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.

September 5, 2024

Methodology guide

earth action

What is Plastic Overshoot Day?

Plastic...is...everywhere.

By 2040 plastic production is set to double, with plastic pollution expected to triple

Plastic pollution is an environmental crisis - a crisis rooted in the imbalance between the volumes of plastic that are produced and used, and the world's ability to manage those volumes when they become waste.

The imbalance results in a significant amount of plastic ending up in the environment every year, with a devastating portion ending up in the oceans. Mismanaged plastic waste is a significant threat to global ecosystems and by extension, human well-being.

In 2024 the volume of plastic waste will overshoot the volume that waste systems can manage on September 5th.

By tracking this date we can more clearly define and understand the problem, and hold governments, businesses and individuals to account for their role in contributing to it.

We can also further support critical efforts to stop the flow of plastic into natural ecosystems and thankfully there is good news to celebrate and positive progress in this regard. Global negotiators are currently working to establish a Plastic Treaty, with a legally-binding agreement set to be in place by the end of 2024 that will reset the course of the plastic pollution crisis.

It's time for action. Together, we can work toward reducing plastic production and use, improving viable waste management systems, promoting sustainable alternatives, and pushing for policy changes to combat plastic pollution and protect our oceans, the environment and the well-being of future generations.

PLASTIC OVERSHOOT DAY

Scope for better impact

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

THE TEAM BEHIND THE PROJECT

The team of dedicated sustainability leaders from the Swiss-based Association EA - Environmental Action is committed to conducting innovative research and providing consulting services for local and global organizations, while leveraging their non-profit arm to address significant environmental issues.

Plastic Overshoot Day emerged out of EA's dedication to investing profits and talents into impactful initiatives. This project is a natural extension of EA's extensive research and publications in the plastics field, and is built upon the methodology of PLASTEAX, the pioneering database offering comprehensive plastic waste management data at both country and polymer-specific levels.

As with all EA and PLASTEAX efforts, Plastic Overshoot Day is committed to transparency, raising awareness about plastic pollution, and driving sustainable solutions to tackle a pressing global challenge.

Plastic Overshoot Day is an initiative by EA Environmental Action, derived from PLASTEAX data. PLASTEAX is a data platform dedicated to plastic environmental analytics and discloses plastic waste management and plastic leakage metrics.

www.plasteax.earth

PLASTEAX is developed by
EA – Environmental Action

www.e-a.earth

Contact us : contact@plasticovershoot.earth

PLASTIC OVERSHOOT DAY

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 [%]
COL_{EXP}	Exported waste collected in partner country [kt]

PLASTIC OVERSHOOT DAY

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Motivations

At EA Environmental 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 with regard to management of plastic waste.

The Mismanaged Waste Index (MWI) is a metric used to quantify the amount 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, there are two main ways to account for exported waste:

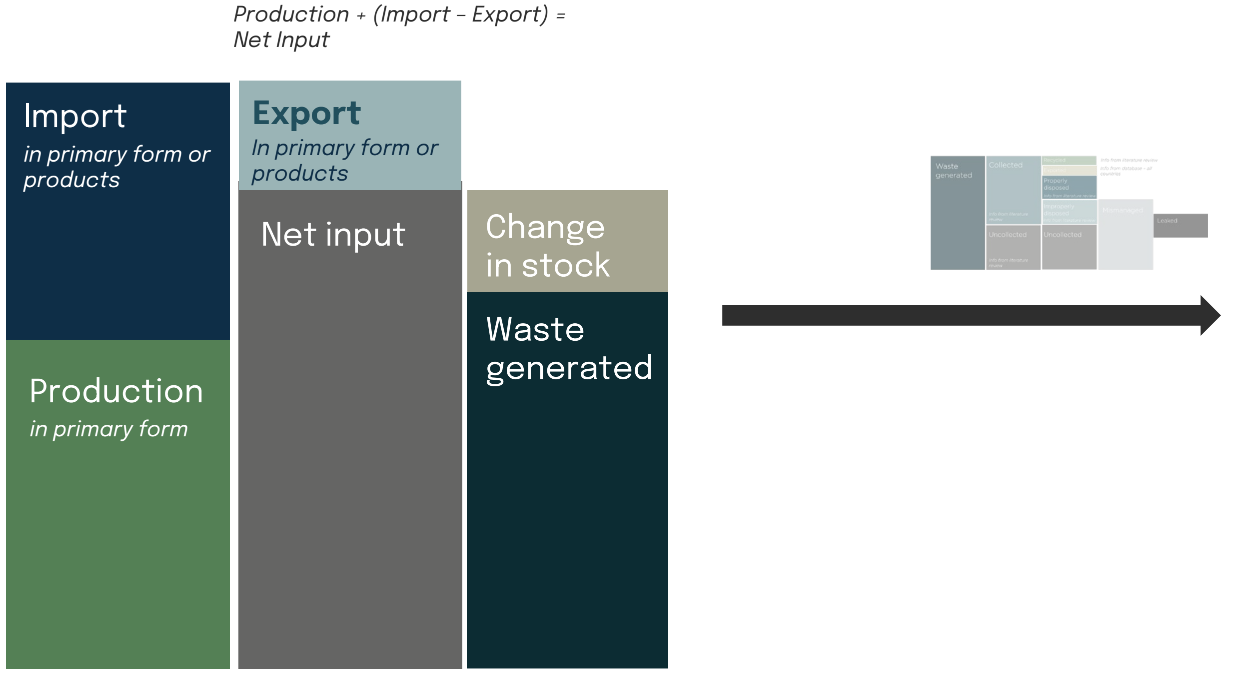
- Approach 1: presume that all exported plastic waste can be considered recycled, like in the European Commission database, Eurostat*. The issue with this approach is that it is too optimistic and does not fully reflect the reality of what transpires with exported waste.
- Approach 2: presume that all exported plastic waste is mismanaged. The issue with this approach is that it is too pessimistic 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.

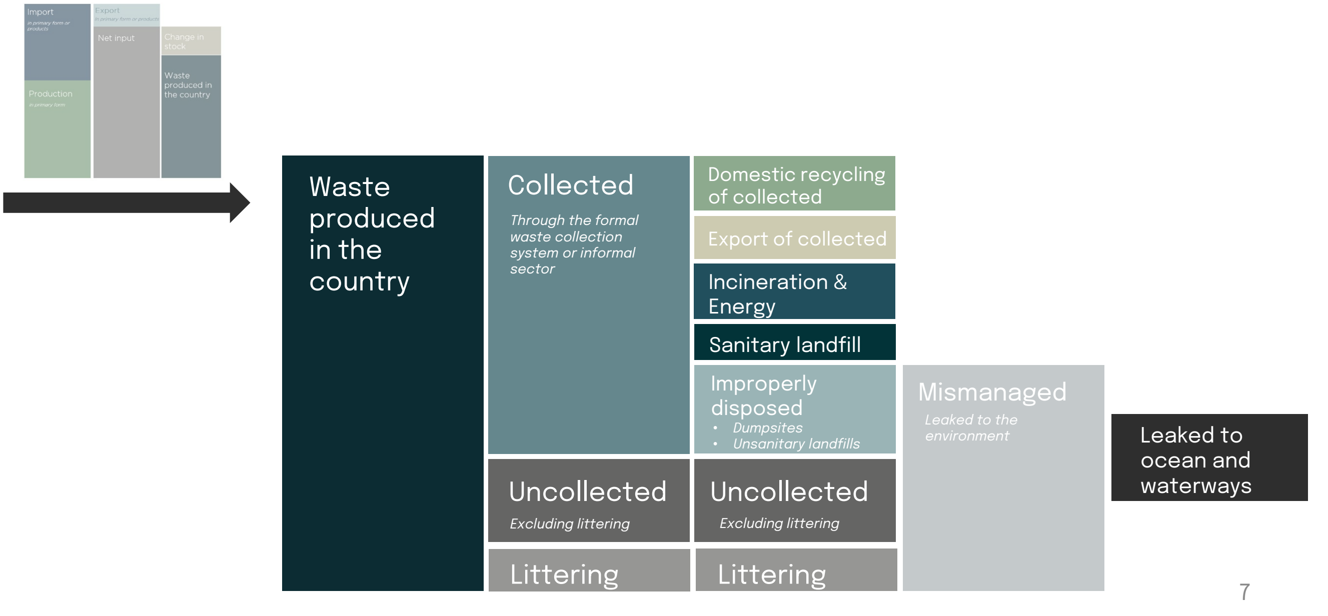
* Eurostat Database: https://ec.europa.eu/eurostat/

1. Plastics leakage pathway

1.1. From primary to material waste



1.2. From waste to leakage



2. MWI: Methodology

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

The focus of POD 2024 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*. Data for household waste management are taken from the WaW 2.0 database.

- STEP 1
  Selection of the country of interest

- STEP 2
  Computation of the Mismanaged Waste from its domestic waste (MW_{DOM})

- STEP 3
  Computation of the Mismanaged Waste from its exported waste (MW_{EXP})

- STEP 4
  Computation of the final Mismanaged Waste:

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

- STEP 5
  Computation of the Mismanaged Waste Index (MWI):

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

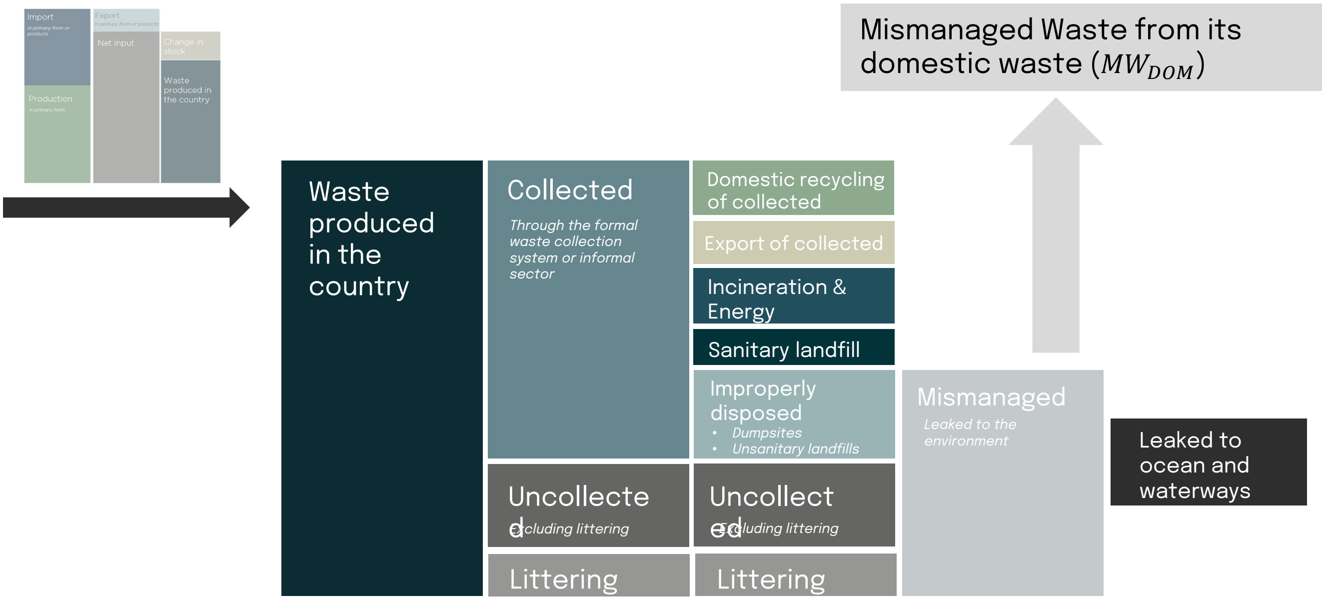
- STEP 6
  Putting all types of waste together:

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

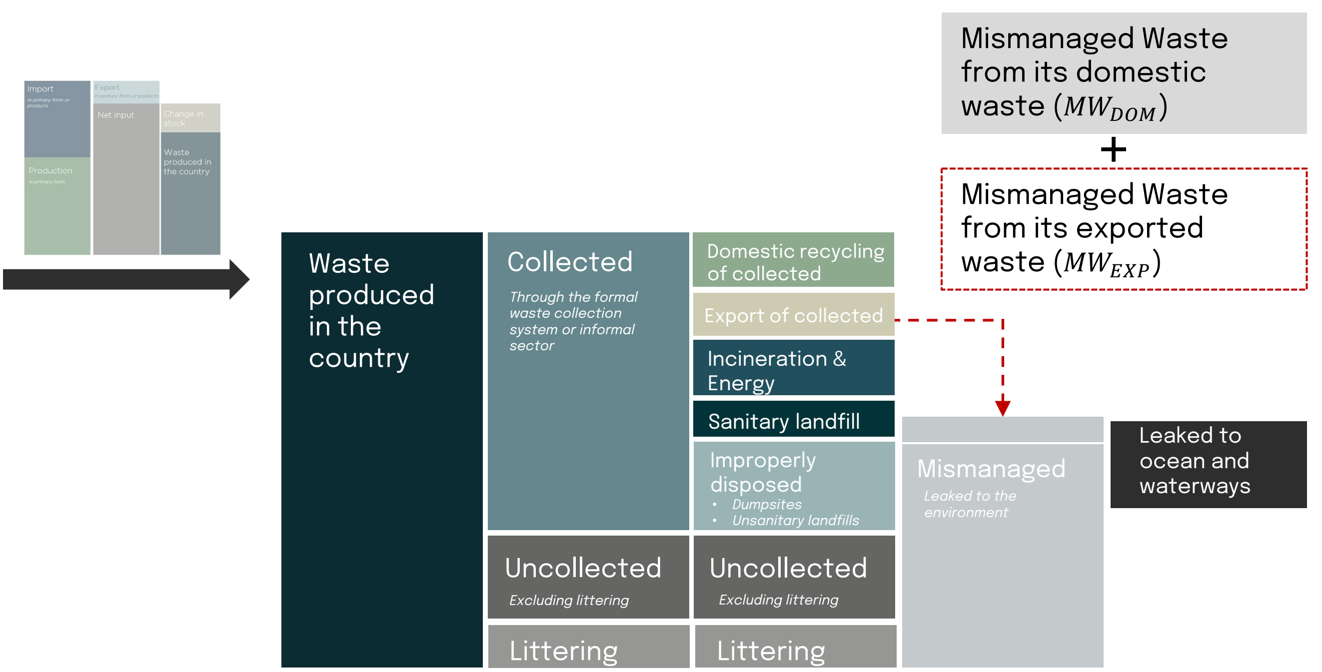
with $sector$ = packaging, textile and household.

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

Mismanaged waste from domestic



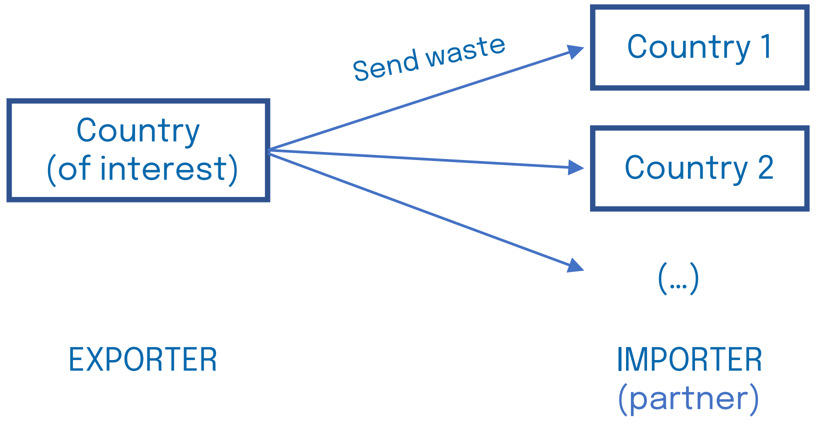
Mismanaged waste from domestic and exported (red arrow)



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 many partners to which it exports some amount of its waste.



- STEP 3.1
  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 the region it belongs to.
- STEP 3.2
  Finally, the mismanaged contributions of every partner country are summed up and added to the domestic mismanaged waste of the country of interest.

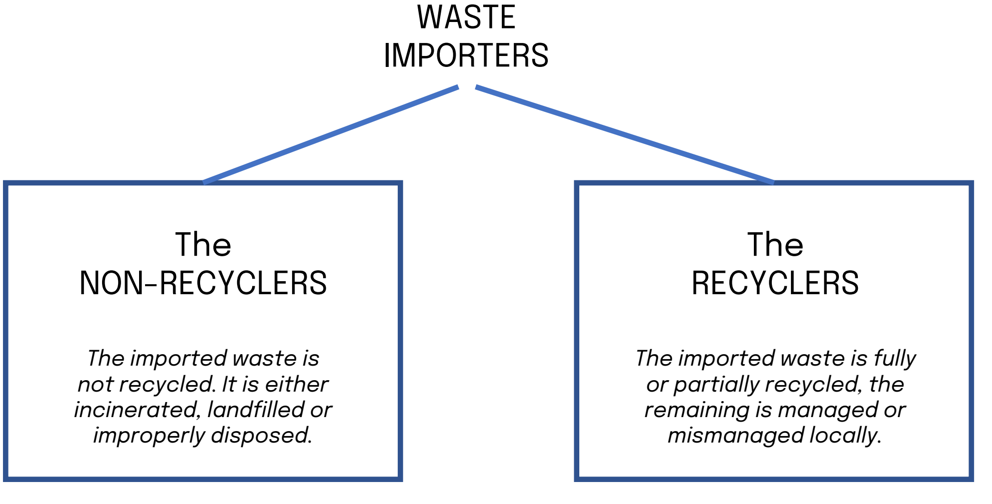
The following sections 4. and 5. explain in more details how this step is done for packaging waste and for textile waste.

4. Mismanaged waste from packaging export

The waste management practices of importing countries are a critical factor to consider when dealing with **STEP 3.1**. Consequently, the current state of waste management in these countries is included 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:



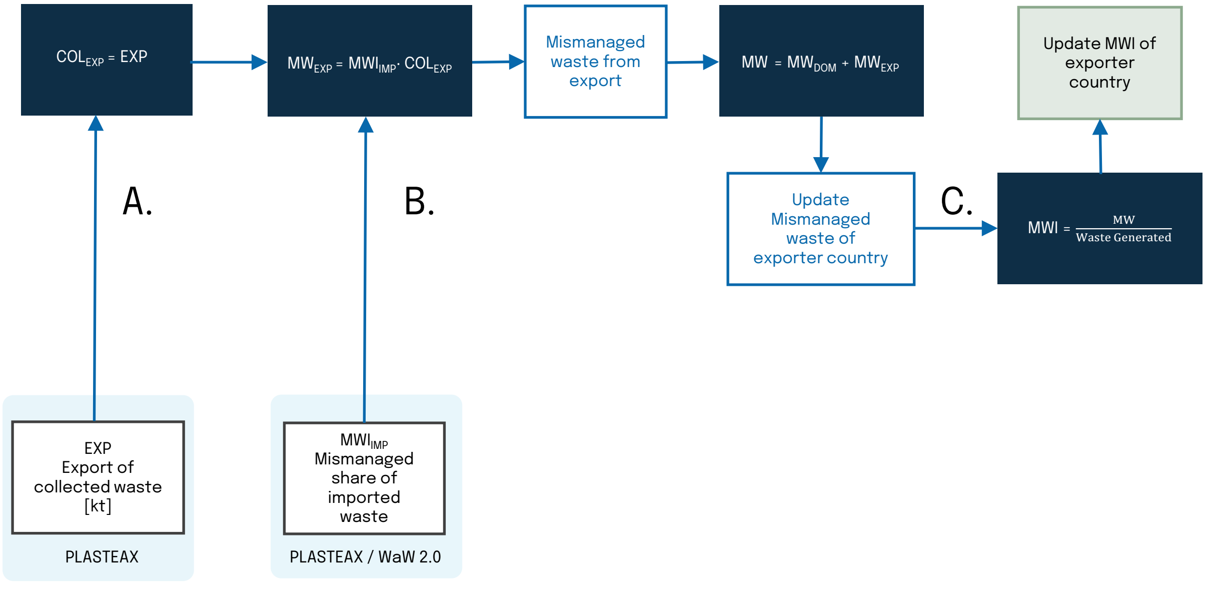
4.1. Case 1: non-recycler

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 collected waste from export (COL_{EXP}).

B. To calculate the mismanaged waste from this 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 waste from export waste is added to the exporter country's domestic 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

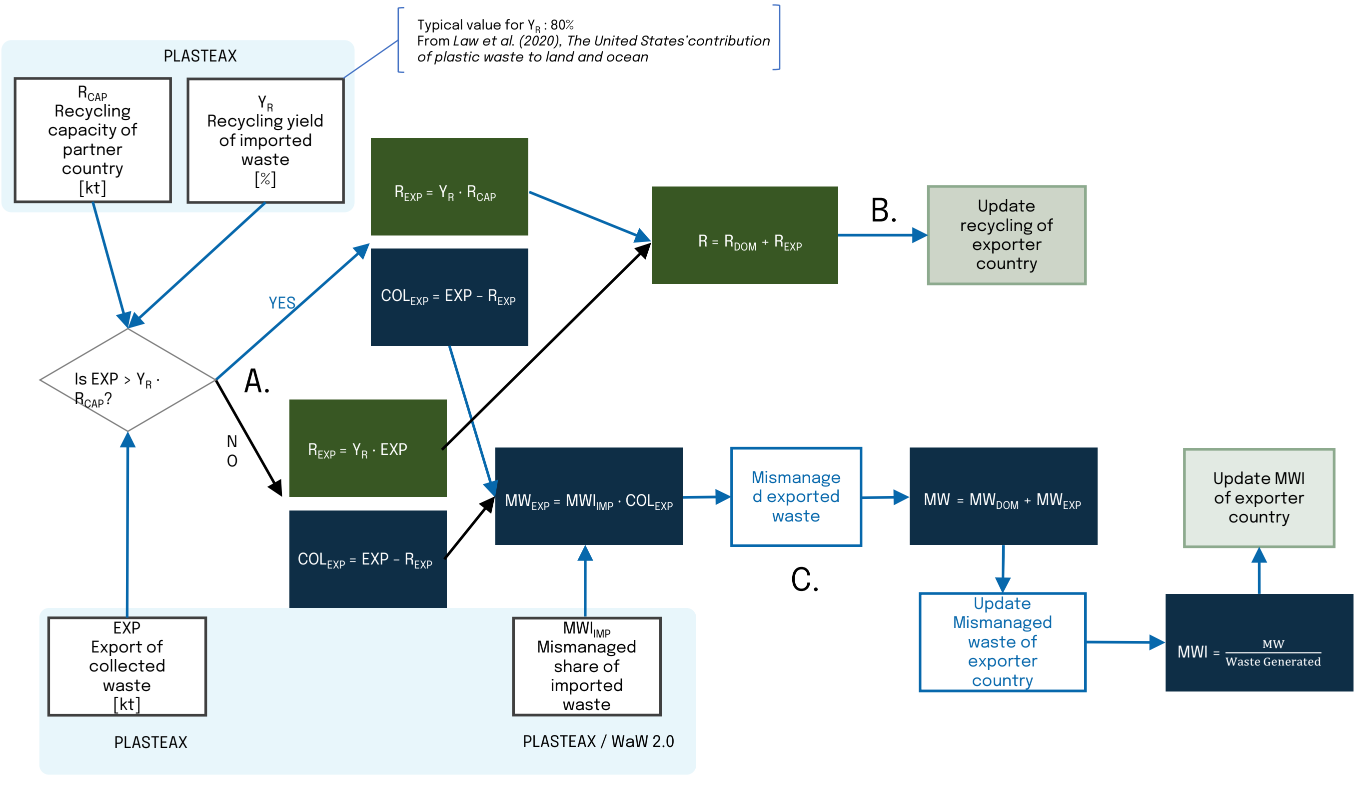
This section describes the situation where the importer country has a RECYCLER profile. As before, PLASTEAX provides data on the export of collected waste (EXP) from the country of interest.

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 collected waste from export (COL_{EXP}).

B. The amount of recycling of the exporter country is updated by adding the contribution from the export waste.

C. Then, the same steps as for a NON-RECYCLER importer country are applied to calculate the (MWI).



5. Mismanaged waste from textile export

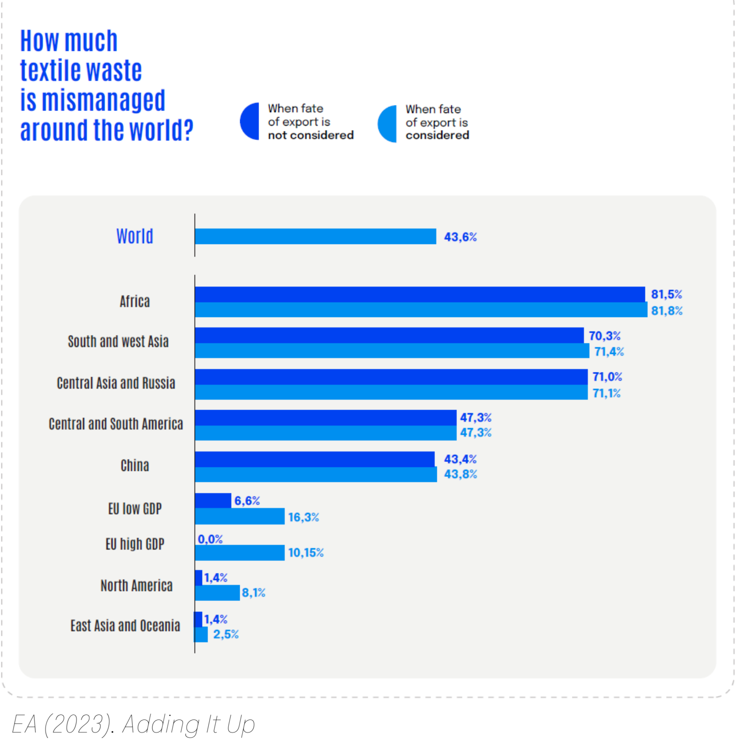
Concerning textile waste management, country-specific information is not yet available.

Data on textile waste trade was used to examine the destinations to which a country exports its textile waste. For each region that the country exports to, textile waste management was modelled, and this information was used to assess the e-o-l of the exported waste from the country of interest. This process was repeated for each region a 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.

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



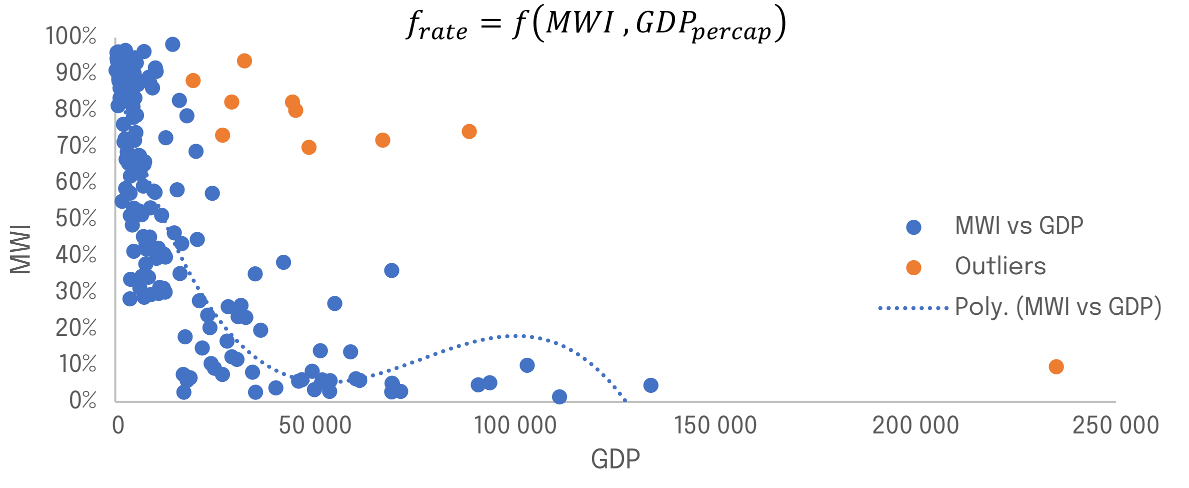
The textile MWI of countries from the Global North is heavily affected by export analysis. This is because often their exported textile waste ends up in regions which lack the proper infrastructure to handle it. As a result, this waste becomes mismanage d.

6. MWI: Updating

In the development of the PLASTEAX data, we ensure that the latest available data is utilized and updated on an annual basis. This means that we use the latest available data and update it yearly to improve the development of the PLASTEAX data. Moreover, for the Plastic Overshoot Day calculation, a forecast model is created to estimate the values for the current year. This process has prompted us to adapt the PLASTEAX methodology to develop the MWI. The subsequent section elaborates on the approach we take to model the MWI.

This methodology identifies 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.

$$MW_{\text{year\_updated}} = MWI + \partial MWI$$

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

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, country classifications were developed to account for such variations.

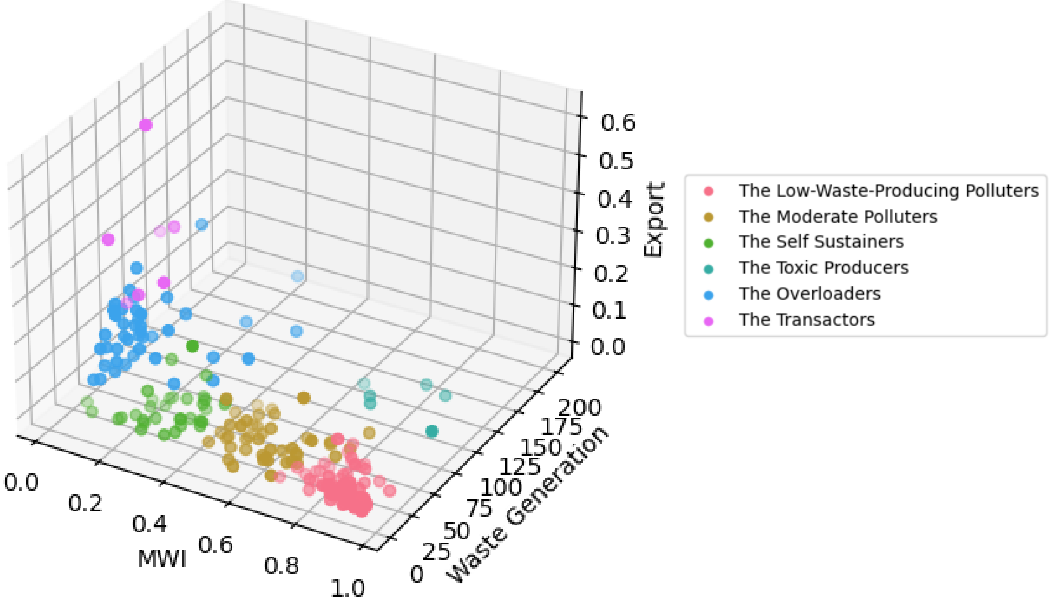
The following section elaborates on the approach that was used to develop these classifications. These are essential to inform countries on adapted interventions for reducing their mismanaged waste index and moving towards a sustainable future.

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.

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 (30 kg/cap/year)**	**High (60%)**	**Medium (2%)**	**Medium (2.5%)**
The Overloaders	**High (75 kg/cap/year)**	**Low (10%)**	**High (5%)**	**High (9%)**
The Low-Waste-Producing Polluters	**Low (12 kg/cap/year)**	**Very high (87%)**	**Low (<0.8%)**	**Medium (1.2%)**
The Toxic Producers	**Very high (109 kg/cap/year)**	**Very high (79%)**	**Low (<0.4%)**	**Medium (1%)**
The Transactors	**High (69 kg/cap/year)**	**Low (11%)**	**Very high (52%)**	**Very high (33%)**
The Self Sustainers	**Medium (32 kg/cap/year)**	**Medium (29%)**	**Medium (2.6%)**	**Medium (2.5%)**

Step 4: Identifying the thresholds
Based on the clusters obtained through the clustering algorithm, 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