www.plasticovershoot.earth

PLASTIC OVERSHOOT DAY

This is the day when the generation of plastic waste exceeds the capacity of waste management, leading to environmental pollution.

Methodology guide 2025

ea for impact

What is Plastic Overshoot Day?

Plastic...is...everywhere.

Its presence is increasingly visible–not just in the environment but in our bodies. Studies now show microplastics in human blood, lungs, and placentas, alongside concerns about chemical additives in plastics and their health impacts. Plastic pollution is no longer just an environmental issue–it is a health and economic challenge.

Plastic Overshoot Day focuses on mismanaged waste. It measures how much plastic waste is generated versus how much can be effectively managed. Every year, there is a point when plastic waste exceeds global waste management capacity.

In 2025, that day falls on September 5th.

Plastic Overshoot Day follows the United Nations National Guidance for Plastic Pollution Hotspotting, classifying waste as:

- Well-managed: Includes incineration, sanitary landfills, and recycling, which prevent direct environmental leakage.
- Mismanaged: Includes dumpsites, unsanitary landfills, other types of improper disposal, littered or uncollected waste, which all pose a high risks of plastic leakage into nature.

While well-managed systems are not flawless–incineration raises air pollution concerns, and landfills have long-term risks–these definitions help assess the gap between plastic production and our ability to manage it responsibly.

With INC-5.2 negotiations in Geneva, governments have a crucial opportunity to shape a legally binding Global Plastics Treaty. Plastic Overshoot Day provides data to empower policymakers, businesses, and civil society to improve waste management and accelerate circular solutions.

Plastic Overshoot Day is a warning–but also an opportunity. The sooner we act, the sooner we can push the date back–and ultimately eliminate it.

Scope for better impact

We help organizations & people create sustainable change by developing strong science, meaningful methodologies & actionable plans.

THE TEAM BEHIND THE PROJECT

EA For Impact is a Swiss non-profit association dedicated to advancing research and multi-stakeholder initiatives that address critical sustainability challenges. We work to identify and fill knowledge gaps, producing science-based, open-access research that empowers decision-makers.

Funded by EA Earth Action SA and philanthropic contributions, EA For Impact fosters collaboration between NGOs, policymakers, researchers, and industry leaders. Through initiatives such as Plastic Overshoot Day, the Plastic Footprint Network, Swiss Plastic Action, and Swiss Climate Action, we provide stakeholders with data-driven insights and tools to accelerate the transition toward a sustainable future.

Plastic Overshoot Day is a natural extension of EA For Impact's extensive work on plastic pollution research and policy analysis. It is built upon the methodology of PLASTEAX, a pioneering data platform for plastic environmental analytics, offering comprehensive insights on plastic waste management, plastic leakage, and pollution metrics at both country and polymer-specific levels.

As with all EA For Impact initiatives, Plastic Overshoot Day is committed to transparency, raising awareness, and driving sustainable solutions to combat the plastic waste crisis.

www.plasteax.earth

Plasteax is developed by
EA - Earth Action

www.e-a.earth

Contact us : contact@plasticovershoot.earth

Notation

EXP	Exported waste [kt]
Y_R	Recycling yield of imported waste [%]
R_{CAP}	Recycling capacity of partner country [kt]
R_{EXP}	Exported waste recycled in partner country [kt]
MW	Mismanaged waste (of exporter country) [kt]
MW_{DOM}	Mismanaged domestic waste [kt]
MW_{EXP}	Mismanaged exported waste [kt]
MWI	Mismanaged waste index of exporter country [%]
MWI_{IMP}	Mismanaged waste index of partner country [%]

PLASTIC OVERSHOOT DAY

Table of content

Motivation

At EA Earth Action, our mission is to shed light on the critical issue of plastic pollution. We achieve this by leveraging scientific research to quantify the magnitude of the problem, and by empowering individuals and organizations to find solutions. To this end, we place a high value on transparency regarding our methodology for measuring plastic pollution. We believe that clear and comprehensive information on our methodology is crucial to building trust with stakeholders.

The main goal of this methodological guide is to explain the concept underpinning Plastic Overshoot Day: the Mismanaged Waste Index, and how it is computed.

This methodological guide will also draw on concepts used in the narrative of Plastic Overshoot Day, such as the classifications of countries regarding their management of plastic waste.

The Mismanaged Waste Index (MWI) is a metric used to quantify the ratio of plastic waste that is not properly managed in a location and therefore ends up in the environment.

Because many countries export their plastic waste, it is critical to account for the fate of the exported waste.

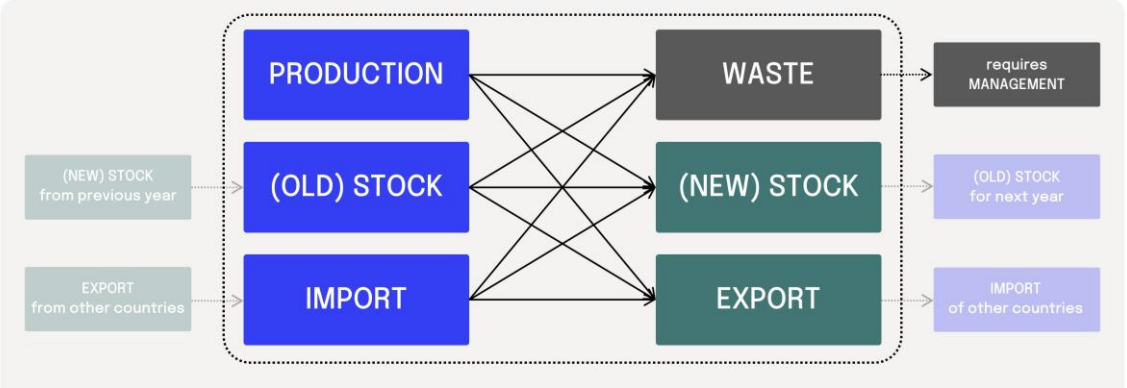
In current methodologies, often the approach is to consider all exported plastic waste as recycled. This is the case for the European Commission database, Eurostat*. The issue with this approach is that it is too optimistic and does not fully reflect the reality of what transpires with exported waste.

The Plasteax methodology, on which Plastic Overshoot Day is built, provides a more realistic modelling framework, one that is closer to reality. Essentially, it models the actual fate of exported waste based on the waste management practices of the importer countries. If a portion of this waste is expected to be mismanaged, this is considered into the mismanaged rate of the exporter.

* Eurostat Database: https://ec.europa.eu/eurostat/

1. Plastic leakage pathways

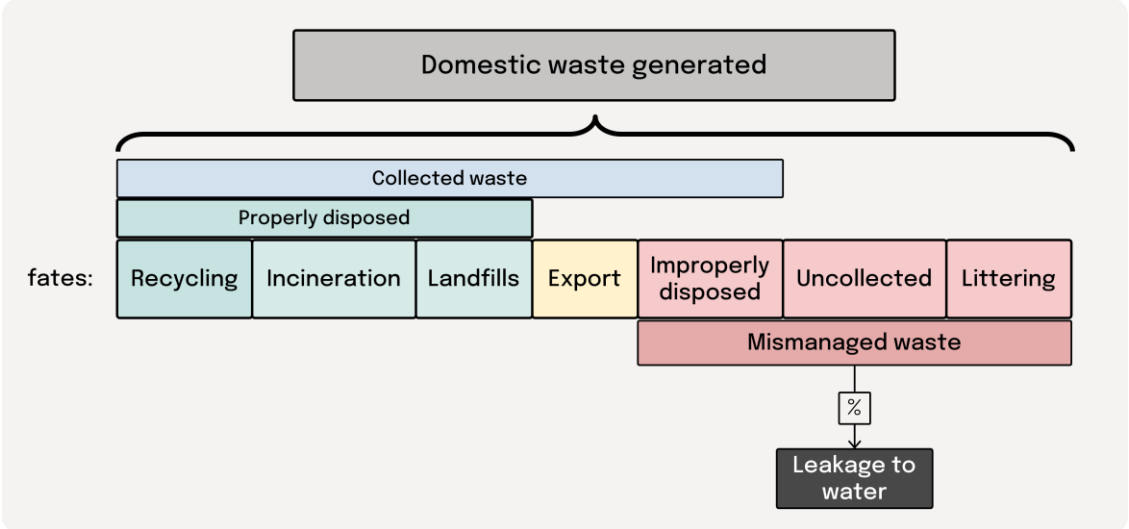
From primary to material waste



Production + Import – Export = Net Input

Net Input - Change in stock = Waste generated

From waste to leakage



For more details check the Plasteax methodology here.

2. MWI: Methodology

Step-by-step explanation of the Mismanaged Waste Index (MWI) calculation, incorporating exported waste.

The focus of POD 2025 is on packaging, textile, and household plastic waste. The export analysis is conducted for packaging and textile waste, which correspond to around 90% of the scope. Data for packaging and textile are sourced from the Plasteax database, and if not available, from regional estimates or WaW 2.0 dataset*. Data for household waste management are taken from the WaW 2.0 dataset.

- STEP 1
  Selection of the country of interest

- STEP 2
  Computation of the Mismanaged Waste from its domestic waste (MW_{DOM}) for each sector. In this case, packaging, textile and household.

- STEP 3
  Computation of the Mismanaged Waste from its exported waste (MW_{EXP}) for each sector. In this case, packaging and textile.

- STEP 4
  Computation of the final Mismanaged Waste for each sector.

  $$MW = MW_{DOM} + MW_{EXP}$$

- STEP 5
  Computation of the Mismanaged Waste Index (MWI) for each sector.

  $$MWI = \frac{MW}{Waste\ Generated}$$

- STEP 6
  Putting all types of waste together:

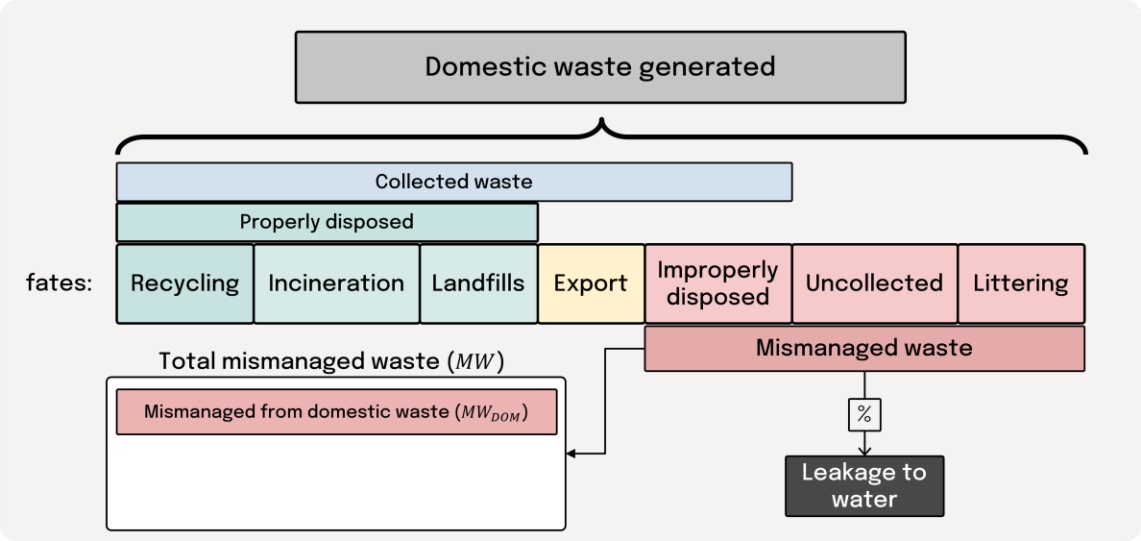
  $$MWI = \sum_{sector} (MWI_{sector} * Waste\ Generated_{sector})$$

  with $sector$ = packaging, textile and household.

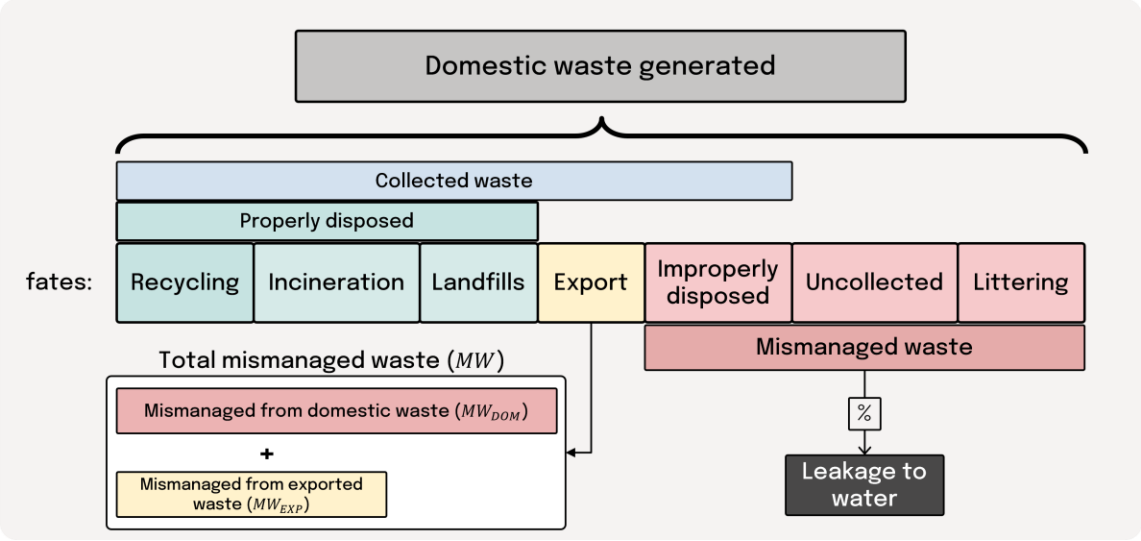
Once the MWI of a country is determined, it is converted into a calendar date through a simple proportion approach. If a country mismanages 50% of its waste, this is equivalent to properly managing waste for half of the year, after which all waste is mismanaged. Therefore, its plastic overshoot day would fall on June 30th. The same principle applies to any other percentage.

**WaW 2.0 = solid waste management powered by the World Bank, https://datatopics.worldbank.org/what-a-waste/*

Mismanaged waste from domestic



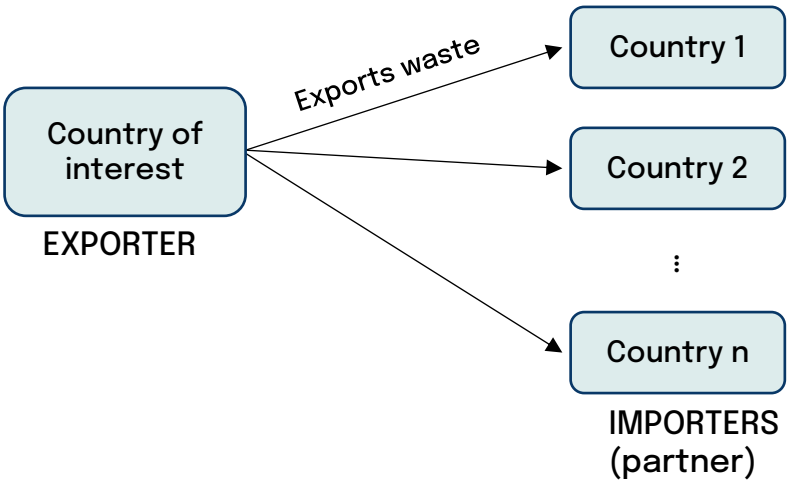
Mismanaged waste from domestic and exported



3. Mismanaged waste from export

This section focuses on STEP 3 and, in particular, on the computation of Mismanaged Waste from the amount of waste a country has exported (MW_{EXP}).

In this example the country has multiple partners to which it exports its plastic waste.



- For packaging waste, each partner is assessed individually, in order to analyse its specific waste management practices, and compute the resulting mismanaged waste. For textile, if country-specific data are not available, the partner is assessed based on regional data.
- The mismanaged contributions of every partner country are summed up and added to the domestic mismanaged waste of the country of interest.

$$MW = MW_{DOM} + \sum_{partner} MW_{EXP,partner}$$

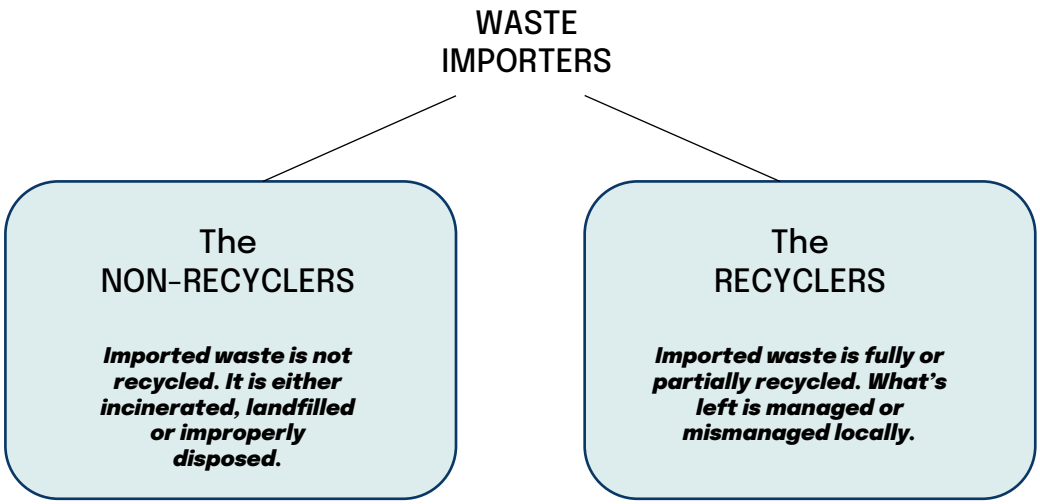
The following sections 4. and 5. explain in more details how this step is done for packaging waste and for textile waste.

4. Mismanaged waste from packaging export

The waste management practices of importing countries are a critical factor to consider when dealing with the export analysis. Consequently, the current state of waste management in these countries is accounted for when calculating the overall mismanaged waste of an exporting country.

There are various factors that affect the management of waste in partner countries, such as recycling infrastructure, waste management policies, and waste management system.

Packaging waste importers can be categorized into two groups:



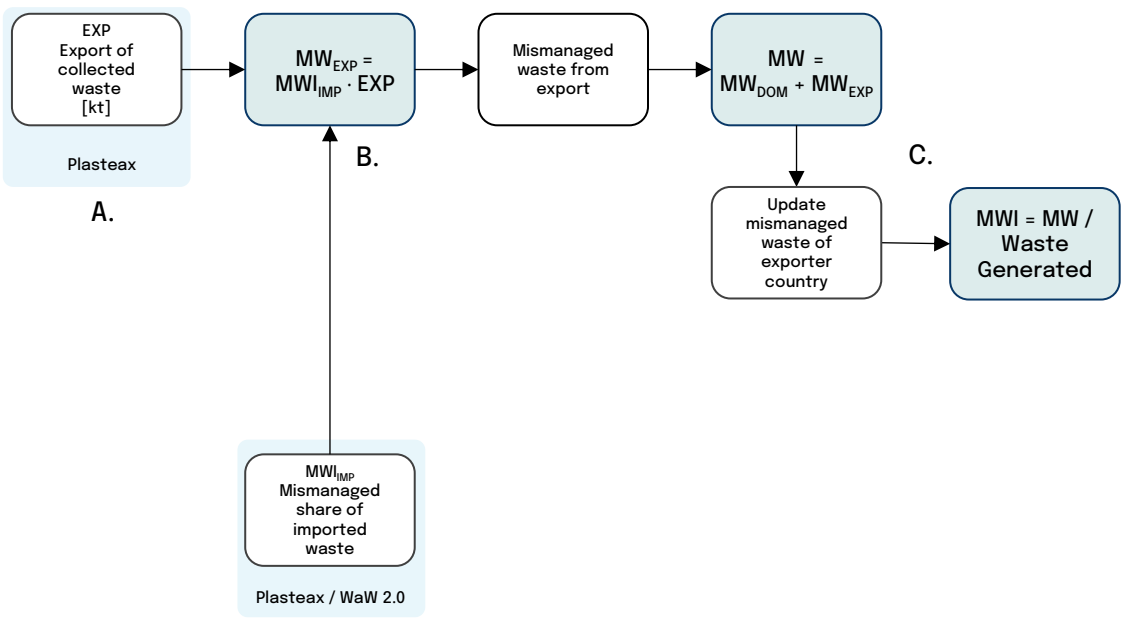
4.1. Case 1: non-recycler

This section explains the scenario where the importer country has a NON-RECYCLER profile.

A. Plasteax provides data of the amount of waste collected and exported by the country of interest to the importer country. This amount is referred to as exported waste from collected (EXP).

B. To calculate the mismanaged share of exported waste, the same mismanaged waste index (MWI_{IMP}) that is applied to the importer country's domestic waste is used. This ratio is available in Plasteax, or, if the country is not in Plasteax, in the WaW 2.0 database.

C. Finally, the contribution of mismanaged exported waste is added to the exporter country's domestic mismanaged waste. To compute the mismanaged waste index, the overall mismanaged waste (export + domestic) is then divided by the total amount of waste generated by the country of interest.



4.2. Case 2: recycler

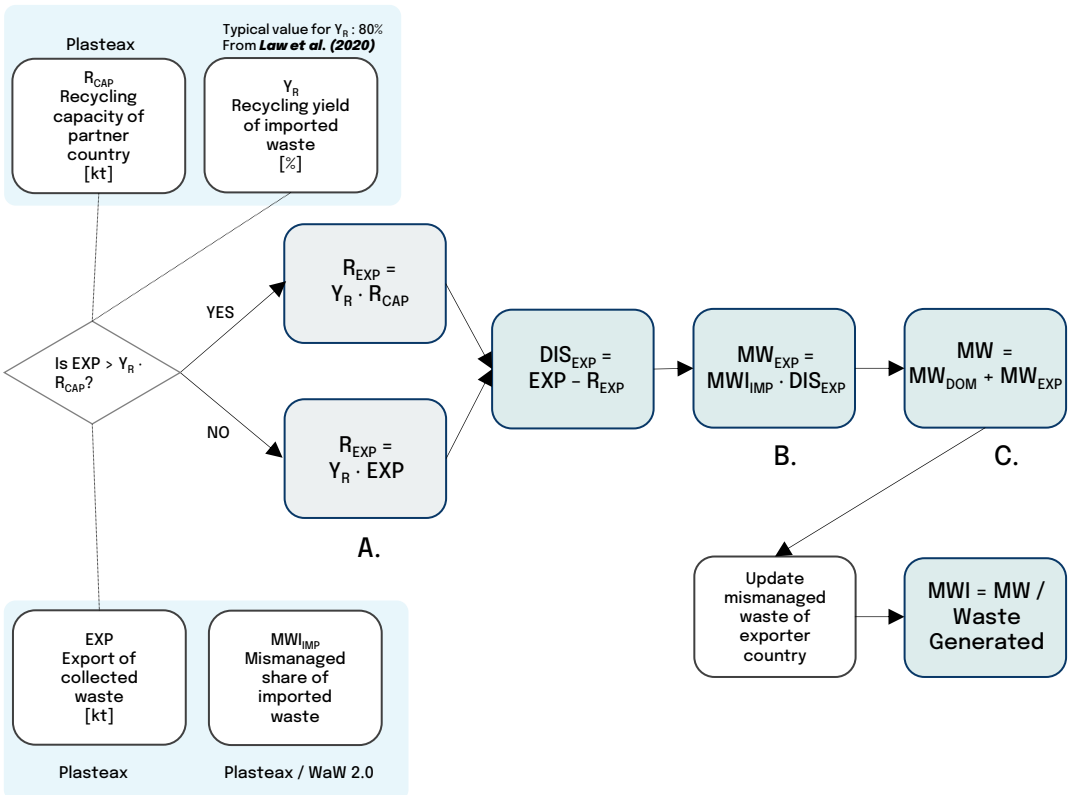
This section describes the situation where the importer country has a RECYCLER profile. As before, Plasteax provides data on the export of collected waste (EXP) from the country of interest.

Two scenarios are considered: 1) the importer lacks the facilities to recycle the entire amount of (EXP); 2) the importer can recycle the entire amount. There is, however, a part of the waste which will not be recycled in any case, due to the recycling efficacy of the process (Y_R). The steps below apply for both scenarios:

A. The importer country will recycle as much waste as it can, and the remaining waste will become the disposed waste from export (DIS_{EXP})

B. This amount of waste (DIS_{EXP}) is mismanaged according to the mismanaged waste index of the importer country MWI_{IMP}

C. The mismanaged waste of the exporter is updated by adding the quantity MW_{EXP}



5. Mismanaged waste from textile export

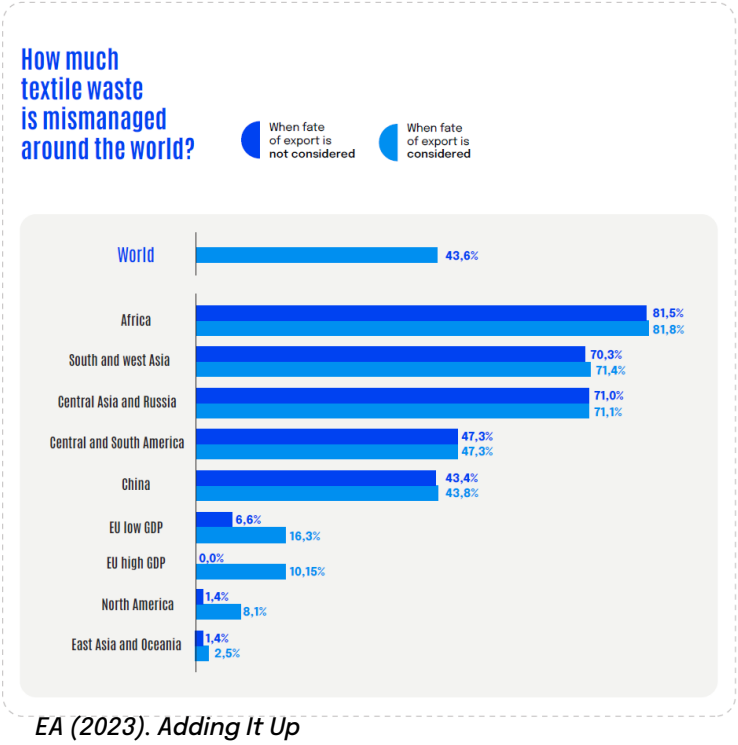
Concerning textile waste management, country-specific information is not yet available. The analysis is similar to the packaging analysis but lacks details by country and replaces them with information by region.

More specifically, data on textile waste trade was used to determine the destinations to which a country exports its textile waste. For each region that the country exports to, information on textile waste management for the region was used to assess the e-o-l of the exported waste from the country of interest. This process was repeated for each region the country exports to. By summing up the different fates, the impact of the export could be put back together in the exporter country's waste management values.

$$MW_{EXP} = \sum_{region} EXP_{region} * MWI_{region}$$

The final mismanaged quantity of the exporter is then obtained by adding the mismanaged domestically and the mismanaged abroad.

$$\text{MW} = MW_{DOM} + MW_{EXP}$$



EA (2023). Adding It Up

The textile MWI of countries from the Global North is heavily affected by export analysis. This is because often their exported textile waste ends up in regions which lack the proper infrastructure to handle it. As a result, this waste becomes mismanaged.

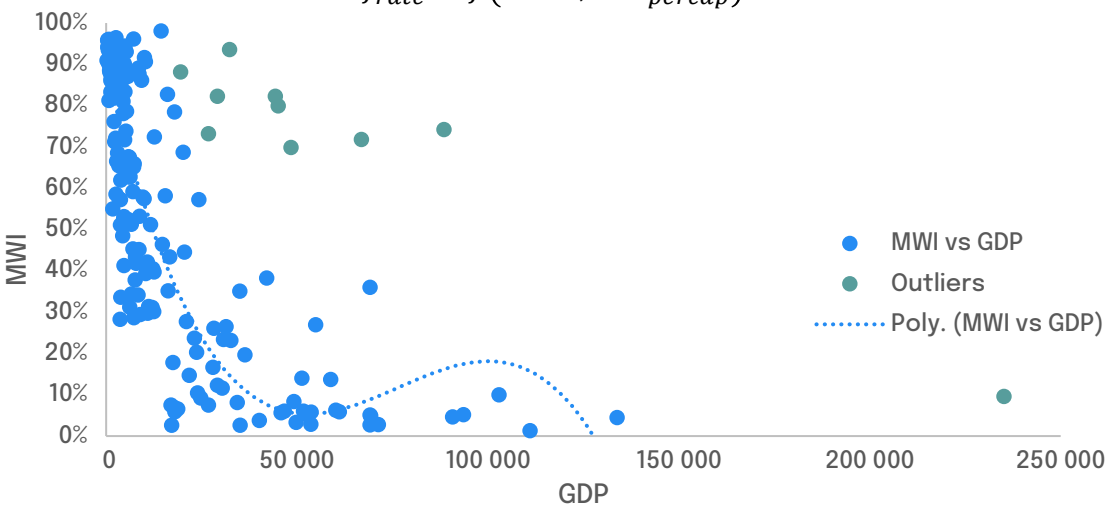
6. Updating the MWI

Plasteax data incorporates the latest available information for updates on an annual basis. However, since data is typically released with a delay of one to two years, Plastic Overshoot Day findings require an additional approach to give information for the current year.

This is why a methodology was developed to update the latest Plasteax MWI (2022) and project its evolution through 2025. The following section details the modeling approach used for the MWI evolution.

This methodology is based on the correlation between GDP per capita and MWI.

$$f_{rate} = f\left(MWI\ , GDP_{percap}\right)$$



By analysing these trends, we extract a predictive model to estimate the MWI for the current year based on projected GDP growth.

$$f_{rate} = f\left(MWI\ , GDP_{percap}\right)$$

$$f'_{rate} = \frac{\partial MWI}{\partial GDP_{percap}}$$

This approach provides an estimation of the MWI for the current year.

$$MW_{\text{year\_updated}} = MWI + \partial MWI$$
$$= MWI + f'_{rate} \cdot \partial GDP_{percap}$$

The methodology assumes that GDP growth enables investments in infrastructure and capacity building for waste management. However, as indicated in the graph above, certain countries have been identified as outliers. Despite having the necessary resources, these countries are unlikely to allocate them toward waste management. Consequently, the MWI for these countries remains unchanged.

Other countries where the MWI remains unchanged include those with a sufficiently high GDP, where additional economic growth does not influence the availability of funds for infrastructure investments.

7. Country classifications

The intention of Plastic Overshoot Day is not just to establish benchmarks for understanding plastic waste mismanagement, but just as critically, to provide insights into potential interventions that countries can implement to reduce their mismanaged waste index, prolong the overshoot date, and ultimately improve their waste management system.

Given that each country has unique realities, distinct patterns of plastic consumption, varying waste management infrastructure, and diverse waste management policies in place, it is vital to recognize that there is no one-size-fits-all solution. For instance, a country with high plastic consumption that primarily exports to developing countries is vastly different from another country with low plastic consumption, which imports and treats the waste of other developed countries.

The unique profile of a given country will substantially influence its ability to prolong its overshoot date and, in turn, impact the global overshoot date. Therefore, a country classification was developed to account for such variations.

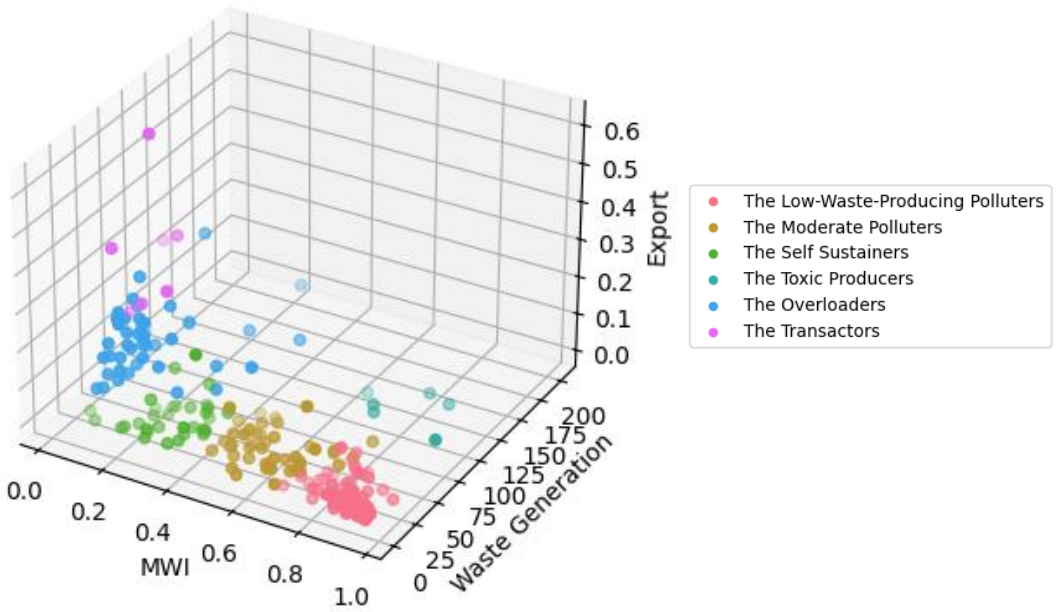
The following section details the approach that was used to develop this classification. The archetypes which are the result of this classification are essential to inform countries on adapted interventions for reducing their mismanaged waste index and moving towards a sustainable future.

Step1: Define the criteria that will determine a country's classification

1. Mismanaged Waste Index: The percentage of plastic waste that is mismanaged in the country.
2. Plastic waste generation level: The amount of waste generated by a country.
3. Waste imported level: The amount of waste a country imports from other countries.
4. Waste exported level: The amount of waste a country exports to other countries.

Step 2: Clustering the countries based on these four criteria.

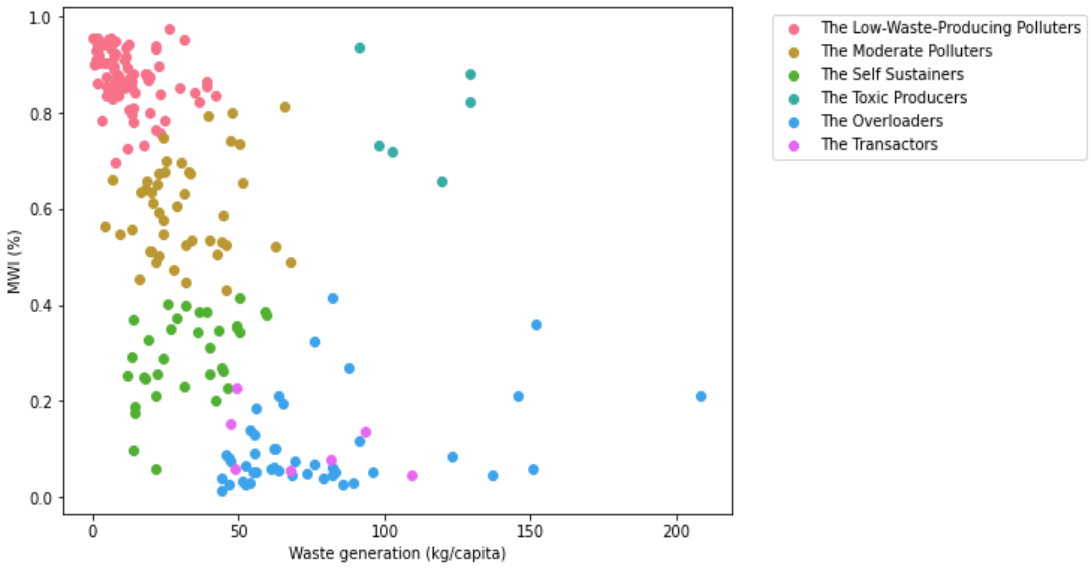
Countries were subdivided in clusters according to these different criteria. Each criterion had a weight in the clustering algorithm: MWI (0.4), Plastic waste generation (0.3), Waste imported (0.15), Waste exported (0.15).



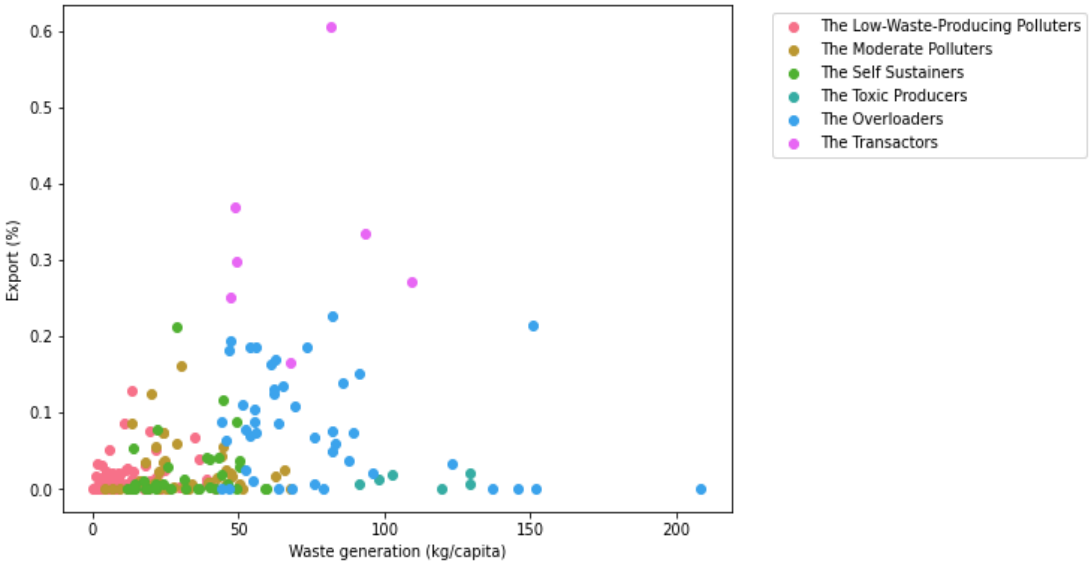
This 3d-visualization of the clusters shows three of the four criteria: MWI, Waste Generation and Export (% out of domestic production). It is important to note that these archetypes are a general and indicative representation of a country's plastic management profile. The number of archetypes was kept as low as possible to enhance clarity and understanding at the expense of capturing all management particularities. Furthermore, the archetype description may be more blurred for the few countries close to the cluster thresholds.

The following scatterplots relate two of the four metrics used for the classification and clearly show the different behaviours each cluster has.

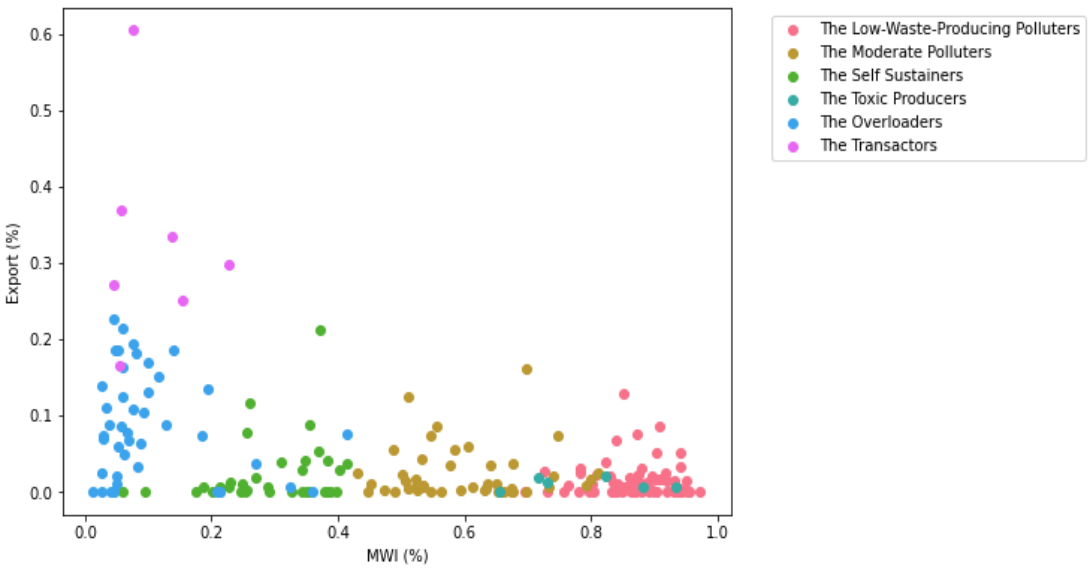
Waste Generation vs Mismanaged Waste Index:



Waste Generation vs Waste Export:



Mismanaged Waste Index vs Waste Export:



In this plot it is interesting to observe that the low-waste-polluters have a high MWI and are exporting low quantities of waste, whereas countries with typically lower MWI are prone to export higher quantities. This is especially the case of transactors, but also of some of the overloaders.

Step 3: Analyzing the clusters and identifying the common features

Country archetypes	Waste generation level	Waste mismanagement level	Import Volumes	Export Volumes
The Moderate Polluters	Medium (31 kg/cap/year)	High (60%)	Medium (2.2%)	Medium (2.4%)
The Overloaders	High (77 kg/cap/year)	Low (10%)	High (5%)	High (8%)
The Low-Waste-Producing Polluters	Low (12 kg/cap/year)	Very high (87%)	Low (0.8%)	Medium (1.3%)
The Toxic Producers	Very high (112 kg/cap/year)	Very high (79%)	Low (0.4%)	Medium (1.1%)
The Transactors	High (71 kg/cap/year)	Low (11%)	Very high (51%)	Very high (33%)
The Self Sustainers	Medium (32 kg/cap/year)	Medium (29%)	Medium (2.5%)	Medium (2.4%)

Step 4: Identifying the thresholds

Based on the clusters obtained, the following thresholds were established:

	Waste generation level (kg/cap/year)	Waste mismanagement level	Import (% of waste generation)	Export (% of waste generation)
Very high	>100	>60%	>10%	>10%
High	50-100	30-60%	3-10 %	3-10 %
Medium	15-50	10- 30%	1-3%	1-3%
Low	<15	<10%	< 1%	< 1%

Contact:
contact@plasticovershoot.earth