.pdf.

Currently, waste management in Benin is driven by two legislative instruments and an interministerial order:

- Law No. 98-030, 1999: As the primary legal framework, Law No. 98-030 prioritizes the "polluter pays" principle as the main driving force for waste management in Benin.[67]
- Law No. 98-005, 1999: This law mandates local governments as directly responsible for the collection and treatment of MSW.[68]
- Interministerial Order No. 136/DHAB, 1995: This order regulates the activities of collection, treatment, and disposal of solid waste in Benin.[69]

Though a national circular-economy strategy has yet to be introduced by Benin's government, Benin has made some strides in the adoption of product and fiscal policies geared toward promoting resource efficiency. Notably, a plastic ban law was introduced in 2017. In addition to prohibiting the manufacture, import, use, and sale of non-biodegradable plastic bags, the law also applies serious fines to persons who contravene its stipulations.[70] Likewise, in 2004 an interministerial order was introduced to authorize the collection of environmental taxes and fines for pollution caused by disposable plastic packaging.[71]



67 Chatham House 2020, "Policies," https://circulareconomy.earth/.

68 Chatham House 2020, "Policies," https://circulareconomy.earth/.

69 Chatham House 2020, "Policies," https://circulareconomy.earth/.

70 Chatham House 2020, "Policies," https://circulareconomy.earth/.

71 Chatham House 2020, "Policies," https://circulareconomy.earth/.

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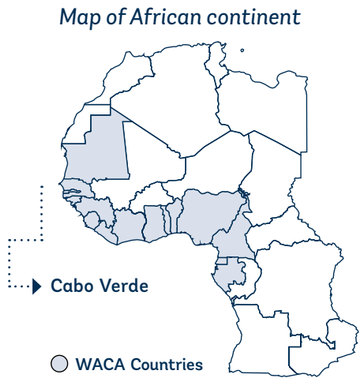
Cabo Verde



Indicator	Data
Population, 2019 (no.)	549,935
Population density, 2018 (people per sq. km of land area)	134.93
Coastal population, 2014 (no.)[72]	522,245
Share of people living in urban areas, 2019 (%)	66.2
Total MSW generated, 2016 (tons/year)[73]	132,555

Socioeconomic profile

Cabo Verde is a lower-middle-income archipelago of 10 islands, located 500 km off the coast of Senegal.[74] Although Cabo Verde's economy is driven by a vibrant tourism sector,[75] it is also dependent on remittances from its large pool of emigrants.[76] The country is divided into 22 administrative municipalities[77] and runs a parliamentary republic system.

In 2019, Cabo Verde's overall GDP (purchasing power parity) fell just below $4 billion, with a GDP (purchasing power parity) per capita of $7,172.[78,79] With an area of 4,033 km^2, Cabo Verde has a population of 549,935 (2019) and a population density of 134.93 people per km^2 (2018).[80]

The majority of Cabo Verde's population resides in urban areas (66.2 percent in 2019.)[81]

Plastic industry and ecosystem

In 2018 and 2019, Cabo Verde had no domestic resin production or conversion. Cabo Verde is a net importer of plastics. In 2019, 1.2 million kg of plastics were imported into the country, with PE accounting for about 84 percent of the imports.[82] Only 4,200 kg of plastics were exported from Cabo Verde that same year, all of which consisted of scrap plastics.[83]

Solid waste management

Cabo Verde generates 0.71 kg of MSW per capita per day and this amounts to an overall daily MSW generation of 363,000 kg.[84] Around 73.7 percent of MSW generated in Cabo Verde is inadequately managed.[85] Plastic waste accounts for about 13 percent of MSW arisings,[86] with a daily generation rate of about 46,000 kg.

Legislation, policies, and other initiatives

The government ministry responsible for municipal waste management in Cabo Verde is the Ministry of Agriculture and Environment.[87] Waste management in Cabo Verde is driven by the following laws:

- Decree-Law No. 56/2015 establishing the general regime for prevention, production, and management of waste, 2015: This law highlights the principles for waste management and extended producer responsibility (EPR). It also spells out the legal regime of licensing and concession of waste management operations; the functioning of the Waste Information System (SIRES); and the management of packaging waste—including reusable and nonreusable packaging and the essential requirements for the composition of packaging.[88]
- Strategic National Plan for the Prevention and Management of Waste (PENGeR) Decree-Law No. 32/2016, 2016: This law approves a 15-year national plan for the management of MSW.[89]

72 Jambeck et al., "Plastic Waste Inputs from Land into the Ocean."

73 Kaza, Silpa, Lisa Yao, Perinaz Bhada-Tata, and Frank Van Woerden. 2018. What a Waste 2.0: A Global Snapshot of Solid Waste Management to 2050. Urban Development Series. Washington, DC: World Bank.

74 World Bank Group, "Cabo Verde—Overview," 2021, https://www.worldbank.org/en/country/Cabo Verde/overview#1.

75 World Bank Group, "Cabo Verde—Overview," 2021, https://www.worldbank.org/en/country/Cabo Verde/overview#1.

76 CIA (Central Intelligence Agency), The World Factbook: Cabo Verde (Langley, VA: CIA, 2021), https://www.cia.gov/the-world-factbook/countries/cabo-verde/#economy.

77 Ibid.

78 GDP, PPP (constant 2017 international $) and GDP per capita, PPP (constant 2017 international $).

79 World Bank Group, "World Development Indicators," 2020.

80 World Bank Group, "World Development Indicators," 2020.

81 World Bank Group, "World Development Indicators," 2020.

82 UN Comtrade 2019, "UN Comtrade Database."

83 UN Comtrade 2019, "UN Comtrade Database."

84 Kaza, Silpa, Lisa Yao, Perinaz Bhada-Tata, and Frank Van Woerden. 2018. What a Waste 2.0: A Global Snapshot of Solid Waste Management to 2050. Urban Development Series. Washington, DC: World Bank.

85 Jambeck et al., "Plastic Waste Inputs from Land into the Ocean."

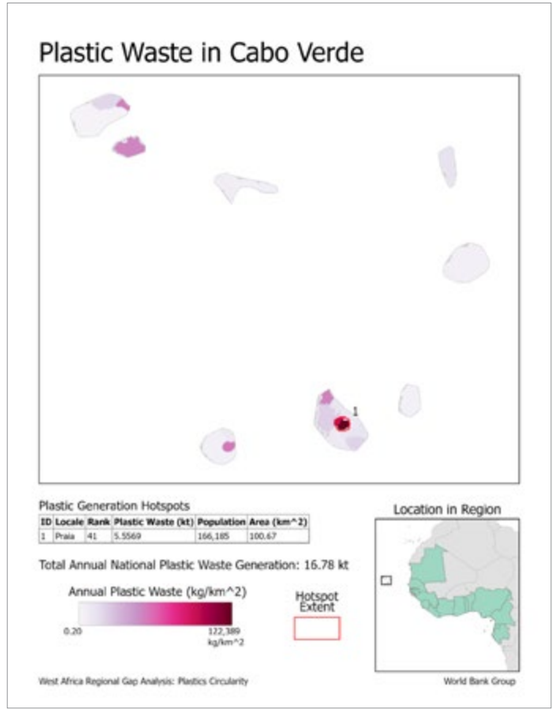
86 Jambeck et al., "Plastic Waste Inputs from Land into the Ocean."

87 Ministry of Agriculture and Environment, "Water and Sanitation," 2018, http://maa.gov.cv/index.php/agua-e-saneamento.

88 Chatham House, "Policies."

89 Chatham House, "Policies."

In 2015, a law banning the production, import, marketing, and use of plastic bags for nonreusable packaging, was provided in the wholesale or retail trade.[90] Also, since 1993, Cabo Verde's environmental policy law—Law No. 86/IV/93—has advocated for the application of fiscal and financial instruments that encourage recycling and reuse of waste.[91]



90 Chatham House, "Policies."

91 Chatham House, "Policies."

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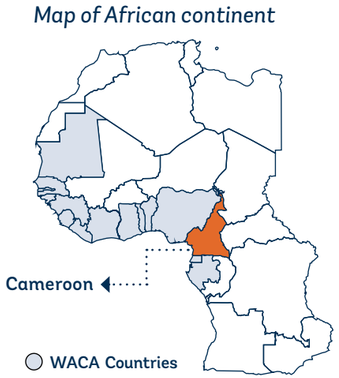
Cameroon



Indicator	Data
Population, 2019 (no.)	25,876,380
Population density, 2018 (people per sq. km of land area)	53.34
Coastal population, 2014 (no.)[92]	1,986,723
Share of people living in urban areas, 2019 (%)	57.0
Total MSW generated, 2016 (tons/year)[93]	3,270,617

Socioeconomic profile

Cameroon is a lower-middle-income country in West Africa bordered by Nigeria, Chad, the Central African Republic, the Republic of Congo, Gabon, and Equatorial Guinea. The country is endowed with rich natural resources, such as fossil-fuel reserves, minerals, high-value timber species, and agricultural products.[94] Cameroon is a unitary state divided into 10 administrative regions, each with an elected regional council.[95] It runs a unitary presidential republic system, with a parliament.

In 2019, Cameroon recorded an overall GDP (purchasing power parity) just above $94 billion and a GDP (purchasing power parity) per capita of $3,642.[96,97] With an area of 475,440 km^2, it has a population of 25,876,380 (2019), and a population density of 53.34 people per km2 (2019).[98] The majority of Cameroon's population—57 percent in 2019[99]—resides in urban areas. In 2014 just under two million people resided in the country's coastal areas,[100] including the important city of Douala.

Plastic industry and ecosystem

In 2018 and 2019, Cameroon had no domestic resin production. Its conversion industry processed 34 kt of resin (9 kt PP, 10 kt PE, and 15 kt PET) in 2018 and 39 kt of resin (4 kt PP, 20 kt PE, 15 kt PET) in 2019. Similar to other West African countries, Cameroon is a net importer of plastics. In 2019, 40 million kg of plastics were imported into the country, with PE, PP, and PVC accounting for about 99 percent of the imports.[101] In comparison, 852,652 kg of scrap plastics were exported from Cameroon that same year.[102]

Solid waste management

Cameroon generates 0.42 kg of MSW per capita per day and this amounts to an overall daily MSW generation of 8.9 million kg.[103] However, about 81.4 percent of MSW generated is inadequately managed.[104]

Plastic waste accounts for just below 6 percent of MSW arisings,[105] with a daily generation rate of about 616,000 kg.

Legislation, policies, and other initiatives

The government ministry responsible for municipal waste management in Cameroon is the Ministry of the Environment, Nature Protection and Sustainable Development[106]: Currently, waste management in Cameroon is driven by the following laws/regulations:

- Environmental law 96/12, 1996: This law regulates the handling of waste in Cameroon and includes requirements and provisions for reuse and recycling.[107]
- National Strategy for Waste Management, 2007: This strategy stipulates the guiding principles for waste management in Cameroon—sustainable development; the "polluter pays" principle; the principle of equity; and the right to information on the dangers of dealing with waste.[108]
- Decree No. 2012/2809, 2012: This decree states the conditions for sorting, collecting, storing, transporting, recovering, recycling, treating, and disposing of waste.[109] Additionally, in 2014, the Cameroonian government introduced a plastic bag ban. This policy instituted a ban on the use of non-biodegradable plastic bags.[110]

92 Jambeck et al., "Plastic Waste Inputs from Land into the Ocean."

93 Kaza, Silpa, Lisa Yao, Perinaz Bhada-Tata, and Frank Van Woerden. 2018. What a Waste 2.0: A Global Snapshot of Solid Waste Management to 2050. Urban Development Series. Washington, DC: World Bank

94 World Bank Group, "Cameroon—Overview," 2021, https://www.worldbank.org/en/country/Cameroon/overview#1.

95 Aaron Neba, Modern Geography of the Republic of Cameroon, 3rd ed. (Bamenda: Neba Publishers, 1999).

96 GDP, PPP (constant 2017 international $) and GDP per capita, PPP (constant 2017 international $).

97 World Bank Group, "World Development Indicators," 2020.

98 World Bank Group, "World Development Indicators," 2020.

99 World Bank Group, "World Development Indicators," 2020.

100 Jambeck et al., "Plastic Waste Inputs from Land into the Ocean."

101 UN Comtrade, "UN Comtrade Database," 2019, https://comtrade.un.org/.

102 UN Comtrade, "UN Comtrade Database," 2019, https://comtrade.un.org/.

103 Kaza, Silpa, Lisa Yao, Perinaz Bhada-Tata, and Frank Van Woerden. 2018. What a Waste 2.0: A Global Snapshot of Solid Waste Management to 2050. Urban Development Series. Washington, DC: World Bank.

104 Jambeck et al. "Plastic Waste Inputs from Land into the Ocean."

105 Jambeck et al. "Plastic Waste Inputs from Land into the Ocean."

106 Climate & Clean Air Coalition, "Solid Waste Management City Profile: Douala, Cameroon," 2017, https://www.waste.ccacoalition.org/sites/default/files/files/city_profile_douala_english.pdf.

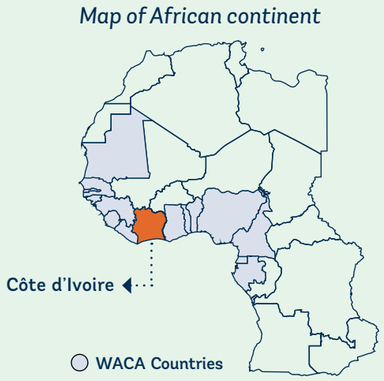
107 Chatham House, "Policies."

108 Chatham House, "Policies."

109 Chatham House, "Policies."

110 Chatham House, "Policies."

Côte d'Ivoire



Indicator	Data
Population, 2019 (no.)	25,716,544
Population density, 2018 (people per sq. km of land area)	78.83
Coastal population, 2014 (no.)[111]	6,230,583
Share of people living in urban areas, 2019 (%)	51.2
Total MSW generated, 2016 (tons/year)[112]	4,440,814

Socioeconomic profile

Côte d'Ivoire is a lower-middle-income country in West Africa bordered by Liberia, Guinea, Mali, Burkina Faso, and Ghana. As the economic hub of Francophone West Africa, Côte d'Ivoire is one of the world's fastest-growing economies and remains the globe's leading producer and exporter of cocoa beans and cashew nuts.[113] The country comprises 12 administrative districts and two district-level autonomous cities.[114] It runs a unitary presidential republic system, with a parliament.

In 2019, Côte d'Ivoire recorded an overall GDP (purchasing power parity) of just over $134 billion, with a GDP (purchasing power parity) per capita of $5,213.[115,116] With an area of 322,463 km2, the country has a population of 25,716,544 (2019) and its population density falls around 78.83 people per km^2 (2018).[117] The majority of Côte d'Ivoire's population resides in urban areas (51.2 percent in 2019).[118] In 2014 over 6 million Ivorians resided in coastal areas,[119] Abidjan being the most important coastal city.

Plastic industry and ecosystem

In 2018 and 2019, Côte d'Ivoire had no domestic resin production. Its conversion industry processed 197 kt of resin (117 kt PE, 57 kt PP, 23 kt PET) in 2018 and 174 kt of resin (128 kt PE, 17 kt PP, 29 kt PET) in 2019.[120] In keeping with the trend found in West Africa, Côte d'Ivoire is also a net importer of plastics. In 2019, over 241 million kg of plastics were imported into the country, with PE, PP, and PVC making up about 99 percent of the imports.[121] Only 4.4 million kg of plastics were exported from Côte d'Ivoire that same year, 74 percent of which was classified as PVC.[122]

As of 2019, there were 110 plastic manufacturing firms operating in Abidjan.[123]

Solid waste management

Côte d'Ivoire generates 0.6 kg of MSW per capita per day. This aggregates to an overall daily MSW generation of approximately 12.2 million kg.[124] About 81.6 percent of MSW generated in Côte d'Ivoire, however, is inadequately managed.[125] Plastic waste is reported to make up about 13 percent of MSW arisings in Côte d'Ivoire,[126] with a daily generation rate of about 1.9 million kg.

According to Anteja (2019),[127] 63 plastic recycling businesses operate in Abidjan. Currently, both PE and PP plastic waste is locally recycled to produce nonfood articles such as black tarpaulins, plastic bags, and other household items.[128]

111 Jambeck et al., "Plastic Waste Inputs from Land into the Ocean."

112 Kaza, Silpa, Lisa Yao, Perinaz Bhada-Tata, and Frank Van Woerden. 2018. What a Waste 2.0: A Global Snapshot of Solid Waste Management to 2050. Urban Development Series. Washington, DC: World Bank.

113 World Bank Group, "Côte d'Ivoire—Overview," 2021, https://www.worldbank.org/en/country/cotedivoire/overview.

114 Permanent Committee on Geographical Names, "Ivory Coast—Administrative Structure," 2015, https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/499705/Ivory_Coast_Administrative_Structure.pdf/. https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/499705/Ivory_Coast_Administrative_Structure.pdf

115 GDP, PPP (constant 2017 international $) and GDP per capita, PPP (constant 2017 international $).

116 World Bank Group, "World Development Indicators," 2020.

117 World Bank Group, "World Development Indicators," 2020.

118 World Bank Group, "World Development Indicators," 2020.

119 Jambeck et al., "Plastic Waste Inputs from Land into the Ocean."

120 UN Comtrade 2019, "UN Comtrade Database."

121 UN Comtrade 2019, "UN Comtrade Database."

122 UN Comtrade 2019, "UN Comtrade Database."

123 Anteja 2019, "Présentation de la filière des déchets plastiques en Côte d'Ivoire. »

124 Kaza, Silpa, Lisa Yao, Perinaz Bhada-Tata, and Frank Van Woerden. 2018. *What a Waste 2.0: A Global Snapshot of Solid Waste Management to 2050.* Urban Development Series. Washington, DC: World Bank.

125 Jambeck et al., "Plastic Waste Inputs from Land into the Ocean."

126 Jambeck et al., "Plastic Waste Inputs from Land into the Ocean."

127 Anteja 2019, "Présentation de la filière des déchets plastiques en Côte d'Ivoire."

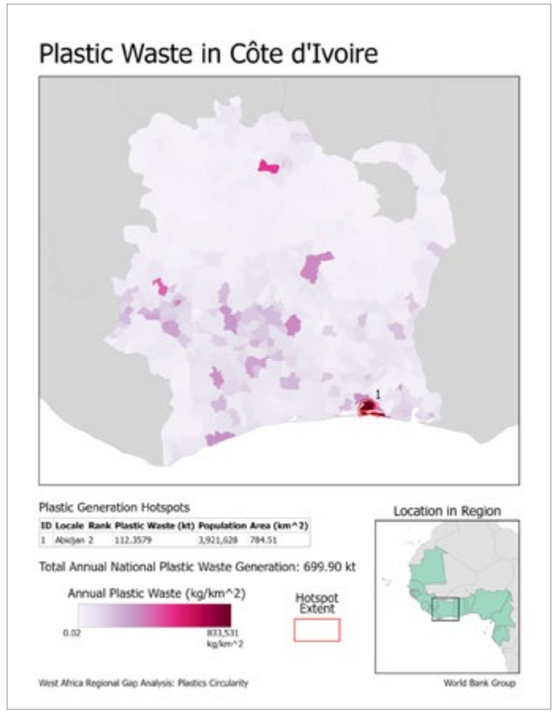
128 Anteja 2019, "Présentation de la filière des déchets plastiques en Côte d'Ivoire."

Legislation, policies, and other initiatives

The government ministry responsible for municipal waste management in Côte d'Ivoire is the Ministry of Environment and Sustainable Development.[129] Currently, waste management in Côte d'Ivoire is driven by the following law:

- Framework Act 96-766 under the Environmental Code, 1996: This law highlights the legal framework provisions for the collection and management of waste.[130]

Furthermore, a decree banning the use of plastic bags (Decree No. 2013-327) was introduced in 2013. It prohibits the production, import, marketing, and use of non-biodegradable plastic bags with a thickness less than 50 microns.[131] However, exceptions were made for some applications of plastic bags. These included their use in the agricultural sector; in primary packaging of perishable foods and pharmaceutical products; and in the storage of MSW.[132] Additionally, Decree No. 2013-327 includes an EPR requirement.[133]



129 Climate & Clean Air Coalition, "Abidjan, Ivory Coast," 2017, https://www.waste.ccacoalition.org/participant/abidjan-ivory-coast.

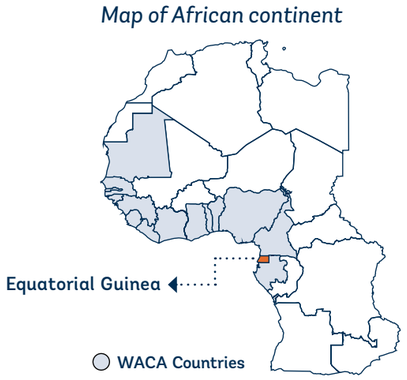
130 Chatham House, "Policies."

131 Chatham House, "Policies."

132 UNEP (United Nations Environment Programme), *Legal Limits on Single-Use Plastics and Microplastics: A Global Review of National Laws and Regulations* (Nairobi, Kenya: UNEP, 2018), https://wedocs.unep.org/bitstream/handle/20.500.11822/27113/plastics_limits.pdf.

133 UNEP (United Nations Environment Programme), *Legal Limits on Single-Use Plastics and Microplastics: A Global Review of National Laws and Regulations* (Nairobi, Kenya: UNEP, 2018), https://wedocs.unep.org/bitstream/handle/20.500.11822/27113/plastics_limits.pdf.

Equatorial Guinea



Indicator	Data
Population, 2019 (no.)	1,355,986
Population density, 2018 (people per sq. km of land area)	46.67
Coastal population, 2014 (no.)[134]	351,600
Share of people living in urban areas, 2019 (%)	72.6
Total MSW generated, 2016 (tons/year)[135]	198,443

Socioeconomic profile

Equatorial Guinea is an upper-middle-income country in West Africa, bordered by Gabon and Cameroon. Equatorial Guinea's economy is dominated by the country's oil and gas sector.[136] The country is divided into eight administrative provinces[137] and runs a presidential republic system with a parliament.

In 2019, Equatorial Guinea's overall GDP (purchasing power parity) was just above $25.2 billion, with a GDP (purchasing power parity) per capita of $18,558.[138,139] With an area of 28,051 km^2, Equatorial Guinea has a population of 1,355,986 (2019) and a population density of 46.67 people per km^2 (2018).[140] The majority of Equatorial Guineans—72.6 percent of the total population in 2018—reside in urban areas.[141] In 2014, approximately 351,600 Equatorial Guineans lived in coastal areas,[142] notably in the capital city, Malabo.

Plastic industry and ecosystem

In 2018 and 2019, Equatorial Guinea had no domestic resin production or conversion, and the country is a net importer of plastics. In 2019, 789,734 kg of plastics were imported, with PE accounting for about 99 percent of the imports.[143] Only 92,195 kg of plastics were exported from Equatorial Guinea that same year, all of which consisted of PE.[144]

Solid waste management

Equatorial Guinea generates 0.45 kg of MSW per capita per day. This amounts to an overall daily MSW generation of 543,300 kg.[145] Approximately 30.5 percent of MSW generated in Equatorial Guinea is inadequately managed.[146] Plastic waste accounts for about 12 percent of MSW arisings[147] with a daily generation rate of about 46,600 kg.

Legislation, policies, and other initiatives

A prominent government ministry dealing with waste management issues in Equatorial Guinea is the Ministry of Agriculture, Livestock, Forests and Environment.[148] Currently, there are no laws or regulations dealing specifically with municipal waste management.

134 Jambeck et al., "Plastic Waste Inputs from Land into the Ocean."

135 Kaza, Silpa, Lisa Yao, Perinaz Bhada-Tata, and Frank Van Woerden. 2018. What a Waste 2.0: A Global Snapshot of Solid Waste Management to 2050. Urban Development Series. Washington, DC: World Bank.

136 CIA, The World Factbook: Equatorial Guinea (Langley, VA: CIA, 2021), https://www.cia.gov/the-world-factbook/countries/equatorial-guinea/.

137 CIA, The World Factbook: Equatorial Guinea (Langley, VA: CIA, 2021), https://www.cia.gov/the-world-factbook/countries/equatorial-guinea/.

138 GDP, PPP (constant 2017 international dollars) and GDP per capita, PPP (constant 2017 international dollars).

139 World Bank Group, "World Development Indicators," 2020.

140 World Bank Group, "World Development Indicators," 2020.

141 World Bank Group, "World Development Indicators," 2020.

142 Jambeck et al., "Plastic Waste Inputs from Land into the Ocean."

143 UN Comtrade 2018, "UN Comtrade Database."

144 UN Comtrade 2018, "UN Comtrade Database."

145 Kaza, Silpa, Lisa Yao, Perinaz Bhada-Tata, and Frank Van Woerden. 2018. What a Waste 2.0: A Global Snapshot of Solid Waste Management to 2050. Urban Development Series. Washington, DC: World Bank.

146 Jambeck et al., "Plastic Waste Inputs from Land into the Ocean."

147 Jambeck et al., "Plastic Waste Inputs from Land into the Ocean."

148 Ministry of Agriculture, Livestock, Forest and Environment, Republic of Equatorial Guinea 2019, First National Communication to the United Nations Framework Convention on Climate Change (Malabo, Equatorial Guinea: Ministry of Agriculture, Livestock, Forest and Environment, Republic of Equatorial Guinea). https://unfccc.int/sites/default/files/resource/INC%20of%20Equatorial%20Guinea_English%20version.pdf.

Gabon

Map of African continent

Indicator	Data
Population, 2019 (no.)	2,172,579
Population density, 2018 (people per sq. km of land area)	8.22
Coastal population, 2014 (no.)[149]	862,328
Share of people living in urban areas, 2019 (%)	89.7
Total MSW generated, 2016 (tons/year)[150]	238,102

Socioeconomic profile

Gabon is an upper-middle-income country in West Africa bordered by Equatorial Guinea, Cameroon, and the Republic of Congo. According to the United Nations Development Programme, Gabon is one of Sub-Saharan Africa's wealthiest nations, due to its petroleum reserves and foreign private investment.[151] The country comprises nine administrative provinces[152] and runs a unitary presidential republic system, with a parliament.

Gabon's overall GDP (purchasing power parity) in 2019 was just below $32 billion and reported a GDP (purchasing power parity) per capita of $14,950.[153,154] With an area of 267,667 km^2, it has a population of 2,172,579 (2019) and a population density of 8.22 people per km2 (2018).[155] Gabon has a highly urbanized population, with 89.7 percent of Gabonese living in urban areas in 2019.[156] In 2014, over 862,000 of Gabon's residents, accounting for about 46 percent of the population, resided along the country's coastline,[157] particularly in the capital city of Libreville.

Plastic industry and ecosystem

In 2018 and 2019, Gabon had no domestic resin production or conversion. Similar to its regional neighbors, Gabon is a net importer of plastics. In 2019, approximately 2.7 million kg of plastics were imported into the country, with PE, PP, and PVC making up about 96 percent of the imports.[158] Only 462,190 kg of plastics were exported from Gabon that same year, 88 percent of which were classed as PVC and PE.[159]

Solid waste management

Gabon generates 0.56 kg of MSW per capita per day, amounting to an overall daily MSW generation of 652,000 kg.[160] About 34 percent of MSW generated in Gabon is inadequately managed.[161] Plastic waste accounts for 12 percent of MSW arisings,[162] with a daily generation rate of about 118,000 kg.

149 Jambeck et al., "Plastic Waste Inputs from Land into the Ocean."

150 Kaza, Silpa, Lisa Yao, Perinaz Bhada-Tata, and Frank Van Woerden. 2018. What a Waste 2.0: A Global Snapshot of Solid Waste Management to 2050. Urban Development Series. Washington, DC: World Bank.

151 UNDP (United Nations Development Programme), 2018 Human Development Report (New York: UNDP, 2018), https://web.archive.org/web/20180914203906/http://hdr.undp.org/en/2018-update.

152 Statoids, "Provinces of Gabon," 2016, http://www.statoids.com/uga.html.

153 GDP, PPP (constant 2017 international $) and GDP per capita, PPP (constant 2017 international $).

154 World Bank Group 2020, "World Development Indicators."

155 World Bank Group 2020, "World Development Indicators."

156 World Bank Group 2020, "World Development Indicators."

157 Jambeck et al., "Plastic Waste Inputs from Land into the Ocean."

158 UN Comtrade 2019, "UN Comtrade Database."

159 UN Comtrade 2019, "UN Comtrade Database."

160 Kaza, Silpa, Lisa Yao, Perinaz Bhada-Tata, and Frank Van Woerden. 2018. What a Waste 2.0: A Global Snapshot of Solid Waste Management to 2050. Urban Development Series. Washington, DC: World Bank.

161 Jambeck et al. 2014, "Plastic Waste Inputs from Land into the Ocean."

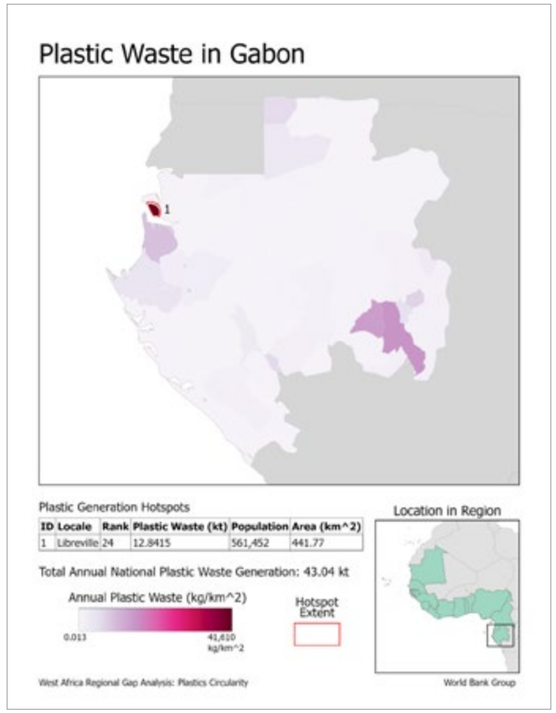
162 Jambeck et al. 2014, "Plastic Waste Inputs from Land into the Ocean."

Legislation, policies, and other initiatives

The government ministry responsible for municipal waste management in Gabon is the Ministry of Waters, Forests, Sea, Environment, Climate Plan and Land Use Plan.[163] Currently, waste management in Gabon is driven by the following law:

- Decree No. 000541/PR/MEFEPEPN: This decree stipulates the legal framework for the management of waste in Gabon and emphasizes waste prevention efforts.[164]

In 2010, the Gabonese government announced a decree (Order No. 1489 / MECIT) that banned the importation and marketing of nonrecyclable plastic bags.[165] Furthermore, in 2015, the Gabon Green Operation Plan was introduced. It is one of a few African government plans that specifically calls for application of circular economy principles in the promotion of waste recycling channels.[166]

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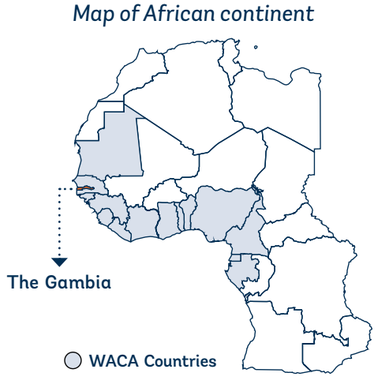
163 Extractive Hub 2020, "Gabon," https://www.extractivehub.org/servefile/getFile/id/7663.

164 Chatham House, "Policies."

165 Chatham House, "Policies."

166 Chatham House, "Policies."

The Gambia



Indicator	Data
Population, 2019 (no.)	2,347,706
Population density, 2018 (people per sq. km of land area)	225.31
Coastal population, 2014 (no.)[167]	1,324,214
Share of people living in urban areas, 2019 (%)	61.9
Total MSW generated, 2016 (tons/year)[168]	193,441

Socioeconomic profile

The Gambia is a low-income country in West Africa which—with the exception of the Gulf of Guinea—is bordered by Senegal. The Gambia's economy is dependent on agriculture and tourism, normally accounting for approximately 33 percent and 20 percent of GDP, respectively.[169] Administratively, The Gambia is divided into five regions, one municipality, and one city (Banjul).[170] It runs a presidential republic system with a parliament.

In 2019, The Gambia had an overall GDP (purchasing power parity) of approximately $5.2 billion, with a GDP (purchasing power parity) per capita of $2,223.[171,172] With an area of 11,300 km^2, The Gambia has a population of 2,347,706 (2019) and a population density of 225.31 people per km^2 (2018).[173] The population is highly urbanized, with 61.9 percent of Gambians residing in urban areas in 2019.[174] Though its coastline measures only 70 km, 1.3 million Gambians resided in coastal areas as of 2014,[175] notably in the capital city, Banjul.

Plastic industry and ecosystem

In 2018 and 2019, The Gambia had no domestic resin production or conversion. The Gambia is a net importer of plastics. In 2019, 1.6 million kg of plastics were imported into the country, with PE and PVC accounting for about 82.6 percent of the imports.[176] Only 28,039 kg of plastics were exported from The Gambia that same year, 99.9 percent of which consisted of PE.[177]

Solid waste management

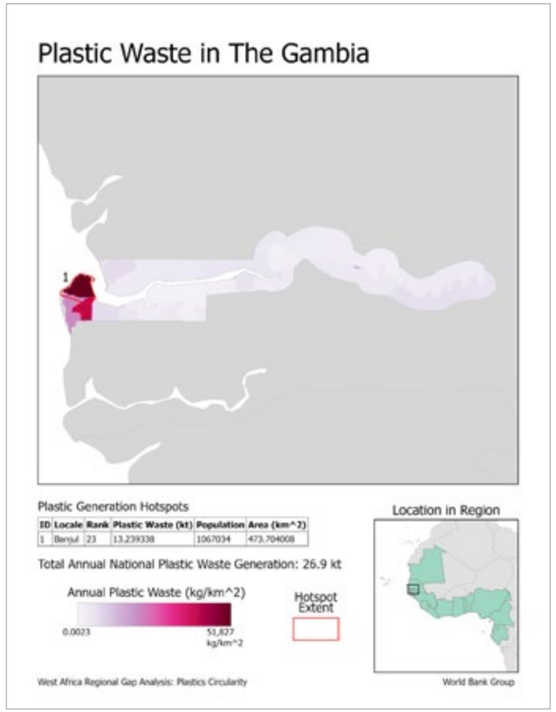
The Gambia generates 0.41 kg of MSW per capita per day. This amounts to an overall daily MSW generation of approximately 530,000 kg.[178] Approximately 83.6 percent of MSW generated in The Gambia is inadequately managed.[179]

Plastic waste accounts for 9 percent of MSW arisings in The Gambia,[180] with a daily generation rate of about 74,000 kg.

Legislation, policies, and other initiatives

The government ministry responsible for municipal waste management in The Gambia is the Ministry of Environment.[181] Waste management in The Gambia is driven by the following:

- National Environmental Management Act, 1994: This act provides the framework for environmental quality standards, monitoring, and enforcement covering waste management activities.[182]
- Waste Management Bill, 2007: This bill complements the National Environmental Management Act, closing its enforcement gaps relating to waste management.[183]
- Anti-Littering Regulation, 2008: This regulation is responsible for making indiscriminate littering a public offence, and promotes proper environmental sanitation and hygienic practices through the institution of a nationwide monthly cleansing exercise.[184] In 2015, the Gambian government instituted a ban on the sale, import, and use of plastic bags.[185] In addition to imposing fines for breaches, the law also mandated manufacturers to be responsible for the recovery and recycling of plastic bags.[186]



167 Jambeck et al., "Plastic Waste Inputs from Land into the Ocean."

168 Kaza, Silpa, Lisa Yao, Perinaz Bhada-Tata, and Frank Van Woerden. 2018. *What a Waste 2.0: A Global Snapshot of Solid Waste Management to 2050*. Urban Development Series. Washington, DC: World Bank.

169 CIA, 2021, *The World Factbook: Gambia, The* (Langley, VA: CIA), https://www.cia.gov/the-world-factbook/countries/gambia-the/#government.

170 CIA, 2021, *The World Factbook: Gambia, The* (Langley, VA: CIA), https://www.cia.gov/the-world-factbook/countries/gambia-the/#government.

171 GDP, PPP (constant 2017 international dollars) and GDP per capita, PPP (constant 2017 international dollars).

172 World Bank Group, "World Development Indicators," 2020.

173 World Bank Group, "World Development Indicators," 2020.

174 World Bank Group, "World Development Indicators," 2020.

175 Jambeck et al,, "Plastic Waste Inputs from Land into the Ocean."

176 UN Comtrade, 2019, "UN Comtrade Database."

177 UN Comtrade, 2019, "UN Comtrade Database."

178 Kaza, Silpa, Lisa Yao, Perinaz Bhada-Tata, and Frank Van Woerden. 2018. *What a Waste 2.0: A Global Snapshot of Solid Waste Management to 2050*. Urban Development Series. Washington, DC: World Bank.

179 Jambeck et al., "Plastic Waste Inputs from Land into the Ocean."

180 Jambeck et al., "Plastic Waste Inputs from Land into the Ocean."

181 Climate & Clean Air Coalition 2017, "Solid Waste Management City Profile: Lomé, The Gambia," https://www.waste.ccacoalition.org/sites/default/files/files/lome_city_profile_0.pdf.

182 UN (United Nations) 2015, "Sanitation Country Profile: Gambia," https://www.wsp.org/sites/wsp.org/files/publications/CSO-Gambia.pdf.

183 Chatham House, "Policies."

184 Chatham House, "Policies."

185 Chatham House, "Policies."

186 Chatham House, "Policies."

Ghana

Indicator	Data
Population, 2019 (no.)	30,417,856
Population density, 2018 (people per sq. km of land area)	130.82
Coastal population, 2014 (no.)[187]	7,727,702
Share of people living in urban areas, 2019 (%)	56.7
Total MSW generated, 2016 (tons/year)[188]	3,538,275

Socioeconomic profile

Ghana is a lower-middle-income country in West Africa bordered by Côte d'Ivoire, Burkina Faso, and Togo. As the second-largest economy in the Economic Community of West African States,[189] West Africa's regional body, Ghana's economy is driven by its three main export commodities: oil, cocoa, and gold.[190] Ghana comprises 16 administrative regions[191] and runs a unitary presidential republic system with a parliament.

In 2019, Ghana recorded an overall GDP (purchasing power parity) of approximately $165 billion and a GDP (purchasing power parity) per capita of $5,413.[192,193] With an area of 238,533 km^2, it has a population of 30,417,856 (2019) and a population density of 130.82 people per km^2 (2018).[194] Due to increasing urbanization, the majority of Ghana's population resides in urban areas (56.7 percent in 2019.)[195] Just under eight million Ghanaians reside in coastal areas (2014),[196] particularly in important enclaves such as Accra, the capital, Tema, and Takoradi.

Plastic industry and ecosystem

In 2018 and 2019, Ghana had no domestic resin production. Its conversion industry processed 262 kt of resin (158 kt PE, 53 kt PP, 51 kt PET) in 2018 and 205 kt of resin (135 kt PE, 15 kt PP, 55 kt PET) in 2019. Similar to other West African countries, Ghana is a net importer of plastics. In 2019, 233 million kg of plastics were imported into the country, with PE and PVC accounting for about 86 percent of the imports.[197] Comparatively, only 1,041,278 kg of plastics were exported from Ghana that same year, 90 percent of which were classified as PE and scrap plastics.[198]

As Ghana lacks a well-developed downstream oil and gas sector, plastics are imported into Ghana as either virgin pellets or finished products, mainly from Asia and Europe.[199] The imported virgin pellets feed Ghana's burgeoning domestic plastics industry.[200] With at least 120 manufacturers operating in the country,[201] the local plastics industry produces semi-finished goods, such as bottles, plastic bags, and plastic film for water sachets.[202] According to the Ghana Plastics Manufacturers Association, the industry produces 27,000 million tons per annum of flexible packaging for domestic consumption by multinational corporations and informal microenterprises.[203] Furthermore, the association also highlights that PET bottle production in Ghana stands at 68,000 million tons per year.[204]

187 Jambeck et al., "Plastic Waste Inputs from Land into the Ocean."

188 Kaza, Silpa, Lisa Yao, Perinaz Bhada-Tata, and Frank Van Woerden. 2018. *What a Waste 2.0: A Global Snapshot of Solid Waste Management to 2050*. Urban Development Series. Washington, DC: World Bank.

189 Carmen Torres and Jeske van Seters 2016, "Overview of Trade and Barriers to Trade in West Africa: Insights in Political Economy Dynamics, with Particular Focus on Agricultural and Food Trade," https://www.tralac.org/images/docs/10274/overview-of-trade-and-barriers-to-trade-in-west-africa-insights-in-political-economy-dynamics-agricultural-trade-ecdpm-july-2016.pdf.

190 World Bank Group 2021, "Ghana—Overview," https://www.worldbank.org/en/country/Ghana/overview#1.

191 City Population 2020, "Ghana: Regions, Major Cities & Urban Localities: Population Statistics in Maps and Charts," retrieved October 6, https://www.citypopulation.de/en/ghana/cities/.

192 GDP, PPP (constant 2017 international $) and GDP per capita, PPP (constant 2017 international $).

193 World Bank Group, 2020, "World Development Indicators."

194 World Bank Group, 2020, "World Development Indicators."

195 World Bank Group, 2020, "World Development Indicators."

196 Jambeck et al., "Plastic Waste Inputs from Land into the Ocean."

197 UN Comtrade 2019, "UN Comtrade Database."

198 UN Comtrade 2019, "UN Comtrade Database."

199 World Bank 2020, Ghana: Country Environmental Analysis (Washington, DC: World Bank, http://documents1.worldbank.org/curated/en/419871588578973802/pdf/Ghana-Country-Environmental-Analysis.pdf.

200 World Bank 2020, Ghana: Country Environmental Analysis (Washington, DC: World Bank, http://documents1.worldbank.org/curated/en/419871588578973802/pdf/Ghana-Country-Environmental-Analysis.pdf.

201 GEF (Global Environment Facility) 2019, Establishing a Circular Economy Framework for the Plastics Sector in Ghana (Washington, DC: GEF), https://www.thegef.org/sites/default/files/web-documents/10401_MFA_PIF.pdf.

202 World Bank, Ghana: Country Environmental Analysis.

203 World Bank, Ghana: Country Environmental Analysis.

204 Trinomics 2020, Circular Economy in Africa-EU Cooperation: Country Report for Ghana (Brussels: European Commission), http://trinomics.eu/wp-content/uploads/2020/12/Country-Report-Ghana_Final_20122020.pdf.

Solid waste management

Ghana generates 0.45 kg of MSW per capita per day, amounting to an overall daily MSW generation of 9.7 million kg.[205] About 81 percent of MSW generated in Ghana is inadequately managed.[206] Plastic waste accounts for just below 5 percent of MSW arisings[207] with a daily generation rate of about 743,000 kg.

Currently, there are only 25 plastic recycling companies operating in Ghana, with a combined processing capacity of 320 tons of flexible plastic per day, mainly sourced from water sachets.[208] Though a few formal waste management companies recover plastic waste for export as scrap,[209] more than 95 percent of recovered plastics in Ghana is captured by informal waste operators.[210] The recovered plastics, dominated by thin-film plastic sachets for drinking water, are supplied to local reprocessors that produce shopping bags.[211] Only two percent of PET bottles in Ghana are recycled.[212]

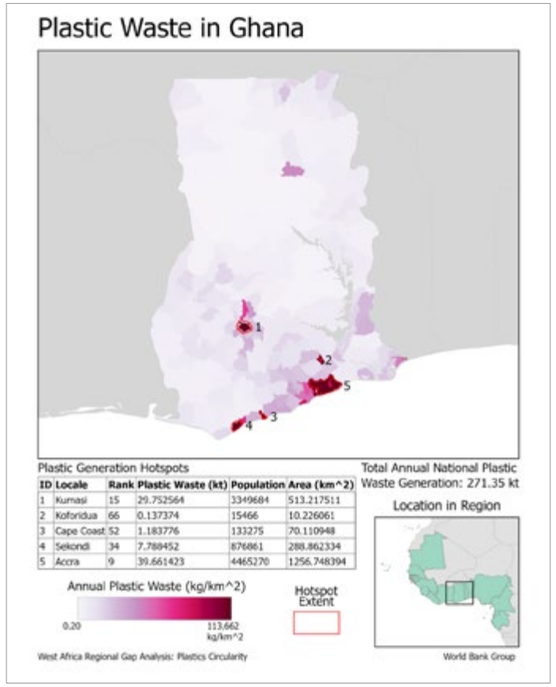
Legislation, policies, and other initiatives

The government ministries responsible for municipal waste management in Ghana are the Ministry of Sanitation and Water Resources and the Ministry of Environment, Science, Technology and Innovation.[213] Currently, waste management in Ghana is driven by the following:

- Environmental Sanitation Policy, 2009: This policy emphasizes the promotion of the "Four Rs" for waste management in Ghana—reduction, reuse, recycling, and recovery.[214]
- National Environmental Sanitation Strategy and Action Plan, 2010: This government initiative highlights the strategies and related action plans for promoting solid waste management in Ghana.[215]

To facilitate funding for plastic waste management in Ghana, the government applies an environmental excise tax on plastic and plastic products. According to the Customs and Excise (Duties and Other Taxes) (Amendment) Act, 2013,[216] a 10 percent tax is applied on imported plastics and plastic products, with at least half of the revenue accrued intended to go toward the funding of plastics recycling and the production of plastic waste bins and bags, and biodegradable plastics. However, in the absence of an approved fund-management authority, the funds generated from the tax have yet to be disbursed to the local plastics recycling sector.[217]

In 2019, Ghana signed up to the Global Plastic Action Partnership and set up a National Plastic Action Partnership It is currently developing a National Plastic Management Policy.[218] Ghana's EPR (Hazardous and Electronic Waste Control and Management Act 2017), introduced in 2016 Please check dates. 2016 predates the date of the Act., covers plastics embedded in waste electrical and electronic equipment.



205 Kaza, Silpa, Lisa Yao, Perinaz Bhada-Tata, and Frank Van Woerden. 2018. *What a Waste 2.0: A Global Snapshot of Solid Waste Management to 2050*. Urban Development Series. Washington, DC: World Bank.

206 Jambeck et al., "Plastic Waste Inputs from Land into the Ocean."

207 Jambeck et al., "Plastic Waste Inputs from Land into the Ocean."

208 Trinomics, *Circular Economy in Africa-EU Cooperation*.

209 GEF, Establishing a Circular Economy Framework.

210 World Bank, *Ghana: Country Environmental Analysis*.

211 World Bank, *Ghana: Country Environmental Analysis*.

212 Trinomics, *Circular Economy in Africa-EU Cooperation*.

213 Netherlands Enterprise Agency, "Market Survey Waste and Circular Economy in Ghana," 2019, https://www.rvo.nl/sites/default/files/2019/08/Ghana-Market-Survey-Waste-Circular-Economy.pdf.

214 Chatham House, "Policies."

215 Chatham House, "Policies."

216 Parliament of the Republic of Ghana 2013, "Customs and Excise (Duties and Other Taxes) (Amendment) Act" http://www.odekro.org/Images/Uploads/Customs%20and%20Excise%20Duties%20(Amendment)%20Act%202013.pdf.

217 Trinomics, *Circular Economy in Africa-EU Cooperation*.

218 Trinomics, *Circular Economy in Africa-EU Cooperation*.

Guinea

Indicator	Data
Population, 2019 (no.)	12,771,246
Population density, 2018 (people per sq. km of land area)	50.52
Coastal population, 2014 (no.)[219]	1,996,496
Share of people living in urban areas, 2019 (%)	36.5
Total MSW generated, 2016 (tons/year)[220]	596,911

Socioeconomic profile

Guinea is a low-income country in West Africa bordered by Guinea-Bissau, Senegal, Mali, Côte d'Ivoire, Liberia, and Sierra Leone. Guinea's mining sector drives the economy of the nation—particularly gold, bauxite, and diamond mining.[221] The country comprises seven administrative regions and one *gouvenorat*,[222] and runs a presidential republic system, with a parliament.

In 2019, Guinea recorded an overall GDP (purchasing power parity) of $32.7 billion and a GDP (purchasing power parity) per capita of $2,562.[223,224] With an area of 245,857 km^2, it has a population of 12,771,246 (2019) and a population density of 50.52 people per km^2 (2018).[225] Though urbanization has been increasing, the majority of Guinea's population still resides in rural areas—approximately 63.5 percent in 2019.[226] In 2014, two million Guineans resided in coastal areas,[227] predominantly in the capital city, Conakry.

Plastic industry and ecosystem

In 2018 and 2019, Guinea had no domestic resin production. Its conversion industry processed 15 kt of resin (14 kt PE, 1 kt PET) in 2018 and 17 kt of resin (16 kt PE, 1 kt PET) in 2019. Similar to other West African countries, Guinea is a net importer of plastics. In 2019, 51.9 million kg of plastics were imported into the country, with PE and PP accounting for about 90.2 percent of the imports.[228] Only 25,948 kg of PVC plastics were exported from Guinea that same year.[229]

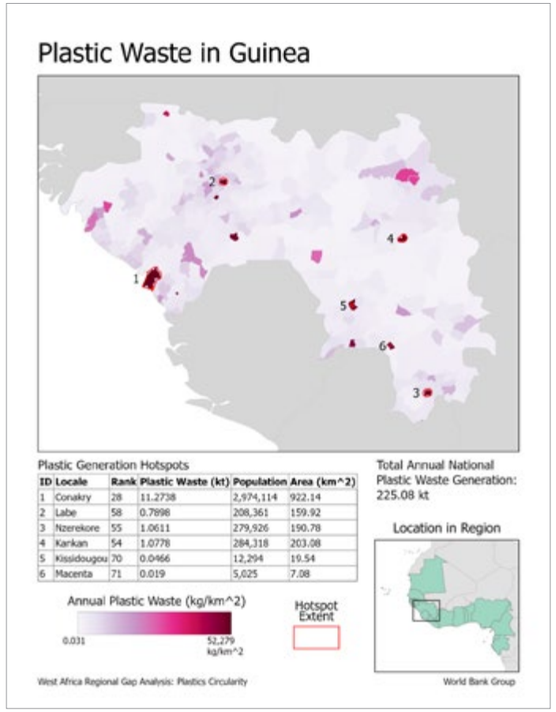
Solid waste management

Guinea generates 0.2 kg of MSW per capita per day. This amounts to an overall daily MSW generation of 1.6 million kg.[230] However, the West African nation has struggled to effectively manage its waste arisings—about 83.5 percent of MSW generated in Guinea is inadequately managed.[231] Plastic waste management has increasingly been cited by Guinea's government as a pressing environmental issue for the nation. Plastic waste accounts for 5 percent of MSW arisings[232] with a daily generation rate of about 616,000 kg.

Legislation, policies, and other initiatives

In Guinea, the Ministry of Environment, Water and Forests is responsible for overseeing waste management.[233] Currently, waste management in Guinea is driven by the following:

- Environmental Code, 2019: This law establishes guidance on appropriate waste reduction, management, and disposal.[234]



219 Jambeck et al., "Plastic Waste Inputs from Land into the Ocean."

220 Kaza, Silpa, Lisa Yao, Perinaz Bhada-Tata, and Frank Van Woerden. 2018. *What a Waste 2.0: A Global Snapshot of Solid Waste Management to 2050*. Urban Development Series. Washington, DC: World Bank.

221 CIA, *The World Factbook: Guinea* (Langley, VA: CIA, 2021), https://www.cia.gov/the-world-factbook/countries/guinea/.

222 CIA, *The World Factbook: Guinea* (Langley, VA: CIA, 2021), https://www.cia.gov/the-world-factbook/countries/guinea/.

223 GDP, PPP (constant 2017 international dollars) and GDP per capita, PPP (constant 2017 international dollars).

224 World Bank Group, 2020, "World Development Indicators."

225 World Bank Group, 2020, "World Development Indicators."

226 World Bank Group, 2020, "World Development Indicators."

227 Jambeck et al, "Plastic Waste Inputs from Land into the Ocean."

228 UN Comtrade 2019, "UN Comtrade Database."

229 UN Comtrade 2019, "UN Comtrade Database."

230 Kaza, Silpa, Lisa Yao, Perinaz Bhada-Tata, and Frank Van Woerden. 2018. *What a Waste 2.0: A Global Snapshot of Solid Waste Management to 2050*. Urban Development Series. Washington, DC: World Bank.

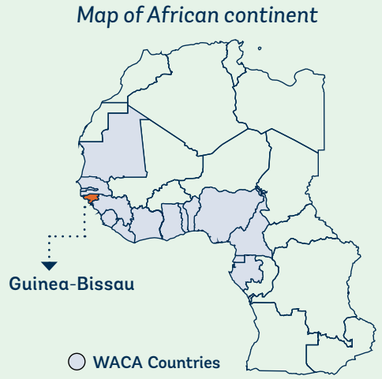
231 Jambeck et al., "Plastic Waste Inputs from Land into the Ocean."

232 Jambeck et al., "Plastic Waste Inputs from Land into the Ocean."

233 World Bank 2019, *Republic of Guinea: Planning, Connecting, Financing in Conakry* (Washington, DC: World Bank), https://openknowledge.worldbank.org/bitstream/handle/10986/31757/Guinea-Urban-Sector-Review-Planning-Connecting-Financing-in-Conakry.pdf;jsessionid=6987DA2905ACB4AD6B6E7B37CA971373?sequence=1.

234 Chatham House, "Policies."

Guinea-Bissau



Indicator	Data
Population, 2019 (no.)	1,920,922
Population density, 2018 (people per sq. km of land area)	66.65
Coastal population, 2014 (no.)[235]	1,208,106
Share of people living in urban areas, 2019 (%)	43.8
Total MSW generated, 2016 (tons/year)[236]	289,514

Socioeconomic profile

Guinea-Bissau is a low-income country in West Africa bordered by Senegal and Guinea. Guinea Bissau's economy is dependent on subsistence farming and cashew nut exports.[237] The country comprises nine administrative regions and runs a semi-presidential republic system of government.[238]

Guinea-Bissau's overall GDP (purchasing power parity) in 2019 was approximately $3.8 billion. It reported a GDP (purchasing power parity) per capita of $1,989.[239,240] With an area of 36,125 km^2, Guinea-Bissau has a population is 1,920,922 (2019) and a population density of 66.7 people per km^2 (2018).[241] Most of Guinea-Bissau's residents (56.2 percent of the total population in 2019) live in rural areas.[242] In 2014, just over 1.2 million Guinea-Bissau residents lived along the country's coastline,[243] particularly in the capital city of Bissau.

Plastic industry and ecosystem

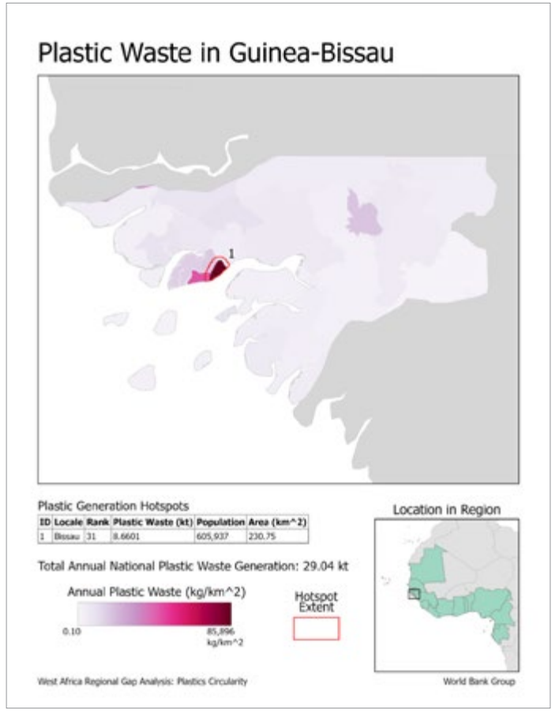
In 2018 and 2019, Guinea-Bissau had no domestic resin production. Its conversion industry processed 2 kt of PE resin in 2018 and 2019. Similar to its regional neighbors, Guinea-Bissau is a net importer of plastics. In 2019, 5.2 million kg of plastics were imported into the country, with PE and PP making up about 93.2 percent of the imports.[244] In that same year, no plastic products or resin were exported from Guinea-Bissau.[245]

Solid waste management

Guinea-Bissau generates 0.45 kg of MSW per capita per day, amounting to an overall daily MSW generation of 793,000 kg.[246] About 83.5 percent of MSW generated in Guinea-Bissau is inadequately managed.[247] Plastic waste accounts for about 9 percent of MSW arisings[248] with a daily generation rate of about 79,500 kg.

Legislation, policies, and other initiatives

The main government ministry responsible for municipal waste management in Guinea-Bissau is the Ministry of Health.[249] Currently, there are no overarching laws dealing specifically with waste management in Guinea-Bissau. However, in 2013 the government introduced a ban on the use, manufacture, import, sale, and distribution of plastic bags through Decree Law 16/2013.[250]



235 Jambeck et al., "Plastic Waste Inputs from Land into the Ocean."

236 Kaza, Silpa, Lisa Yao, Perinaz Bhada-Tata, and Frank Van Woerden. 2018. *What a Waste 2.0: A Global Snapshot of Solid Waste Management to 2050*. Urban Development Series. Washington, DC: World Bank.

237 CIA, *The World Factbook: Guinea-Bissau*, Langley, VA: CIA, 2021, https://www.cia.gov/the-world-factbook/countries/guinea-bissau/.

238 CIA, *The World Factbook: Guinea-Bissau*, Langley, VA: CIA, 2021, https://www.cia.gov/the-world-factbook/countries/guinea-bissau/.

239 GDP, PPP (constant 2017 international dollars) and GDP per capita, PPP (constant 2017 international dollars).

240 World Bank Group 2020, "World Development Indicators."

241 World Bank Group 2020, "World Development Indicators."

242 World Bank Group 2020, "World Development Indicators."

243 Jambeck et al., "Plastic Waste Inputs from Land into the Ocean."

244 UN Comtrade 2019, "UN Comtrade Database."

245 UN Comtrade 2019, "UN Comtrade Database."

246 Kaza, Silpa, Lisa Yao, Perinaz Bhada-Tata, and Frank Van Woerden. 2018. *What a Waste 2.0: A Global Snapshot of Solid Waste Management to 2050*. Urban Development Series. Washington, DC: World Bank.

247 Jambeck et al., "Plastic Waste Inputs from Land into the Ocean."

248 Jambeck et al., "Plastic Waste Inputs from Land into the Ocean."

249 Katia Ferrari, Streng Cerise, Rita Gamberini, Bianca Rimini, and Francesco Lolli 2016, "An International Partnership for the Sustainable Development of Municipal Solid Waste Management in Guinea-Bissau, West Africa," XXI Summer School "Francesco Turco," September, https://www.researchgate.net/publication/309373688_An_international_partnership_for_the_sustainable_development_of_Municipal_Solid_Waste_Management_in_Guinea-Bissau_West_Africa.

250 Chatham House, "Policies."

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Liberia

Indicator	Data
Population, 2019 (no.)	4,937,374
Population density, 2018 (people per sq. km of land area)	50.03
Coastal population, 2014 (no.)[251]	2,148,271
Share of people living in urban areas, 2019 (%)	51.6
Total MSW generated, 2016 (tons/year)[252]	564,467

Socioeconomic profile

Liberia is a low-income country in West Africa bordered by Sierra Leone, Guinea, and Côte d'Ivoire. Liberia's principal exports are iron ore, rubber, diamonds, and gold, while palm oil and cocoa are emerging increasingly as new export products.[253] The country is divided into 15 administrative counties[254] and runs a presidential republic system with a parliament.

In 2019, Liberia's overall GDP (purchasing power parity) was just above $7 billion, with a GDP (purchasing power parity) per capita of $1,428.[255,256] With an area of 111,369 km^2, Liberia has a population of 4,937,374 (2019) and a population density of 50.03 people per km^2 (2018).[257] Majority of Liberians—51.6 percent of the total population (2018)—reside in urban areas.[258] In 2014, 2.1 million Liberians resided in coastal areas,[259] most notably in the capital city, Monrovia.

Plastic industry and ecosystem

In 2018 and 2019, Liberia had no domestic resin production. Its conversion industry processed 5 kt of PE resin in 2018 and 2 kt of PE resin 2019. Liberia is a net importer of plastics. In 2019, 13.3 million kg of plastics were imported into the country, with PE and PP accounting for about 94.6 percent of the imports.[260] Only 125,606 kg of plastics were exported from Liberia that same year, all of which consisted of PE.[261]

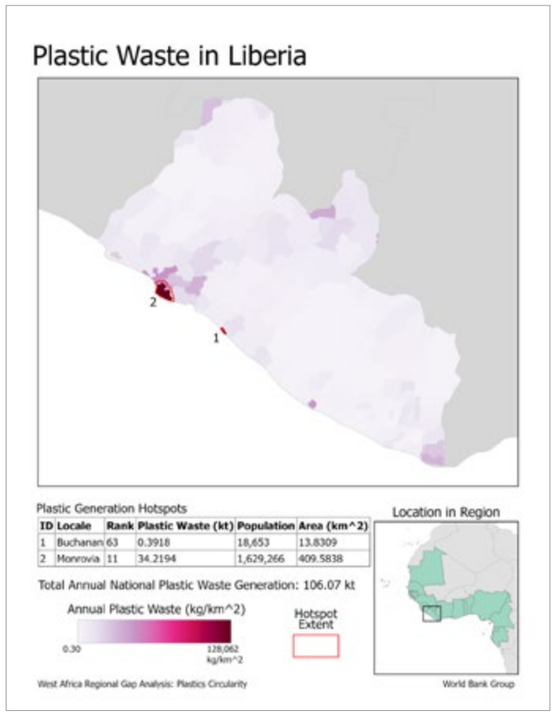
Solid waste management

Liberia generates 0.44 kg of MSW per capita per day and this amounts to an overall daily MSW generation of 1.5 million kg.[262] It should be noted, however, that about 84.4 percent of MSW generated in Liberia is inadequately managed.[263] Plastic waste accounts for about 14 percent of MSW arisings[264] with a daily generation rate of about 290,400 kg.

Legislation, policies, and other initiatives

The government ministries responsible for municipal waste management in Liberia are the Ministry of Health and Social Welfare, and the Ministry of Lands, Mines and Energy.[265] Waste management in Liberia is driven by the following law:

- Environment Protection and Management Law of Liberia, 2002: This law regulates solid waste disposal at the national level.[266]



251 Jambeck et al., "Plastic Waste Inputs from Land into the Ocean."

252 Kaza, Silpa, Lisa Yao, Perinaz Bhada-Tata, and Frank Van Woerden. 2018. What a Waste 2.0: A Global Snapshot of Solid Waste Management to 2050. Urban Development Series. Washington, DC: World Bank.

253 CIA, The World Factbook: Liberia (Langley, VA: CIA, 2021), https://www.cia.gov/the-world-factbook/countries/liberia/.

254 CIA, The World Factbook: Liberia (Langley, VA: CIA, 2021), https://www.cia.gov/the-world-factbook/countries/liberia/.

255 GDP, PPP (constant 2017 international dollars) and GDP per capita, PPP (constant 2017 international dollars).

256 World Bank Group 2020, "World Development Indicators."

257 World Bank Group 2020, "World Development Indicators."

258 World Bank Group 2020, "World Development Indicators."

259 Jambeck et al., "Plastic Waste Inputs from Land into the Ocean."

260 UN Comtrade 2019, "UN Comtrade Database."

261 UN Comtrade 2019, "UN Comtrade Database."

262 Jambeck et al., "Plastic Waste Inputs from Land into the Ocean."

263 Jambeck et al., "Plastic Waste Inputs from Land into the Ocean."

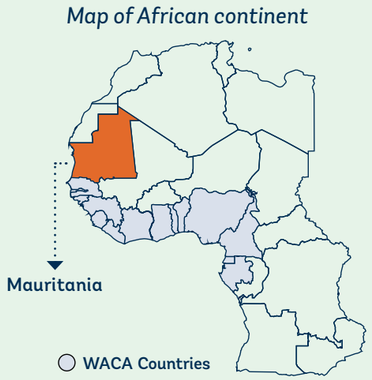
264 Jambeck et al., "Plastic Waste Inputs from Land into the Ocean."

265 Victor Emery David, Yasinta John, and Shahid Hussain 2020, "Rethinking Sustainability: A Review of Liberia's Municipal Solid Waste Management Systems, Status, and Challenges," *Journal of Material Cycles and Waste Management* 22 (1299–317, https://link.springer.com/article/10.1007/s10163-020-01046-x.

266 Chatham House, "Policies."

Mauritania

Map of African continent



Indicator	Data
Population, 2019 (no.)	4,525,696
Population density, 2018 (people per sq. km of land area)	4.27
Coastal population, 2014 (no.)[267]	1,005,481
Share of people living in urban areas, 2019 (%)	54.5
Total MSW generated, 2016 (tons/year)[268]	454,000

Socioeconomic profile

Mauritania is a lower-middle-income country in West Africa bordered by Western Sahara/Morocco, Algeria, Mali, and Senegal. Its economy is dominated by agricultural production and extractive industries such as oil, gold, and copper.[269] The country comprises 15 administrative regions[270] and runs a presidential republic system of government.

Mauritania's overall GDP (purchasing power parity) in 2019 was approximately $23.5 billion and it reported a GDP (purchasing power parity) per capita of $5,197.[271,272] Though Mauritania has an area of 1,030,700 km^2, its population is only 4,525,696 (2019). Population density is 4.27 people per km^2 (2018).[273] The majority of Mauritania's residents (54.5 percent of the total population in 2019) live in urban areas.[274] In 2014, just over one million of Mauritania's residents lived along the country's coastline,[275] particularly in the capital city of Nouakchott.

Plastic industry and ecosystem

In 2018 and 2019, Mauritania had no domestic resin production or conversion. Similar to its regional neighbors, Mauritania is a net importer of plastics. In 2019, 9.2 million kg of plastics were imported into the country, with PE and PP making up about 94.3 percent of the imports.[276] Only 980,560 kg of plastics were exported from Mauritania that same year, 90.4 percent of which were classed as scrap plastic.[277]

Solid waste management

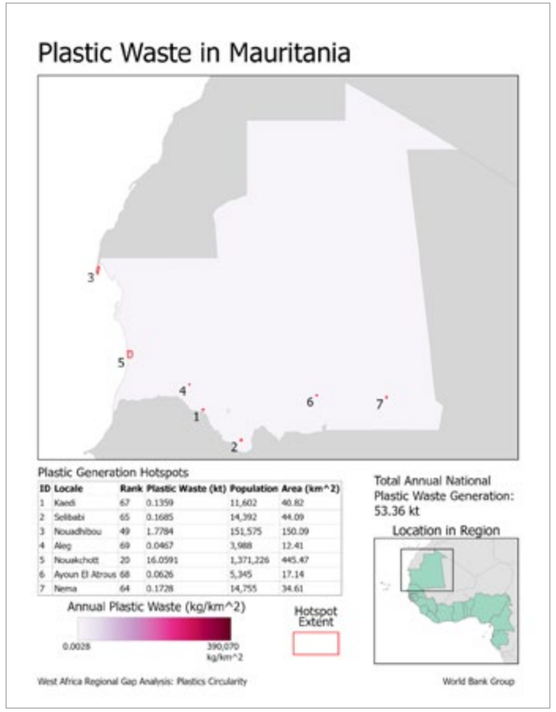
Mauritania generates 0.36 kg of MSW per capita per day, amounting to an overall daily MSW generation of 1.2 million kg.[278] About 82.4 percent of MSW generated in Mauritania is inadequately managed.[279] Plastic waste accounts for about 9 percent of MSW arisings,[280] with a daily generation rate of about 146,100 kg.

Legislation, policies, and other initiatives

The government ministry responsible for municipal waste management in Mauritania is the Ministry of Environment.[281] Currently, waste management in Mauritania is driven by the following law:

- Law No. 2000-045: This law spells out the general principles of Mauritania's national policy on environmental management and includes waste management.[282]

In 2012, the government introduced a decree (Decree No. 2012-157) that banned manufacture, use, and import of plastic bags.[283]



267 Jambeck et al., "Plastic Waste Inputs from Land into the Ocean."

268 Kaza, Silpa, Lisa Yao, Perinaz Bhada-Tata, and Frank Van Woerden. 2018. *What a Waste 2.0: A Global Snapshot of Solid Waste Management to 2050*. Urban Development Series. Washington, DC: World Bank

269 CIA 2021, *The World Factbook: Mauritania* (Langley, VA: CIA), https://www.cia.gov/the-world-factbook/countries/mauritania/#economy.

270 CIA 2021, *The World Factbook: Mauritania* (Langley, VA: CIA), https://www.cia.gov/the-world-factbook/countries/mauritania/#economy.

271 GDP, PPP (constant 2017 international $) and GDP per capita, PPP (constant 2017 international $).

272 World Bank Group, "World Development Indicators," 2020.

273 World Bank Group, "World Development Indicators," 2020.

274 World Bank Group, "World Development Indicators," 2020.

275 Jambeck et al., "Plastic Waste Inputs from Land into the Ocean."

276 UN Comtrade 2019, "UN Comtrade Database."

277 Ibid.

278 Kaza, Silpa, Lisa Yao, Perinaz Bhada-Tata, and Frank Van Woerden. 2018. *What a Waste 2.0: A Global Snapshot of Solid Waste Management to 2050*. Urban Development Series. Washington, DC: World Bank.

279 Jambeck et al., "Plastic Waste Inputs from Land into the Ocean."

280 Jambeck et al., "Plastic Waste Inputs from Land into the Ocean."

281 GIZ, *Report on the Solid Waste Management in Mauritania* (Tunis: GIZ, 2013), https://www.resource-recovery.net/sites/default/files/mauritanis_ra_ang_web_0.pdf.

282 Chatham House, "Policies."

283 Chatham House, "Policies."

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Nigeria

Map of African continent

Indicator	Data
Population, 2019 (no.)	200,963,599
Population density, 2018 (people per sq. km of land area)	215.1
Coastal population, 2014 (no.)[284]	27,477,112
Share of people living in urban areas, 2019 (%)	49.5
Total MSW generated, 2016 (tons/year)[285]	27,614,830

Socioeconomic profile

Nigeria is the most populous country in Africa and West Africa, with an estimated 201 million inhabitants in 2019.[286] This is more than 50 percent of the total population in West Africa. The Nigerian economy, classified as lower middle income, is considered a major emerging market in the context of Africa and globally. The country is a federal republic, comprising 36 states and the Federal Capital Territory, where its capital—Abuja—is located. Lagos is the most populous coastal city in Africa, with an estimated population of over 24 million residents.[287]

Nigeria has the second-highest population density in the West African region after Gabon, at 215.1 people per km^2 (2018).[288] About half the country live in urban areas while 13.7 percent live in coastal regions.[289]

Plastic industry and ecosystem

Nigeria is Africa's largest oil producer. The oil and gas sector accounts for about 10 percent of GDP, and petroleum exports represent around 86 percent of total exports revenue.[290] Nigeria is the only resin producer in the WACA region. It produced 486 kt of resin (325 kt PE, 96 kt PP, 65 kt PET) in 2018 and 498 kt of resin (322 kt PE, 101 kt PP, 75 kt PET) in 2019. Nevertheless, the country is a net importer of plastics, which in its raw form is typically made from oil (naphtha). In 2019, imports of plastics into Nigeria amounted to $1.7 billion, including net imports of all key plastics resins (PE, PP, polystyrene [PS], and PVC).[291] Almost two-thirds of demand for virgin resins in Nigeria is currently met through imports; thus Nigeria is the continent's largest importer of resins.[292] Nigeria's conversion industry processed 1,094 kt of resin (581 kt PE, 367 kt PP, 137 kt PET, and 9 kt PS) in 2018 and 978 kt of resin (564 kt PE, 238 kt PP, 164 kt PET, 12 kt PS) in 2019.

Nigeria's large consumption of primary plastics (resins) supports a robust plastic manufacturing sector. According to market reports, plastic production in Nigeria has grown rapidly—at a rate of 13.9 percent annually—from 120 kt in 2007 to a projected 513 kt in 2020.[293] While being a net importer of resin, Nigeria is West Africa's largest producer of olefin and polyolefin plastics, an industry led by Indorama Eleme Petrochemicals Limited.[294] Nigeria has over 3,000 plastic companies today, producing products ranging from jerry cans and shopping bags, to tables and mats.[295] The literature highlights the challenge of managing waste from water sachets; it is estimated that over 1,500 water sachet factories are present in Lagos alone.

In terms of plastics recovery, studies have found that less than 12 percent of plastic waste is recycled in Nigeria.[296] There are reportedly eight completed plastic waste recycling plants in the country, with 18 others at various stages of completion.[297] There is no current capacity for waste-to-energy, for example, in cement kilns or incinerators with heat recovery. The remaining plastic waste (~80 percent) goes to landfills and dumpsites.[298] Examples of businesses that are pioneering circular plastics solutions include Lagos-based Salubata, a company that produces shoes from recycled plastic waste. (This company was also the recent winner of African Innovation Week 2020.)[299]

Solid waste management

Nigeria generates 0.51 kg of MSW per capita per day, amounting to an overall daily MSW generation of 75.6 million kg.[300] About 81 percent of MSW generated in Nigeria is inadequately managed.[301] Plastic waste accounts for approximately 13 percent of MSW arisings,[302] with a daily generation rate of about 12.9 million kg. Relatedly, Nigeria is home to three out of the top 20 plastic polluting rivers globally—that is, the Cross, Imo, and Kwa Ibo rivers.[303] Studies have found microplastics due to pollution—and especially mismanagement of low-value plastics—in aquatic life.[304] Nigeria's recycling industry is still largely informal, with recovery and recycling activities dominated by informal waste reclaimers, intermediaries, artisans, and re-manufacturing small-scale enterprises[305].

Legislation, policies, and other initiatives

There is significant momentum in Nigeria to tackle plastics waste through circular economy principles. In 2020, the Nigerian Federal Executive Council approved a new law on plastic waste to encourage the development of a circular economy around plastic waste.[306]

Nigeria's National Environmental Regulations[307] introduced EPR requirements for the following industries: food; beverages; tobacco; pharmaceuticals; soap and detergent; electricals and electronics; and plastics. Additionally, the EPR Programme was introduced in 2016 as a framework geared toward achieving a zero-waste society, including the reduction of the environmental impact of packaging waste.

In May 2019, a plastic bag prohibition bill was passed, providing "an Act to prohibit the use, manufacture and importation of all plastic bags used for commercial and household packaging in order to address harmful impacts to oceans, rivers, lakes, forests, environment as well as human beings and also to relieve pressure on landfills and waste management and for other related matters."[308] The bill further states that a retailer should offer a paper bag to customers at the point of sale.[309] However, this bill is reportedly not yet implemented as the president has not assented to it.[310]


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284 Jambeck et al., "Plastic Waste Inputs from Land into the Ocean."

285 Kaza, Silpa, Lisa Yao, Perinaz Bhada-Tata, and Frank Van Woerden. 2018. *What a Waste 2.0: A Global Snapshot of Solid Waste Management to 2050*. Urban Development Series. Washington, DC: World Bank.

286 World Bank, "Data: Population, Total," accessed February 3, 2021, https://data.worldbank.org/indicator/SP.POP.TOTL.)

287 Lagos Bureau of Statistics, 2016.

288 World Bank Group 2020, "World Development Indicators."

289 Jambeck et al., "Plastic Waste Inputs from Land into the Ocean."

290 OPEC (Organization of the Petroleum Exporting Countries), "Nigeria," accessed February 5, 2021, https://www.opec.org/opec_web/en/about_us/167.htm.

291 UN Comtrade 2019, "UN Comtrade Database."

292 World Bank, Internal document Nigerian PROBLUE team.

293 Statista 2020, "Plastic Production Nigeria 2020," accessed February 4, 2021, https://www.statista.com/statistics/994633/plastic-production-nigeria/.

294 Indorama Eleme Petrochemicals Limited: https://www.indorama.com/affiliated-companies/indorama-eleme-petrochemicals-limited.

295 Vanessa Obioha 2019, "Nigeria: Promoting Local Production in Plastic Industry," allAfrica.com, June 21, https://allafrica.com/stories/201906210661.html.

296 Joshua O. Babayemi, Mary B. Ogundiran, Roland Weber, and Oladele Osibanjo 2018, "Initial Inventory of Plastics Imports in Nigeria as a Basis for More Sustainable Management Policies" Journal of Health and Pollution 8, no. 18 (June 1): 180601, https://doi.org/10.5696/22156-9614-8.18.1.

297 Down to Earth, "Nigeria Well Placed to Beat Plastic Pollution: Vice President," accessed February 4, 2021, https://www.downtoearth.org.in/news/environment/nigeria-well-placed-to-beat-plastic-pollution-vice-president-60786.

298 Babayemi et al. 2018, "Initial Inventory of Plastics Imports in Nigeria."

299 Sören Bauer 2021, "Spotlight on Circularity in Africa," 4, https://revolve.media/wp-content/uploads/2021/02/REVOLVE-38-Spotlight-on-Circularity-in-Africa.pdf.

300 Kaza, Silpa, Lisa Yao, Perinaz Bhada-Tata, and Frank Van Woerden. 2018. *What a Waste 2.0: A Global Snapshot of Solid Waste Management to 2050*. Urban Development Series. Washington, DC: World Bank.

301 Jambeck et al., "Plastic Waste Inputs from Land into the Ocean."

302 Jambeck et al., "Plastic Waste Inputs from Land into the Ocean."

303 Laurent C. M. Lebreton, Joost van der Zwet, Jan-Willem Damsteeg, Boyan Slat, Anthony Andrady, and Julia Reisser, "River Plastic Emissions to the World's Oceans" 2017, Nature Communications 8, no. 1 (June 7): 15611, https://doi.org/10.1038/ncomms15611.

304 Emmanuel O. Akindele 2020, "Why Microplastics Found in Nigeria's Freshwaters Raise a Red Flag" The Conversation, October 13, http://theconversation.com/why-microplastics-found-in-nigerias-freshwaters-raise-a-red-flag-147432.

305 Trinomics. 2020. Circular Economy in Africa-EU Cooperation – Country report for Nigeria. Country-Report-Nigeria_Final_20122020.pdf (trinomics.eu).

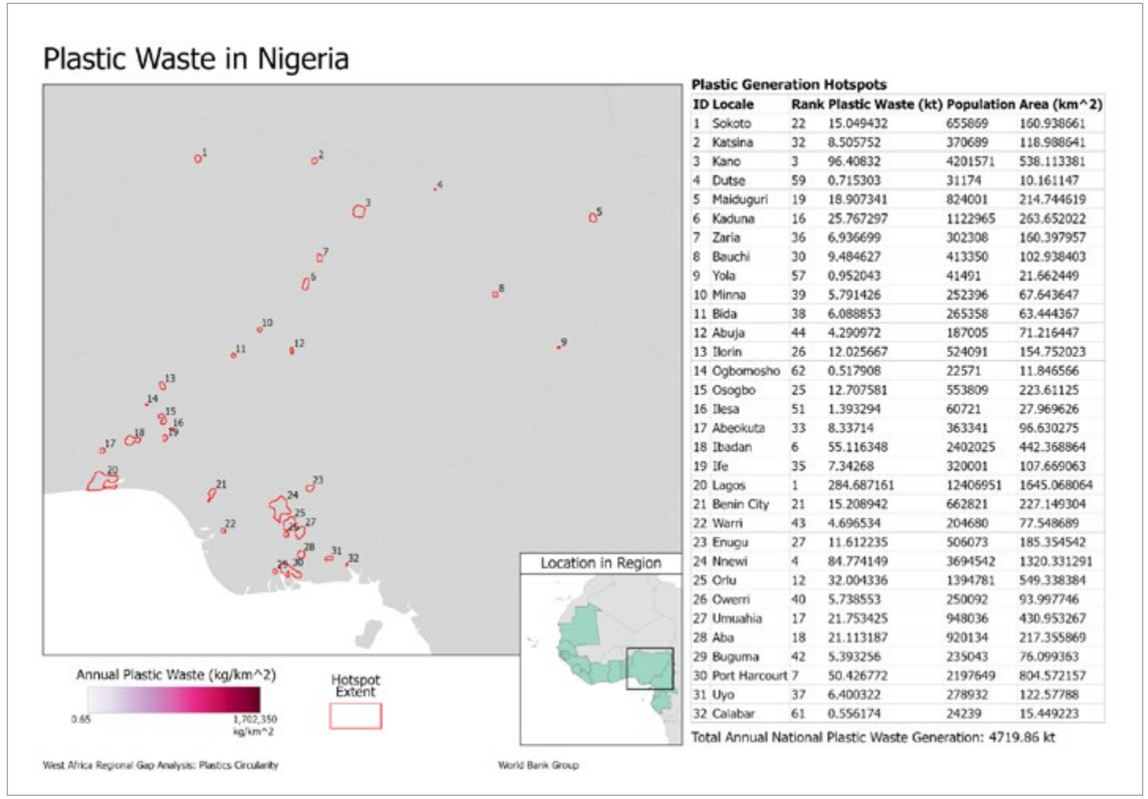
306 Inès Magoum 2020, "Nigeria: The FEC Approves a New Law on Plastic Waste Management," Afrik 21, October 23, https://www.afrik21.africa/en/nigeria-the-fec-approves-a-new-law-on-plastic-waste-management/.

307 National Environmental Regulation 2009 and National Environmental Regulation 2011.

308 Chinedu Asadu 2019, "Reps Pass Bill to Ban Plastic Bags, Prescribe 3-Year Jail Term for Sale," TheCable, May 21, https://www.thecable.ng/reps-pass-bill-to-ban-plastic-bags-prescribe-3-year-jail-term-for-sale.

309 Rachel Karasik, Zoie Diana, Janet Bering, Juan Caldas, Amy Pickle, Daniel Rittschof, and John Virdin, 2020, 20 Years of Government Responses to the Global Plastic Pollution Problem (Durham, NC: Duke University Press).

310 Akindele, "Why Microplastics Found in Nigeria's Freshwaters Raise a Red Flag."



Plastic Generation Hotspots

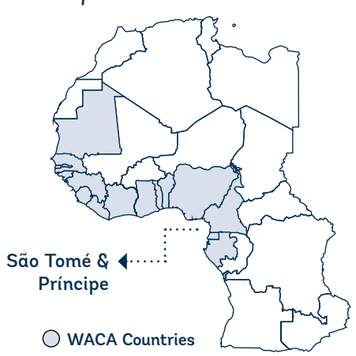
ID	Locale	Rank	Plastic Waste (kt)	Population	Area (km^2)
1	Sokoto	22	15.049432	655869	160.938661
2	Katsina	32	8.505752	370689	118.988641
3	Kano	3	96.40832	4201571	538.113381
4	Dutse	59	0.715303	31174	10.161147
5	Maiduguri	19	18.907341	824001	214.744619
6	Kaduna	16	25.767297	1122965	263.652022
7	Zaria	36	6.936699	302308	160.397957
8	Bauchi	30	9.484627	413350	102.938403
9	Yola	57	0.952043	41491	21.662449
10	Minna	39	5.791426	252396	67.643647
11	Bida	38	6.088853	265358	63.444367
12	Abuja	44	4.290972	187005	71.216447
13	Ilorin	26	12.025667	524091	154.752023
14	Ogbomosho	62	0.517908	22571	11.846566
15	Osogbo	25	12.707581	553809	223.61125
16	Ilesa	51	1.393294	60721	27.969626
17	Abeokuta	33	8.33714	363341	96.630275
18	Ibadan	6	55.116348	2402025	442.368864
19	Ife	35	7.34268	320001	107.669063
20	Lagos	1	284.687161	12406951	1645.068064
21	Benin City	21	15.208942	662821	227.149304
22	Warri	43	4.696534	204680	77.548689
23	Enugu	27	11.612235	506073	185.354542
24	Nnewi	4	84.774149	3694542	1320.331291
25	Orlu	12	32.004336	1394781	549.338384
26	Owerri	40	5.738553	250092	93.997746
27	Umuahia	17	21.753425	948036	430.953267
28	Aba	18	21.113187	920134	217.355869
29	Buguma	42	5.393256	235043	76.099363
30	Port Harcourt	7	50.426772	2197649	804.572157
31	Uyo	37	6.400322	278932	122.57788
32	Calabar	61	0.556174	24239	15.449223

Total Annual National Plastic Waste Generation: 4719.86 kt

Note: Hotspots are delineated based on their statistical significance, then associated with the nearest locale. Multiple hotspots may be associated with a single locale (as in the case of 14 and 15 being associated with Oshogbo).

São Tomé and Príncipe

Map of African continent



Indicator	Data
Population, 2019 (no.)	215,056
Population density, 2018 (people per sq. km of land area)	219.82
Coastal population, 2014 (no.)[311]	163,740
Share of people living in urban areas, 2019 (%)	73.6%
Total MSW generated, 2016 (tons/year)[312]	25,587

Socioeconomic profile

São Tomé and Príncipe is a small, lower-middle-income island state 350 km off the coast of West Africa[313]. It has a small agrarian economy highly dependent on the exportation of cocoa beans.[314] São Tomé and Príncipe is divided into six administrative districts and runs a semi-presidential republic system.[315]

311 Jambeck et al., "Plastic Waste Inputs from Land into the Ocean."

312 Kaza, Silpa, Lisa Yao, Perinaz Bhada-Tata, and Frank Van Woerden. 2018. *What a Waste 2.0: A Global Snapshot of Solid Waste Management to 2050*. Urban Development Series. Washington, DC: World Bank.

313 World Bank Group 2021. São Tomé and Príncipe – Overview. https://www.worldbank.org/en/country/saotome/overview

314 CIA 2021. World Factbook – São Tomé and Príncipe. https://www.cia.gov/the-world-factbook/countries/sao-tome-and-principe/#economy.

315 CIA 2021. World Factbook – São Tomé and Príncipe. https://www.cia.gov/the-world-factbook/countries/sao-tome-and-principe/#economy.

In 2019, the country's overall GDP (purchasing power parity) fell just above $891 million, with a GDP (purchasing power parity) per capita of $3,970.[316,317] With an area of 964 km2, São Tomé and Príncipe has a population of 215,056 (2019) and a population density of 219.82 people per km^2 (2018).[318] Most of the population resides in urban areas (73.6 percent in 2019).[319]

Plastic industry and ecosystem

In 2018 and 2019, São Tomé and Príncipe had no domestic resin production or conversion. The island state is a net importer of plastics. In 2019, 271,000 kg of plastics were imported into the country, with PE accounting for about 93.4% of the imports[320]. São Tomé and Príncipe exported only 47,452 kg of plastics that same year, all of which consisted of PE plastics.[321]

Solid waste management

São Tomé and Príncipe generates 0.37 kg of municipal solid waste (MSW) per capita per day. This amounts to an overall daily MSW generation of 70,050 kg.[322] About 81.1 percent of MSW generated in São Tomé and Príncipe is inadequately managed.[323] Plastic waste accounts for just below 13 percent of MSW arisings,[324] with a daily generation rate of about 9,360 kg.

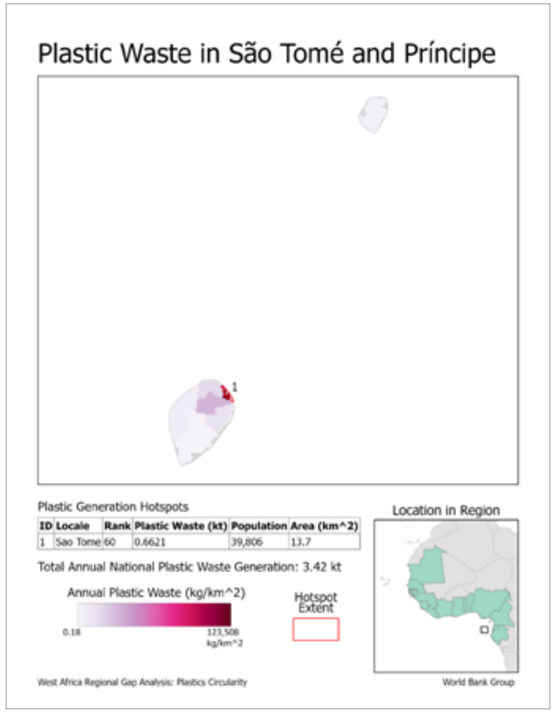
Legislation, policies, and other initiatives

The government ministry responsible for municipal waste management in São Tomé and Príncipe is the Ministry of Infrastructure, Natural Resources and Environment.[325] Waste management in São Tomé and Príncipe is driven by the following law:

- Environmental Law No. 10/99, 1999

This law highlights the basic principles for waste management (including the principles of prevention and precaution, and user-pays and polluter-pays) and also advocates for the reuse of waste.[326]

In 2013, the government of São Tomé and Príncipe introduced an extended producer responsibility law, applicable to a set of priority products and articles.[327] In addition, since 1993 São Tomé and Príncipe's environmental policy law (Law No. 86/IV/93) has advocated for the application of fiscal and financial instruments that encourage recycling and reuse of waste, as well as a levy (the Environmental Impact Fee) applied to all economic agents importing the set of priority products and articles.[328]



316 GDP, PPP (constant 2017 international $) and GDP per capita, PPP (constant 2017 international $)

317 World Bank Group 2020. World Development Indicators. https://datacatalog.worldbank.org/dataset/world-development-indicators

318 World Bank Group 2020. World Development Indicators. https://datacatalog.worldbank.org/dataset/world-development-indicators

319 World Bank Group 2020. World Development Indicators. https://datacatalog.worldbank.org/dataset/world-development-indicators

320 UN Comtrade 2019. UN Comtrade Database. https://comtrade.un.org/

321 UN Comtrade 2019. UN Comtrade Database. https://comtrade.un.org/

322 Kaza, Silpa, Lisa Yao, Perinaz Bhada-Tata, and Frank Van Woerden. 2018. *What a Waste 2.0: A Global Snapshot of Solid Waste Management to 2050*. Urban Development Series. Washington, DC: World Bank.

323 Jambeck et al., 2014. Plastic Waste Inputs from Land into the Ocean. https://jambeck.engr.uga.edu/landplasticinput.

324 Jambeck et al., 2014. Plastic Waste Inputs from Land into the Ocean. https://jambeck.engr.uga.edu/landplasticinput.

325 General Directorate of the Environment 2018. Minamata Initial Assessment Report: São Tomé and Príncipe. http://www.mercuryconvention.org/Portals/11/documents/MIAs/Sao-Tome-and-Principe-MIA-2018.pdf.

326 Chatham House 2020. Policies. https://circulareconomy.earth/.

327 General Directorate of the Environment 2018. Minamata Initial Assessment Report: São Tomé and Príncipe. http://www.mercuryconvention.org/Portals/11/documents/MIAs/Sao-Tome-and-Principe-MIA-2018.pdf.

327 Chatham House 2020. Policies. https://circulareconomy.earth/.

328 General Directorate of the Environment 2018. Minamata Initial Assessment Report: São Tomé and Príncipe. http://www.mercuryconvention.org/Portals/11/documents/MIAs/Sao-Tome-and-Principe-MIA-2018.pdf.

328 Chatham House 2020. Policies. https://circulareconomy.earth/.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Senegal

Map of African continent

Indicator	Data
Population, 2019 (no.)	16,296,364
Population density, 2018 (people per sq. km of land area)	82.35
Coastal population, 2014 (no.)[329]	8,125,063
Share of people living in urban areas, 2019 (%)	47.7
Total MSW generated, 2016 (tons/year)[330]	2,454,059

Socioeconomic profile

Senegal is a lower-middle-income country in West Africa bordered by Mauritania, Mali, Guinea, Guinea-Bissau, and Gambia. In recent years, economic growth in Senegal has been driven by the services sector.[331] The country comprises 12 regions[332] and runs a unitary presidential republic system, with a parliament.

In 2019, Senegal recorded an overall GDP (purchasing power parity) of $ 55 billion and a GDP (purchasing power parity) per capita of $ 3,395.[333,334] With an area of 196,722 km^2, it has a population of 16,296,364 (2019) and a population density of 82.35 people per km^2 (2018).[335] Though urbanization has increased in recent decades, the majority of Senegal's population still resides in rural areas (52.3 percent in 2019).[336] In 2014, over eight million Senegalese resided in coastal areas,[337] including in the capital city, Dakar.

Plastic industry and ecosystem

In 2018 and 2019, Senegal had no domestic resin production. In 2018, its conversion industry processed 47 kt of resin (22 kt PE, 21 kt PP, 4 kt PET) and in 2019, 37 kt of resin (18 kt PE, 11 kt PP, 8 kt PET). Similar to other West African countries, Senegal is a net importer of plastics. In 2019, 79.4 million kg of plastics were imported into the country, with PE, PP, and PVC accounting for about 89.7% of the imports.[338] Only 8,389,031 kg of plastics were exported from Senegal that same year, 91.8% of which were classed as scrap plastics, PET, and PP.[339]

329 Jambeck et al., "Plastic Waste Inputs from Land into the Ocean."

330 Kaza, Silpa, Lisa Yao, Perinaz Bhada-Tata, and Frank Van Woerden 2018. *What a Waste 2.0: A Global Snapshot of Solid Waste Management to 2050*. Urban Development Series. Washington, DC: World Bank.

331 World Bank Group 2021. Senegal – Overview. https://www.worldbank.org/en/country/senegal/overview.

332 Statoids 2015. Regions of Senegal. http://www.statoids.com/usn.html.

333 GDP, PPP (constant 2017 international $) and GDP per capita, PPP (constant 2017 international $).

334 World Bank Group 2020. World Development Indicators. https://datacatalog.worldbank.org/dataset/world-development-indicators.

335 World Bank Group 2020. World Development Indicators. https://datacatalog.worldbank.org/dataset/world-development-indicators.

336 World Bank Group 2020. World Development Indicators. https://datacatalog.worldbank.org/dataset/world-development-indicators.

337 Jambeck et al. 2014, "Plastic Waste Inputs from Land into the Ocean." https://jambeck.engr.uga.edu/landplasticinput.)

338 UN Comtrade 2019. UN Comtrade Database. https://comtrade.un.org/.

339 UN Comtrade 2019. UN Comtrade Database. https://comtrade.un.org/.

Solid waste management

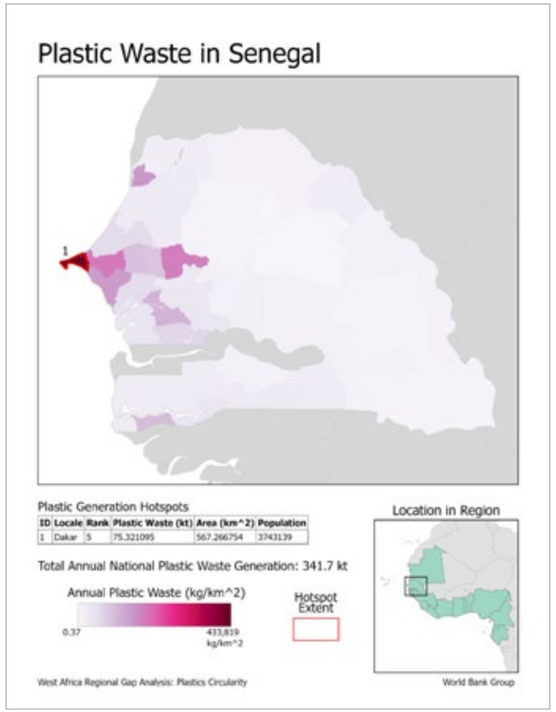
Senegal generates 0.44 kg of municipal solid waste (MSW) per capita per day, amounting to an overall daily MSW generation of 6.7 million kg.[340] However, the West African nation has struggled to effectively manage its waste arisings; about 82 percent of MSW generated in Senegal is inadequately managed.[341] Plastic waste management has increasingly been cited by Senegal's government as a pressing environmental issue for the nation. Plastic waste accounts for just below 13 percent of MSW arisings,[342] with a daily generation rate of about 935,500 kg.

Legislation, policies, and other initiatives

In Senegal, the Ministry of Environment and Sustainable Development is responsible for waste management.[343] Currently, waste management in Senegal is driven by the following:

- Environmental Code 2001 (Law No. 2001-01), 2001. This law requires the environmentally friendly disposal or recycling of all kinds of waste.[344]
- Decentralization Law (Acte III de la Décentralisation) and the Local Governments Law (Code des Collectivités Territoriales). These laws give local governments the responsibility of providing waste management services.

In 2020, the Single Use Plastics Prohibition Law (Law No. 2020-04) was introduced by the Senegalese government. The law prohibits the use of single-use plastic products such as cups, lids, and pipettes.[345] Additionally, it applies extended producer responsibility to plastic product producers in Senegal.[346]



340 Kaza, Silpa, Lisa Yao, Perinaz Bhada-Tata, and Frank Van Woerden. 2018. *What a Waste 2.0: A Global Snapshot of Solid Waste Management to 2050*. Urban Development Series. Washington, DC: World Bank.

341 Jambeck et al. 2014, Plastic waste inputs from land into the ocean. https://jambeck.engr.uga.edu/landplasticinput.

342 Jambeck et al. 2014, Plastic waste inputs from land into the ocean. https://jambeck.engr.uga.edu/landplasticinput

343 Development Aid 2021. Ministry of Environment and Sustainable Development of Senegal. https://www.developmentaid.org/#!/donors/view/154893/ministry-of-environment-and-sustainable-development-of-senegal-ministere-de-lenvironnement-et-du-dev.

344 Chatham House 2020. Policies. https://circulareconomy.earth/

345 ibid.

346 ibid.

Sierra Leone

Indicator	Data
Population, 2019 (no.)	7,813,215
Population density, 2018 (people per sq. km of land area)	105.99
Coastal population, 2014 (no.)[347]	2,887,017
Share of people living in urban areas, 2019 (%)	42.5
Total MSW generated, 2016 (tons/year)[348]	610,222

Socioeconomic profile

Sierra Leone is a low-income country in West Africa bordered by Guinea and Liberia.[349] Its economy is driven by mining activities, with its principal exports being iron ore, diamonds, and rutile.[350] The country is divided into four provinces and one administrative area,[351] and runs a unitary presidential republic system.

In 2019, Sierra Leone's overall GDP (purchasing power parity) was approximately $13.4 billion, with a GDP (purchasing power parity) per capita of $1,718.[352,353] With an area of 71,740 km^2, Sierra Leone has a population of 7,813,215 (2019) and a population density of 105.99 people per km^2 (2018).[354] According to statistics for 2019, 57.5 percent of Sierra Leone's population resides in rural areas.[355] Likewise, just under three million Sierra Leoneans were found to reside in coastal areas in 2014,[356] such as its capital city, Freetown.

Plastic industry and ecosystem

In 2018 and 2019, Sierra Leone had no domestic resin production. Its conversion industry processed 6 kt of resin (4 kt PE and 2 kt PET) in 2018 and 2019. Sierra Leone is a net importer of plastics. In 2019, 9 million kg of plastics were imported into the country, with PE and PP accounting for about 81.9 percent of the imports.[357] It relies heavily on Ghana for its plastic imports—92 percent of Sierra Leone's plastic imports were sourced from Ghana in 2019.[358] Only 23,200 kg of plastics were exported from Sierra Leone that same year, 95.4 percent of which consisted of PE.[359]

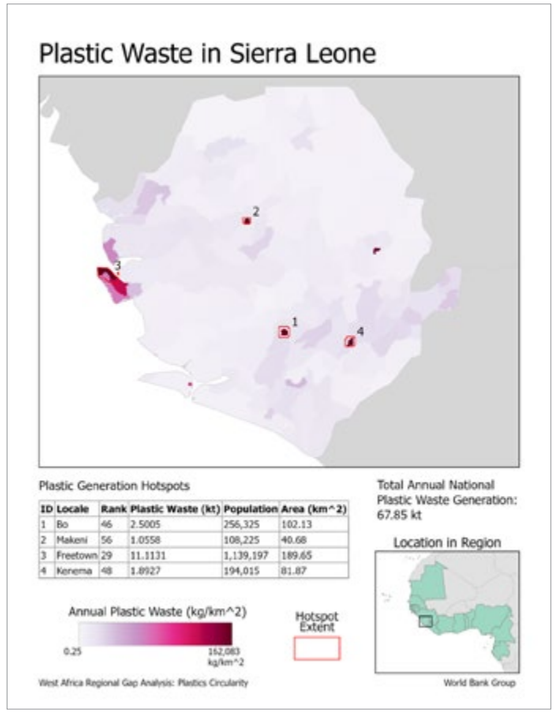
Sierra Leone has a small plastic manufacturing sector, generating 8,750 metric tons of plastic products.[360] Fifty percent of locally manufactured plastic products are classed as PE products.[361] As a formal plastics recycling sector is nonexistent in Sierra Leone, the informal sector is primarily responsible for the recovery of plastic waste.[362]

Solid waste management

Sierra Leone generates 0.31 kg of MSW per capita per day. This amounts to an overall daily MSW generation of 1.7 million kg.[363] Around 83.8 percent of MSW generated in Sierra Leone is inadequately managed.[364] Plastic waste accounts for just below 9 percent of MSW arisings[365], with a daily generation rate of about 186,000 kg.

Legislation, policies, and other initiatives

The government ministry responsible for municipal waste management is Sierra Leone's Ministry of Health and Sanitation, through its Directorate of Environmental Health and Sanitation.[366] Though the Sierra Leonean government is yet to introduce a law dealing specifically with MSW, it produced the National Environmental Health and Sanitation Strategy. This policy document highlights the proposed actions and activities for enhancing waste management in Sierra Leone, including specific strategies for promoting reuse and recycling.[367]



347 Jambeck et al., "Plastic Waste Inputs from Land into the Ocean."

348 Kaza, Silpa, Lisa Yao, Perinaz Bhada-Tata, and Frank Van Woerden. 2018. *What a Waste 2.0: A Global Snapshot of Solid Waste Management to 2050*. Urban Development Series. Washington, DC: World Bank.

349 World Bank Group, "Sierra Leone," 2021, https://data.worldbank.org/country/SL.

350 CIA, *The World Factbook: Sierra Leone*: Economy (Langley, VA: CIA, 2021), https://www.cia.gov/the-world-factbook/countries/sierra-leone/#economy.

351 CIA, *The World Factbook: Sierra Leone*: Government (Langley, VA: CIA, 2021), https://www.cia.gov/the-world-factbook/countries/sierra-leone/#government.

352 GDP, PPP (constant 2017 international dollars) and GDP per capita, PPP (constant 2017 international dollars).

353 World Bank Group 2020, "World Development Indicators."

354 World Bank Group 2020, "World Development Indicators."

355 World Bank Group 2020, "World Development Indicators."

356 Jambeck et al., "Plastic Waste Inputs from Land into the Ocean."

357 UN Comtrade, "UN Comtrade Database," 2019.

358 Anteja, "Sierra Leone Circular Economy in Plastics for Sustainable Tourism and Economic Diversification," 2021, https://anteja-ecg.com/portfolio-items/accelerating-sierra-leones-circular-economy-in-plastics-for-sustainable-tourism-and-economic-diversification/.

359 UN Comtrade 2019, "UN Comtrade Database."

360 Anteja, "Sierra Leone Circular Economy in Plastics."

361 Anteja, "Sierra Leone Circular Economy in Plastics."

362 Anteja, "Sierra Leone Circular Economy in Plastics."

363 Kaza, Silpa, Lisa Yao, Perinaz Bhada-Tata, and Frank Van Woerden. 2018. *What a Waste 2.0: A Global Snapshot of Solid Waste Management to 2050*. Urban Development Series. Washington, DC: World Bank.

364 Jambeck et al., "Plastic Waste Inputs from Land into the Ocean."

365 Jambeck et al., "Plastic Waste Inputs from Land into the Ocean."

366 Ministry of Health and Sanitation, Draft—National Environmental Health and Sanitation Strategy: 2015–2020 (Freetown, Republic of Sierra Leone: Ministry of Health and Sanitation, 2017), https://mohs2017.files.wordpress.com/2017/06/national-environmental-health-and-sanitation-strategy-2015-2020-draft.pdf.

367 Ministry of Health and Sanitation, Draft—National Environmental Health and Sanitation Strategy: 2015–2020 (Freetown, Republic of Sierra Leone: Ministry of Health and Sanitation, 2017), https://mohs2017.files.wordpress.com/2017/06/national-environmental-health-and-sanitation-strategy-2015-2020-draft.pdf.

Togo

Map of African continent

Indicator	Data
Population, 2019 (no.)	8,082,366
Population density, 2018 (people per sq. km of land area)	145.05
Coastal population, 2014 (no.)[368]	1,991,642
Share of people living in urban areas, 2019 (%)	42.2
Total MSW generated, 2016 (tons/year)[369]	1,109,030

Socioeconomic profile

Togo is a low-income country in West Africa, bordered by Ghana, Burkina Faso, and Benin. Although Togo's poverty rate fell from 61.7 percent in 2006 to 53.5 percent in 2017, poverty and inequality remain extremely high, especially in rural areas. In 2015, 69 percent of rural households were living below the poverty line.[370] The country is divided into five administrative regions,[371] and runs a unitary presidential republic system with a parliament.

In 2019, Togo's overall GDP (purchasing power parity) fell just below $13 billion, with a GDP (purchasing power parity) per capita of $1,597.[372,373] With an area of 56,785 km^2, Togo has a population of 8,082,366 (2019) and a population density of 145.05 people per km^2 (2018).[374] Though urbanization has increased in recent decades, the larger part of Togo's population still resides in rural areas (57.8 percent in 2019).[375] Though its coastline measures only 51 km, just under two million Togolese were living in coastal areas in 2014,[376] notably in the capital city, Lomé.

Plastic industry and ecosystem

In 2018 and 2019, Togo had no domestic resin production. In 2018 its conversion industry processed 54 kt of resin (37 kt PE, 17 kt PP) and in 2019, 43 kt of resin (41 kt PE, 2 kt PP). Togo is a net importer of plastics. In 2019, 95 million kg of plastics were imported into the country, with PE and PP accounting for about 95 percent of the imports.[377] Only 896,069 kg of plastics were exported from Togo that same year, 95 percent of which consisted of scrap plastics and PE.[378]

Solid waste management

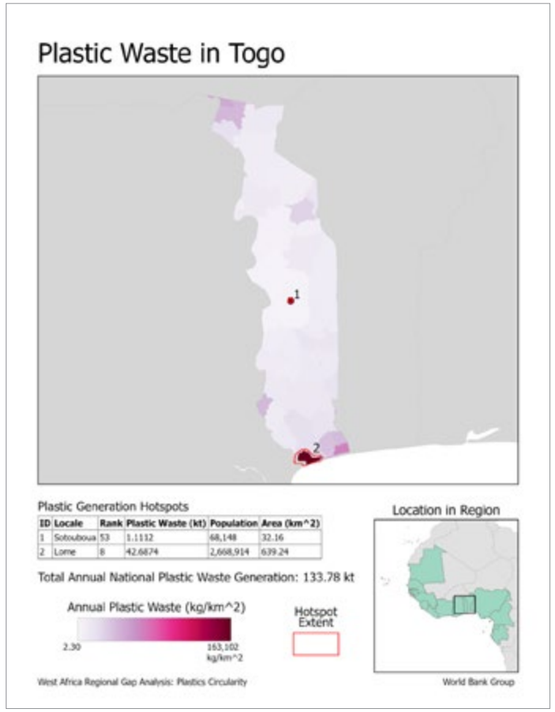
Togo generates 0.42 kg of MSW per capita per day, amounting to an overall daily MSW generation of three million kg.[379] About 83.5 percent of MSW generated in Togo is inadequately managed.[380] Plastic waste accounts for just below 11 percent of MSW arisings,[381] with a daily generation rate of about 366,000 kg.

Legislation, policies, and other initiatives

The government ministry responsible for municipal waste management in Togo is the Ministry of Environment.[382] Waste management in Togo is driven by the following law:

- Framework Law on the Environment 2008-005, 2008: This law highlights the legal framework for the management of MSW in Togo, as well as industrial and hazardous waste.[383]

In 2011, through Decree No. 2011-003-PR, the Togolese government instituted a ban on the production, import, and marketing of non-biodegradable plastic bags, while simultaneously authorizing the sale and use of biodegradable alternatives.[384]



368 Jambeck et al., "Plastic Waste Inputs from Land into the Ocean."

369 Kaza, Silpa, Lisa Yao, Perinaz Bhada-Tata, and Frank Van Woerden. 2018. *What a Waste 2.0: A Global Snapshot of Solid Waste Management to 2050*. Urban Development Series. Washington, DC: World Bank.

370 World Bank Group, "Togo—Overview," 2021, https://www.worldbank.org/en/country/togo/overview#1.

371 Statoids, "Regions of Togo," 2015, http://www.statoids.com/utg.html.

372 GDP, PPP (constant 2017 international dollars) and GDP per capita, PPP (constant 2017 international dollars).

373 World Bank Group, "World Development Indicators," 2020.

374 Ibid.

375 Ibid.

376 Jambeck et al., "Plastic Waste Inputs from Land into the Ocean."

377 UN Comtrade 2019, "UN Comtrade Database."

378 Ibid.

379 Kaza, Silpa, Lisa Yao, Perinaz Bhada-Tata, and Frank Van Woerden. 2018. *What a Waste 2.0: A Global Snapshot of Solid Waste Management to 2050*. Urban Development Series. Washington, DC: World Bank.

380 Jambeck et al., "Plastic Waste Inputs from Land into the Ocean."

381 Ibid.

382 Climate & Clean Air Coalition, "Solid Waste Management City Profile: Lomé, Togo," 2017, https://www.waste.ccacoalition.org/sites/default/files/files/lome_city_profile_0.pdf.

383 Chatham House, "Policies."

384 Ibid.

Appendix D. List of Plastic Waste Generation Hotspots

The analysis of plastic waste hotspots identified 71 hotspots. Each hotspot was associated with the closest named city from the ESRI Africa Cities dataset. Table D.1 summarizes the attributes of the hotspots for each of the 71 named locales. It ranks them based on the total annual plastic waste generation for the delineated hotspot(s) associated with the locale.

Table Fields

Rank. The rank of each hotspot locale based on annual plastic waste generation.

Locale. The named locale closest to the hotspot.

Hotspot area. The area enclosed by the hotspot boundary or boundaries for each locale. This may or may not represent the full extent of the indicated locale.

Hotspot population. The number of people living within the area enclosed by the hotspot boundary/ boundaries for each locale. This may or may not represent the full population of the indicated locale.

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Table D.1: *List of plastic waste generation hotspots*

Rank	Locale	Country	Annual Plastic Waste (kt)	Population	Area (km2)
1	Lagos	Nigeria	284.687	12,406,951	2,020.0
2	Abidjan	Côte d'Ivoire	112.358	3,921,628	1,017.9
3	Kano	Nigeria	96.408	4,201,571	538.1
4	Nnewi	Nigeria	84.774	3,694,542	1,320.3
5	Dakar	Senegal	75.321	3,743,139	1,017.5
6	Ibadan	Nigeria	55.116	2,402,025	442.4
7	Port Harcourt	Nigeria	50.427	2,197,649	1,171.3
8	Lome	Togo	42.687	2,668,914	714.9
9	Accra	Ghana	39.661	4,465,270	1,407.0
10	Yaounde	Cameroon	34.524	4,006,132	582.1
11	Monrovia	Liberia	34.219	1,629,266	618.8
12	Orlu	Nigeria	32.004	1,394,781	643.3
13	Douala	Cameroon	30.294	3,515,388	2,020.1
14	Porto Novo	Benin	30.071	3,080,583	1,771.7
15	Kumasi	Ghana	29.753	3,349,684	513.2
16	Kaduna	Nigeria	25.767	1,122,965	424.0
17	Umuahia	Nigeria	21.753	948,036	431.0
18	Aba	Nigeria	21.113	920,134	1,171.3
19	Maiduguri	Nigeria	18.907	824,001	214.7
20	Nouakchott	Mauritania	16.059	1,371,226	553.2
21	Benin City	Nigeria	15.209	662,821	304.7
22	Sokoto	Nigeria	15.049	655,869	160.9
23	Banjul	Gambia, The	13.239	1,067,034	762.4
24	Libreville	Gabon	12.841	561,452	634.2
25	Osogbo	Nigeria	12.708	553,809	371.1
26	Ilorin	Nigeria	12.026	524,091	154.8
27	Enugu	Nigeria	11.612	506,073	185.4
28	Conakry	Guinea	11.274	2,974,114	1177.4
29	Freetown	Sierra Leone	11.113	1,139,197	340.5
30	Bauchi	Nigeria	9.485	413,350	102.9
31	Bissau	Guinea-Bissau	8.660	605,937	340.4
32	Katsina	Nigeria	8.506	370,689	119.0
33	Abeokuta	Nigeria	8.337	363,341	96.6
34	Sekondi	Ghana	7.788	876,861	392.4
35	Ife	Nigeria	7.343	320,001	371.1
36	Zaria	Nigeria	6.937	302,308	424.0

Rank	Locale	Country	Annual Plastic Waste (kt)	Population	Area (km2)
37	Uyo	Nigeria	6.400	278,932	122.6
38	Bida	Nigeria	6.089	265,358	131.1
39	Minna	Nigeria	5.791	252,396	131.1
40	Owerri	Nigeria	5.739	250,092	643.3
41	Praia	Cabo Verde	5.557	166,185	100.7
42	Buguma	Nigeria	5.393	235,043	1171.3
43	Warri	Nigeria	4.697	204,680	304.7
44	Abuja	Nigeria	4.291	187,005	71.2
45	Malabo	Equatorial Guinea	4.104	225,602	835.4
46	Bo	Sierra Leone	2.500	256,325	102.1
47	Bafoussam	Cameroon	2.267	263,091	228.3
48	Kenema	Sierra Leone	1.893	194,015	81.9
49	Nouadhibou	Mauritania	1.778	151,575	352.6
50	Abomey	Benin	1.534	157,106	130.6
51	Ilesa	Nigeria	1.393	60,721	371.1
52	Cape Coast	Ghana	1.184	133,275	93.3
53	Sotouboua	Togo	1.111	68,148	32.2
54	Kankan	Guinea	1.078	284,318	203.1
55	Nzerekore	Guinea	1.061	279,926	190.8
56	Makeni	Sierra Leone	1.056	108,225	40.7
57	Yola	Nigeria	0.952	41,491	21.7
58	Labe	Guinea	0.790	208,361	159.9
59	Dutse	Nigeria	0.715	31,174	10.2
60	São Tomé	São Tomé and Príncipe	0.662	39,806	54.9
61	Calabar	Nigeria	0.556	24,239	15.4
62	Ogbomosho	Nigeria	0.518	22,571	371.1
63	Buchanan	Liberia	0.392	18,653	65.4
64	Nema	Mauritania	0.173	14,755	34.6
65	Selibabi	Mauritania	0.169	14,392	44.1
66	Koforidua	Ghana	0.137	15,466	10.2
67	Kaedi	Mauritania	0.136	11,602	40.8
68	Ayoun El Atrous	Mauritania	0.063	5,345	17.1
69	Aleg	Mauritania	0.047	3,988	12.4
70	Kissidougou	Guinea	0.047	12,294	19.5
71	Macenta	Guinea	0.019	5,025	7.1

Appendix E. WACA Plastic Landscape

Table E.1: *Net resin imports (kt); plastic resin conversion (kt); and net finished plastic product imports (kt) for WACA countries, 2018*

WACA Countries	Net Resin Imports (kt)	Plastic Resin Conversion (kt)	Net Finished Plastic Product Imports (kt)
Benin	1	1	49
Cabo Verde	0	0	7
Cameroon	34	34	96
Côte d'Ivoire	197	197	129
Gabon	0	0	13
Ghana	262	262	34
Guinea	15	15	19
Guinea-Bissau	2	2	7
Equatorial Guinea	0	0	7
Liberia	5	5	17
Mauritania	0	0	21
Nigeria	608	1,094	753
São Tomé and Príncipe	0	0	1
Senegal	47	47	42
Sierra Leone	6	6	25
Gambia, The	0	0	5
Togo	54		14

References and Bibliography

Afrik21. 2021. “Africa: The New GACERE Alliance for the Adoption of the Circular Economy,” February 24, https://www.afrik21.africa/en/africa-the-new-gacere-alliance-for-the-adoption-of-the-circular-economy/.

Anteja. 2021. “Sierra Leone Circular Economy in Plastics for Sustainable Tourism and Economic Diversification,” https://anteja-ecg.com/portfolio-items/accelerating-sierra-leones-circular-economy-in-plastics-for-sustainable-tourism-and-economic-diversification/.

Arora, R. et al. 2017. “Potential and Relevance of Urban Mining in the Context of Sustainable Cities.” IIMB Management Review. 29, no. 3: 210–24. https://doi.org/10.1016/j.iimb.2017.06.001.

Bob Maughon and Mark Jones. 2019. “R&D Efforts to Make Plastic More Sustainable,” R&D World, January 29. https://www.rdworldonline.com/rd-efforts-to-make-plastic-more-sustainable/.

Building as Material Banks. 2020. Enabling Circular Building Industry. https://www.bamb2020.eu/.

Carmen Torres and Jeske van Seters. 2016. “Overview of Trade and Barriers to Trade in West Africa: Insights in Political Economy Dynamics, with Particular Focus on Agricultural and Food Trade.” https://www.tralac.org/images/docs/10274/overview-of-trade-and-barriers-to-trade-in-west-africa-insights-in-political-economy-dynamics-agricultural-trade-ecdpm-july-2016.pdf.

Chatham House. 2020, “Policies.” https://circulareconomy.earth/.

Chinedu Asadu. 2019, “Reps Pass Bill to Ban Plastic Bags, Prescribe 3-Year Jail Term for Sale,” TheCable, May 21. https://www.thecable.ng/reps-pass-bill-to-ban-plastic-bags-prescribe-3-year-jail-term-for-sale.

CIA (Central Intelligence Agency). 2021, The World Factbook: Cabo Verde (Langley, VA: CIA). https://www.cia.gov/the-world-factbook/countries/cabo-verde/#economy.

CIA. 2021. World Factbook: São Tomé and Príncipe. https://www.cia.gov/the-world-factbook/countries/sao-tome-and-principe/#economy.

CIA. 2021, The World Factbook: Equatorial Guinea (Langley, VA: CIA). https://www.cia.gov/the-world-factbook/countries/equatorial-guinea/.

CIA. 2021. The World Factbook: Guinea (Langley, VA: CIA). https://www.cia.gov/the-world-factbook/countries/guinea/.

CIA. 2021. The World Factbook: Guinea-Bissau (Langley, VA: CIA). https://www.cia.gov/the-world-factbook/countries/guinea-bissau/.

CIA. 2021. The World Factbook: Liberia (Langley, VA: CIA). https://www.cia.gov/the-world-factbook/countries/liberia/.

CIA. 2021. The World Factbook: Mauritania (Langley, VA). https://www.cia.gov/the-world-factbook/countries/mauritania/#economy.

CIA. 2021. The World Factbook: Sierra Leone: Economy (Langley, VA). https://www.cia.gov/the-world-factbook/countries/sierra-leone/#economy.

CIA. 2021. The World Factbook: Sierra Leone: Government (Langley, VA: CIA). https://www.cia.gov/the-world-factbook/countries/sierra-leone/#government.

City Population. 2020, “Ghana: Regions, Major Cities & Urban Localities: Population Statistics in Maps and Charts,” retrieved October 6. https://www.citypopulation.de/en/ghana/cities/.

Climate & Clean Air Coalition. 2017, “Abidjan, Ivory Coast.” https://www.waste.ccacoalition.org/participant/abidjan-ivory-coast.

Climate & Clean Air Coalition. 2017, “Solid Waste Management City Profile: Porto Novo, Benin.” https://www.waste.ccacoalition.org/sites/default/files/files/city_profile_porto-novo_english_vf.pdf.

Climate & Clean Air Coalition. 2017, “Solid Waste Management City Profile: Douala, Cameroon.” https://www.waste.ccacoalition.org/sites/default/files/files/city_profile_douala_english.pdf.

Climate & Clean Air Coalition. 2017. “Solid Waste Management City Profile: Lomé, The Gambia.” https://www.waste.ccacoalition.org/sites/default/files/files/lome_city_profile_0.pdf.

Climate & Clean Air Coalition. 2017. “Solid Waste Management City Profile: Lomé, Togo.” https://www.waste.ccacoalition.org/sites/default/files/files/lome_city_profile_0.pdf.

Dalberg. 2021. “African Circular Economy Alliance, African Development Bank, and World Economic Forum, Five Big Bets for the Circular Economy in Africa 2021.” (Geneva: World Economic Forum). https://www.afdb.org/en/documents/five-big-bets-circular-economy-africa.

Dasgupta S., Roy S., Sarraf M., and Wheeler D. 2022 (under review). The Economics of Plastic Use and Cleanup Priorities for West African Coastal Countries. Washington, DC: World Bank Group.

Development Aid. 2021. Ministry of Environment and Sustainable Development of Senegal. https://www.developmentaid.org/#!/donors/view/154893/ministry-of-environment-and-sustainable-development-of-senegal-ministere-de-lenvironnement-et-du-dev.

Down to Earth. 2018. “Nigeria Well Placed to Beat Plastic Pollution: Vice President.” Accessed February 4, 2021. https://www.downtoearth.org.in/news/environment/nigeria-well-placed-to-beat-plastic-pollution-vice-president-60786.

Emmanuel O. Akindele. 2020, “Why Microplastics Found in Nigeria’s Freshwaters Raise a Red Flag,” The Conversation, October 13. http://theconversation.com/why-microplastics-found-in-nigerias-freshwaters-raise-a-red-flag-147432.

Extractive Hub. 2020. “Gabon.” https://www.extractiveshub.org/servefile/getFile/id/7663.

Frederic Gallo, Cristina Fossi, Roland Weber, David Santillo, Joao Sousa, Imogen Ingram, Angel Nadal, and Dolores Romano. 2018. “Marine Litter Plastics and Microplastics and Their Toxic Chemicals Components: The Need for Urgent Preventive Measures,” Environmental Science Europe. 30, no. 1: 1–14.

Garcés-Ayerbe, C. et al. 2019. “Is It Possible to Change from a Linear to a Circular Economy? An Overview of Opportunities and Barriers for European Small and Medium-Sized Enterprise Companies.” International Journal of Environmental Research and Public Health. 16, no. 5: 851. Is It Possible to Change from a Linear to a Circular Economy? An Overview of Opportunities and Barriers for European Small and Medium-Sized Enterprise Companies - PubMed (nih.gov).

GEF (Global Environment Facility). 2019. “Establishing a Circular Economy Framework for the Plastics Sector in Ghana.” Washington, DC: GEF. https://www.thegef.org/sites/default/files/web-documents/10401_MFA_PIF.pdf.

General Directorate of the Environment 2018. Minamata Initial Assessment Report: São Tomé and Príncipe. http://www.mercuryconvention.org/Portals/11/documents/MIAs/Sao-Tome-and-Principe-MIA-2018.pdf.

GIZ. 2013. Report on the Solid Waste Management in Mauritania (Tunis: GIZ, 2013), https://www.resource-recovery.net/sites/default/files/mauritanis_ra_ang_web_0.pdf.

Green Jams. 2020. Carbon Negative Building Materials. https://www.greenjams.org/.

Greenpeace Africa. 2020. “34 Plastic Bans in Africa: A Reality Check,” May 19, 2020, https://www.greenpeace.org/africa/en/blogs/11156/34-plastic-bans-in-africa/.

IHS Markit Energy Expert. 2022. “Voluntary carbon markets poised for growth in 2022.” https://cleanenergynews.ihsmarkit.com/research-analysis/voluntary-carbon-markets-poised-for-growth-in-2022.html.

Indorama Eleme Petrochemicals Limited. n.d. https://www.indorama.com/affiliated-companies/indorama-eleme-petrochemicals-limited.

Inès Magoum. 2020. “Nigeria: The FEC Approves a New Law on Plastic Waste Management,” Afrik 21, October 23. https://www.afrik21.africa/en/nigeria-the-fec-approves-a-new-law-on-plastic-waste-management/.

Jambeck, J.R., Andrady, A., Geyer, R., Narayan, R., Perryman, M., Siegler, T., Wilcox, C., and Lavender Law, K. 2015. “Plastic waste inputs from land into the ocean.” Science. 347, p. 768-771.

Joshua O. Babayemi, Mary B. Ogundiran, Roland Weber, and Oladele Osibanjo. 2018. “Initial Inventory of Plastics Imports in Nigeria as a Basis for More Sustainable Management Policies,” Journal of Health and Pollution 8, no. 18 (June 1): 180601, https://doi.org/10.5696/22156-9614-8.18.1.

Katia Ferrari, Streng Cerise, Rita Gamberini, Bianca Rimini, and Francesco Lolli. 2016. “An International Partnership for the Sustainable Development of Municipal Solid Waste Management in Guinea-Bissau, West Africa.” XXI Summer School, “Francesco Turco.” September. https://www.researchgate.net/publication/309373688_An_international_partnership_for_the_sustainable_development_of_Municipal_Solid_Waste_Management_in_Guinea-Bissau_West_Africa.

Kirchherr, J., Reike, D., and Hekkert, M. 2017. “Conceptualizing the Circular Economy: An Analysis of 114 Definitions.” Resources, Conservation and Recycling. 127 (December): 221–32. https://doi.org/10.1016/j.resconrec.2017.09.005.

Laurent C. M. Lebreton, Joost van der Zwet, Jan-Willem Damsteeg, Boyan Slat, Anthony Andrady, and Julia Reisser. 2017. “River Plastic Emissions to the World’s Oceans.” Nature Communications 8, no. 1 (June 7): 15611, https://doi.org/10.1038/ncomms15611.

Let's Do It Foundation. 2021. "Circular Economy in Africa." https://letsdoitfoundation.org/2021/01/28/circular-economy-in-africa/.

McKinsey Sustainability. 2020. "How the voluntary carbon market can help address climate change." https://www.mckinsey.com/business-functions/sustainability/our-insights/how-the-voluntary-carbon-market-can-help-address-climate-change.

Mialy Andriamahefazafy and Pierre Failler. 2021. "Towards a Circular Economy for African Islands: An Analysis of Existing Baselines and Strategies." Circular Economy and Sustainability. https://link.springer.com/article/10.1007/s43615-021-00059-4.

Michal Grabia, Tomasz Markowski, and Piotr Gruszka. 2019. Report: Development of a Fishing Gear Marking System Based on Passive RFID Technology (Sweden: MARELITT Baltic). https://www.academia.edu/41700173/Development_of_a_fishing_gear_marking_system_based_on_passive_RFID_technology.

Ministry of Agriculture and Environment. 2018. "Water and Sanitation." http://maa.gov.cv/index.php/agua-e-saneamento.

Ministry of Agriculture, Livestock, Forest and Environment, Republic of Equatorial Guinea. 2019. First National Communication to the United Nations Framework Convention on Climate Change (Malabo, Equatorial Guinea: Ministry of Agriculture, Livestock, Forest and Environment, Republic of Equatorial Guinea). https://unfccc.int/sites/default/files/resource/INC%20of%20Equatorial%20Guinea_English%20version.pdf.

Ministry of Health and Sanitation. 2017. Draft—National Environmental Health and Sanitation Strategy: 2015–2020. Freetown, Republic of Sierra Leone: Ministry of Health and Sanitation. https://mohs2017.files.wordpress.com/2017/06/national-environmental-health-and-sanitation-strategy-2015-2020-draft.pdf.

Netherlands Enterprise Agency. 2019. "Market Survey Waste and Circular Economy in Ghana." https://www.rvo.nl/sites/default/files/2019/08/Ghana-Market-Survey-Waste-Circular-Economy.pdf.

Olabode Emmanuel Ogunmakinde. 2019, "Developing a Circular-Economy-Based Construction Waste Minimization Framework for Nigeria." Doctoral thesis, Bond University. https://research.bond.edu.au/en/publications/developing-a-circular-economy-based-construction-waste-minimisati.

OPEC (Organization of the Petroleum Exporting Countries). 2021. "Nigeria." Accessed February 5, 2021. https://www.opec.org/opec_web/en/about_us/167.htm.

Parliament of the Republic of Ghana. 2013. "Customs and Excise (Duties and Other Taxes) (Amendment) Act 2013." http://www.odekro.org/Images/Uploads/Customs%20and%20Excise%20Duties%20(Amendment)%20Act%202013.pdf.

Plastic Europe. 2018. "An analysis of European plastics production, demand and waste data." https://plasticseurope.org/wp-content/uploads/2021/10/2018-Plastics-the-facts.pdf.

Posen, D., Jaramillo, P.; Landis, A. and Griffin, M. 2017 Environmental Research Letters. Volume 12. https://doi.org/10.1088/1748-9326/aa60a7.

PPP Knowledge Lab. 2021. https://pppknowledgelab.org/countries; https://pppknowledgelab.org/countries/ghana.

Rachel Karasik, Zoie Diana, Janet Bering, Juan Caldas, Amy Pickle, Daniel Rittschof, and John Virdin. 2020. 20 Years of Government Responses to the Global Plastic Pollution Problem. Durham, NC: Duke University Press.

Roland Geyer, Jenna R. Jambeck, and Kara Lavender Law. 2017. "Production, Use, and Fate of All Plastics Ever Made." Science Advances 3, no. 7: e1700782.

Shaena Montanari. 2021. "Old Fish Bones Could Make the Eco-Friendly Plastic We Have Been Waiting For." Popular Science. April 8. https://www.msn.com/en-us/news/technology/old-fish-bones-could-make-the-eco-friendly-plastic-weve-been-waiting-for/ar-BB1freA3.

Sören Bauer. 2021. "Spotlight on Circularity in Africa." 4. Revolve Magazine, issue 38. https://revolve.media/wp-content/uploads/2021/02/REVOLVE-38-Spotlight-on-Circularity-in-Africa.pdf.

Statista. 2021. "Plastic Production Nigeria 2020." Accessed February 4, 2021. https://www.statista.com/statistics/994633/plastic-production-nigeria/.

Statoids. 2015. "Regions of Senegal." http://www.statoids.com/usn.html.

Statoids. 2019. "Departments of Benin." http://www.statoids.com/ubj.html.

Statoids. 2015. "Regions of Togo." http://www.statoids.com/utg.html.

Statoids. 2016. Provinces of Gabon. http://www.statoids.com/uga.html.

Trinomics. 2020. Circular Economy in Africa-EU Cooperation: Country Report for Ghana http://trinomics.eu/wp-content/uploads/2020/12/Country-Report-Ghana_Final_20122020.pdf.

Trinomics. 2020. Circular Economy in Africa-EU Cooperation – Country report for Nigeria. Country-Report-Nigeria_Final_20122020.pdf (trinomics.eu).

UN (United Nations). 2015. "Sanitation Country Profile: Gambia." https://www.wsp.org/sites/wsp.org/files/publications/CSO-Gambia.pdf.

UN. 2018. "UN Comtrade Database." https://comtrade.un.org/.

UN. 2018. UN World Urbanization Prospects. https://population.un.org/wup/.

UN. 2022. "UN Comtrade Database." https://comtrade.un.org/.

UNDP (United Nations Development Programme). 2018. Human Development Report. New York: UNDP. https://web.archive.org/web/20180914203906/http://hdr.undp.org/en/2018-update.

UNEP (United Nations Environment Programme). 2018. "Legal Limits on Single-Use Plastics and Microplastics: A Global Review of National Laws and Regulations." (Nairobi, Kenya: UNEP). https://wedocs.unep.org/bitstream/handle/20.500.11822/27113/plastics_limits.pdf.

US Energy Information Administration. 2021. "Total Petroleum and Other Liquids Production Annual." https://www.eia.gov/international/data/world/petroleum-and-other-liquids/annual-petroleum-and-other-liquids-production.

Vanessa Obioha. 2019. "Nigeria: Promoting Local Production in Plastic Industry." AllAfrica.com. June 21. https://allafrica.com/stories/201906210661.html.

Victor Emery David, Yasinta John, and Shahid Hussain. 2020. "Rethinking Sustainability: A Review of Liberia's Municipal Solid Waste Management Systems, Status, and Challenges," Journal of Material Cycles and Waste Management 22: 1299–317. https://link.springer.com/article/10.1007/s10163-020-01046-x.

Vikas Khandelwal. 2019. "Replacement of Sand with Shredded Plastic in Cement Concrete." International Journal of Engineering Research and Technology (IJERT). https://www.ijert.org/replacement-of-sand-with-shredded-plastic-in-cement-concrete#:~:text=CONCLUSIONS%3A,28%20days%20of%20proper%20curing.

World Bank Group. 2020. "World Development Indicators." https://datacatalog.worldbank.org/dataset/world-development-indicators.

World Bank Group. 2021. "Benin—Overview" https://www.worldbank.org/en/country/benin/overview#1.

World Bank Group. 2021. "Cabo Verde—Overview." https://www.worldbank.org/en/country/Cabo Verde/overview#1.

World Bank Group. 2021. "Cameroon—Overview." https://www.worldbank.org/en/country/Cameroon/overview#1.

World Bank Group. 2021. "Ghana—Overview." https://www.worldbank.org/en/country/Ghana/overview#1.

World Bank Group. 2021. "São Tomé and Príncipe – Overview." https://www.worldbank.org/en/country/saotome/overview.

World Bank Group. 2021. "Senegal – Overview." https://www.worldbank.org/en/country/senegal/overview.

World Bank Group. 2021. "Sierra Leone– Overview." https://data.worldbank.org/country/SL.

World Bank Group. 2020. "World Development Indicators." https://datacatalog.worldbank.org/dataset/world-development-indicators.

World Bank Group. 2018. TCdata 360. "Environmental performance index." https://tcdata360.worldbank.org/indicators/a18c8c05?country=BRA&indicator=40408&viz=line_chart&years=2013,2020.

World Bank Group. 2021. "Togo—Overview." https://www.worldbank.org/en/country/togo/overview#1.

World Bank Group. 2021. What a Waste 2.0. A Global Snapshot of Solid Waste Management to 2050. https://datatopics.worldbank.org/what-a-waste/tackling_increasing_plastic_waste.html.

World Bank Group. 2021. World Bank Development Indicators Database. https://datacatalog.worldbank.org/dataset/world-development-indicators.

World Bank. "Data: Population, Total." Accessed February 3, 2021. https://data.worldbank.org/indicator/SP.POP.TOTL.

World Bank. 2020. Ghana: Country Environmental Analysis (Washington, DC: World Bank) http://documents1.worldbank.org/curated/en/419871588578973802/pdf/Ghana-Country-Environmental-Analysis.pdf.

World Bank. 2019. Republic of Guinea: Planning, Connecting, Financing in Conakry. Washington, DC: World Bank). https://openknowledge.worldbank.org/bitstream/handle/10986/31757/Guinea-Urban-Sector-Review-Planning-Connecting-Financing-in-Conakry.pdf;jsessionid=

6987DA2905ACB4AD6B6E7B37CA971373?sequence=1.

World Wildlife Fund. 2021 "Stopping Ghost Gear." https://www.worldwildlife.org/projects/stopping-ghost-gear.

World Wildlife Fund. 2021. "WWF Position: Plastic Crediting and Plastic Neutrality." https://www.worldwildlife.org/publications/wwf-position-plastic-crediting-and-plastic-neutrality.

World Wildlife Fund. 2021. "WWF Position: Plastic Crediting and Plastic Neutrality." https://www.worldwildlife.org/publications/wwf-position-plastic-crediting-and-plastic-neutrality.

Xavier, L. H. et al. 2019. "Sustainability and the Circular Economy: A Theoretical Approach Focused on E-Waste Urban Mining." Resources Policy. 74. https://doi.org/10.1016/j.resourpol.2019.101467.

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