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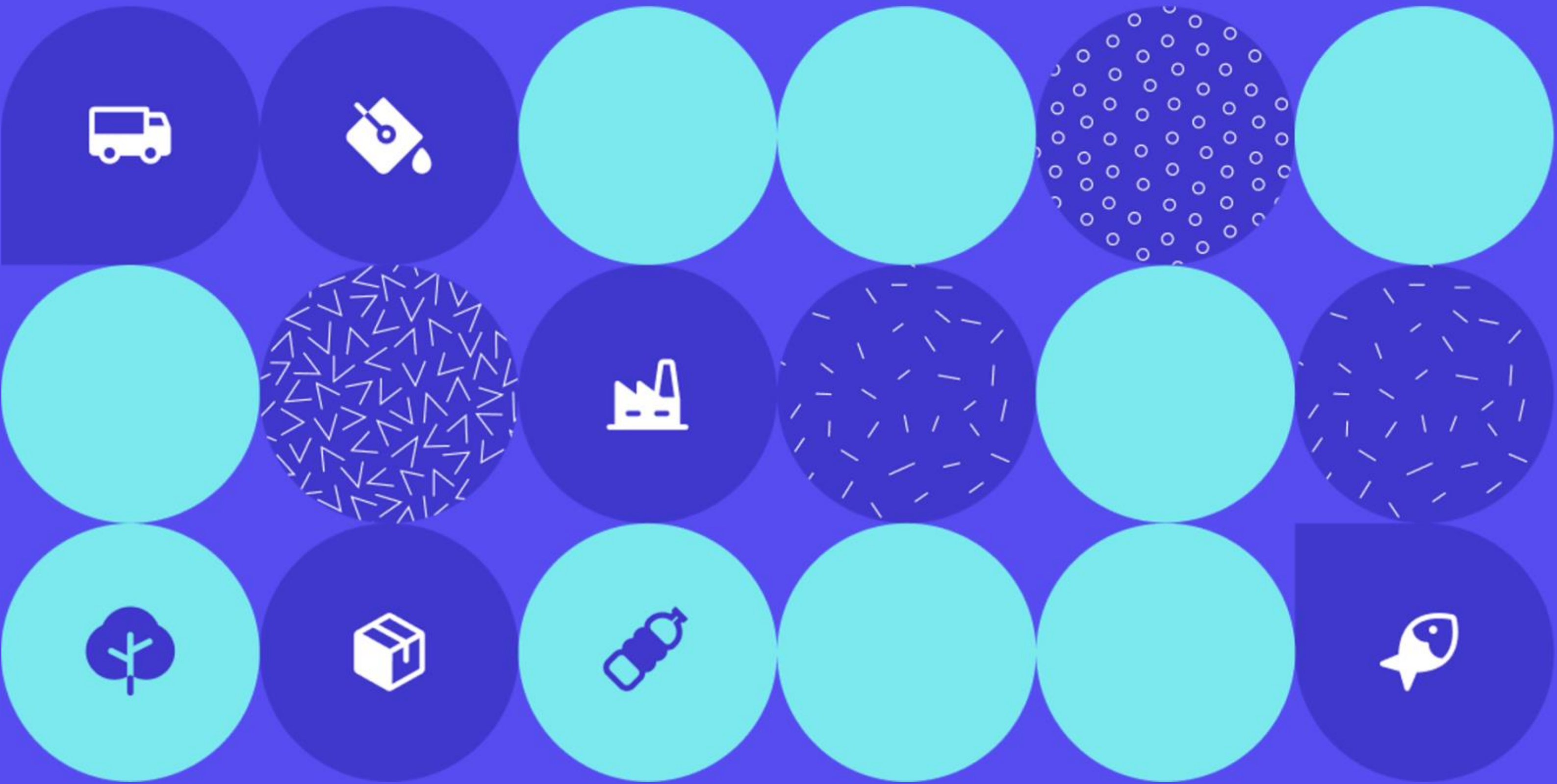
Guidance on plastic footprinting

An introduction to the Plastic Footprint Network (PFN) methodology for practitioners

April 2025



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Foreword - Earth Action

Plastic pollution is one of the most visible and complex environmental challenges of our time–yet until recently, the tools to understand and act on it were fragmented and inconsistent. Companies have long lacked the clarity and confidence to measure their plastic impacts, let alone reduce them in a credible and science-based way.

That's why we created the Plastic Footprint Network (PFN).

Since its launch in 2022, PFN has worked to close a critical gap: building a science-based, harmonized framework for plastic accountability–much like the GHG Protocol did for climate. By uniting scientists, companies, NGOs, and disclosure experts, PFN helps develop methodologies that are rigorous, practical, and aligned with global goals like the UN Treaty on Plastic Pollution.

This guidance document consolidates the foundations of plastic footprinting into a shared framework. It equips organizations to assess their plastic use, identify risks and opportunities, and take meaningful, data-driven action. As part of this broader effort, PFN has also developed the Plastic Pollution Mitigation Action Framework (PAF)–a companion resource designed to help companies classify and account for mitigation efforts across their value chain.

We recognize that the journey doesn't stop here. One of the next frontiers is the development of science-aligned target setting–a challenge PFN will continue to explore with its partners. Likewise, our work is supported by tools like Plasteax, a country- and polymer-level plastic leakage database, which provides the granular data needed to make footprinting more locally relevant and actionable.

This work would not be possible without the PFN community: a growing coalition of organizations that believe in collaboration over competition, in science over spin, and in the power of transparency to drive change. We are especially grateful to the experts who contribute their time and insight to review and strengthen our methodologies through the PFN's Scientific and Technical Committees.

At Earth Action, we are proud to host and support PFN. But this is a collective effort–and a shared opportunity. Whether you are using this document to begin your plastic footprint journey, refine your existing approach, or align with emerging policy frameworks, we hope it helps move your work–and the world–forward.

If you'd like to get involved or contribute to this work, we'd love to hear from you: contact@plasticfootprint.earth

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Foreword - mariLCA

In recent years, mariLCA has played a critical role in refining impact assessment models for plastics, ensuring they account for the long-term persistence and transformation of plastics in the environment. This research has helped shape regionalized fate modeling approaches, allowing for more precise estimations of plastic pollution impacts across different ecosystems. By integrating exposure pathways and ecotoxicity considerations, mariLCA contributes to a more comprehensive understanding of how plastic pollution interacts with ecosystems, biodiversity, and human health. Additionally, mariLCA has contributed to the development of plastic-specific characterization factors – an essential step in making plastic footprinting methodologies more applicable across industries, regulatory frameworks, and scientific assessments.

As a scientific partner within the Plastic Footprint Network (PFN), mariLCA ensures that the methodology remains at the cutting edge of environmental impact modeling. Our ongoing work focuses on harmonizing plastic footprint metrics with established LCA frameworks, integrating toxicity and persistence factors, and improving predictive models for micro- and macroplastic pollution. These advancements ensure that the PFN's methodologies remain scientifically robust, relevant and above-all, actionable.

The PFN framework serves both the private sector and public policymakers. For businesses, it provides a standardized approach to measuring and disclosing plastic footprints, supporting regulatory compliance, corporate sustainability reporting, and science-based target setting. For governments and regulators, it offers a data-driven foundation for policy and strategy development as well as extended producer responsibility (EPR) schemes.

This guidance document, developed by EA Earth Action with inputs from the mariLCA team, provides a structured overview of the PFN rationale and methodology, including key concepts such as plastic loss, release, and leakage, and approaches for assessing macro- and microplastic pollution. We extend our gratitude to EA for establishing and administering the PFN. Together, we are committed to ensuring that this methodology remains a valuable tool for businesses, policymakers, and researchers working toward plastic pollution mitigation.

Anne-Marie Boulay, PhD

Professor at Polytechnique Montreal and General Director of
the International Research Consortium of Life Cycle
Assessment and Sustainable Transition of the CIRAIG

1 Introduction to plastic footprinting

1.1 Why measure the impact of plastics?

"Our planet is drowning in plastic litter and microplastics. Plastic waste is now so ubiquitous in the natural environment that scientists have suggested it could serve as a geological indicator of the Anthropocene era. Plastic and microplastic pollution is found in all ecosystems, from ocean and coast to mountains, cities and rural areas. Evidence of plastic pollution has been found even in the most remote places, including Mount Everest, the Mariana Trench and the Arctic […]" (Geneva Environment Network 2024).

Aside from the well documented impact on marine and terrestrial species (see e.g. Steer & Thompson 2020; Bucci *et al.* 2020; and Zhang *et al.* 2022*)*, recent studies have detected microplastics in various human tissues, leading to oxidative stress, inflammation, and potential disruptions to the endocrine and immune systems (see e.g. Schwabl *et al.* 2024; Marfella *et al.* 2024; Enyoh *et al.* 2023; and Leslie *et al.* 2022). Evidence shows that plastics are even exacerbating other global environmental crises, and urgent action is needed to address plastics pollution as a global governance priority, integrating it into climate, biodiversity, and resource-use policies (Villarrubia-Gómez *et al.* 2024).

Given these alarming findings, plastic is clearly a major challenge of our time. Global plastic waste emissions are estimated at over 52 million metric tonnes per year, with over half of this material ending up burned or disposed of without any environmental controls in place (Cottom *et al.* 2024). Estimating plastic leakage into the environment is thus an important process, enabling a range of stakeholders to:

- Determine the quantity, types, and sources of plastic pollution;
- Develop baseline and ongoing data on pollution levels;
- Pinpoint the main contributors/root causes;
- Track the impact of plastics over time and assess affected areas;
- Inform evidence-based policies and solutions;
- Communicate the problem in more tangible terms; and
- Make comparisons and foster cooperation across regions, countries, sectors and value chains.

The Plastic Footprint Network (hereafter PFN) is built upon the recognition that both public and private actors need to be empowered to address the plastic pollution crisis through high quality data and rigorous analysis. More specifically, the PFN's plastic footprint methodology aims to address the need for standardization and harmonization of methodologies and frameworks for assessing, measuring, reporting and mitigating the release (or "leakage") of plastics into both aquatic and terrestrial ecosystems.

1.2 What is a footprint?

A footprint is an assessment of the environmental and/or human health effects associated with a product, service, activity, or entire company throughout its life cycle. The footprinting process includes data collection on material and energy flows, compilation of an inventory of associated emissions, and characterization of their impact on specific areas of concern – i.e. environmental topics of societal interest, such as climate change, resource depletion, or human toxicity. This way, footprints provide a standardized, unified measure enabling to evaluate a diverse set of activities, going far beyond simple metrics of material consumption or waste generation. This is why, although it is related, the notion of *circularity* – which focuses on material recovery and resource efficiency – is not a direct parameter in a footprint analysis. Footprints do however provide reliable and verifiable data, enabling businesses to improve sustainability efforts, set science-based reduction targets, and help consumers make more informed choices (European Commission 2024; Boucher *et al.* 2019).

1.3 What is a plastic footprint?

Footprint analysis provides a framework for assessing various environmental and societal impacts associated with specific activities, products, or materials. In the case of plastics, footprint methodologies can encompass multiple Areas of Protection (AoPs), such as climate change impacts, human health risks, depletion of primary resources, and effects on ecosystem quality (ISO 2006a).

A conventional environmental Life Cycle Assessment (LCA) of plastics evaluates impacts across all AoPs by analyzing resource use, emissions, and potential environmental burdens throughout the entire life cycle–from raw material extraction and production to end-of-life treatment (ISO 2006b). However, standard LCA methodologies primarily rely on mass balance approaches and fate modeling within managed systems (e.g., industrial processes, waste management, energy recovery). This means they focus on plastic flows within the economy but do not comprehensively account for *plastic leakage* – the fraction of plastic waste that escapes managed waste streams and enters terrestrial and aquatic ecosystems (Boucher and Friot 2017).

Given the predicted exponential increase in plastic waste generation, with current mitigation efforts failing to keep pace (Borrelle *et al.* 2020), traditional LCA approaches may also underestimate the long-term environmental burden of plastics. While LCA effectively assesses environmental trade-offs within industrial systems, it lacks the ability to track and quantify how plastics persist in and impact the natural environment.

This gap in assessment highlights the need for plastic footprint methodologies which explicitly integrate plastic leakage and long-term environmental fate into impact assessments (Boucher *et al. 2019*). To address this, the PFN's plastic footprint methodology integrates Material Flow Analysis (MFA) and Environmental Fate Modelling to assess how plastic waste escapes into the natural environment and persists over time.

The MFA is a method used to track the movement of materials through different stages of their life cycle, from production to disposal. It quantifies how much plastic enters the system, how it is used, where it accumulates, and how it exits – whether through recycling, incineration, landfill, or leakage into nature (ISO 2006a). In the context of plastics, MFA helps identify critical leakage points, such as mismanaged waste, illegal dumping, and losses from industries like fisheries, textiles, and packaging (Boucher and Friot 2017). For example, an MFA might reveal that a certain percentage of plastic used in single-use packaging is not effectively collected by waste management systems, leading to direct leakage into rivers and oceans - warranting improved collection systems or alternative material choices (Ellen MacArthur Foundation 2016).

In turn, Environmental Fate Modelling predicts what happens to plastic once it enters the natural environment. Fate modelling simulates how plastics disperse/move through air, water, and soil, considering also which ecosystems are most affected (Boucher and Friot 2017; Borrelle *et al.* 2020).

By integrating MFA and Environmental Fate Modeling, the PFN's plastic footprint methodology provides a more realistic and complete picture of plastic pollution than conventional LCA-based footprint assessments. This means that the PFN methodology looks at not just the production and disposal of plastic, but also at its long-term environmental consequences, enabling to get a more realistic picture of global plastic pollution and to design more effective interventions (PFN 2023).

1.4 How does the plastic footprint compare to other footprints?

Environmental footprints can be specific to a particular area of concern, such as climate change (i.e., carbon footprint) or water consumption and pollution (i.e., water footprint). Alternatively, a Life Cycle Assessment (LCA) provides a comprehensive environmental footprint, covering all potential environmental impacts (ISO 2006a). Given the increasing importance of plastic pollution, it is essential to understand how the Plastic Footprint Network (PFN) methodology compares to other widely used footprinting approaches.

A **carbon footprint** quantifies the total greenhouse gas (GHG) emissions associated with an entity (e.g., a company, product, or activity), typically expressed in tonnes of CO_2-equivalent (tCO_2e) (IPCC 2021). Unlike plastic pollution, which has localized and ecosystem-specific impacts, GHG emissions contribute to global climate change by accumulating in the atmosphere, trapping heat, and driving global warming (UNFCCC 2024).

Carbon footprints can be classified across three scopes as defined by the Greenhouse Gas Protocol (GHG Protocol 2016):

- Scope 1: Direct emissions from owned or controlled sources (e.g., fuel combustion in company vehicles).
- Scope 2: Indirect emissions from purchased electricity, steam, or heat.
- Scope 3: Indirect emissions across the entire supply chain, including raw material extraction, transportation, and product end-of-life.

Many organizations use carbon footprinting to set climate targets and assess progress towards the Paris Agreement goal of limiting global warming to 1.5°C above pre-industrial levels (UNFCCC 2024). Additionally, the concept of "net zero" has emerged as a key goal, meaning that any remaining emissions are offset by natural or technological carbon sinks–such as forests, oceans, and carbon capture technologies (UN 2024).

Although both footprints assess human-driven environmental impacts, carbon footprinting primarily addresses atmospheric pollution and climate change, whereas the plastic footprint focuses on direct material leakage into the biosphere. Unlike GHGs, which behave as a global pollutant, plastics accumulate in specific terrestrial and aquatic environments, leading to distinct ecological and health concerns (Borrelle *et al.* 2020).

On the other hand, a **water footprint** measures the total volume of freshwater consumed, polluted, or evaporated due to human activities, typically expressed in cubic meters (m^3) per unit of production (Hoekstra *et al.* 2011). It accounts for both direct and indirect water use, helping to quantify water stress and scarcity risks.

Unlike carbon and plastic footprints, which assess global warming and physical material leakage, respectively, the water footprint is closely linked to geographical variability–since water availability varies significantly across regions (Mekonnen and Hoekstra 2016). Water footprinting is typically broken down into the following components:

1. Blue Water Footprint: The amount of surface and groundwater consumed (e.g., irrigation, industrial use);
2. Green Water Footprint: The volume of rainwater used for crop growth;
3. Grey Water Footprint: The amount of freshwater needed to dilute pollutants to meet water quality standards; and
4. The Water Scarcity Index (WSI)

Aspect	Carbon footprint	Water footprint	Plastic footprint
Main environmental concern	Climate change (GHG emissions)	Water use & scarcity	Plastic leakage & pollution
Unit of measurement	TCO_2e (tonnes of CO_2-equivalent)	m^3 (cubic meters of water)	t (tonnes) or kg of plastic lost
Scope of impact	Global (GHGs mix in the atmosphere)	Regional (depends on local water availability)	Localized (plastic persists in specific ecosystems)
Key calculation parameters	Energy use, fuel consumption, industrial processes	Direct and indirect water consumption, water scarcity index	Plastic waste production, recycling rate, mismanaged waste, fate modeling
Application in policy & business	Net-zero targets, emission reduction strategies	Water conservation, risk management in water-stressed regions	Waste management, plastic reduction strategies
Fate in the Environment	GHGs accumulate in the atmosphere, contributing to climate change	Water is used, evaporated, or polluted, but remains part of the hydrological cycle	Plastic persists for decades, breaking into microplastics and affecting ecosystems
Complexity of calculation	Moderate – standardized emission factors available	High – water scarcity index varies by region	Highest – requires material flow analysis (MFA) and environmental fate modeling
Example calculation output	Company consumes 10,000 kWh, emits 4 tCO_2e	Factory consumes 5,000 m^3 of freshwater	500 tonnes of plastic leak into the environment

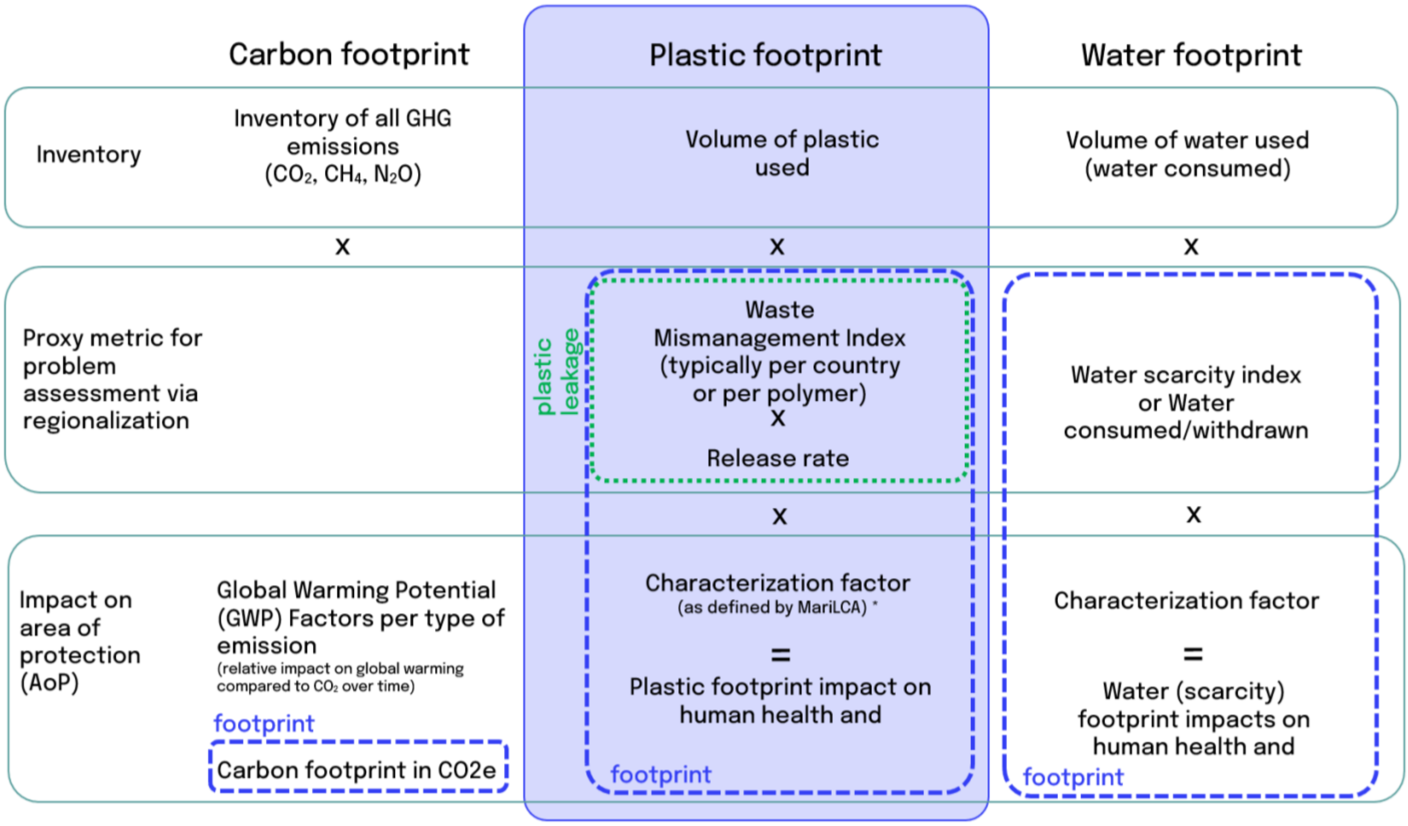
Table 1: Comparison of key aspects of commonly used environmental footprints.

A water footprint alone does not indicate whether water use is sustainable. To account for regional water stress, a Water Scarcity Index (WSI) is often applied, which measures the availability of freshwater relative to human consumption in a specific area (Pfister *et al.* 2009). The WSI provides a context-sensitive assessment, distinguishing between regions with ample water resources and areas where even minimal water use may contribute to severe water scarcity.

For example, a product manufactured in a water-scarce region (e.g., Middle East, parts of India) may have a higher water footprint impact than the same product made in a water-abundant region (e.g., Canada, Scandinavia) (Mekonnen and Hoekstra 2016).

In this way, WSI-adjusted water footprinting helps companies and policymakers to prioritize water conservation efforts where they are needed most.

The key differences between the three footprint types are summarized in table 1 on the previous page, and in diagram 2 below.



	Carbon footprint	Plastic footprint	Water footprint
Inventory	Inventory of all GHG emissions (CO_2, CH_4, N_2O)	Volume of plastic used	Volume of water used (water consumed)
	x	x	x
Proxy metric for problem assessment via regionalization		Waste Mismanagement Index (typically per country or per polymer) x Release rate	Water scarcity index or Water consumed/withdrawn
		x	x
Impact on area of protection (AoP)	Global Warming Potential (GWP) Factors per type of emission (relative impact on global warming compared to CO_2 over time) footprint Carbon footprint in CO2e	Characterization factor (as defined by MariLCA) * = Plastic footprint impact on human health and footprint	Characterization factor = Water (scarcity) footprint impacts on human health and footprint

Diagram 2: Key metrics and calculation pathways of different environmental footprints (sourced from PFN module "Introduction to plastic footprinting").

Note: *MariLCA addresses a key gap in plastic footprinting by developing characterization factors (CFs) that quantify the environmental harm of plastic emissions based on size, polymer type, and fate. These CFs enable plastic footprint models to convert plastic leakage (kg) into marine ecosystem impact units, integrating biodiversity indicators like Potentially Disappeared Fraction of species per square meter per year (PDF·m^2·yr). This advancement allows for more actionable assessments, as well as policy and industry decisions.

1.5 How does the plastic footprint relate to circularity assessments?

Circularity assessments are an increasingly important tool in sustainability and environmental analysis. While they share some similarities with footprinting methodologies, they focus more on resource efficiency, material cycles, and waste reduction rather than direct environmental impacts.

A circularity assessment essentially measures the degree to which a system, product, or organization operates within a circular economy framework, meaning it minimizes waste, reduces reliance on primary (virgin) resources, and maximizes material reuse and recycling (Ellen MacArthur Foundation 2019).

Unlike carbon, water, or plastic footprints, which assess specific environmental burdens, circularity assessments evaluate how well a system keeps materials in use and reduces primary resource depletion. Several indicators are used to quantify circularity, including:

Material circularity indicator (MCI): Measures the percentage of materials that are reused, recycled, or recovered, rather than disposed of as waste (Ellen MacArthur Foundation, 2019).

Circular economy performance indicators (CEPI): Focus on resource efficiency, product longevity, and material recirculation (Potting *et al.*, 2017).

Primary resource intensity: Tracks the proportion of virgin vs. secondary (recycled) resources in a product or supply chain (ISO, 2021).

Circular transition indicators (CTI): (and more specifically the % material circularity indicator, developed by the WBCSD) measure a business's circularity by evaluating circular inflows (renewable/non-virgin content), recovery potential (materials recoverable at end-of-life), and actual recovery rates (materials effectively recovered).

Interestingly, a study by EA (Gallato *et al.* 2024) found that while circularity interventions can improve circularity scores, they do not necessarily reduce plastic pollution. Conversely, plastic reduction strategies can effectively decrease pollution but are not reflected in circularity metrics.

This disconnect suggests that focusing solely on circularity is insufficient to tackle plastic waste. A comprehensive plastic strategy must integrate both circularity measures and strong reduction targets while also addressing waste management infrastructure to ensure actual recovery.

It is suggested that to effectively curb plastic pollution, companies must adopt both upstream solutions (such as material reduction, design for reuse, and alternative materials) and downstream solutions (improved recycling systems, waste management infrastructure, and increased recovery rates). Without a dual focus on circularity, reduction, and both upstream and downstream interventions, plastic pollution will continue to rise despite improvements in circularity scores.

Although circularity assessments are not a traditional "footprint" (since they measure resource flows rather than direct environmental impacts), they can still play a crucial role in sustainability strategy development by addressing the root cause of environmental impacts – resource overuse and waste generation. For a complete sustainability strategy, organizations should therefore ideally track both footprint metrics and circularity indicators.

2 Using a plastic footprint

2.1 For whom is plastic footprinting relevant?

A wide range of actors can leverage science-based plastic footprinting to measure, manage, and mitigate their environmental impact. Some key stakeholder groups include:

Corporations and businesses:

Consumer goods companies (e.g., food, beverage, cosmetics, apparel and retail) can assess their plastic use and leakage across supply chains, identifying opportunities for reduction and circular solutions.

Packaging manufacturers can evaluate the environmental impact of both conventional and alternative packaging materials, enabling data-driven decisions for sustainability.

Sustainability-driven enterprises across all sectors can integrate plastic footprinting into their net-zero and circular economy strategies, ensuring credible, measurable progress.

Governments and policymakers:

National and regional governments can quantify plastic footprints to supplement environmental assessments, establish baselines for policy interventions, and track the effectiveness of plastic waste management strategies over time.

Policymakers can use footprint data to design evidence-based regulations, set realistic reduction targets, and align with global plastic treaties.

Producer responsibility organizations (PROs) that manage Extended Producer Responsibility (EPR) schemes:

By quantifying the footprint, PROs can identify high-impact formats that contribute most to waste and pollution, guiding efforts toward eco-friendly alternatives and improved waste management strategies.

Plastic footprint data can be used to penalize packaging formats with high environmental impacts (e.g., non-recyclable, multi-layer plastics), incentivize low-footprint, circular-friendly designs, and to establish “ecomodulation” fees for producers based on their packaging choices.

Non-governmental organizations (NGOs):

Environmental and social advocacy groups can utilize plastic footprint data to drive awareness campaigns, corporate engagement, and consumer behaviour change.

Policy advocacy organizations working on international agreements and standards can leverage footprint assessments to support negotiations and rationalize policy development with empirical evidence.

Academic and research institutions:

Universities and independent researchers can employ plastic footprinting methodologies in studies exploring the environmental, social, and economic impacts of plastic pollution.

Environmental, Social and Governance (ESG) consulting firms can integrate footprint assessments into sustainability advisory services, helping clients meet environmental targets and regulatory compliance.

Investors and financial institutions:

Sustainable investment funds, banks, and asset managers can use plastic footprint assessments to evaluate corporate environmental risks, inform ESG portfolios, and drive capital towards low-impact, circular economy solutions.

2.2 How is a plastic footprint used at corporate level?

A plastic footprint analysis is a valuable tool for organizations seeking to understand, manage, and mitigate the environmental impact of plastic use across their value chains. It can be used in several ways:

1. Identifying leakage hotspots in the value chain

A plastic footprint analysis enables companies to pinpoint:

- Which sectors, products, or plastic polymers contribute the most to environmental leakage.
- Where leakage occurs geographically, helping to identify high-risk countries, regions and/or market segments.
- Which stages of the product life cycle (such as production, distribution, or post-consumer waste) are responsible for the highest levels of plastic pollution.

By identifying these hotspots, businesses can prioritize interventions where they will have the most impact (Peano *et al.* 2020).

2. Establishing a baseline for mitigation strategies

Once hotspots are identified, a plastic footprint analysis provides a quantifiable baseline against which organizations can measure progress in reducing plastic waste and leakage. Subsequent strategies for mitigation may include:

- Eco-design and material substitution (designing products with recycled or biodegradable materials);
- Reducing single-use plastic consumption (phasing out unnecessary packaging and single-use items)
- Enhancing recycling and circularity (increasing the proportion of plastic that is reused or recycled at the end of its life); and
- Improving waste management infrastructure (ensuring plastic waste is collected and properly treated).

By continuously using the plastic footprint as a monitoring tool, companies can also assess the effectiveness of these initiatives and refine them as needed.

3. Supporting corporate disclosure and sustainability reporting

Plastic footprinting enhances corporate transparency and accountability, allowing organizations to report on their plastic use, waste management, and pollution reduction efforts. By systematically tracking and disclosing plastic-related data, organizations can foster credibility and trust among clients, partners and investors, while also driving industry-wide improvements in plastic management (Peano *et al.*, 2020).

Until recently, there has been no globally harmonized approach to measure plastic impact and mitigation. As of 2025 however, companies will be required to disclose their plastic-related risks, impacts, and mitigation efforts as part of a range of sustainability reporting frameworks, including:

- CDP (Carbon Disclosure Project) which has expanded its plastics-related disclosure requirements, thereby mandating companies to report on their plastic footprint and mitigation strategies. The PFN's Plastic Mitigation Accounting Framework (PAF) seeks to ensure that companies can quantify their plastic mitigation strategies/actions in alignment with CDP's expectations - covering plastic reduction, collection, and recycling efforts.
- CSRD (Corporate Sustainability Reporting Directive) is requiring

large companies in the EU to publish regular reports on how their activities impact people and the environment, including plastic material-related disclosures which are now part of their rigorous environmental/social/governance (ESG) reporting requirements;

- TNFD (Taskforce on Nature-related Financial Disclosures) highlights plastic pollution as a key environmental risk, reinforcing the importance of structured plastic footprint reporting; and
- PPWR (EU Packaging and Packaging Waste Regulation) introduces mandatory recyclability and reuse targets, requiring businesses to transparently quantify, report and mitigate their plastic footprint, thereby making plastic footprinting methodologies like PFN increasingly critical for corporate compliance.
- WBCSD’s Global Circularity Protocol, is a voluntary framework to guide companies in target-setting, measuring, reporting and disclosing progress on resource efficiency and circularity. It references the PFN reinforcing its role as a leading methodology for corporate plastic reporting.
- WWF's Blueprint for Credible Action on Plastic Pollution outlines how, in their journey towards circularity, companies can move from awareness and commitment to measurable progress backed by science-based recommendations. The Blueprint outlines (inter alia) that better plastic footprint calculations and global waste data harmonization ensure for easier collaboration with regulators and investors, while also enabling businesses to develop targeted plastic pollution mitigation actions.

4. Integration with other environmental metrics

The plastic footprint provides corporations with a quantifiable measure of their plastic use, waste, and environmental leakage. When integrated with Life Cycle Assessment (LCA) methodologies, it enables companies to compare plastic-related impacts with other key environmental metrics, such as carbon and water footprints, as well as resource depletion metrics to identify trade-offs, prioritize sustainability actions, and ensure a holistic approach to environmental impact reduction (Ridoutt *et al.* 2015).

2.3 Product- vs. company-level plastic footprints

A plastic footprint can be measured at the product level or the company level, each serving different reporting, target-setting, and mitigation needs. The key distinction lies in their functional units–the measurement basis for assessing plastic use and impact.

Product-level plastic footprint

A product-level plastic footprint quantifies plastic use, waste, and leakage associated with a single product or service. The functional unit is typically defined per unit of product (e.g., kg of plastic per bottle, per package, or per unit of service). This approach is commonly used for eco-design, product comparisons, and consumer sustainability reporting. Companies can use product-level footprinting to develop lighter packaging, incorporate recyclable materials, or to optimize design.

Company-level plastic footprint

A company-level plastic footprint assesses total plastic use, waste, and leakage across all operations and products. The functional unit is typically annual (e.g., tonnes of plastic used per year), making this approach essential for corporate sustainability reporting, supply chain management, and target setting.

Company-level footprinting enables organizations to track overall plastic use trends, compare performance across business units, and develop high-impact mitigation strategies–such as committing to circular economy principles, supplier engagement, and large-scale material substitution.

While product-level assessments drive design innovation and product sustainability, company-level footprints provide a holistic view of corporate plastic impact. Together, they help businesses set realistic reduction targets, ensuring also that reductions at the product level scale up to the corporate level for meaningful change.How to assess a plastic footprint?

3 How to assess a plastic footprint?

3.1 What metrics does the plastic footprint evaluate?

As previously mentioned, a plastic footprint is an assessment of the effect that plastic leakage associated with a product / company / activity / country has on ecological and human health, over its life cycle.

Accurately evaluating the environmental effect of plastics is an intricate endeavour due to its dependence on a multitude of variables. These are physical attributes like material size and properties, as well as chemical attributes such as polymer type, the presence of additives, and their toxicity. Considering this complexity, the PFN employs a proxy metric to represent potential environmental impact, otherwise known as a *leakage metric*. This metric measures the volume of plastic material that ultimately finds its way into the environment, including oceans, water bodies, soil, and terrestrial compartments, in the form of both macroplastics and microplastics.

The leakage metric is then combined with primary data on human and ecosystem health (typically expressed as Percentage Disappeared Fraction (PDF.sqm.yr) and Disability-Adjusted Life Years (DALYs), as well as the mismanaged waste index (MWI), enabling to compute the plastic footprint, as depicted in diagram 3 below.

A range of supplementary metrics may also be considered, including total plastic production, waste generation, and the proportion of waste that is mismanaged, among others.

Overall, the metrics that can feed into a plastic footprint calculation can be classified into 3 categories. First, a plastic footprint practitioner may choose to look at **inventory metrics**. These metrics essentially quantify the amount, type, and fate of plastic used within a system, product, organization, or sector. They typically include data

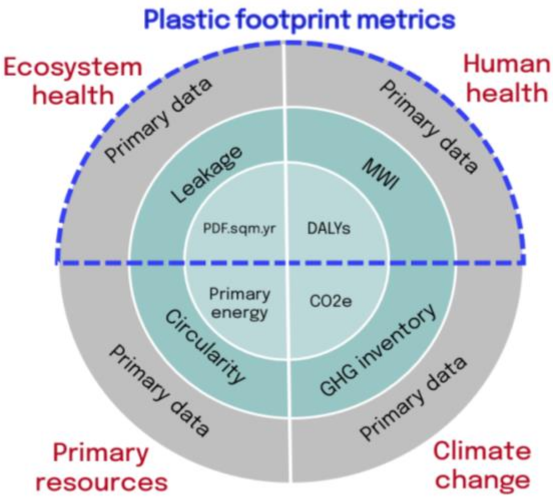


Diagram 3: Typical metrics included in a plastic footprint assessment (sourced from PFN module “Introduction to plastic footprinting”).

such as total plastic mass used (e.g., kg of different polymers), sources and supply chain details (e.g., virgin vs. recycled content), end-of-life fate (e.g., recycled, landfilled, incinerated, leaked into the environment) and geographical distribution (e.g., whether plastic leakage occurs in high- vs. low-risk environmentally sensitive areas). Inventory metrics are calculated using primary (raw) data on plastic usage, its flow, and lifecycle - typically collected through lab experiments, research, observations, surveys and others.

Inventory metrics (i.e. collected data) typically act as primary inputs for **impact metrics**. These quantify the environmental and social *consequences* of plastics, considering factors like plastic pollution potential (e.g., leakage into oceans, microplastic generation), biodiversity and ecosystem damage (e.g., ingestion by marine life, habitat disruption), carbon footprint (e.g., emissions from production, incineration of plastic) and human health concerns (from exposure to fragments or plastic-related chemicals).

Impact metrics, in turn, then inform **actionable metrics**. These are essentially decision-making tools that guide interventions. These metrics distil insights from impact assessments into practical steps that businesses, policymakers, or individuals can take to reduce their plastic footprint. These are often used for corporate sustainability strategies, policy-making, and circular economy initiatives. Examples of actionable metrics include plastic circularity rate (percentage of recycled content in products), plastic intensity per unit of revenue (kg of plastic per dollar of revenue), leakage risk assessment (probability of plastic ending up in nature), reduction targets (e.g., “Reduce virgin plastic use by 30% by 2030”), and substitution potential (evaluating alternative materials).

It must be mentioned that to truly encompass all aspects of plastic pollution, further areas of protection (i.e. impact on climate change and primary resource depletion) must also be assessed, using existing state of the art data, assumptions and methodologies. In other words, if an actor is to develop a truly effective sustainability strategy, she/he should assess not only plastic pollution, but also climate change impacts, primary resource usage, as well as effects on ecosystem quality and on human health, using the corresponding environmental impact assessment methodology.

Table 4 on the next page provides some examples of metrics that could be used in a plastic footprinting exercise, categorized under the four main Areas of Protection (AoPs) that are widely used in Life Cycle Impact Assessment (LCIA) frameworks.

The relationship between inventory, impact, and actionable metrics is typically hierarchical rather than independent, meaning that they often feed into each other rather than being standalone calculations. While there are cases where actionable decisions change inventory data, the usual flow is: Inventory → Impact → Actionable insights. The degree of dependency among metrics varies depending on the methodology and the data available.

3.2 Why focus on leakage?

Plastic leakage is defined as the plastic leaving the technosphere (i.e. the realm of technology or the part of the environment, which is made or modified by humans, including machines, factories, computers, buildings, energy & transport infrastructure etc.) to accumulate in the natural environment. The PFN views this metric as more useful than simply considering total quantities of plastic produced/consumed in a given focus area/region. This is because the core issue lies in the generation of waste, especially when mismanagement is prevalent. Keeping in mind that the ultimate objective of PFN's analyses is to minimize social/environmental impact, the leakage metric provides the necessary precision, gives a perspective on the relative magnitude of impacts in different areas of protection (AoPs) and consequently better informs subsequent strategies, policies and/or interventions.

Area of protection (AoP)	Inventory metrics (data collected)	Impact metrics (environmental & social harm)	Actionable metrics (intervention strategies)
Human health	Plastic waste generation (kg/year); Microplastic concentration in food/water; Exposure levels to plastic-related chemicals	DALYs (Disability-Adjusted Life Years) due to plastic-related diseases; Air pollution effects from plastic incineration; Endocrine disruption from plastic additives	Reduce plastic exposure by X% through safer alternatives; Improve waste worker conditions to lower health risks; Restrict hazardous plastic additives
Ecosystem quality	Total plastic leakage into ecosystems (kg/year); Land-use change due to plastic disposal; Habitat contamination by microplastics	PDF·m^2·yr (Potentially Disappeared Fraction of species per square meter per year) due to plastic pollution; Species mortality from entanglement and ingestion; Soil and water quality degradation from plastic accumulation	Reduce plastic leakage by X% to lower biodiversity loss; Implement Extended Producer Responsibility (EPR) for waste management; Increase plastic waste cleanup efforts
Primary resources	Virgin vs. recycled plastic use (kg/year); Fossil fuel consumption for plastic production; Water usage in plastic manufacturing	Resource depletion potential (kg of fossil resources lost) Water scarcity impact from plastic production Land occupation for plastic waste disposal	Increase recycled plastic content to X%; Shift to bio-based or alternative materials; Optimize resource efficiency in plastic production
Climate change	CO_2 emissions from plastic lifecycle (kg CO_2e/year); Energy use in plastic production and disposal; Transportation emissions for plastic distribution	Global Warming Potential (GWP in kg CO_2e); Carbon footprint of plastic incineration; Methane emissions from plastic degradation in landfills	Reduce plastic lifecycle CO_2 emissions by X%; Increase renewable energy use in plastic manufacturing; Improve circular economy strategies to minimize plastic waste

Table 4: Examples of metrics typically used in a plastic footprint analysis.

Table 5 below summarizes why leakage is considered as the most suitable proxy in a plastic footprint analysis, compared to other metrics. It is important to recognise that both leakage and impact analyses fundamentally rely on primary metrics (i.e. raw collected data) that are then processed using the best available assumptions/models to evaluate plastic mismanagement, its leakage into oceans, land and other compartments, and finally, its impacts on human and environmental health.

Metric	Pros	Cons	Focus or applicability		
Impact	Theoretically the best metric as different plastic types likely have different socio-environmental impacts. It is also compatible with life-cycle analysis (LCA) assessments. Allows to compare impacts from leakage with other sources of impacts (e.g. climate change).	Relies on impact modelling which is more uncertain and currently only includes impact of certain microplastics and only on marine ecosystems. This metric is likely to evolve in the future.	Life cycle analysis (LCA)	Leakage and mismanaged waste index (MWI) analysis	Reporting/disclosure & circularity analyses
Leakage	Allows to integrate both microplastic and macroplastic impacts into a single metric. The model exists for both aquatic and terrestrial environments.	May not reflect real impact (e.g. leakage from textiles is comparatively small in mass, but the release of microfibers potentially has a much larger impact on the environment).			
Primary metrics	More actionable, speaking directly to industries/companies. They have less uncertainty as they hardly rely on theoretical models. Examples include tonnes of plastic utilized and waste generated; percentage of recycled/recyclable inputs, among others.	Many different metrics, making it difficult to ensure consistency and comparability. No single, unified data collection and reporting approach. Little, if any, data collection/reporting on microplastics. Does not translate easily to impact assessments.			

Table 5: The pros and cons of "leakage" as a proxy in a plastic footprint analysis (sourced from PFN module "Introduction to plastic footprinting").

What is more, the plastic leakage metric may not offer actionable insights on its own. Hence, depending on the specific goals of the plastic footprint analysis, other metrics can be integrated/utilized. Diagram 6 below shows the different data sets/metrics that the PFN recommends integrating into a fully comprehensive plastic footprint assessment.

3.3 Defining the scope of the analysis

Popularized by the 2015 Greenhouse Gas Protocol (2023), scopes define how organizations should account for their relative environmental footprints. Widely accepted scoping approaches for environmental pollutants (such as carbon, water, and plastic) are not only critical for corporate environmental strategies and actions, but they also allow for comparisons across organizations and industries.

Scopes define and categorize emission sources based on the degree of control an organization has over them. Understanding the sphere of control helps organizations assess their influence and responsibility for reducing emissions. As for other pollutants, it is crucial to set the scopes of a plastic footprint analysis in a rigorous way, enabling to standardize reporting and disclosure across sectors and industries.

Organizational boundaries determine how an environmental footprint is attributed across an organization's divisions, subsidiaries, or joint ventures. These boundaries are typically set using one of the following approaches:

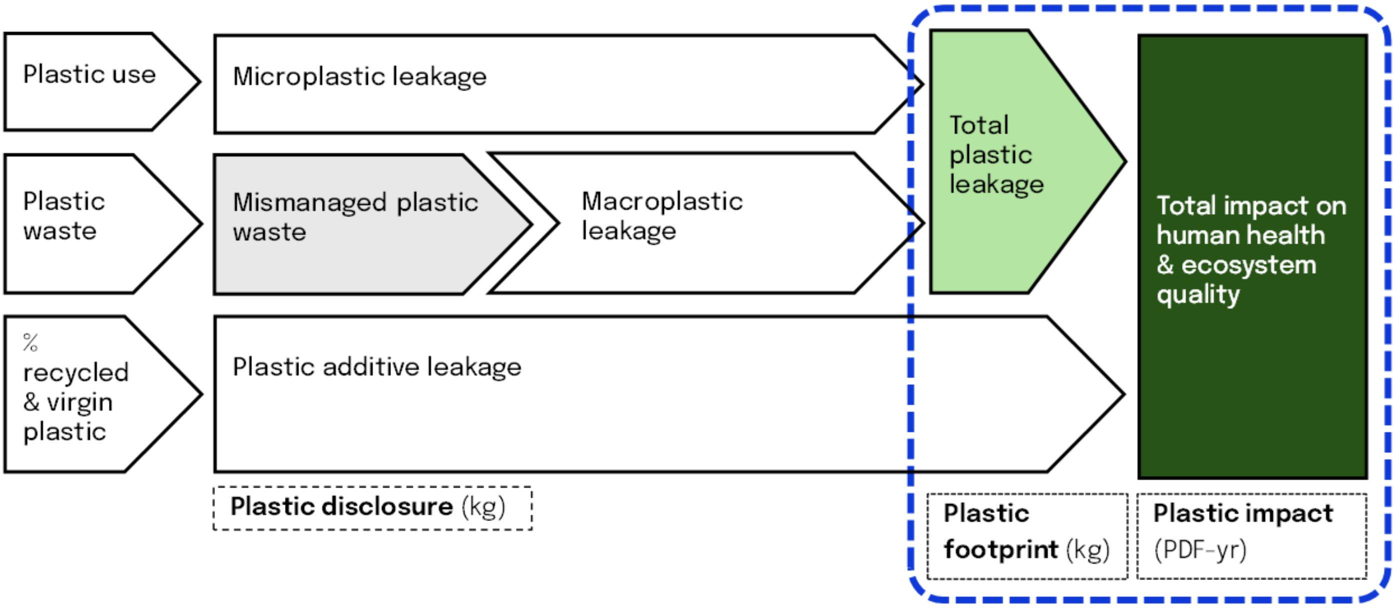


Diagram 6: Metrics that typically feed into a plastic footprint (sourced from PFN module "Introduction to plastic footprinting").

Equity share approach: The environmental footprint (e.g., emissions, resource use) is allocated based on the company's ownership percentage in an operation. This reflects the extent to which a company's investments influence environmental impacts, regardless of operational control.

Control approach: The footprint is assigned based on which operations the company has decision-making authority over and derives economic benefit from. This can be further divided into:

Financial control: The company consolidates 100% of the environmental footprint of operations where it has the right to direct financial and operational policies (even if it does not fully own them).

Operational control: The company accounts for emissions and environmental impacts from facilities and processes it actively manages, even if it does not have full financial ownership thereover.

Once organizational boundaries are established, operational boundaries must be defined based on the degree of control an organization has over different sources of plastic emissions. In the Plastic Footprint Network (PFN) methodology, these boundaries are categorized into three scopes:

Scope 1: Direct control

Plastic emissions generated from pre-consumer activities that an organization owns, manages, or directly governs. These emissions originate from sources that the company has immediate authority/control over and can actively mitigate through operational decisions (i.e. implement reduction, recycling, or elimination measures).

Examples include:

- Plastic waste generated during manufacturing – e.g., scraps, defective products, industrial plastic waste that arise before the product reaches consumers.
- Plastics used and disposed of within company operations – e.g., office plastic waste, protective plastic materials used in production, disposable items used by employees at facilities.
- Plastic emissions from product distribution, transport, and warehousing – including primary (consumer-facing), secondary (bulk transport), and tertiary (pallet wrap, shipping materials) packaging.

Scope 2: Indirect control

Plastic emissions from activities that are not directly owned or managed by the organization but are influenced by its decisions. These emissions occur throughout the product's life cycle, including packaging, transportation, product use, and disposal. The organization does not directly own or control these sources, but it can influence them through product design, material selection, business model innovations (e.g., reusable packaging), or waste take-back initiatives.

Examples include:

- Plastic emissions from product packaging – including primary (consumer-facing), secondary (bulk transport), and tertiary (pallet wrap, shipping materials) packaging.
- Plastics associated with product distribution, transport, and warehousing – including protective plastics used during storage and shipping.
- Plastics generated during product use by consumers – e.g., single-use plastic components discarded after consumption.
- Post-consumer plastic waste – plastic disposed of after use, whether it is recycled, landfilled, incinerated, or littered.

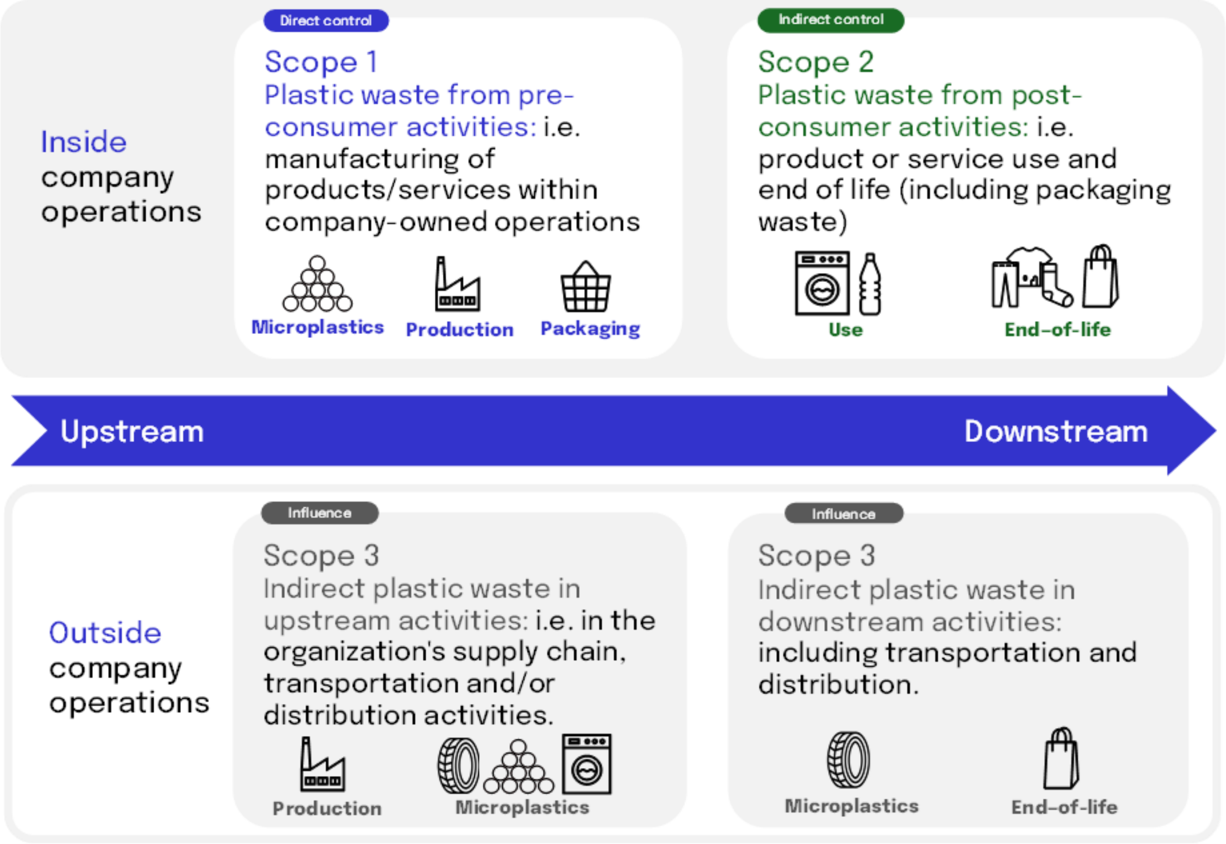
It is important to mention that an organization's definition and level of control over pre- and post-consumer activities depends very much on its own value chain and by the actual services and products that it provides. An organization may have complete or partial control/ownership over all pre-consumer and post-consumer activities within the value chain.

Scope 3: Influence (beyond direct control)

Plastic emissions that are outside the direct operational or financial control of the organization but can still be indirectly influenced through external engagements, partnerships, and policies. These emissions occur upstream or downstream in the supply chain or arise as indirect consequences of business activity. These emissions do not occur within the company's immediate value chain but can still be influenced by corporate policies, industry collaborations, and regulatory advocacy.

Examples include:

- Plastic emissions from suppliers and upstream production processes – e.g., plastics used in raw material extraction and component manufacturing before reaching the company's production sites.
- Plastics lost in downstream shipping, secondary distribution, and post-retail logistics – e.g., plastic used in external distribution networks or third-party e-commerce distributors.
- Indirect plastic waste from increased economic activity – This refers to plastic waste generated indirectly due to the company's market presence. For example, a company's expansion into new markets may increase demand for plastic-intensive products, packaging, or third-party logistics services.



Scope 1
Plastic waste from pre-consumer activities: i.e. manufacturing of products/services within company-owned operations

Scope 2
Plastic waste from post-consumer activities: i.e. product or service use and end of life (including packaging waste)

Scope 3
Indirect plastic waste in upstream activities: i.e. in the organization's supply chain, transportation and/or distribution activities.

Scope 3
Indirect plastic waste in downstream activities: including transportation and distribution.

Diagram 7: Summary of scope 1, 2 and 3 plastic emissions (sourced from PFN module "Scopes & Boundaries").

- Indirect microplastics released – This refers to plastic leakage that is not part of direct material flows but occurs as a side effect of production, use, or disposal.
- Microplastics from wear and tear of products (e.g., synthetic textile fibres shed during washing).
- Microplastics from vehicle tire abrasion (which increase as logistics and transportation needs grow).

The distinction between Scope 2 and Scope 3 plastic emissions lies in how directly they are linked to an organization's core business activities and the extent of control it has over them. Scope 2 emissions occur within the company's product life cycle and include plastics used in packaging, transportation, and post-consumer waste– i.e. areas the company can influence through material choices and product design. For example, a business can reduce its Scope 2 footprint by switching to recyclable packaging to minimize disposal impacts.

Scope 3 emissions, on the other hand, originate outside the organization's immediate value chain and stem from upstream supplier practices, third-party distribution, and broader economic activity. These emissions, though outside direct control, can still be influenced through supplier engagement and policy advocacy. For instance, a company can work with its suppliers to incorporate recycled plastic into its raw material inputs.

Plastic emissions falling under the different scopes are summarised in diagram 7 on the previous page.

3.4 How is the plastic footprint calculated?

3.4.1 Macroplastics

Macroplastic leakage can be calculated using the following equation. This method can be used to evaluate plastic leakage from sources like packaging, synthetic textile products or fishing nets:

Leakage = Mass of waste (kg) * Mismanaged Waste Index (%) * Release Rate (%)

The mass of waste is typically primary (i.e. measured) data documented either at national, municipal or company level.

The Mismanaged Waste Index (MWI) is the ratio between mismanaged plastic waste and total mass of plastic waste. It is the weight (kg/year) of improperly disposed waste (i.e. uncollected, littered, dumped into unsanitary landfills and/or exported) divided by the total weight (kg/year) of waste generated (mismanaged waste weight combined with the weight of properly managed waste i.e. that which is recycled, incinerated and/or disposed of in sanitary landfills) (x 100 to obtain a percentage). A higher MWI means a higher risk of plastic pollution, while a lower MWI indicates better waste management systems. A major global study on plastic leakage into oceans (Jambeck *et al.* 2015) found that countries with high MWI and coastal populations contribute significantly to marine plastic pollution.

The Release Rate (RR) is the ratio between leakage and total mismanaged waste. Is it the fraction of plastic waste that escapes waste management systems and enters natural environments (e.g., oceans, rivers, soil). It is often expressed % of total plastic used, or % of mismanaged plastic (or simply in kg/year). RR is not a fixed value and is influenced by the following factors.

Differences in waste management systems: RR varies based on the efficiency of waste collection, recycling, and disposal infrastructure in different regions.

Geographical and environmental conditions: Factors like proximity to water bodies, climate, rainfall and extreme weather events affect how much plastic escapes into the environment.

Type of plastic waste: Lighter, more mobile plastics are more prone to leakage, while heavier plastics are less likely to escape but may still contribute to pollution over time.

Leakage pathways & exposure scenarios: The way plastic waste is handled (e.g., informal recycling, landfill containment, open dumping) determines how much actually leaks into the environment.

Seasonal and societal factors: Events, tourism, and seasonal variations in waste production and disposal practices influence RR fluctuations.

Degradation and transformation rates: Plastics break down at different speeds, affecting how they leak into ecosystems over time rather than all at once.

This means that RR for oceans and waterways is generally higher than for terrestrial compartments because plastics in aquatic systems are more easily transported by currents, tides, and river flow, leading to rapid dispersal and accumulation in marine environments. In contrast, plastics on land tend to be retained longer in soils, urban infrastructure, and landfills, where they degrade, fragment, or remain trapped before eventual leakage. Terrestrial plastics may take years to migrate to water bodies, while stormwater, floods, and wastewater discharge accelerate plastic movement into aquatic systems. Factors such as coastal proximity, climate conditions, and waste management efficiency influence the speed and extent of plastic transport, making RR highly context dependent.

3.4.2 Microplastics

The calculation of microplastic leakage differs from macroplastic leakage because of fundamental differences in their sources, transport mechanisms, environmental fate, and measurement methods. Because microplastics are often released in microscopic amounts over time, their leakage cannot be estimated solely from waste mismanagement. While macroplastics (e.g., plastic bottles, bags, fishing gear) will often enter the environment as whole objects and degrade over time, microplastics (particles <5(mm) can originate from both fragmentation of larger plastics through UV exposure, mechanical stress, and/or weathering (to create *secondary* microplastics); and from direct release from products (as *primary* microplastics such as synthetic textile fibers, tire wear particles, cosmetics etc.) (also see glossary). As microplastics are generated differently (i.e. through product use and wear), their leakage is calculated using emission factors based on material wear rates. In contrast, macroplastic leakage is typically based on mismanaged waste rates. With this in mind, microplastic leakage can be calculated using the following equation:

Leakage = Activity (-) * Loss rate (%) * Release rate (%)

The activity is the driver of the loss (e.g. washing, driving, painting, etc.), and it determines how much plastic is involved in the system.

The Loss Rate (LR) is the share of plastic mass removed from the plastic object during the activity (e.g. abrasion of tires during driving or textile fibre shedding during washing).

The Release Rate (RR) is the fraction of the loss that is released into different environmental compartments. Microplastics are smaller, more diffuse, and can spread as airborne particles, or through road runoff, wastewater discharge, and even via atmospheric deposition. Because of this, their RR values are typically higher than those for macroplastics. Infrastructure may capture some microplastics during their leakage pathways (e.g. a waste-water treatment plant), but for some sources (e.g. tire wear for which there is no collection system) the RR can approach 100%.

4 What data feeds into a plastic footprint?

4.1 Primary vs. secondary data

A plastic footprint analysis requires a combination of primary and secondary data to estimate plastic use, waste, and leakage.

Primary data refers to direct, first-hand data collected by a company or researcher. This includes internal waste audits, material flow tracking, supplier surveys, and direct measurements of plastic leakage in the environment. Since primary data is collected specifically for the analysis, it is typically more accurate and company-specific. However, collecting primary data can be time-consuming and expensive, requiring dedicated resources and monitoring systems. Examples of **company-specific primary data** include:

- **Procurement data:** Detailed records of the volume and types of plastics purchased for products and packaging.
- **Waste audits:** Comprehensive on-site evaluations that analyze waste streams to determine the quantity and types of plastic waste generated.
- **Supplier reports:** Information obtained from suppliers regarding the plastic content, recyclability, and reuse potential of materials provided.
- **Recycling and waste management records:** Documentation of the percentages of plastic waste that are collected, recycled, sent to landfills, or incinerated.
- **Logistics and transport data:** Insights into the use of plastics in shipping and transportation processes, such as plastic films used for pallet wrapping.

In contrast, secondary data consists of pre-existing datasets from reports, scientific studies, and publicly available databases. Examples include industry reports, government waste statistics, and scientific research on plastic degradation and pollution. Secondary data is useful for benchmarking and estimating trends where primary data is unavailable, but it may not always be precise for a company's specific operations or analytical goals.

For example, a beverage company conducting a plastic footprint assessment might collect primary data through an internal waste audit, tracking the exact quantity of plastic used and discarded. However, to estimate how much of this plastic is mismanaged after consumption, the company might rely on secondary data such as national plastic waste management rates.

4.2 Specific vs. generic data

Plastic footprinting also distinguishes between specific data, which is collected by a company for its own operations, and generic data, which consists of industry-wide averages and external data sources.

Specific data is company-specific and often includes details such as plastic raw material purchases, waste composition audits, supplier reports, and recycling records. This type of data provides the most accurate representation of a company's plastic impact. However, not all organizations have access to complete data, especially if they rely on external suppliers for packaging or raw materials.

On the other hand, generic data comes from broader datasets such as global plastic recycling rates, average industry-wide mismanagement factors, and scientific estimates of plastic degradation. These datasets help fill in gaps where specific data is unavailable but may not fully reflect the company's actual footprint. Even more so, using generic or average data (i.e. that groups all plastic waste together) can actually lead to misrepresentative conclusions, as differences between plastic polymer types often have a greater impact on waste management outcomes than national/geographical differences for the same polymer.

For example, a company distributing 10 tonnes of PET bottles and 10 tonnes of flexible water pouches in Thailand would arrive at very different conclusions depending on the level of detail in their data. If they use average plastic waste data, they would estimate that over 6 tonnes of their waste is improperly disposed of, and more than 1.2 tonnes leak into the environment. However, when applying granular polymer-specific data (such as that found in the EA-administered Plasteax database, see section 4.4 below), the results show that PET bottles have a much higher recycling rate (~2.8 tonnes) compared to flexible pouches (~0.6 tonnes), while the latter contributes significantly more to plastic leakage (~0.7 tonnes vs. 0.2 tonnes for PET bottles).

This highlights the importance of data granularity (see also section on data quality below) and how aggregating plastics into a single category may mask the true environmental impact and thereby limit the effectiveness of interventions developed following a plastic footprint analysis. Using polymer-specific data improves the accuracy of plastic leakage estimations, allowing companies to design more effective plastic waste management strategies. Plastic footprint practitioners are therefore encouraged to integrate both specific and generic data sources, ensuring that results reflect both company-level realities and broader environmental trends.

4.3 Data quality

Depending on the intended application of a plastic footprint, varying levels of precision may be necessary.

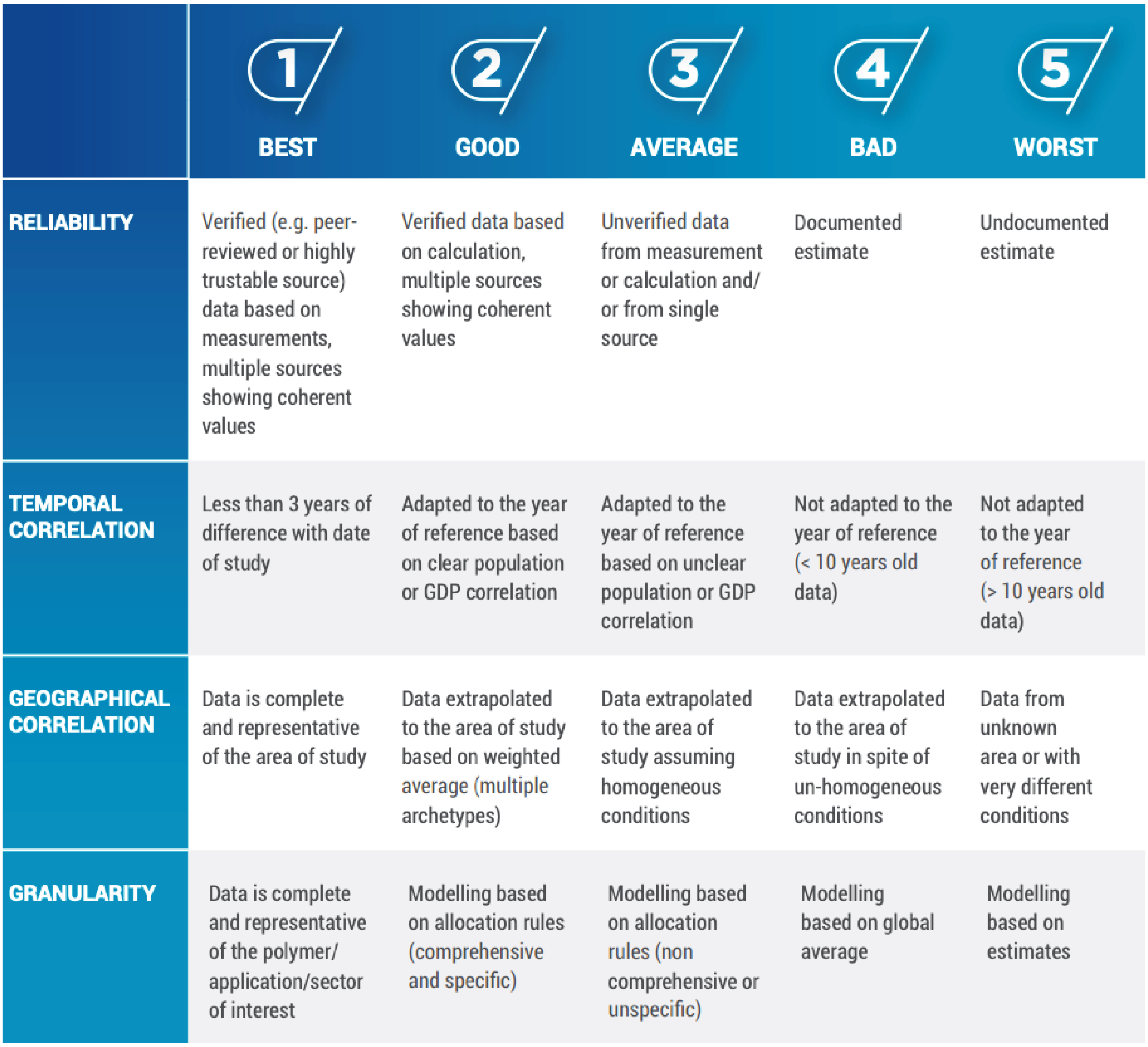
Having defined the scope of our analysis, the next critical step is selecting the best available data to perform a plastic footprint assessment. In doing so, it is necessary to define standards for data quality and transparency, and to ensure consistency across various assessment purposes. It is also important to consider how data usage can be continuously enhanced to keep pace with evolving knowledge, technology and methodologies in the field of plastic footprinting.

The level of data quality and granularity (measure of the level of detail in a data structure) varies according to the intended use of the plastic footprint analysis.

For internal uses such as developing/enforcing a Plastic Mitigation Strategy within an organisation (typically involving hotspot identification for internal decision-making), data granularity and quality requirements are less stringent. This applies also to corporate and product screening assessments (ISO 2022). Higher quality data is of course encouraged but not mandatory for such analyses.

However, when utilizing plastic footprinting for external communication (e.g. showcasing a company's progress towards plastic mitigation strategies, determining plastic credit offsetting values, or declaring/comparing the footprint of products), it is critical to ensure the highest possible levels of data granularity and quality.

This also applies to instances where a plastic footprint analysis needs to adhere to the internationally recognized ISO 14000 series of environmental management standards (in particular, ISO 14040 and 14044 on life-cycle assessment). The highest levels of data transparency, standardization, and validation are required for analyses with such outward-looking objectives.



	1 BEST	2 GOOD	3 AVERAGE	4 BAD	5 WORST
RELIABILITY	Verified (e.g. peer-reviewed or highly trustable source) data based on measurements, multiple sources showing coherent values	Verified data based on calculation, multiple sources showing coherent values	Unverified data from measurement or calculation and/or from single source	Documented estimate	Undocumented estimate
TEMPORAL CORRELATION	Less than 3 years of difference with date of study	Adapted to the year of reference based on clear population or GDP correlation	Adapted to the year of reference based on unclear population or GDP correlation	Not adapted to the year of reference (< 10 years old data)	Not adapted to the year of reference (> 10 years old data)
GEOGRAPHICAL CORRELATION	Data is complete and representative of the area of study	Data extrapolated to the area of study based on weighted average (multiple archetypes)	Data extrapolated to the area of study assuming homogeneous conditions	Data extrapolated to the area of study in spite of un-homogeneous conditions	Data from unknown area or with very different conditions
GRANULARITY	Data is complete and representative of the polymer/application/sector of interest	Modelling based on allocation rules (comprehensive and specific)	Modelling based on allocation rules (non comprehensive or unspecific)	Modelling based on global average	Modelling based on estimates

Table 8: «Pedigree matrix» for evaluating the quality of data used in a plastic footprinting exercise (sourced from UNEP 2020, PFN module "Data governance").

In connection with the latter, it is important to consider the sources of data used. Typically, this would be a combination of company production figures (primary data), waste management or loss rates data (primary or secondary data), and plastic release rates (secondary data - also see glossary). In plastic footprinting, data quality is determined by four key criteria: reliability, temporal correlation, geographical correlation, and granularity. The "pedigree matrix"(table 8) on the previous page, developed as part of UNEP's (2020) National Guidance for Plastic Pollution Hotspotting, provides a structured approach to evaluate the quality of data used for plastic footprinting (and life-cycle analyses) according to these four key criteria. An example of how these criteria and scoring system are used can be found in the PFN module on Data governance.

In most cases, plastic footprint practitioners will probably have to conduct a dynamic process, where they initially start with available data, even if it may not be of the best quality, and as the analysis unfolds, they will iteratively improve the input data quality to meet the contextual demands of the assessment.

Naturally, practitioners are encouraged to utilize the highest quality data available to maximize the accuracy and relevance of a plastic footprint assessment. It is, however, important to remember that these scores may be weighted differently according to the intended final use of the analysis. For example, a company seeking to externally showcase its transparency or apply for plastic credits/compensation will likely face scrutiny and will therefore seek the highest data quality and granularity. Conversely, a company performing a plastic footprint analysis intended for purely internal benchmarking, could settle for lower quality data. These final use-dependent data requirements are summarized in table 9 below.

4.4 Reference data sets

Various secondary data sources can provide broader context and benchmarks for a plastic footprint analysis, especially when internal, primary data is lacking.

Indicator	Minimum requirements for internal use	Minimum requirements for external use
Reliability	Estimated data is well documented.	Data validation and transparency are essential.
Temporal correlation	Data is not more than 10 years old.	Data less than 5 years old is typically of highest relevance.
Geographical correlation	If primary and country level data is not available, regional data is acceptable, with a plan to improve accuracy over time.	If primary data is not available, national level data is mandatory.
Granularity	Generic data covering all polymers is acceptable.	Flexible/rigid polymer data is a mandatory requirement, utilizing data with even higher granularity is highly encouraged.

Table 9: Minimum requirements in data quality depending on intended end-use of a plastic footprint assessment (sourced from PFN module "Data governance").

Plasteax (2025): Launched by Earth Action in 2021, Plasteax addresses significant gaps in data about plastic pollution. The expansive database provides global metrics and actionable information about the reality of plastics at the end of their life cycle. Users can access data at polymer and application levels, standardized for 73 countries worldwide. With over 30,000 data points and regular updates, Plasteax is a valuable resource for organizations seeking metrics on plastic pollution. Naturally it is a key tool for the PFN's methodology and is continually being integrated into other platforms such as the WWF's ReSource initiative.

ecoinvent (2025): A comprehensive global life cycle inventory database offering data on plastic production, disposal, and degradation processes.

Plastics Europe (2025): An association that publishes detailed reports on plastic material flows, production statistics, and recycling rates within Europe.

Ellen MacArthur Foundation (2025): Known for its research on circular economy principles, this foundation offers insights into plastic circularity and global leakage rates.

Organisation for Economic Co-operation and Development (OECD) (2025): Offers reports on plastic waste management practices and international policies.

World Bank's "What a Waste" Database (2025): A comprehensive global project that aggregates data on solid waste management from nearly all countries and over 330 cities. It provides insights into waste generation, collection, composition, and disposal methods.

Cottom *et al.* (2024): Estimate emission hotspots across 50,702 municipalities worldwide from five land-based plastic waste emission sources.

Kawecki and Nowack (2019): Mapping of emissions of macro- and microplastics for seven commodity polymers.

Jambeck *et al.* (2015): Provide global estimates of plastic waste mismanagement and its environmental impacts.

Readers are also advised to refers to the PFN technical modules and data files referenced therein for more sector-specific suggestions of secondary data sources.

5 Limitations and evolution of the plastic footprint

Thus far this document has overviewed the PFN's strategic guidance modules that were designed to help organizations understand the goals, scope and data requirements for an effective plastic footprint assessment. For a more in-depth look at each of the topics covered in this document thus far, as well as a few practical examples, readers are encouraged to consult the respective modules found on the PFN website.

Guidance : Instructions on how to navigate through the various PFN modules and how to construct an assessment.

Glossary : Key terms relevant to plastic footprint analysis.

Introduction to plastic footprinting : Concept and definition of a plastic footprint, relevant metrics, and practical applications.

Introduction to plastic leakage : The module explains what plastic leakage is and how it is calculated for both macroplastics and microplastics.

Scopes and boundaries : Standardized approach for determining which activities in a value chain fall within the scope of a corporate plastic footprint assessment.

Data governance : Comprehensive guidelines for the selection and utilization of data in a plastic footprint assessment, based on its diverse purposes.

While the Plastic Footprint Network (PFN) methodology represents a significant advancement in quantifying plastic leakage, it is important to acknowledge that plastic leakage and release rate modelling remains a developing field. Current approaches, such as Material Flow Analysis (MFA) and Environmental Fate Modelling, offer useful frameworks but are still limited in their ability to predict real-world environmental impacts with high accuracy (Boucher & Friot 2017; Lebreton & Andrady 2019).

One major challenge lies in modelling the pathways and dynamics of plastic leakage across different environmental compartments–terrestrial, freshwater, and marine ecosystems. Significant uncertainties persist regarding the transformation, retention, and ultimate fate of plastics in these systems.

For example, national waste management statistics often form the basis of leakage estimates, yet these typically overlook the role of informal waste sectors and can severely underrepresent leakage in many regions (Jambeck *et al.* 2015). Notably, EA’s Plasteax database is one of the first efforts to systematically address such data blind spots.

Additional limitations to the methodology discussed thus far include:

- Temporary retention of plastics in vegetation, soil, drainage systems, and infrastructure, which delays but does not eliminate eventual leakage (van Emmerik & Schwarz 2020).
- Degradation processes, such as UV exposure, mechanical abrasion, and biological breakdown, which can transform macroplastics into micro- and nanoplastics, complicating traceability and risk assessment (Andrady 2011; Geyer *et al.* 2017).
- Environmental variability, including differences in climate, hydrology, and urban design, which can significantly influence leakage patterns and model outputs (Urbanek 2021).
- Transboundary leakage, such as plastics exported for treatment or recycling in other countries, where oversight and infrastructure may vary. Even advanced recycling facilities can contribute to leakage through process losses or mismanagement of residues (Brooks *et al.* 2018).

To address these limitations, the PFN and its partners, including mariLCA, are actively working on several fronts. mariLCA brings a complementary perspective rooted in life cycle thinking, helping to develop more robust release rate factors and to integrate plastic leakage within broader environmental impact assessments. Current joint efforts focus on:

- Developing improved release and degradation models for various plastic polymers and forms (Cowger *et al.* 2021).
- Enhancing microplastic modelling capabilities, including fragmentation pathways and fate in aquatic and terrestrial environments (Koelmans *et al.* 2017).
- Promoting bottom-up, empirical data collection, such as field measurements, plastic tracking technologies, and leakage audits to validate and calibrate model assumptions (van Calcar & van Emmerik 2019).

- Investigating the (eco)toxicological impacts of leachates, especially from plastics in prolonged contact with different biota, their habitats as well as with human populations (Hermabessiere *et al*. 2017).
- Studying the impacts of additives, coatings, and composite materials, which often behave differently than base polymers and may pose unique ecological and human health risks (Lithner *et al.* 2011).

Together, these developments signal a promising evolution of the plastic footprint methodology–from a largely inventory-based assessment tool to a more dynamic, spatially explicit, and impact-oriented decision-support framework.

In partnering with the mariLCA project and its global network of experts, the PFN aims to advance the field by integrating more precise environmental impact modelling of plastic release rates into diverse environmental sinks. This includes refining region-specific release factors, accounting for polymer-specific degradation pathways, and assessing the transport and transformation of plastic across ecological boundaries.

Moreover, the collaboration seeks to deepen our understanding of the long-term ecological consequences of plastic pollution–specifically, its impacts on ecosystem functionality and the ecosystem services that are vital to human well-being, such as water purification, soil fertility, carbon sequestration, and biodiversity support (Rochman *et al.* 2015; SAPEA 2019). By bridging material flow models with life cycle impact pathways, the PFN and mariLCA are helping to shape a methodology that not only quantifies leakage but also connects it to systemic environmental and socio-economic risks.

5.1 Sector- and application specific plastic footprinting modules

In building on the evolving core methodology and addressing the above-mentioned limitations, the PFN, in collaboration with EA and mariLCA, is actively developing sector- and application-specific technical modules.

Adapting plastic footprint methodologies to specific sectors and product categories is essential. Different industries exhibit highly diverse plastic use patterns, end-of-life scenarios, leakage pathways, and environmental risks. As such, generic assessment tools may fail to capture critical, sector-specific nuances. Tailored modules enable more accurate data modelling as well as context-appropriate interventions.

The PFN's "technical" modules (as visualized in diagram 10 on the next page) include a combination of system maps, calculation routes, guidance documents, and curated datasets. These are designed to support practitioners, policymakers, and companies in conducting reliable and sector-relevant plastic footprint assessments. They can also enhance companies' ability to track, report, and benchmark their plastic use and leakage in alignment with evolving disclosure frameworks and regulatory expectations.

By aligning footprint assessments with specific product categories or operations, the PFN aims to enable companies (and other stakeholders) to generate more transparent, comparable, and decision-relevant data - supporting internal sustainability goals, external reporting requirements, and ultimately, more effective plastic pollution reduction strategies.

The list of publicly available methodological modules offered by the PFN continues to grow in response to emerging data and stakeholder needs. These modules also undergo regular revision by the PFN's scientific committee to ensure they remain aligned with the latest academic thinking, publications and other developments in the plastics and life-cycle assessment fields:

Leakage from export : This module establishes a standardized methodology to estimate plastic leakage resulting from the international export of plastic waste. It considers destination country risk profiles, treatment pathways (formal vs. informal), and applies weighted emission factors to exported waste streams. The module supports integration into national or organizational plastic footprints, aligning with Extended Producer Responsibility (EPR) and Basel Convention implications.

Leakage from agriculture : Focused on the diffuse emission of microplastics from agricultural activities, this module addresses polymer-based mulch films, greenhouse coverings, controlled-release fertilizers, and irrigation equipment. It reviews degradation mechanisms such as photodegradation and tillage. It also proposes mass-based emission factors for different farming systems. It also highlights the data needs for regionally specific leakage assessments.

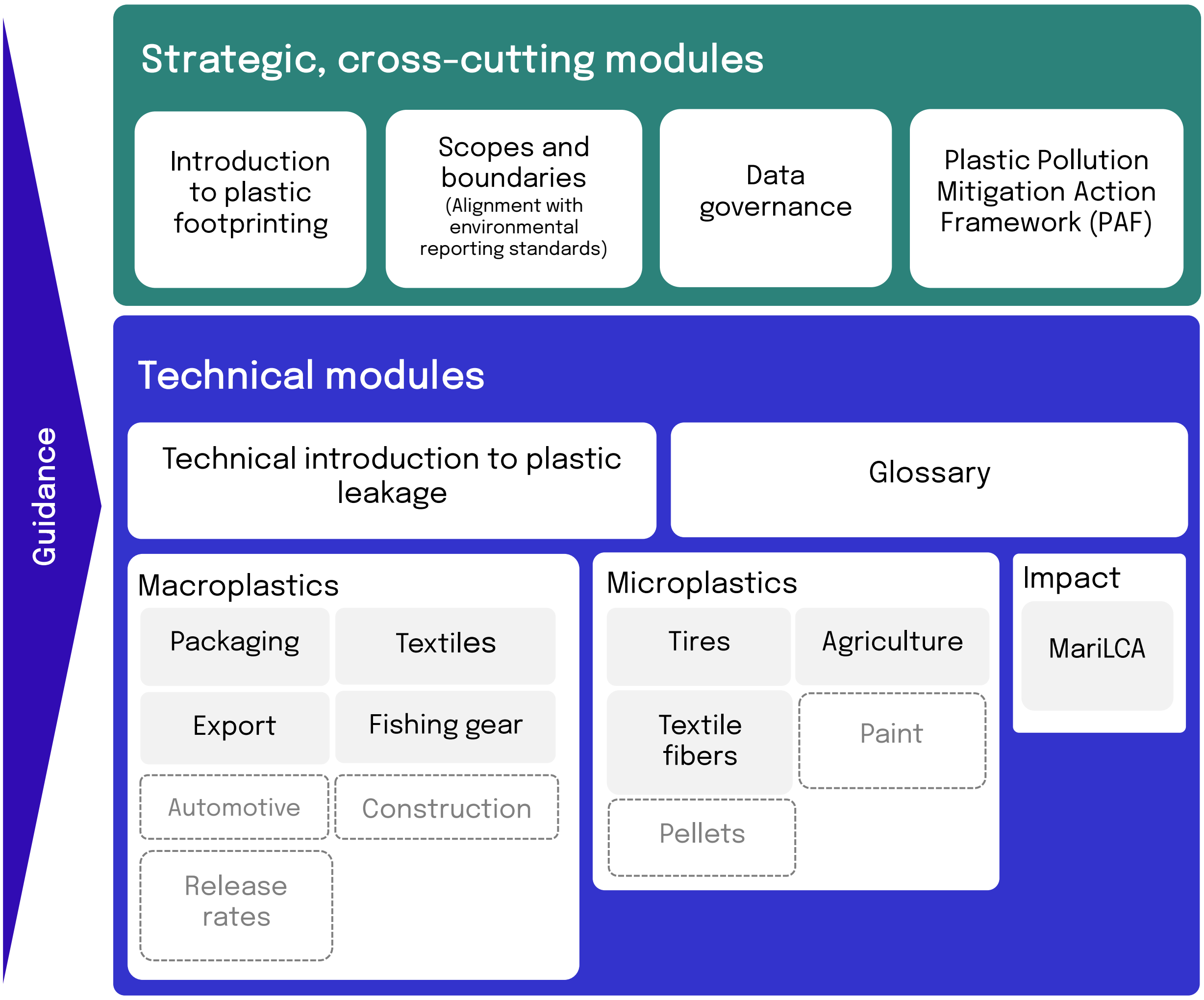


Diagram 10: Overview of strategic and technical modules currently offered and under development by the PFN (situation in April 2025).

Fishing gear : This module provides a method to quantify plastic leakage from commercial fishing activities, including gear loss and discards.It uses catch effort (e.g., days at sea, number of vessels, gear type) as a proxy for leakage estimation. Key elements include standardized leakage rates per gear type (e.g., gillnets, trawls), gear polymer composition, and adjustment factors for regional fishing practices.

Packaging : Targeting primary, secondary, and tertiary packaging, this module outlines a method for estimating packaging-related macroplastic leakage. It differentiates between rigid and flexible formats, polymer types, and end-use sectors (e.g., food, household goods). The approach includes mismanagement factors based on geographic and waste system contexts and supports modelling at both product and portfolio levels.

Textiles - macro-plastic leakage: This module defines a methodology for assessing synthetic textile leakage at end-of-life, especially through informal disposal or inadequate collection. It focuses on polyester, polyamide, and acrylic-based garments and industrial textiles, integrating fibre composition data and waste handling scenarios. It emphasizes the need for primary data on post-consumer textile management.

Textiles - micro-plastic leakage: This module quantifies microfibre emissions from synthetic textiles during washing and wear. It uses parameters such as fibre type, textile construction, wash frequency, and washing conditions. Emission factors are provided per wash cycle, and guidance is given on how to incorporate wastewater treatment plant (WWTP) retention efficiencies into net leakage estimates.

Tires : Addressing tire and road wear particles (TRWPs), this module provides a methodology for calculating microplastic emissions based on vehicle type, road surface, and driving behaviour. It defines TRWPs as heterogeneous aggregates of rubber, minerals, and heavy metals, and estimates the polymer fraction contributing to microplastic pollution. Environmental fate pathways include road runoff, wind dispersion, and sedimentation.

Impact of microplastics leakage : Developed in collaboration with mariLCA, this module connects microplastic emissions to environmental and human health impact categories using fate and exposure modelling. It outlines how to convert inventory data into midpoint indicators such as “ecosystem quality” and “human toxicity,” incorporating particle size, shape, and chemical properties. It is designed to complement existing life cycle impact assessment (LCIA) methods.

Plastic pollution mitigation action framework (PAF) : A decision-support tool to assess, categorize, and measure the effectiveness of plastic leakage prevention measures, aiding in action planning and impact tracking.

Release rates (Coming soon): A forthcoming module aimed at improving the modelling of macroplastic release into different environmental compartments, incorporating time-based dynamics and retention scenarios.

The PFN encourages practitioners, researchers, and organizations to consult these technical modules for up-to-date best practices in plastic footprinting. The PFN’s work is grounded in principles of open collaboration and aims to support the evolving research in the plastic pollution landscape. We welcome feedback on this document as well as references therein, and invite readers to connect with the PFN by reaching out to contact@plasticfootprint.earth

6 Glossary of key terms in plastic pollution & footprinting

Given the technical nature of this document, readers are advised to familiarise themselves and to continually refer to the terms and definitions below when consulting this guidance document.

Plastic types	
Polymers	Group of organic, semi-organic, or inorganic chemical substances composed of large molecules. These molecules are formed by linking together smaller molecules, called monomers, by polymerizations processes (in Greek: polys = many, meros = part). According to the International Union of Pure and Applied Chemistry (IUPAC), a polymer and a macromolecular substance are synonyms. Plastic polymers can be both natural (e.g. cellulose) or synthetic (e.g. polypropylene, nylon, polyester, etc.)
Plastic	Plastics are commercially used materials made from monomers and other raw materials chemically bound into a macromolecular structure i.e. the polymer - which forms the main structural component of the plastic. The name plastic refers to their easy processability and shaping (in Greek: plas-tein = to form, to shape). Plastics are usually divided into two groups according to their physical or chemical hardening processes: thermoplastic and thermosetting resins(polymers). Plastics contain additives to achieve defined properties, as well as non-intentionally added substances (NIAS) (impurities of raw materials and degradation, or breakdown products of intentionally added chemicals).
Additives	Additives are chemical compounds added (e.g., during shaping of the polymer, through injection molding, extrusion, blow molding, vacuum molding) to improve the performance, functionality, and ageing properties of a polymer. These chemicals can be classified depending on their chemical structure and/or their function. The most used additives in polymeric packaging materials are plasticizers, flame retardants, antioxidants, acid scavengers, light and heat stabilizers, lubricants, pigments, antistatic agents, slip compounds and thermal stabilizers. Each additive plays a distinct role in delivering/enhancing the functional properties of a plastic product. Its important to mention that we still do not fully appreciate

	the hazardous properties of such additives, according to UNEP, extensive scientific data on the potential adverse impacts of about 7,000 substances associated with plastics show that more than 3,200 of them have one or more hazardous properties of concern.
Elastomer/Rubber	Rubber is an elastic substance comprised mainly of elastomers, or "elastic polymers". These are large chainlike molecules that can be stretched to great lengths and yet recover to their original shape. Rubbers can be natural, such as latex (aqueous suspension of cis-polyisoprene), or synthetic like neoprene, styrene-butadiene, and many others.
Biopolymer	Biopolymers are polymers that are produced by or derived from living organisms, such as plants and microbes, rather than from petroleum, the traditional source of polymers. The primary sources of biopolymers are renewable. Many, but not all, biopolymers are biodegradable, which means they are capable of decomposing into carbon dioxide, methane, water, inorganic compounds or biomass by the enzymatic action of microorganisms. Polylactic Acid (PLA) and Polyhydroxyalkanoate (PHA) are commonly used biopolymers.
Bio-based plastic	Bio-based plastics are made wholly or partially from renewable biological resources. Bio-based plastics are a wide range of plastics (bio-PE, bio-PET, PLA, PHA, TPS, etc.) today produced mainly from resources such as sugar cane, sugar beets, wheat and corn. Properties, potential recycling and end-of-life options of bio-based plastics vary considerably. It is important to note that not all bio-based plastics are biodegradable or compostable.
Biodegradable plastic	Biodegradable plastics are a family of plastics that can biodegrade (be decomposed by microorganisms into water, carbon dioxide and biomass) in a specific environmental compartment (such as soil, salt- or freshwater) or a man-made environment (industrial or home composting).
Compostable plastic	Composting is a process of enhanced biodegradation under managed conditions. Typically, this involves forced aeration and natural heat production resulting from the biological activity taking place inside the material. The resulting material, i.e. the compost, contains valuable nutrients and may improve soils. Industrial composting requires elevated temperatures (55-60°C) combined with relatively high humidity and the presence of oxygen, and it is optimal compared to other everyday biodegradation conditions, i.e., in soil, surface water and salt water. According to the EN 13432 standard, plastic can be called compostable if:

	▪ the material and its relevant organic components (>1 wt.%) are naturally biodegradable (under certain conditions); ▪ disintegration of the material takes place in a composting process for organic waste within a certain time; ▪ the plastic material has no negative effect on the composting process; and ▪ the quality of the compost is not negatively influenced by the material.
Virgin plastic	A virgin plastic is a plastic made from virgin raw material, i.e., the extraction of crude oil. It is also called fossil-based plastic. The term "primary" is often used interchangeably with "virgin".
Recycled plastic	Recycled plastic is a plastic made from recovered and recycled material. The term "secondary" is often used interchangeably with "recycled".
Macroplastics	Macroplastics are large plastic waste readily visible by the naked eye and with dimensions larger than 5 mm. Examples include plastic packaging, synthetic textiles, fishing nets or large fragments thereof.
Microplastics	Microplastics are small plastic particulates below 5 mm in size. Two types of microplastics are contaminating the world's oceans - primary and secondary microplastics.
Primary microplastics	Primary microplastics are plastics released directly into the environment in the form of small particulates. They may be intentionally added to products (e.g. scrubbing agents in toiletries and cosmetics) or they may originate from the abrasion of large plastic objects during manufacturing, use or maintenance (e.g. erosion of tires when driving or abrasion of synthetic textiles during washing).
Secondary microplastics	Secondary microplastics originate from the fragmentation of larger plastic items into smaller plastic fragments once exposed to the environment. This happens through photodegradation and other weathering processes of mismanaged waste.
Primary packaging	Primary packaging is often referred to as "sales packaging" constituting a sales unit to the final user or consumer at the point of purchase, e.g. PET Plastic Bottle and PP lid.
Secondary packaging	Secondary packaging or group packaging is packaging conceived so as to constitute at the point of purchase a grouping of a certain number of sales units whether the latter is sold as such to the final user or consumer or whether it serves only as a means to replenish the shelves at the point of sale; it can be removed from the product without affecting its characteristics, e.g. Low Density

	Polyethylene (LDPE) film to group the water bottles (or other primary packaged items).
Tertiary packaging	Tertiary packaging transport packaging is packaging conceived so as to facilitate handling and transport of a number of sales units or grouped packaging in order to prevent physical handling and transport damage, e.g. LDPE protective wrap for pallets that group products. Transport packaging does not include road, rail, ship and air containers.
Plastic flows	
Plastic pollution	The negative effects and emissions resulting from the production and consumption of plastic materials and products across their entire life cycle. This definition includes plastic waste that is mismanaged (e.g., open-burned and dumped in uncontrolled dumpsites) and leakage and accumulation of plastic objects and particles that can adversely affect humans and the living and non-living environment.
Leakage	Plastic leakage is defined as the plastic leaving the technosphere (human environment) to accumulate in the natural environment.
Loss	The loss is the quantity of plastic that leaves a properly managed product or waste management system. This could be the quantity of materials that is detached from the plastic product during manufacturing, use or transport (for microplastics) or simply mismanaged waste of macroplastics. These quantities do not necessarily end up in the natural environment, for example, a fraction of the microfibers lost during apparel washing are recaptured in wastewater treatment plants; or a fraction of mismanaged plastic waste is recollected by authorities or informal waste pickers.
Loss rate	The ratio (%) between the lost amount and the total amount of plastic involved. It is specific to the source or activity. For example: ▪ For microfibres, it is the ratio between the quantity of fibres that gets lost during the washing process, and the total amount that was being washed. It is measured in mg/kg (mg of lost fibres out of kg washed); ▪ For microplastic from tires, it is the ratio between the quantity that is lost during driving, and the length of the drive. It is measured in mg/km and it depends on the type of vehicle, type of road, and other factors; ▪ For packaging, it is the ratio between the quantity that is mismanaged and the whole amount of packaging waste;

	▪ For textile, it is the ratio between the quantity that is mismanaged and the whole amount of textile waste.
Release	The quantity of plastics that ultimately leaves the human environment for the natural environment is said to be released. The natural environment is made of different compartments: waterways and oceans, soil and terrestrial compartments as well as air. The sum of the plastic released into the different environmental compartments corresponds to the total leakage.
Release rate (RR)	The release rate is the fraction of mismanaged plastic that is ultimately released into specific environmental compartments: waterways and oceans, soils, other terrestrial environment, as well as air. Release rates are influenced by different factors, such as the size of the item, the geography of the country, the distance to water and the amount of precipitation, for example. Release rates are specific to environmental compartments, so there is a RR for oceans and water ways, and another RR for terrestrial compartments.
Releases to waterways and oceans	Represent the plastics released to rivers, lakes or directly into seas and oceans.
Releases to soils	Represent the plastics released to either the soil surface or into shallow and deeper soil, such as plastics leaching from unsanitary waste dumps.
Releases to terrestrial environment	Represent the plastics released into the terrestrial environment other than soils, such as plastics deposited and stored in dumpsites, plastics deposited on buildings or trees, or simply littered plastics.
Releases to air	Represent the plastic released to air, such as plastic micro-fibres emitted when synthetic textiles are worn.
Plastic waste management	
Waste collected	The amount of waste generated that is moved from the point of generation, such as specific addresses or designated collection points, to facilities where the waste is recovered, disposed (properly or improperly) or exported. This includes all collection modalities (i.e. by municipal governments, non-state actors or by the informal sector).
Collection rate	Ratio between plastic waste collected and that generated.
Uncollected	Waste that is not collected, either by the formal or the informal sector. It does not include littering.

Littering	The act of dropping waste on the ground in public areas.
Dumping	Dumping is the deliberate disposal of larger quantities of litter in an unauthorized area. Dumping can be the result of the formal or informal collection sector. Discarded items could range from a single bag of rubbish to a large sofa or broken refrigerator.
Properly disposed	Waste that is disposed of in a waste management system where no leakage is expected to occur, such as an incineration facility or a sanitary landfill.
Improperly disposed	Waste that is disposed in a waste management system where leakage is expected to occur, such as a dumpsite or an unsanitary landfill. A dumpsite is a particular area where large quantities of waste are deliberately disposed in an uncontrolled manner and can be the result of both the formal and informal sectors. A landfill is considered as unsanitary when waste management quality standards are not met, thus entailing a potential for leakage into the environment.
Mismanaged waste	Waste that is not recycled or otherwise properly disposed, and that will therefore leak into the environment. It includes waste that is uncollected, littered, and improperly disposed.
Mismanaged waste index (MWI)	The ratio (%) between the mismanaged waste and the overall waste produced. It can be country-specific and specific to the type of waste, for example for textiles (see below).
Mismanaged textile waste index (MTWI)	The ratio (%) between the mismanaged textile waste and the overall textile waste produced.
Incineration with energy recovery	Incineration with energy recovery refers to incineration processes where the energy created in the combustion process is harnessed for re-use.
Incineration without energy recovery	Incineration without energy recovery means the heat generated by combustion is dissipated into the environment.
Open burning	Waste that is combusted without efforts for minimisation or treatment of resultant emissions.
Sanitary landfill	A facility where solid waste is disposed on land, in a full-controlled manner that protects the environment. More specifically, leachate is contained and managed, slope is stabilized to mitigate risk of landslide, waste is layered and compacted promptly, with daily and intermediate covers applied regularly.
Unsanitary landfill	Particular area where large quantities of waste are deliberately disposed of in an uncontrolled manner.

Recycling	The process of converting waste materials into new materials to produce new products.
Mechanical recycling	Mechanical recycling is the process of recovering plastic waste by mechanical processes such as sorting, washing, drying, grinding, re-granulating and compounding.
Chemical recycling	Chemical recycling aims at converting plastic waste into chemicals. It is a process where the chemical structure of a polymer is changed and converted into "chemical building blocks" including monomers which are then used again as a raw material. There are different types of chemical recycling: from plastic to polymer (purification or dissolution), from plastic to monomer (depolymerisation, chemical solvolysis or bio-chemical through enzymes), from plastic to hydrocarbons (thermal cracking, pyrolysis, gasification).
Downcycling	Downcycling is a recycling process where the value of the recycled material decreases over time, being used in less valued processes, with lesser quality material and with changes in inherent properties, as compared to its original use.
Upcycling	Upcycling is when materials are recycled to produce a higher value or quality product than the original.
Domestic recycling	Recycling of waste collected in a country. It does not include recycling of imported waste nor waste collected for export and recycling abroad.
Data types	
Specific data	Specific data in plastic footprinting is detailed and focused on a particular location, product, or material. It includes precise end-of-life data, such as PET polymer usage in plastic bottles within a specific country.
Generic data	Generic data in plastic footprinting is broader and covers a wider scope. It encompasses general information related to waste management, plastic waste, or municipal solid waste and is often applied to larger regions rather than specific situations.
Primary data	Primary data is information obtained directly from the source, often through methods like weighing quantities, as conducted by the company itself. It is highly precise and specific but requires significant efforts to collect. Mass of plastic involved and specifications about it (type, polymers, markets, etc.) typically should come in the form of primary data. Waste management data, or loss rates, can be primary data when the company has direct access to this information or can directly weigh them.

Secondary data	Conversely, secondary data is derived from external sources, such as literature and external data repositories. While it is easier to produce, it tends to be less precise compared to primary data. This kind of data is not specific to a company or product, but it replaces what cannot be weighed/measured directly. Waste management data, loss rates and release rates are example of what can be considered as secondary data, as it is difficult to measure directly and there is often reliable, peer-reviewed scientific literature on this subject.
Directly weighed data	It refers to quantitative information obtained through direct measurement. This often occurs when a company can measure the weight of its products, and the volume of products sold.
Extrapolated data	Extrapolated data is derived from estimates based on average values or from literature when direct measurement is unfeasible. For instance, it is used to estimate the number of microfibers lost during production without conducting specific tests.
Economic data	Economic data is presented in the form of sales revenue or monetary figures. This type of data is typically expressed in terms of financial transactions, such as the revenue generated from the sale of products.
Quantity data	Quantity data is the specific weight or amount of a product typically needed for plastic footprinting. When this weight data is not readily available, it can be derived from sales data and the average weight of the plastic products sold, thus converting economic data into weight-based data.

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