

ReSource Footprint Tracker Methodology Overview

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Introduction

About ReSource: Plastic

Plastic waste is choking the planet, polluting the air, water, and soil that both people and wildlife need to survive. And with plastics threatening the natural environment on which we depend, change can't wait. As this crisis spreads to every corner of the globe, World Wildlife Fund (WWF) is leading the charge to help reimagine how we source, design, dispose of, and reuse plastic materials upon which most communities depend. Because while plastic can help make our hospitals safer, our food last longer, and our packages more efficient to ship, it has no place in nature.

To tackle the complex scope and large scale of the global crisis, WWF's No Plastic in Nature initiative is engaging everyone—from policy makers and the public to cities and companies—around critical efforts to transform the broken plastic system. Through the *ReSource: Plastic* activation hub, WWF is tapping into an especially powerful lever for change: business.

Business is uniquely positioned to affect change at scale and across the value chain of plastic. Companies can reduce plastic waste both within the control of their supply chain—how plastic is sourced and how its products are designed, managed, and reused—and beyond it, through interventions in waste management, public policy, and collective action.

While some of the world's most powerful companies have already gotten started with plastic commitments to

reduce, re-source, recycle, and more, they need to move from aspiration to impact.

ReSource: Plastic partners with companies that are ready to translate plastic commitments into meaningful and measurable action but need a road map to get there. *ReSource* closes that "how" gap through an innovative measurement framework that helps companies take actions aligned to a three-pronged approach to systems change:

- Eliminate unnecessary plastic through business model innovation, reduction, and substitution.
- For plastic that is necessary, shift from virgin plastic sourcing to sustainable inputs, including recycled content, responsibly sourced biobased content, and advanced materials.
- Double rates of global collection, recycling, and composting of plastic so that the plastic going into the system is circulated back.

ReSource does this by helping companies **measure** and track the impact of their plastic mitigation activities through annual public reporting, **maximize** the potential for impact by using data-driven insights to shape activities, and **multiply** this impact by fostering collaboration and opportunities for collective action with other *ReSource* members and partners.

FIGURE 1. ReSource: Plastic Theory of Change



ReSource launched in 2019 with five principal member companies:Keurig Dr Pepper, McDonald's Corporation, Procter & Gamble, The Coca-Cola Company, and Starbucks. In 2020, Amcor, Colgate-Palmolive, and Kimberly-Clark became the newest *ReSource* members.

The Ellen MacArthur Foundation and Ocean Conservancy, leaders in the global effort to stop plastic pollution, are thought partners to WWF on *ReSource*.

By 2030, *ReSource* aims to prevent 50 million metric tons of plastic waste by enlisting at least 100 companies. As both the availability of data and our understanding of the plastic waste crisis improves over time, these metrics for success may evolve. The purpose of this document is to provide a comprehensive look into the methodology of *ReSource's* innovative framework to measure and report corporate action on plastic, the Resource Footprint Tracker.

About the Methodology

The ReSource Footprint Tracker is the mechanism used to measure *ReSource: Plastic* member companies' impact on plastic waste mitigation. The tool was developed to improve the way companies solve a high-stakes and complex problem—a problem in which effective corporate action can potentially lead to positive and largescale transformation.

In addition to serving as a tool for *ReSource* member companies, the Tracker was built to fill a critical measurement gap in effectively advancing corporate plastic sustainability at large. With these goals in mind, the ReSource Footprint Tracker methodology is designed to

- render a more complete and updated corporate plastic footprint profile, aligning company plastic portfolios with the global waste management system
- measure and track the progress of member companies' plastic waste mitigation activities

- produce data-driven insights to help companies sharpen, refine, and prioritize activities that can maximize their potential for impact
- help companies multiply their impact by fostering new opportunities for collaboration and collective action with other companies and across sectors
- establish a common language and framework on corporate plastic sustainability

The ReSource Footprint Tracker was piloted in 2019 by five *ReSource* member companies to demonstrate the feasibility of the methodology and establish baseline footprints, resulting in a proof of concept for a common framework to measure effective corporate action on plastic. Please refer to the **Transparent 2020** report for the outcomes of the pilot year assessment.

The following sections of this document detail the methodology's components, data limitations, and assumptions, and its practical interpretations and applications.



Tracker Components

The ReSource Footprint Tracker methodology consists of three main components: the Company Plastic Survey to measure plastic use by country, polymer type, form, and use of sustainable inputs; the Waste Management Model to estimate likely waste management outcomes for this plastic; and the Beyond Supply Chain Survey to track a company's initiatives and investments to reduce plastic pollution beyond their own supply chains (Figure 2). WWF led in the development of the methodology with support and alignment on best practices from *ReSource* thought partners as well as The Recycling Partnership, Circulate Capital, and the Plastic Leak Project.

FIGURE 2. ReSource Footprint Tracker data components



Company Plastic Survey

The Company Plastic Survey collects member company plastic procurement and sales data, which is used to analyze plastic inputs and packaging types, including polymer and form. This is used to understand the composition of a company's plastic portfolio and subsequently inform strategies for eliminating unnecessary plastic and shifting to sustainable inputs.

Member companies are asked to report data regarding plastic use within the supply chain. This section describes the data collected and reported through the Tracker's Company Plastic Survey. This section should be used to help member companies identify the types of operations and polymers that are within scope for annual reporting. The outputs from the tool will provide information on the different plastic packaging formats and plastic resins used by the company.

Note that the primary focus of the Tracker is on single-use plastic consumer products and packaging. However, the Tracker is designed to also capture durable products and reusable packaging, which allows for year-over-year tracking of the shift away from single-use plastics.

DATA COLLECTION

ReSource members populate the Company Plastic Survey with procurement and sales data on all single-use plastics, including "back of house" packaging for shipping, through an Excel spreadsheet developed by Eastern Research Group, Inc. (ERG). Additional data elements required to complete the analysis include the year of data collection, country of sale/use, packaging form, and weight broken down by polymer type and whether the material is comprised of recycled content or responsibly sourced biobased content, where applicable (Figure 3). A company must identify an internal point person to gather procurement and/or sales data and share their data with WWF within six months of joining *ReSource*.

SCOPE OF ANALYSIS

The data provided by companies and input into the Tracker will vary by industry or sector.

The scope of Company Plastic Survey includes

- coverage of all direct operations, as determined by the company, including but not limited to manufacturing, retail, consumer packaged goods, and licensed and international operations^A
- coverage of all single-use plastics, including "back of house" plastics consumed and managed internally, as well as one-way and reusable packaging for shipping
- documentation of all assumptions and calculations; e.g., estimations of plastic product weight based on unit/case weight

In cases where data constraints make it unrealistic for a company to accurately report all plastics in their direct operations, it is critical that the company fully discloses the limitations of their reported data and anything that has been excluded.

FIGURE 3. Example of Company Plastic Survey (Tracker user interface)



A For additional information about scope of reporting for principal members, see Transparent 2020 Report.

Note that due to data constraints in the first year of reporting, the scope of analysis did not include secondary packaging and transport packaging. Additionally, some members were unable to report data for each company in which they operate. The intention is to standardize the requirements for the scope of reported data in the coming years.

DATA ELEMENTS AND DEFINITIONS

This section contains detailed information about each of the data fields requested in the Company Plastic Survey. WWF identifies priority and secondary tiers of data elements. WWF encourages members to provide as much data as possible to ensure completeness in tracking plastic use (Table 1). Priority data are necessary to produce the tables and charts in the summary tabs of the Tracker. Secondary data are not necessary to produce the summary tables and charts but do help to provide a more complete picture of a company's annual plastic use and waste management.

1. Country

All plastics data must be linked to a country so that management outcome can be determined through country level waste management calculations. If only regional data are available, the data are split among the countries that constitute a region using the best estimate for each country (e.g., allocated based on country-level sales data); this is then noted in the company's data scope and assumptions.

2. Plastic Use Classification

This field groups plastic products and packaging into one of three preset options, as described in Table 2, page 4. The purpose of this field is to further classify plastic products either as products for sale or direct use by a company, or as packaging on products sold or procured by a company. The Tracker relies on the following definitions:

Packaging: Per ISO 21067-1:2016, "Product to be used for the containment, protection, handling, delivery, storage, transport and presentation of goods, from raw materials to processed goods, from the producer to the user or consumer, including processor, assembler or other intermediary." TABLE 1. Priority and Secondary-Tier Datain the Company Plastic Survey

Data Element	Data Tier
Country	Priority
Plastic Use Classification	Priority
Procurement or Sales	Priority
Form Category	Priority
Primary Polymer Type	Priority
Form Description	Priority
Total Weight	Priority
Weight Units	Priority
Percent Recycled Content	Priority
Percent Biobased Content	Priority
Mono-material or Multi-material Designation	Secondary
Primary Polymer Percent	Secondary
Secondary Material	Secondary
"Other" Secondary Material	Secondary
Responsible Sourcing of Biobased Content	Secondary
Sourcing Justification	Secondary
Compostability	Secondary
Recyclability Assessment	Secondary
Durable Product Designation	Secondary
Reusable Packaging Designation	Secondary
End Use/Fate of Product	Priority
Internal Management	Secondary
Additional Notes	Secondary

Plastic for product use: Plastic in the actual product that is used by the end user and does not fall under the definition of packaging. The product can be either durable or non-durable.

Plastic packaging on purchased items and plastic for packaging of sold products: These include primary, secondary, and tertiary packaging. Per ISO 21067-1:2016, primary packaging is designed to come into direct contact with the product; secondary packaging is designed to contain one or more primary packagings together with any protective materials where required; tertiary packaging is designed to contain one or more articles or packages, or bulk material, for the purposes of transport, handling, and/or distribution. This distinction and resulting data aggregation provide the member company and WWF with detailed information about the breakdown of plastics used in products and in packaging on those products, which could help identify unnecessary plastic use in the supply chain.

3. Procurement or Sales

This field accounts for the various types of plastic products and packaging consumed within the supply chain. As noted above in the "Scope of Analysis" section, some industries may find that reporting only procurement or only sales data is appropriate for the Tracker. Other industries may report both types of data.

Procurement: Plastics procured by the member company, which could either be managed in-house, sold to businesses, or sold directly to the consumer.

Sales: Plastics sold to businesses or directly to the consumer.

Please note that companies may report a combination of procurement and sales data, such as in the case of a company that both manufactures plastic forms (such as bottles) and procures other forms (such as caps and labels). Because the Tracker is primarily interested in the final form of the plastic, manufactured plastics would typically be reported as sales data.

4. Form Category and Form Description

The tool allows for data entry in eight form categories. Classifying by category allows for data to be compiled and visualized for simplified year-over-year reporting.

Form Category: This field is used to classify the wide range of plastic products into broader categories for data aggregation and reporting across the wide variety of companies using the tool. By creating categories that cover the majority of single-use plastic types, WWF can create a high-level overview of plastic use and compare across member companies from a variety of industry types. This field is a preset list of eight categories to which all company plastic should be assigned.

Form Description: This field is primarily available to companies to facilitate internal tracking at a more granular level than the form category data field allows. The form description allows for a more detailed look at the plastic forms used and will vary greatly across industries and companies.

The form categories are defined below in Table 3, page 5. A list of possible form descriptions is provided for each form category. That list is non-exhaustive and will change over time as new forms and products enter and exit the market.

Classification	Description	Examples (non-exhaustive)	Procurement or Sales
Plastic for product use	Plastic for direct use in a product sold or used by company	Plastic kitchen utensils; plastic toothbrushes; plastic stems in cotton swabs	Could be either procurement or sales
Plastic packaging on purchased items	Plastic packaging on incoming purchased items used by company, and removed and managed by company	Plastic sleeves on cups purchased; plastic jugs for milk used as a beverage ingredient; plastic packaging used to ship empty personal care bottles and caps to fill with a consumer product	Always procurement
Plastic for packaging of sold products	Plastic purchased for use in packaging products sold to a consumer, retailer, or business customer	Plastic cups purchased for selling beverages; plastic wrap used to secure filled cases of filled personal care bottles to pallets; protective wrap around rolls of coated rollstock shipped to fillers	Could be either procurement or sales

TABLE 2. Plastic Use classifications

TABLE 3. Form categories and descriptions

Packaging Classification	Form Category	Form Category Definition	Examples	
Rigid	Bottle	Per ISO 21067:2016: typically of glass or plastic, having a comparatively narrow neck or mouth, with a closure and usually no handle.	Bottles for water, soft drinks, cooking oils, detergents, milk, jelly; large refillable water containers	
	Closure	Includes caps and closures that would be left on containers going to recycling (caps/closures that would be disposed of separately from the primary container would fall under small plastics— problematic to recycle as separate components due to size)	Screw caps on plastic bottles	
	Rigid—foam	Rigid products made from foamed polymers, typically polystyrene (PS)	Foamed products like EPS cups, foamed PS plates, egg cartons, meat and produce trays	
	Other rigid	Category used to capture rigids that are not classified as bottles, closures, foamed rigids, or small plastics	Solid cups, jars, disposable utensils, thermoforms, trays, blisters, non-foam clamshells	
Rigid/Flexible	Small plastics	As defined by the Association of Plastic Recyclers (APR): items smaller than two inches in two dimensions require testing to determine the appropriate APR recyclability category ¹	Plastic coffee sticks, straws, utensils	
	Raw material	Polymer used as raw material for manufacturing plastic products or packaging	Polymer pellets used as primary content of molded or extruded product, polymer used as coating or barrier material	
Flexible	Mono- material film	Mono-material stretch and shrink films, as defined by ISO 21067-1:2016, or mono-material film bags and sacks that are suited for recycling	Pallet wrap, stretch or shrink	
		Shrink film: plastic material that shrinks in size when heated to conform to the item(s) packaged	wrap around products for shipment, single-use plastic	
		Stretch wrap: material that elongates when applied under tension and which, through elastic recovery, conforms to item(s) packaged	grocery bags	
	Other flexible	Includes multi-material/laminate films	Direct product packaging, laminated beverage or food pouches, metallized films, snack bags and wrappers	

5. Primary Polymer Type

The primary polymer type for each form category is reported in the Tracker. The Tracker is designed to capture all plastic products made from the polymers listed in Table 4. WWF will update the polymer list as new packaging and polymers are developed.

6. Total Weight and Weight Units

The total weight of the plastic portion for the form described in the row is reported. Any secondary material will not be used in the Waste Management Model.

If purchasing a multi-material product such as plastic-coated paper cups, only the weight of polymer coating on the paper cup is reported. If the weight of

TABLE 4. Polymer types

Polymer Type	Notes
Polyethylene terephthalate (PET)	
Polyethylene terephthalate glycol (PETG)	
High-density polyethylene (HDPE)	
Polyvinyl chloride (PVC)	
Low-density polyethylene (LDPE)	
Linear low-density polyethylene (LLDPE)	
Polypropylene (PP)	
Polystyrene (PS)	Includes EPS, GPPS
Polylactic acid (PLA)	Biopolymer
Polybutylene adipate terephthalate (PBAT)	Biopolymer
Polybutylene succinate (PBS)	Biopolymer
Polybutylene succinate adipate (PBSA)	Biopolymer
Polyethylene furoate (PEF)	Biopolymer
Polyhydroxyalkanoate (PHA)	Biopolymer
Nylon	Catch-all category
Ethylene vinyl alcohol (EVOH)	Mostly an additive
Polyvinyl alcohol (PVOH)	Mostly used as coating/additive
Polycarbonate (PC)	
Acrylonitrile-butadiene-styrene copolymer (ABS)	Mostly used in durable goods

polymer in the cup is not known, an estimate based on supplier or manufacturer information is provided and justification is included.

7. Percent Recycled Content

The percent of the total plastic weight made from recycled content is reported. Recycled content as indicated only refers to post-consumer recycled content. The "Recycled Content" designation does not include pre-consumer recycled content.

The Tracker relies on the ISO 14021:2016 definition of post-consumer recycled content or the definition of pre-consumer recycled content:

Post-consumer recycled content: The proportion, by mass, of post-consumer recycled material in a product or packaging.

Pre-consumer recycled content: Materials diverted from the waste stream during a manufacturing process.

The Tracker does not include pre-consumer recycled content since an ideal circular economy would avoid pre-consumer waste in optimized production practices.

8. Percent Biobased Content

The percent of the total plastic weight made from biobased content is reported. WWF is interested in tracking plastic from biobased sources, as bioplastics and biomaterials represent a shift toward a bio-economy in which goods are made from responsibly sourced biomass.

Biobased content has been defined (by the U.S. Department of Agriculture in the Farm Security and Rural Investment Act of 2002) as "a commercial or industrial product (other than food or feed) that is composed, in whole or in significant part, of biological products, including renewable domestic agricultural materials (including plant, animal, and aquatic materials), forestry materials, intermediate materials, or feedstocks."² If relevant, companies should indicate if biobased content is responsibly sourced.

9. Mono-material or Multi-material Designation

The mono- and multi-material designations are used to capture plastics that are used in multi-material forms where the secondary material type may be a different polymer or a non-plastic material. For example, plastic coating on paper cups or rollstock should be included in the Tracker even though 100% of the form is not plastic.

While this designation is not formally incorporated into the current model, it is strategically important to note as the "recyclability of a form" is further refined. For example, a plastic bottle with a barrier or coating layer may not be recyclable, versus a bottle with no added coating layer.

Mono-material: A form that contains only one type of polymer, including different versions of the same polymer. For example, a bottle made with both virgin and recycled PET content would be considered mono-material. The addition of other polymers or additives to a plastic form can still classify the product as mono-material if the additives do not render the package non-recyclable. See the Association of Plastic Recyclers' Design Guide for full guidance on recyclability.

Multi-material: Generally, a multi-material product is a form that contains more than one type of polymer, or polymer and non-polymer materials. Examples include plastic bottles with a different polymer barrier layer or coating, polymer-coated paperboard products, multilayer laminate films containing several polymer types or a mix of polymer and paper and/or foil, metallized films, etc.

WWF recognizes two definitions for multi-material products:

- Per the Sustainable Packaging Coalition, "Multimaterial flexible packaging is composed of two or more materials joined together with adhesive or wax. By layering different materials together, manufacturers can create a package with unique barrier and mechanical properties."³
- 2. Per WRAP, "Laminated packaging is an increasingly popular option for lightweight product packaging, comprising multiple thin layers of material, each with a particular function."⁴

Please note that a product's material composition at recycling/disposal is more relevant to the Tracker's classification of mono- or multi-material than it is at point of sale to consumer. For further guidance on multi-material products refer to **The Recycling Playbook** for best practices regarding material of labels, attachments, and closures to increase recyclability.

10. Primary Polymer Percent and Secondary Material

Primary polymer percent and the secondary material description are secondary data fields.

The information can be used to help determine recyclability and waste management outcome modeling based on the total material composition of a form.

11. Responsible Sourcing of Biobased Content

WWF defines responsibly sourced biobased content based on a definition provided by the Bioplastic Feedstock Alliance. Under their definition, responsibly sourced biobased content is, at a minimum⁵

- legally sourced
- derived from renewable biomass
- posing no adverse impacts on food security
- having no negative impact on land conversion, deforestation, or critical ecosystems
- providing environmental benefits

Credible certifications such as the Roundtable on Sustainable Biomaterials certification can help ensure responsible sourcing.

12. Sourcing Justification

Member companies must submit written justification for how material content meets WWF's criteria for "responsibly sourced biobased content."

Justification should include documentation that verifies the content is responsibly sourced per WWF's definition, or that it adheres to a credible certification standard. Guidance for WWF's Principles of Certification can be seen here.

13. Compostability

Compostability can vary by waste management practices and conditions for material composition, design, use, contamination, and collection.

The data collected serves to track whether the form meets the following definition of "compostable" from the New Plastics Economy Global Commitment: "Packaging or packaging component is compostable if it is in compliance with relevant international compostability standards and if its successful post-consumer collection, (sorting) [sic], and composting is proven to work in practice and at scale."⁶

14. Recyclability Assessment

WWF acknowledges that recyclability varies widely due to many factors, including but not limited to varying waste management practices dependent on material composition, design, use, contamination, and collection.

The Recyclability Assessment is based on the New Plastics Economy Global Commitment Recyclability Assessment Tool and is included to assist companies in assessing the recyclability of their portfolio for Global Commitment reporting. It serves to track whether the form meets the following definition of "recyclable":

"A packaging or packaging component is recyclable if its successful post-consumer collection, sorting, and recycling is proven to work in practice and at scale. A package is considered recyclable is its main packaging components, together representing greater than 95 percent of the entire packaging weight are recyclable according to this definition, and if the remaining minor components are compatible with the recycling process and do not hinder the recyclability of the main components."

Source: New Plastics Economy Global Commitment⁷

The Global Commitment recyclable definition applies at a global level and does not account for any local and regional context that impacts recyclability. WWF is exploring how to incorporate local and regional conditions into the recyclable definition as the Tracker evolves. The first step of the recyclability assessment considers whether a "system for recycling" exists in practice and at scale for plastic packaging (e.g., does this packaging category achieve a 30% post-consumer recycling rate in multiple regions, collectively representing at least 400 million inhabitants?). This field will be automatically populated based on the polymer and form of the packaging.

The second step of the recyclability assessment involves manually inputting the "share of packaging that 'fits' the system for recycling." For example, while a system for recycling exists in practice and at scale for PET bottles, the recycling of a specific bottle could be hindered by size, colorants, additives, labels, caps/lids, glues, inks, etc. Various design-for-recycling guidelines, tools, and testing methods are available from the Association of Plastics Recyclers, Plastic Recyclers Europe, European PET Bottle Platform, and many other groups.

More information and guidance on the recyclability assessment can be found in Appendix II of the Global Commitment Reporting Guidelines document.

15. Durable Product Designation

This is a secondary data field, included in the Tracker to track and incorporate durable products for future versions of the Waste Management Model.

The purpose of the designation is to track the flow of durable products procured and/or sold by the company each year. Note that durable goods are excluded from the model because they are generally estimated to have a lifetime of three years or more, a definition provided by the US Environmental Protection Agency (EPA).

16. Reusable Packaging Designation

This is a secondary data field, included in the Tracker to track changes in plastic waste associated with the use of reusable packaging over time. The Tracker aligns with the ISO 18603:2013 definition of packaging reuse as cited in the New Plastics Economy Global Commitment, namely:

"[An] operation by which packaging is refilled or used for the same purpose for which it was conceived, with or without the support of auxiliary products present on the market, enabling the packaging to be refilled."

Further, ISO 18603:2013 defines reusable packaging as: "Packaging which has been designed to accomplish or proves its ability to accomplish a minimum number of trips or rotations in a system for reuse."⁸

ISO defines a trip as transfer of packaging from filling/ loading to emptying/unloading. ISO defines a rotation as a cycle undergone by reusable packaging from filling/ loading to filling/loading.

As discussed in the New Plastics Economy Global Commitment Reporting Guidance, attention should be paid to the intended use and function of the packaging. If packaging is being employed for a secondary use (rather than the same purpose for which it was designed), it is not considered reusable packaging. For a container to qualify as reusable, there should be a system for reuse in place enabling the user to ensure that it is reused in practice. This system should be able to prove a significant actual reuse rate (or average number of use-cycles of a package), in normal conditions of use.

17. End Use/Fate of Product

The end use/fate of product must be designated for each form reported into the Tracker to model the management pathways. There are four options as described in Table 5 below:

Category	Description	Waste Management Model Assumption	
	This category should capture forms that are sold to the following industry categories:		
	 Packaged goods companies, including fast-moving consumer goods (FMCG) 		
	Packaging producers	Assume country in which product is sold is	
Sold to business	Raw material producers	also where it is managed; assume form sold to filler does not change substantially	
	 Durable goods producers 	enough to impact management.	
	 Suppliers to the plastic packaging industry 		
	This category is selected for products sold to a business that is not considered a filler or retailer or hospitality business.		
Sold to filler or retailer	This category should capture forms that are sold to fillers, or to retailers and hospitality businesses, as intermediaries for the form before it reaches the consumer.	Assume country in which product is sold is also where it is managed; assume form sold to filler does not change substantially enough to impact management.	
Sold to consumer	This category captures all forms sold directly to the consumer by the reporting company. Note that the consumer could be a business consumer, for example a company purchasing, using, and disposing of products managed by a commercial hauler.	Assume country in which product is sold is also where it is managed.	
Managed in-house	This category captures all plastics procured by the company, consumed in-house, and managed by the company.	Management reported by company, not	
	Examples of these plastics might include packaging on procured items that is discarded before product sale—e.g., a plastic film wrapper on food items discarded before those items are provided to the customer.	Model. Manual inputs of internal waste management outcome required.	

TABLE 5. End Use/Fate of Product

18. Internal Management

These secondary data fields help companies assess internal waste management. This information is only requested if End Use/Fate of Product was selected as "Managed In-House."

Because internal plastic waste management is specific to individual companies, the Tracker relies on companies to report how company waste is managed internally. This means the Waste Management Model is not used to assign management outcomes to internally managed waste.

19. Additional Notes

This space is provided for any additional notes not already captured in the Tracker. Notes can include but are not limited to explanations regarding internal data aggregation, missing or estimated data, and assumptions related to company data collection and reporting.

COMPANY PLASTIC SURVEY ASSUMPTIONS

Assumptions regarding data collected in the Company Plastic Survey are summarized below.

- country assignment and Waste Management Model assumptions
 - For plastics where only procurement data are available and/or are the only data entered in the Tracker, the assigned country of procurement is also the country in which material management occurs.

- For plastics sold to another business before being sold to the consumer, the ultimate end user and disposer of the plastic, the country of sale is assumed to be the country in which material management occurs.
- For plastics sold to a filler or retailer, the model assumes that the country in which a product is sold is also where it is managed; assumes form sold to filler does not change substantially enough to impact management.
- For plastics sold to the consumer, the country of sale is assumed to be the country in which material management occurs.
- For plastics managed in-house, waste management outcomes are reported by the company and not determined by the model.
- total weight
 - To calculate total plastic procured/sold, the Tracker assumes that the weight reported is the total weight of the plastic material of a form, even if the final product form is comprised of plastic and another non-plastic material.
- mono- and multi-material designation
 - If the components of a multi-material product can be recycled together, the product is considered mono-material. If the components cannot be recycled together, the product is considered multi-material.



Waste Management Model

The ReSource Footprint Tracker's Waste Management Model is designed to estimate the share of consumer-facing plastic packaging for individual companies that is recycled, landfilled, incinerated, or mismanaged around the world, at a national level. The outputs of the model are intended to help companies identify opportunities in key geographies to eliminate or substitute plastics at high risk of mismanagement, design for local recycling or composting infrastructure, and invest in improving waste management systems.

The model was developed by Anthesis Group, with review and input from WWF, key thought partners, and *ReSource* member companies in fall 2019 and winter 2020. We also collaborated with The Recycling Partnership, Circulate Capital, the Plastic Leak Project, and other organizations to align the Waste Management Model methodology with current best practices.

Other methodologies exist to help various stakeholders track their plastic usage and/or waste management outcome. However, the ReSource Footprint Tracker fills previous gaps by standardizing corporate data and collection and reporting as well as by improving the quality and precision of our understanding of the plastic waste system. To avoid the proliferation and duplication of efforts, the ultimate goal is to align this model with other approaches to support streamlined reporting.

MANAGEMENT OUTCOMES DEFINITIONS

The model identifies four waste management outcomes for consumer-facing plastic packaging: recycling, incineration, landfill, and mismanagement.^B

Recycling

According to the US EPA, "recycling is the process of collecting and processing materials that would otherwise be thrown away as trash and turning them into new products."⁹ Recycling can be either mechanical or chemical.

Incineration

Incineration includes incineration both with and without energy recovery. Incineration primarily occurs in high-capacity, high-income, and land-constrained countries, as the construction and operation of incineration facilities require large capital inputs and high management and technical capacity.¹⁰

Landfill

Landfill refers to waste treatment and disposal in 1) sanitary landfills with landfill gas collection systems, 2) controlled landfills that are engineered but gas collection systems either do not exist or are not known to exist, and 3) unspecified landfills. Waste bound for unspecified landfills is categorized as either landfilled or mismanaged on a country-by-country basis. Open dumps are categorized under mismanaged waste.¹¹

Mismanagement

We follow the definition of mismanaged waste outlined by Jambeck et al. (2015): "Material that is either littered or inadequately disposed."¹² Mismanaged waste typically includes uncontrolled landfills and open dumps, waste that is not collected, and waste that is littered. Thus, this value is not how much plastic enters nature, but rather a potential volume that is not adequately managed, which has the potential to enter ecosystems. We consider mismanaged plastic waste to be indicative of potential plastic leakage, as mismanaged waste can enter terrestrial environments through inadequate disposal. This waste could eventually enter freshwater environments and thus move to marine environments via inland waterways, wastewater outflows, and transport by wind or tides. Future versions of the model will aim to incorporate more direct approaches to measuring plastic leakage.

B Future iterations of the Tracker will include composting as well, as more data becomes available regarding the prevalence of composting for plastic waste.

MODEL DEVELOPMENT

To develop the model, Anthesis first conducted a literature review of publicly available data sources on recycling, landfill, incineration, and mismanagement rates for plastics and constructed a country-level waste management database.¹³ Since there is currently not a complete data set available for the global flows and management of plastic waste, Anthesis used this database as a basis for developing assumptions to fill in the remaining data gaps. Advice from an expert in plastic waste management was used to fill in data gaps and inform and verify the assumption development. The identified data sources provided the following:

- Waste management information at various levels of material. E.g., some datasets look at all waste materials (including plastic), others at plastic waste, others at plastic packaging waste, and still others at specific formats and/or plastic resins.
- Varying levels of completeness of waste management data for each country. E.g., some data sets only provide information on one form of management (such as recycling), whereas others provide information for the complete set of management systems.
- Different number of countries within the data set. E.g., some data sets are only relevant to the European Union, and in some cases, there is information at a regional level but not for specific countries within the region.

The resulting output is tonnage by waste management outcome, both as an aggregate and for individual countries (Figure 4, page 13).

OUTPUT USE

The model builds on data provided by each company in the ReSource Footprint Tracker Company Plastic Survey to provide an output showing the waste management outcomes for their plastic packaging placed on the market. To do this, the model uses the best available published data, expert assumptions, and calculations.

Intended uses of the data

- Outputs provide an estimated overview of the waste management outcomes of plastic packaging and can help determine where further research is required.
- Outputs are a starting point to understand the global waste management outcomes of materials put on the market by different companies.
- Outputs may highlight areas where WWF and *ReSource* members can work together on further data gathering, material recovery efforts, innovation projects, and other Beyond Supply Chain activities.

OUTPUT INTERPRETATION

The ReSource Footprint Tracker uses the best available information, but limiting factors remain. When interpreting outputs, please consider the following limiting factors.

- The outputs should not be used as a sole basis for guiding company decisions on investment, operations, or product design, but rather in conjunction with additional company and local context.
- Waste and recycling rates are not globally defined, and national reporting frameworks for each country differ.
 - e.g., Chemical recycling would not contribute toward recycling rates in EU member states, whereas in Japan it would count.
- It is difficult to collect reliable data for informal recycling rates; and therefore, there is higher uncertainty in countries where informal recycling is prevalent.
- Materials may be sent for recycling, but due to their design or the capabilities of the reprocessing facility, may not actually be recycled.
 - e.g., Black plastic, multi-layer film bags, paper coffee cups lined with PE
- Available data on mismanaged plastic waste is scarce. The model is primarily informed by data from Jambeck et al.,¹⁴ as well as by a detailed literature review on more recent country-level reporting meriting inclusion (i.e., World Bank's *What a Waste 2.0* study¹⁵). It is important to note that different calculation

FIGURE 4. Example of Waste Management Model inputs and outputs



*The level of detail and accuracy for the output section will depend on:

- data that can be input
- level of granularity the assumptions can be produced to, within an agreed margin of error based on the data sources reviewed for this project

approaches and assumptions may lead to different estimates in rates of recycling, incineration, landfill, and mismanagement at a country level. As part of our methodology development, we compared mismanagement rate estimates from Jambeck et al.,¹⁶ Lebreton and Andrady,¹⁷ and the Plastic Leak Project's methodological guidelines,¹⁸ before finalizing our approach.

- The source data is variable in nature and at times based on studies undertaken over 10 years ago. Due to the model's reliance upon Jambeck et al. at a country level, it may not factor in improvements made within the waste sector achieved in the past 5–10 years. These and other data quality issues are addressed through the provision of data quality scores and flags in the model.
- Outputs do not currently account for global trade flows of plastic.

Further discussion on these points is provided later in this document.

DATA TIERS

The model uses six tiers of data with increasing specificity to identify the management of single-use plastic packaging (Figure 5, page 15), from all solid waste (Tier 1) to specific polymers and packaging forms, e.g., PET bottles (Tier 6). Tier 1 and Tier 2 refer to solid waste and municipal solid waste data, respectively, and were only used when plastic-specific data were not available. The main data source used was the World Bank's *What a Waste 2.0* report.²⁰

The primary tiers employed in the analysis are Tier 3 All Plastics, Tier 4 Rigids/Flexibles, and Tier 5 Form. These tiers are outlined below:

Tier 3 All Plastics—Most reported waste management data for plastic is aggregated for all plastics (Tier 3). At this tier, country-level plastic recycling rate data is either sourced, assumed to be similar to that of a comparator country, or estimated based on Anthesis' knowledge and engagement with an external expert on secondary plastics. The model's country-level mismanagement rates are based on those estimated by Jambeck et al.¹⁹ If landfill and incineration rates specific to plastic are not available, estimates from the World Bank's *What* *a Waste 2.0* report²⁰ are used to apportion the remaining material after accounting for recycling and mismanagement. Reported rates may be adjusted to allow for consistency across all waste management pathways (to ensure that all rates add up to 100%).

Tier 4 Rigids/Flexibles—Waste management rates for rigid and flexible plastics were calculated using the ratio of recycling rates for rigids and flexibles in Europe based on the Waste and Resource Action Programme (WRAP)²¹ and Deloitte Sustainability and Plastic Recyclers Europe²² and then multiplied by the Tier 3 All Plastics recycling rates for the remaining countries. Mismanagement estimates from Jambeck et al.23 are applied across all waste management tiers, meaning estimated mismanagement is currently the same for rigids and flexibles. This does not reflect known trends that flexibles are mismanaged at higher rates than rigids and has been identified as a desired key improvement area in the next version of the model. All countries in the model have waste management rates for rigid and flexible plastic (Tier 4).

Tiers 5 and 6 Form and Polymer—Countries primarily in North America and Europe have form-specific (Tier 5) rates for bottles, "other rigids," and mono-material film. The model does not currently utilize any polymer- and form-specific rates (Tier 6). This limits the ability of the analysis to differentiate waste management pathways for specific packaging types (e.g., PP cups) from their broader category (e.g., rigid plastic). The model is designed for assumptions to be easily updated as better information is published, and this information will be reviewed, and available updates incorporated, prior to 2021 reporting.

The model provides outputs at a combined performance level which dynamically utilizes the highest tier of data available, with the aim of providing the most granular and accurate picture of a company's performance for what materials they place on the market. For example, at this combined performance level, if management-based data for PET bottles is known, then this data will be used to calculate the outputs, while for other waste streams where management-based data is less specific, the model will apply a rigid plastics assumption.

FIGURE 5. Data tiers for identifying and reporting plastic waste management



DATA AVAILABILITY

When the Waste Management Model was developed and updated by Anthesis (2019–2020), there was no global dataset covering the flows and waste management outcomes of plastic packaging to this level of detail. Therefore, Anthesis undertook a structured literature review to collate publicly available data sources that contained information on management outcomes of plastic packaging in order to develop a global reference list. This review captured both national and regional-level studies. Due to data scarcity, the literature review also started as an open search with no parameters for the quality of study undertaken. As such, the long list of literature reviewed included a full range of sources, from academic studies to regulatory reported data. The data quality was then assessed in a two-stage process, as explained in the following sections.

When undertaking the literature review, a reference list of gaps in the literature was also collated. This identified areas where assumptions or the use of proxy data would need to be employed to provide global estimates of



waste management pathways. For countries with the most limited data, advice from an expert^c in plastic packaging management was used to help fill in data gaps with estimates and inform and verify the assumption development. Anthesis and WWF worked closely on the literature review and data quality assessment protocol.

Each data source was assessed in relation to the depth of data (the level of data available) and the breadth of data (the coverage of data/number of countries) the source provides.

Based on the literature review, Anthesis selected key source information to fill the selected tiers and geographical regions. A full list of sources utilized in the Waste Management Model can be found in the Assumptions table.

DATA QUALITY ASSESSMENT (PHASE 1)

The literature review was supported by a structured assessment of the quality of each source's methodology

C Mike Jefferson (Verde Research and Consulting)

and outputs. For each source, a level of confidence has been applied using a consistent approach. This approach is made up of two steps:

- 1. Apply a pedigree matrix to assess the robustness of each source. Table 6, page 17, outlines the pedigree matrix used, which defines a clear approach to identifying the validity, completeness, timeliness, and consistency of each data source. This process is designed to determine the quality and robustness of the source data itself and the methodology behind its development. For example, this process captures to what extent the source data has a defined methodology that is documented and consistently applied in the collation of data for regulatory purposes or national reporting. In this assessment, each criterion is scored 1 to 5, 1 being the lowest scoring and 5 being the highest scoring, indicating a more robust source of waste management data.
- 2. An assessment of the source's relevance in application to a certain geography/country. The pedigree matrix (Table 6) was used as a

template to develop a literature database. All

TABLE 6. Literature assessment matrix

Criteria/Score	1	2	3	4	5
Validity	Non-qualified estimate or unknown source	Qualified estimate by industry expert	Non-verified data partly based on assumptions	Verified data (compliance/ regulatory data) partly based on assumptions	Verified data based on measurements for compliance/ regulatory reporting
Completeness	Data covering a single source (post-consumer, post-industrial, packaging) of plastic and containing a single waste management outcome, e.g., recycling rates	Data covering all sources (post- consumer, post-industrial, packaging) of plastic, containing a single waste management outcome, e.g., recycling rates	Data covering a single source (post-consumer, post-industrial, packaging) of plastic and containing only formal waste management (recycling, incineration, landfill)	Data covering all sources (post- consumer, post-industrial, packaging) of plastic with referenced collection coverage, containing all formal waste management (recycling, incineration, landfill)	Data covering all sources (post- consumer, post-industrial, packaging) of plastic with referenced collection coverage, containing all waste management outcomes (recycling, incineration, landfill, mismanagement)
Timeliness	Older than 10 years or unknown	Data that is 7 to 10 years old	Data that is 4 to 7 years old	Data that is 2 to 4 years old	Current year or up to 1 year out of date
Consistency	One off study based on case study or less than annual timeframe	One off study based on case study with annual timeframe	Annual data available from a repeated study (2 years of data but not consecutive)	Regular data based on consistent approach available for 2 consecutive years, or published biennially	Annual data based on consistent approach available for 5+ years

reviewed literature sources have been scored against the parameters; comments have been added to give additional information on the data source. Each reference has been given a unique reference number in order to be easily identified within the model. In addition to the scoring, the database also includes the tier and the country to which the data directly applies.

This is important when scoring the geographical application of the data. For more details, please see the "Data Quality Assessment (Phase 2)" section.

Assumption development

Certain calculations and adjustments to referenced datasets were required in order to provide global waste management outcome estimates for Tiers 3 and 4, as well as for adjusting Tier 5 and 6 data. These calculations are consistent across the data tiers, using a three-step approach:

1. Source data has been researched and reviewed to populate data for management outcomes for recycling, landfill, and incineration rates. In most instances, data for incineration and landfilling of waste is sourced from the *What a Waste 2.0* study,²⁴ supplemented with additional plastic-specific recycling figures where available or more appropriate. For example, European Commission data is utilized to populate countries under the EU reporting framework. Where the literature review process did not identify a single source with coverage of all formal and informal management of waste (that add up to 100%), adjustments to the combined figures have to be made as per steps 2 and 3 below. In the case of multiple reported management outcomes (mainly applicable for recycling data), the most credible source was determined by Anthesis in collaboration with WWF.

- 2. Calculations are then applied to adjust managed waste streams (formal recycling, incineration, and landfill) to equal 100%. This is prompted by the following:
 - There was a need to merge two datasets creating a full set of assumptions including conventional management data (recycling, landfill, incineration) and ensuring that the full set of rates equate to 100%.
 - To account for mismanaged plastic waste (e.g., waste that falls outside of the "managed" waste system), the managed plastic waste rates were adjusted downward proportionally in line with the estimated mismanagement rates from Jambeck et



al.²⁵ This was based on the assumption that mismanaged plastic is not fully accounted for in reported waste management rates. The model has been populated with flags to note when other sources, primarily Lebreton and Andrady²⁶ and Plastic Leak Project's methodological guidelines,²⁷ diverge from Jambeck el al.

3. To ensure that a company's overall results incorporate the best available data and reflect their portfolio as accurately as possible, tiers with the highest levels of reported data were prioritized during the assumption process. For example, if data was available for a country's recycling rate at Tier 5, this data is prioritized with data from lower tiers and adjusted accordingly. An example calculation is included below:

Data available

- primary source data for Tier 5: recycling rate of 70%
- calculated Tier 4 incineration rate of 20%
- calculated Tier 4 landfill rate of 10%
- calculated Tier 4 mismanagement rate of 30%

In this example, the 70% recycling rate is used with the remaining 30% apportioned between incineration, landfill, and mismanagement based on Tier 4 assumptions. If 100 tonnes of material was placed on the market, 70 tonnes would be recycled, 10 tonnes would be incinerated, 5 tonnes would be landfilled, and 15 tonnes mismanaged.

4. When data was reported at the same tier, mismanagement estimates were prioritized over the other management outcomes. Simply put, higher tier estimates were prioritized over lower tier estimates and mismanagement estimates from Jambeck et al. were prioritized over other Tier 3 estimates.

Source of data and information for the above calculation approach:

• **Recycling**—Recycling rates are either sourced from studies and reports found as part of the literature review or assumed based on insights from a plastic market specialist. In some instances, the recycling

rates are presumed to be similar to those of a comparable country or calculated based on the average performance of countries within the same national income bracket.

- Incineration—Incineration data is either sourced from studies and reports found as part of the literature review or drawn from the *What a Waste 2.0* study.²⁸ In certain examples, rates may be presumed to be similar to those of a comparable country or calculated based on the average performance of countries within the same national income bracket.
- Landfill—Landfill data is either sourced from studies and reports found as part of the literature review or drawn in from the *What a Waste 2.0* study.²⁹ In certain examples, it may be presumed to be similar to that of a comparable country or calculated based on the average performance of countries within the same national income bracket.
- **Mismanagement**—Mismanagement data is available from Jambeck et al.³⁰ for most countries with a coastline. A range of calculations have been made on the source data to help complete the assumptions database.
 - "Calculated—average rate for all Upper Middle Income Countries (UMC) where data is available or inferred from similar countries" = calculated average of other UMC income bracket countries from data sourced from Jambeck et al.
 - "Calculated—average rate for all Low Income Countries (LIC) where data is available or inferred from similar countries" = calculated average of other LIC income bracket countries from data sourced from Jambeck et al.
 - "Calculated—average rate for all Low and Middle Income Countries (LMC) where data is available or inferred from similar countries" = calculated average of other LMC income bracket countries from data sourced from Jambeck et al.
 - "Calculated average rate for all High-Income Countries (HIC) were data is available or inferred from similar countries" = calculated average of other HIC income bracket countries from data sourced from Jambeck et al.

TABLE 7. Geographical scoring

Score	1	2	3	4	5
Geography	Source data is applied to a country purely based on geographic proximity	Source data from a regional study is applied to a country (not within the region) with similar waste management systems and regulations	Source data from a country is applied to a country with similar waste management systems and regulations	Source data from region is applied to a country from within	Source data is applied directly to a representative country
	E	D	C	В	Α

DATA QUALITY ASSESSMENT (PHASE 2)

In order to determine if the source data has been applied to the country for which it was originally developed/reported, or if it has been applied to a country with missing data based on the previously defined assumptions, an additional scoring of 1–5 for geographical criteria has been added.

1. An assessment of the source's relevance in application to a certain geography/country. Once each source has been evaluated using the assessment matrix, a final step is required to determine how relevant the source is in its application to a specific country. In this respect, the data quality can score highly and be reported via a robust methodology, but if it is being applied to a region with limited applicability, then it will be given a low "geographic" criterion scoring. Therefore, the assessment separates the evaluation of the data quality from data application. In the assessment, a score of E refers to the application of data that is loosely applicable while the top score A refers to data that is directly applicable, e.g., collated and recorded from the country to which it is being applied (see Table 7).

The combination of the first and second data quality assessment steps provides a transparent methodology to articulate data confidence for the user. For each source utilized in the model, an associated numeric score is applied out of a maximum of 25. This accounts for all scored elements of the data assessment (validity, completeness, timeliness, consistency, and geography). Each geographic score is further translated into a letter grade from A to E and appended at the end of the numeric score. For example, two management-based assumptions may be recorded with scores of 21A or 21E. In the first instance this would mean it has received a score of 16 for validity, completeness, timeliness, and consistency, and a 5 for geography. In the second case, the source has received a score of 20 for validity, completeness, timeliness, and consistency, and a 1 for geography.

This additional information is provided so that in the instance where a user wishes to review the assumptions in more granular detail, they can understand how a reference's score is split between the robustness of the data quality and geographical applicability.

Where data from the literature review is adapted and/or used out of context, some additional data quality scoring changes are made:

• Application of source data to different

countries. In instances where no direct waste management data for a specific country is available, data is incorporated from similar countries or regions based on geography or similar waste management sectors. To account for the application of another country's data, the 1–5 scoring for geography will be reduced by the applicable number. This will enable users to identify cases where data is applied to a different country or region for which it was collected/ reported. If the values are based on geographical proximity, the scoring is reduced by 1 point and the geography is set to B. Within the assumptions documents available to users, each source is therefore scored out of a total of 25 but appended with a geographical applicability letter from A to E.

- Calculations using source data. If averages of datasets, such as in the Jambeck et al. study, are used to identify reasonable assumptions for countries' waste management data, then this will be represented by reduced scoring for the validity and geographic scoring categories. Both of these steps will be recorded in the model's assumptions tabs to provide transparency as to how the data has been scored, but also with a key aim of reflecting lower scores where "good data" is not available. For example, where data is based on average income levels (based on the Jambeck study), the scoring is reduced by 3 points and set to D, as the geographical scoring is based on countries with assumed similar waste management systems and regulations, but not on geographical proximity.
- Using lower-tier data to fill gaps at a higher tier.
 Where gaps in data exist and are required to be filled by the use of lower-tier data, e.g., having to take Tier 4 data and applying it to Tier 5 data, scoring will be consistently downgraded by 3 points. For Tier 5 and 6 the "adjusted rates" should be viewed as calculations since the data is based on Tier 4 data and adjusted to the recycling rate of Tier 5 and 6 data to equal 100%. Although the source has been collected in a robust manner, it is being applied in a different context than intended for Tiers 5 and 6. This reduction in scoring is important for flagging areas of poorer quality data for further investigation.

Reporting confidence in data

The output confidence calculations are based on the tonnage of material reported for each country and waste management outcome, each with its own confidence level. As such, the output confidence of the data is presented in three distinct ways in the model:

 An overall data quality score is provided representing the weighted average score of the source data used. As per the individual source scoring, this is out of a maximum score of 25. This is the top-level metric that should give the user a clear indication of the overall confidence that they should be able to have in their data submission and mirrors what is included in the Assumptions Table (available for download).

- 2. A graph presented within the model demonstrating proportionally how much of the data is of high, medium, or low quality-weighted based on tonnage. The thresholds for data quality brackets have been set as the following, and the scoring of each is based on how well each piece of data scores out of a maximum score of 25:
 - -5-11 = Low-quality data
 - 12-18 = Medium-quality data
 - 19-25 = High-quality data

This score gives the user an indication of the spread of quality in the data used to calculate the management outputs. For example, the data quality could be a mixture of both high-quality and low-quality data, or it could be that all of the source data quality is average. This should provide the user with an indication that some parts of the data are more reliable than others and whether potential further research may be required to access better source data.

3. A graph providing insight into the proportion of source data and its geographical applicability. This will provide the user with a clear indication as to how much of their fate reporting is based on source data that has been applied with direct geographical applicability and how much may have been sourced from regional sources.

Examples of data quality scoring can be found in Figure 6 (page 22). This output demonstrates to the user that they have an "18 out of 25" overall quality data score, with 16% high-quality reference data and 73% of its source having direct, "country of origin" geographical applicability.

As a result, the output confidence calculations should provide a rapid assessment of the quality of the data used to estimate waste management outcomes for any given tier, region, or country. For any countries where there is a high proportion of low-quality data, there is lower confidence in the final outputs, and further research may be required to gather better-quality information for future iterations of the model. Since the output confidence levels are weighted based on the tonnage, this implies that the emphasis will always be on good-quality data for larger quantities of plastic waste. The highly variable data quality and lack of country-level reporting on the issue represents a significant impediment to prevention of plastic leakage. It is the intention of *ReSource* to further explore how this improved data collection and reporting can be accomplished.

Uncertainties in reported data

When using the model, please consider that waste and recycling rates are not globally defined, and the national reporting frameworks of each nation differ. For example, in the UK, municipal solid waste (MSW) includes waste from households as well as similar waste streams generated at commerce, offices, public institutions, and selected municipal services that may be co-collected via local authority collection services. However, this can differ significantly between countries. In India, MSW includes construction and demolition waste, which presents a completely different picture of recycling performance. Another example is that in the EU, chemical recycling would not contribute toward recycling, whereas in Japan it would. This means the data for different nations is not directly comparable, as it is not possible to reliably standardize these figures through data adjustments.

It is also important to consider that

- The reported figures may not be the true management outcome of materials: Waste may be collected and sent for recycling but may be mismanaged at export destination. For example, the UK may report 50,000 tons of material as being sent for recycling. If some of this waste is mismanaged at point of treatment in the export country, then this is challenging to account for.
- Nationally reported figures for recycling are unlikely to include **informal activities** that contribute toward

FIGURE 6. Example of data quality scoring (Tracker user interface)



Contextual Flags

Waste Management data has been drawn from a range of sources as well as estimated where no reference sources are available.

Where referenced data is available from reported sources, it has been used, but waste management definitions can differ from one country or region to another.

Source data utilized may not always include the benefits of activities undertaken by the informal sector.

recycling. If the informal sector is extracting recyclables before the formal sector (on which reporting is based), then it is possible that the reported figures are artificially lower, as valuable materials are extracted prior to formal collections. • Some **problematic materials** will be counted as being "sent for recycling" but will not actually be recycled (such as black plastic).

Where these potential data issues can be identified, flags are provided in the model (Figure 7).

Beyond Supply Chain Survey

The quantitative analysis of the ReSource Footprint Tracker, which examines companies' plastic portfolios and estimates likely waste management outcomes, is critical to understanding how various plastics contribute to the plastic waste issue. However, there are many activities that organizations are undertaking that aren't captured in this analysis but that may be impactful in advancing solutions that improve global material management, increase collection and recovery, and build circular systems to reduce plastic pollution. The Beyond Supply Chain Survey is intended to measure the impact of activities that contribute to the improvement of plastic waste management outside of a company's direct operations.

The Beyond Supply Chain Survey captures information on any type of collaboration that works to make changes to the landscape as a whole and is not solely focused on a company's own supply chain. This helps with development of an understanding of the scope and locations of such projects, as well as their potential and actual impact. WWF encourages reporting for all current projects with which a company is involved. Examples include collection programs such as municipal incentive programs or reverse vending machines, education and outreach campaigns, infrastructure development, investment through third parties (e.g., Closed Loop Fund), R&D, collaboration with entrepreneurs, or place-based programs. Beyond Supply Chain data will not be integrated with quantitative data collected by the Company Plastic Survey. However, this information can be paired with quantitative information about plastic waste management within a company's portfolio to employ a systems thinking approach and inform mitigation strategies.

The first version of the Beyond Supply Chain Survey is an Excel-based survey developed by ERG (Eastern Research Group, Inc.), with review and input from World Wildlife Fund, key thought partners, and member companies in fall 2019. The Beyond Supply Chain survey was not included in the 2019 Tracker pilot, but is being refined and updated for 2020 implementation. WWF and member companies will continue improving data collection and alignment with applicable third-party initiatives for the Beyond Supply Chain Survey as relevant in upcoming reporting cycles.



Tracker Analysis & Interpretation

The ReSource Footprint Tracker results produce an overview of plastic packaging for a company's global operations, highlight areas where further information is needed, and identify potential collaboration opportunities for data gathering, responsible sourcing, plastic recycling and composting, product design and business model innovation, and infrastructure improvements.

These results are framed against *ReSource: Plastic's* three goals of: eliminating unnecessary plastic; switching to sustainable inputs for the remaining plastic; and doubling global recycling and composting of plastic. Based on the results of the portfolio and waste management analysis, several outputs emerge, including the identification of highly used plastic products (both by polymer type and form) and priority countries with high landfill and/or high mismanagement tonnages.

Any analysis of the Tracker results should account for data assumptions and limitations, as outlined in previous sections. In this current iteration of the methodology, the Tracker results primarily reflect

- the portfolio of member companies in terms of polymer sourcing and forms of plastic sold (where did the plastic come from, what kind of plastic is it, and what is it used for?)
- the estimated waste management practices in countries of sale (where the plastic is sold, how it is managed once it is used)

Because the Waste Management Model results are heavily influenced by the specific forms in a company's portfolio and the countries they operate in, which will vary significantly from company to company and across industries, it is difficult to benchmark or compare companies across industries. For example, PET bottles generally have higher recycling rates than most other plastic forms, so one would expect the waste management outcomes for the beverage sector to differ from, for example, the restaurant sector. Similarly, a company that only operates in Europe or North America would be expected to have different waste management outcomes than a company in the same sector that operates in regions with higher rates of mismanagement.

The results should currently **not** be used as the sole basis for decisions regarding investment, operations, or product design, but can help inform a company's wider thinking on overall strategy, as well as priority areas for further investigation. It is also important to acknowledge that while the results help identify global hotspots for mismanagement and landfilling of plastics, due to the limitations of waste management data globally, these estimates involve several layers of assumptions, and in some cases, data which is several years old. Therefore, additional data collection in "high mismanagement" risk countries must be done as a part of mitigation efforts.

In order to achieve a vision of No Plastics in Nature, reporting on plastic use and management must become the norm for companies and governments. Building meaningful strategies to reduce plastic pollution requires an understanding of how much is produced and sold, in what format, and how it is managed afterward. Increased reporting of plastic portfolios through a standardized methodology, which the ReSource Footprint Tracker aims to achieve, will bolster transparency.

But critical gaps in national-level data from governments continue to impede this ambitious effort. Simply put, we can't manage what we can't measure. Improvements in waste management data at country, state, and city levels will enable us to understand the greatest opportunities for intervention. In India, for example, urban waste recycling has the potential to decrease landfill waste by 70%.³¹ Understanding the informal sector's contribution to the recycling process can inform more impactful

interventions, and help ensure collaborations are inclusive and responsive to their needs. If companies, governments, and other stakeholder groups continue to advocate for and implement action on these areas, the Tracker will reflect more representative and accurate data of plastic use and management, enabling more robust analysis that supports broader conclusions. Most importantly, improvements in data quality will support more meaningful and targeted mitigation actions.



Looking Ahead

As part of the effort to strengthen transparency into corporate action on plastic, *ReSource: Plastic* releases an annual public report on indivdual and aggregate member plastic footprints. It includes an analysis of Tracker results and targeted recommendations for corporate action in the year ahead. As part of this process, all companies complete a baseline footprint assessment in year one of membership, and report on progress against this baseline in subsequent years.

The ReSource Footprint Tracker methodology will undergo updates and improvements based on learnings from the pilot year. In upcoming reporting years, WWF will work with ReSource members to standardize (and where relevant, expand) the scope of operations that companies report on, ensure consistency in data gathering processes and methods for inputting or extrapolating to fill data gaps, and apply best practices identified in this report. Part of the expanded reporting scope will include distinguishing between internally managed plastic waste and consumer-facing packaging. As companies are able to expand their scope of analysis, both in terms of coverage of operations and packaging, we will make the necessary normalization changes to more accurately track progress from year to year, or update the baseline with the modified scope of operations.

In spring 2021, WWF will launch a web-based version of the ReSource Footprint Tracker to enable real-time user access and analysis. For Waste Management Model maintenance, WWF will update the database as new information on plastic waste management becomes available. The priorities will be improving data confidence for all plastics (Tier 3) and rigids/flexibles (Tier 4) estimates globally, particularly in regions that currently rely on assumptions and proxy data, and better coverage of form- and polymer-specific data (Tiers 5 and 6), particularly in regions that have high volumes for *ReSource* members and high estimated mismanaged volumes. A longer-term goal is to integrate global trade flows of plastic waste into the model.

We are also working to align with and/or integrate related corporate reporting efforts, including the Plastic Leak Project, the US Plastics Pact, and the New Plastics Economy Global Commitment, among others.

Reporting on plastic use and pollution is a dynamic space, with many different stakeholders working to define improvements in data, consistency in reporting, and measurement protocols for Beyond Supply Chain mitigation activities. We also hope to engage new industries through *ReSource*, which may necessitate additional methodology changes that we can't anticipate at this time. We will review this methodology annually to ensure it reflects the best available data and will provide an annual methodology update to ensure that the approach is transparent.



Appendix

Glossary

Advanced Materials

Advanced products are those that are sustainably produced, mitigate climate change, and reduce the risk of fossil depletion. This term typically captures future materials innovations that are currently in the design stage or at a very small scale. We align with the Roundtable for Sustainable Biomaterials' Advanced Products Standard.

Bottle

A bottle is a form of rigid packaging having a comparatively narrow neck or mouth with a closure and usually no handle.

Source: ISO 21067: 2007

Closure

Closures include caps and closures that would be left on containers going to recycling. Caps/closures that would be disposed separately from the primary container would fall under small plastics (problematic to recycle as separate components due to size).

Compostable

Packaging or a packaging component is compostable if it is in compliance with relevant international compostability standards and if its successful post-consumer collection, (sorting), and composting are proven to work in practice and at scale.

Source: New Plastics Economy Global Plastics Commitment

Durable Product

Durable goods are products with a life span of three years or more. Source: US Environmental Protection Agency

Mismanaged Waste

We follow the definition of mismanaged waste outlined by Jambeck et al.: "Material that is either littered or inadequately disposed." Mismanaged waste typically includes unspecified landfills and open dumps, waste that is not collected, and waste that is littered. Thus, this value is not how much plastic enters the ocean, but rather a potential volume that is not adequately managed, which has the potential to enter ecosystems.

Mono-material Film

Mono-material film is a flexible material containing only one polymer and no non-plastic materials and which is not multilayered. It includes mono-material stretch and shrink films and mono-material film bags and sacks that are suited for recycling.

Shrink Film

Shrink film is a plastic material that shrinks in size when heated to conform to the item(s) packaged. Source: ISO 21067: 2016.

Stretch Wrap

Stretch wrap is a material that elongates when applied under tension and which, through elastic recovery, conforms to item(s) packaged. Source: ISO 21067:2016.

Other Flexible

Other flexible includes multi-material/laminate films.

Other Rigid

The "other rigid" category is used to capture rigids that are not classified as bottles, closures, foamed rigids, or small plastics.

Recyclable

Packaging or a packaging component is recyclable if its successful post-consumer collection, sorting, and recycling are proven to work in practice and at scale. A package is considered recyclable if its main packaging components, together representing greater than 95% of the entire packaging weight, are recyclable according to this definition, and if the remaining minor components are compatible with the recycling process and do not hinder the recyclability of the main components. Source: New Plastics Economy Global Plastics Commitment

Recycled Content

Recycled content is post-consumer recycled content and does not include pre-consumer recycled content.

- Post-consumer recycled content is defined as the proportion, by mass, of post-consumer recycled material in a product or packaging.
- Pre-consumer recycled content is defined as material diverted from the waste stream during a manufacturing process.

Source: ISO 14021:2016

Responsibly Sourced Biobased Content

Responsibly sourced biobased content is, at a minimum

- 1. legally sourced
- 2. derived from renewable biomass and must pose no adverse impacts on food security
- 3. does not have negative impact on land conversion, deforestation, or critical ecosystems
- 4. must provide environmental benefits

Credible certifications such as the Roundtable on Sustainable Biomaterials certification can help ensure responsible sourcing. Together, we consider responsibly sourced biobased content and post-consumer recycled content as constituting sustainable plastic inputs. Source: Bioplastics Feedstock Alliance (https://bioplasticfeedstockalliance.org/)

Rigid Foam

Forms under the "rigid foam" category include rigid products made from foamed polymers, typically polystyrene (PS).

Small Plastics

Small plastics are items smaller than 2 inches in two dimensions that require testing to determine the appropriate APR recyclability category.

Source: The Association of Plastic Recyclers (https://plasticsrecycling.org/images/pdf/design-guide/Full_APR_Design_Guide. pdf)

Sustainable Plastic Inputs

Sustainable plastic inputs as referred to throughout this report include recycled content, responsibly sourced biobased content, and advanced materials.

Unnecessary Plastic

Unnecessary plastic is plastic that, if not used, would not create adverse environmental or social trade-offs—related to, for example, energy use, food waste, or quality of life.

Polymer Classification	
List of Polymers for Single-Use Plastics	Abbreviation
Acrylonitrile-butadiene-styrene copolymer	ABS
Ethylene vinyl alcohol	EVOH
High-density polyethylene	HDPE
Low-density polyethylene	LDPE
Linear low-density polyethylene	LLDPE
Nylon	Nylon
Other (please specify in description)	Other
Polybutylene adipate terephthalate	PBAT
Polybutylene succinate	PBS
Polybutylene succinate adipate	PBSA
Polycarbonate	PC
Polyethylene furanoate	PEF
Polyethylene terephthalate	PET
Polyethylene terephthalate glycol	PETG
Polyhydroxyalkanoate	РНА
Polylactic acid	PLA
Polypropylene	PP
Polystyrene	PS
Polyvinyl chloride	PVC
Polyvinyl alcohol	PVOH

End Notes

- 1 "The APR Design[®] Guide for Plastics Recyclability." The Association of Plastic Recyclers, 2018. https:// plasticsrecycling.org/images/pdf/design-guide/ Full_APR_Design_Guide.pdf.
- 2 "Farm Security and Rural Investment Act of 2002." Public Law 107-171, 107th Congress, May 12, 2002. https://www.govinfo.gov/content/pkg/PLAW-107publ171/pdf/PLAW-107publ171.pdf.
- 3 "Multi-Material Flexible Packaging Recovery Collaborative." Sustainable Packaging Coalition, Sustainable Packaging Coalition. https:// collaboratives.sustainablepackaging.org/multimaterial-flexible-packaging-recovery.
- 4 "Recycling of laminated packaging." WRAP, September 2011. https://www.wrap.org.uk/sites/ files/wrap/Recycling%20of%20laminated%20 packaging.pdf.

- 5 "Responsible Bioplastics: Sustainable Sourcing and the Circular Economy." Bioplastic Feedstock Alliance, November 1, 2015. https:// bioplasticfeedstockalliance.org/bioplastics/BFA_ Responsible_Bioplastics.pdf.
- 6 "The New Plastics Economy: Rethinking the Future of Plastics." World Economic Forum, Ellen MacArthur Foundation, and McKinsey & Company, January 2016. https://newplasticseconomy.org/publications/ report-2016.
- 7 Ibid.
- 8 Ibid.
- 9 US Environmental Protection Agency. "Recycling Basics." https://www.epa.gov/recycle/recyclingbasics
- 10 Kaza, S., L. Yao, P. Bhada-Tata, and D. Van Woerden. "What a Waste 2.0: A Global Snapshot of Solid Waste Management to 2050." World Bank (2018).
- 11 Ibid.
- 12 Jambeck, J. R., R. Geyer, C. Wilcox, T. R. Siegler, M. Perryman, A. Andrady, R. Narayan, and K. L. Law. "Plastic Waste Inputs from Land into the Ocean." *Science* 347, no. 6223 (February 13, 2015): 768–71. https://doi.org/10.1126/science.1260352.
- 13 Recycling includes both mechanical and chemical recycling; landfill refers to sanitary landfills; incineration includes incineration both with and without energy recovery; and mismanagement includes waste that is littered or inadequately disposed, including in open dumps and uncontrolled landfills (following the definition in Jambeck et al., 2015).
- 14 Jambeck, J. R., R. Geyer, C. Wilcox, T. R. Siegler, M. Perryman, A. Andrady, R. Narayan, and K. L. Law. "Plastic Waste Inputs from Land into the Ocean." *Science* 347, no. 6223 (February 13, 2015): 768–71. https://doi.org/10.1126/science.1260352.
- 15 Kaza, S., L. Yao, P. Bhada-Tata, and D. Van Woerden. "What a Waste 2.0: A Global Snapshot of Solid Waste Management to 2050." World Bank (2018).
- 16 Jambeck, J. R., R. Geyer, C. Wilcox, T. R. Siegler, M. Perryman, A. Andrady, R. Narayan, and K. L. Law. "Plastic Waste Inputs from Land into the Ocean." *Science* 347, no. 6223 (February 13, 2015): 768–71. https://doi.org/10.1126/science.1260352.
- 17 Lebreton, L. and A. Andrady. "Future scenarios of global plastic waste generation and disposal." *Palgrave Communications* 5, no. 6 (2019). https://doi. org/10.1057/s41599-018-0212-7.

- 18 "Tackling plastic pollution: A pioneering methodology to measure plastic leakage and identify its pathways into the environment." Quantis and EA, March 2020. https://quantis-intl.com/report/the-plastic-leakproject-guidelines/.
- 19 Jambeck, J. R., R. Geyer, C. Wilcox, T. R. Siegler, M. Perryman, A. Andrady, R. Narayan, and K. L. Law. "Plastic Waste Inputs from Land into the Ocean." *Science* 347, no. 6223 (February 13, 2015): 768–71. https://doi.org/10.1126/science.1260352.
- 20 Kaza, S., L. Yao, P. Bhada-Tata, and D. Van Woerden. "What a Waste 2.0: A Global Snapshot of Solid Waste Management to 2050." World Bank (2018).
- 21 "PlasticFlow 2025—Plastic Packaging Flow Data Report." Waste and Resource Action Programme, October 12, 2018. https://www.wrap.org.uk/ content/plasticflow-2025-plastic-packaging-flowdata-report.
- 22 "Blueprint for plastics packaging waste: Quality sorting & recycling. Deloitte Sustainability and Plastic Recyclers Europe Final Report, 2014. https://www2. deloitte.com/content/dam/Deloitte/my/ Documents/risk/my-risk-blueprint-plasticspackaging-waste-2017.pdf.
- 23 Jambeck, J. R., R. Geyer, C. Wilcox, T. R. Siegler, M. Perryman, A. Andrady, R. Narayan, and K. L. Law. "Plastic Waste Inputs from Land into the Ocean." Science 347, no. 6223 (February 13, 2015): 768–71. https://doi.org/10.1126/science.1260352.
- 24 Kaza, S., L. Yao, P. Bhada-Tata, and D. Van Woerden. "What a Waste 2.0: A Global Snapshot of Solid Waste Management to 2050." World Bank (2018).
- 25 Jambeck, J. R., R. Geyer, C. Wilcox, T. R. Siegler, M. Perryman, A. Andrady, R. Narayan, and K. L. Law. "Plastic Waste Inputs from Land into the Ocean." Science 347, no. 6223 (February 13, 2015): 768–71. https://doi.org/10.1126/science.1260352.
- 26 Lebreton, L. and A. Andrady. "Future scenarios of global plastic waste generation and disposal." *Palgrave Communications* 5, no. 6 (2019). https://doi. org/10.1057/s41599-018-0212-7.
- 27 "Tackling plastic pollution: A pioneering methodology to measure plastic leakage and identify its pathways into the environment." Quantis and EA, March 2020. https://quantis-intl.com/report/the-plastic-leakproject-guidelines/.
- 28 Kaza, S., L. Yao, P. Bhada-Tata, and D. Van Woerden. "What a Waste 2.0: A Global Snapshot of Solid Waste Management to 2050." World Bank (2018).
- 29 Ibid.

- 30 Jambeck, J. R., R. Geyer, C. Wilcox, T. R. Siegler, M. Perryman, A. Andrady, R. Narayan, and K. L. Law. "Plastic Waste Inputs from Land into the Ocean." Science 347, no. 6223 (February 13, 2015): 768–71. https://doi.org/10.1126/science.1260352.
- 31 Hande, S. "The Informal Waste Sector: A Solution to the Recycling Problem in Developing Countries." Field Action Science Reports, Special Issue 10: Reinventing Plastics (2019): 28-35. https://journals.openedition. org/factsreports/5143.

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