www.plasticovershoot.earth

PLASTIC OVERSHOOT DAY

The date when the amount of plastic waste outweighs the world's ability to manage it, with environmental pollution occurring as a result.

28 July 2023

Methodology guide

PLASTIC OVERSHOOT DAY

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 2023 the volume of plastic waste will overshoot the volume that waste systems can manage on July 28th.

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.

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

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

Table of contents

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.

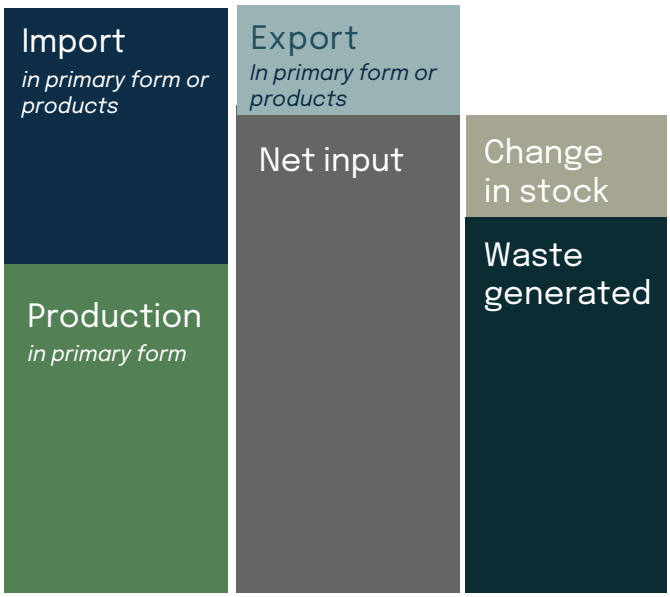
The PLASTEAX methodology, on which Plastic Overshoot Day is built, provides a more realistic modelling framework, one that is closer to reality.

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

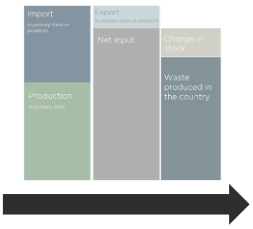
1. Plastics leakage pathway

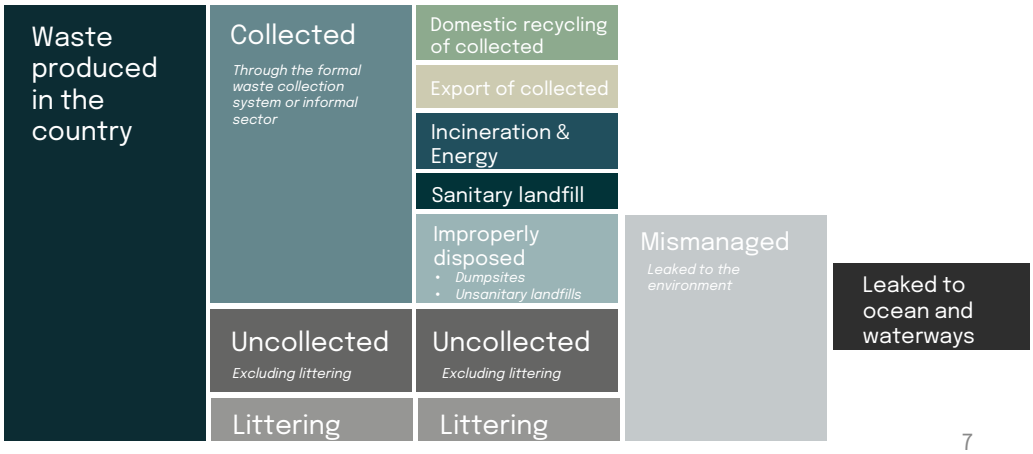
1.1. From primary to material waste

Production + (Import – Export) = Net Input



1.2. From waste to leakage





PLASTIC OVERSHOOT DAY

MWI = Mismanaged Waste Index

$$= \frac{\text{Mismanaged}}{\text{Waste Generated}}$$

Waste produced in the country

Collected
Through the formal waste collection system or informal sector

Domestic recycling of collected

Export of collected

Incineration & Energy

Sanitary landfill

Improperly disposed
- *Dumpsites*
- *Unsanitary landfills*

Uncollected
Excluding littering

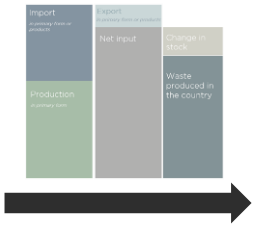
Littering

Uncollected
Excluding littering

Littering

Mismanaged
Leaked to the environment

Leaked to ocean and waterways



MWI = Mismanaged Waste Index

$$= \frac{\text{Mismanaged}}{\text{Waste Generated}}$$

Waste produced in the country

Collected
Through the formal waste collection system or informal sector

Domestic recycling of collected

Export of collected

Incineration & Energy

Sanitary landfill

Improperly disposed
- *Dumpsites*
- *Unsanitary landfills*

Uncollected
Excluding littering

Littering

Uncollected
Excluding littering

Littering

Mismanaged
Leaked to the environment

Leaked to ocean and waterways

PLASTIC OVERSHOOT DAY

2. MWI: Methodology

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

- 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:

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

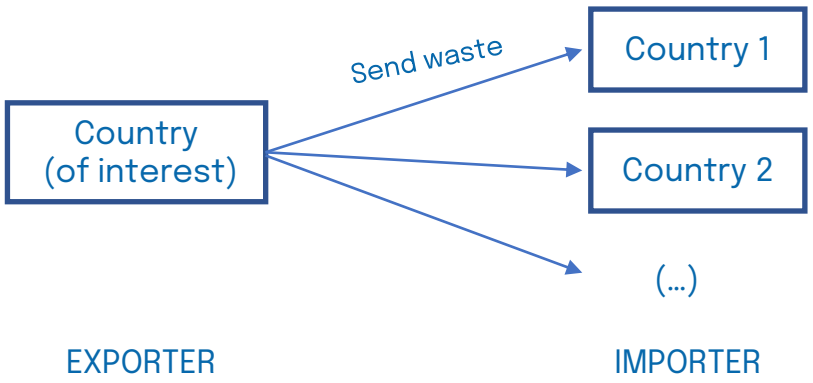
- STEP 5
  Computation of the Mismanaged Waste Index (MWI):

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

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.



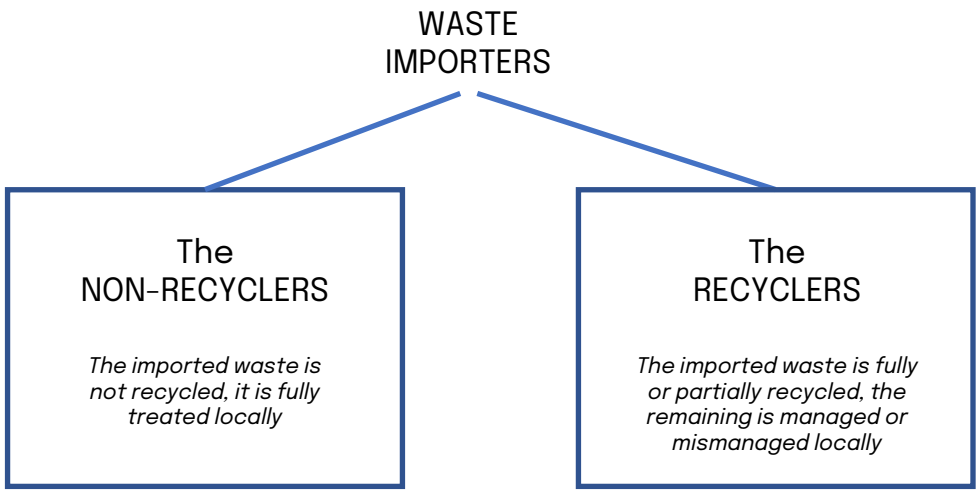
- STEP 3.1
  Each partner is assessed individually, in order to analyse its waste management practices, and compute the partner's mismanaged waste.
- STEP 3.2
  Finally, we sum up the mismanaged contributions of every partner country.

4. Importer country profiles

The waste management practices of importing countries are a critical factor to consider when dealing with STEP 3.1. To narrow our focus, we can examine the current state of waste management in these countries.

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

To categorize waste importers, we can divide them into two groups:

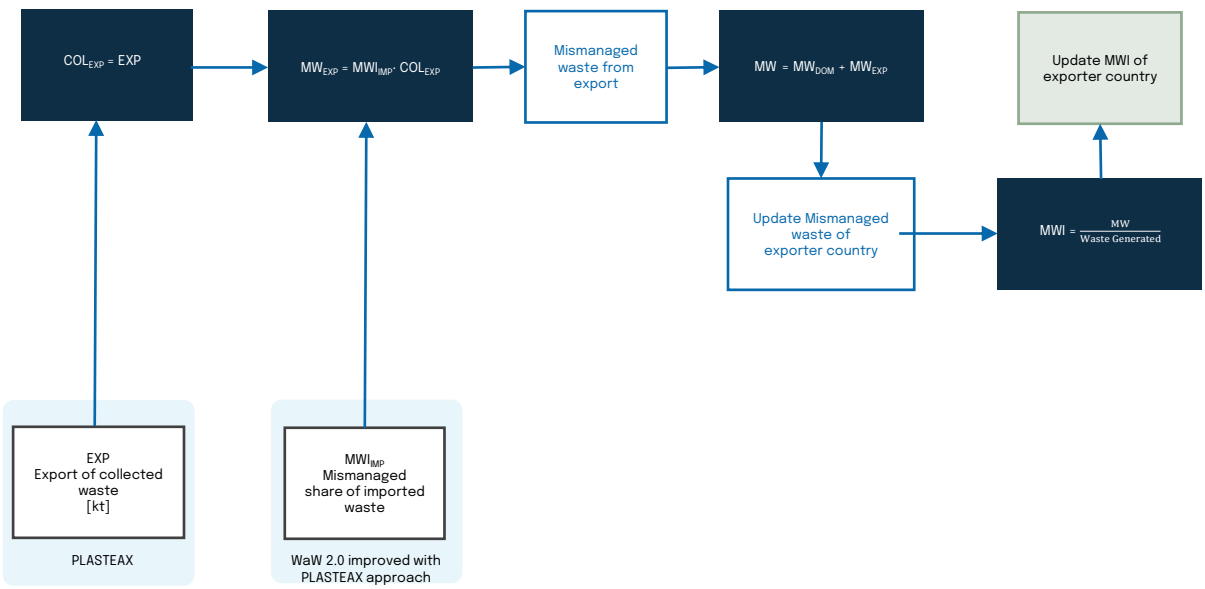


5. MWI: Modeling

5.1. Case 1: non-recycler

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

- PLASTEAX provides data of the amount of waste collected and exported by the country of interest to the importer country, which we will refer to as collected waste from export (COL_{EXP}).
- To calculate the mismanaged waste from this exported waste, we use the same mismanaged waste index (MWI_{IMP}) that is applied to the importer country's domestic waste. This ratio is available in the WaW 2.0 database improved with PLASTEAX approach.
- Next, the contribution of mismanaged waste from export waste is added to the importer country's domestic waste and the mismanaged waste index is calculated by dividing it by the total amount of waste generated by the country of interest.



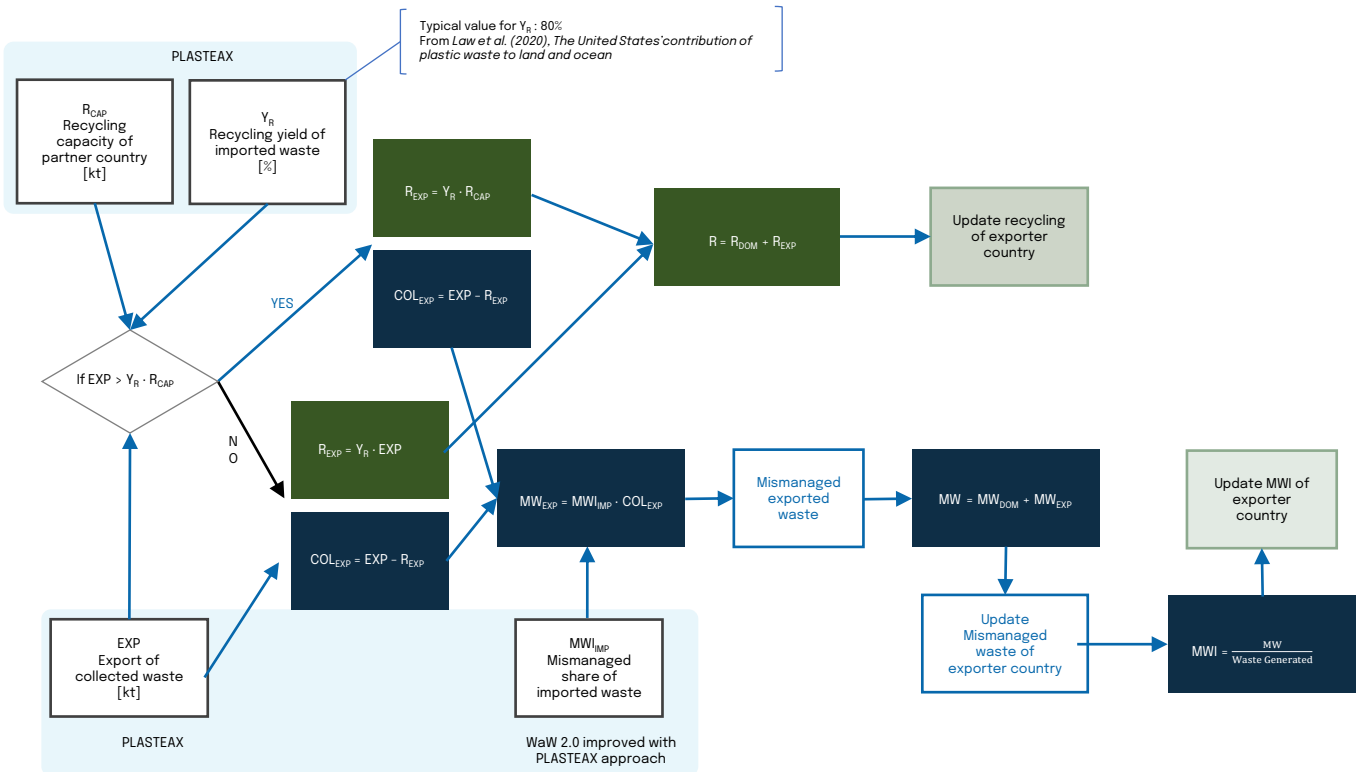
5.2. Case 2: recycler

We move to 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.

We distinguish two scenarios: where the importer lacks the facilities to recycle the entire amount of (EXP), and the other where it can recycle the entire amount up to a global threshold of recycling yield (Y_R).

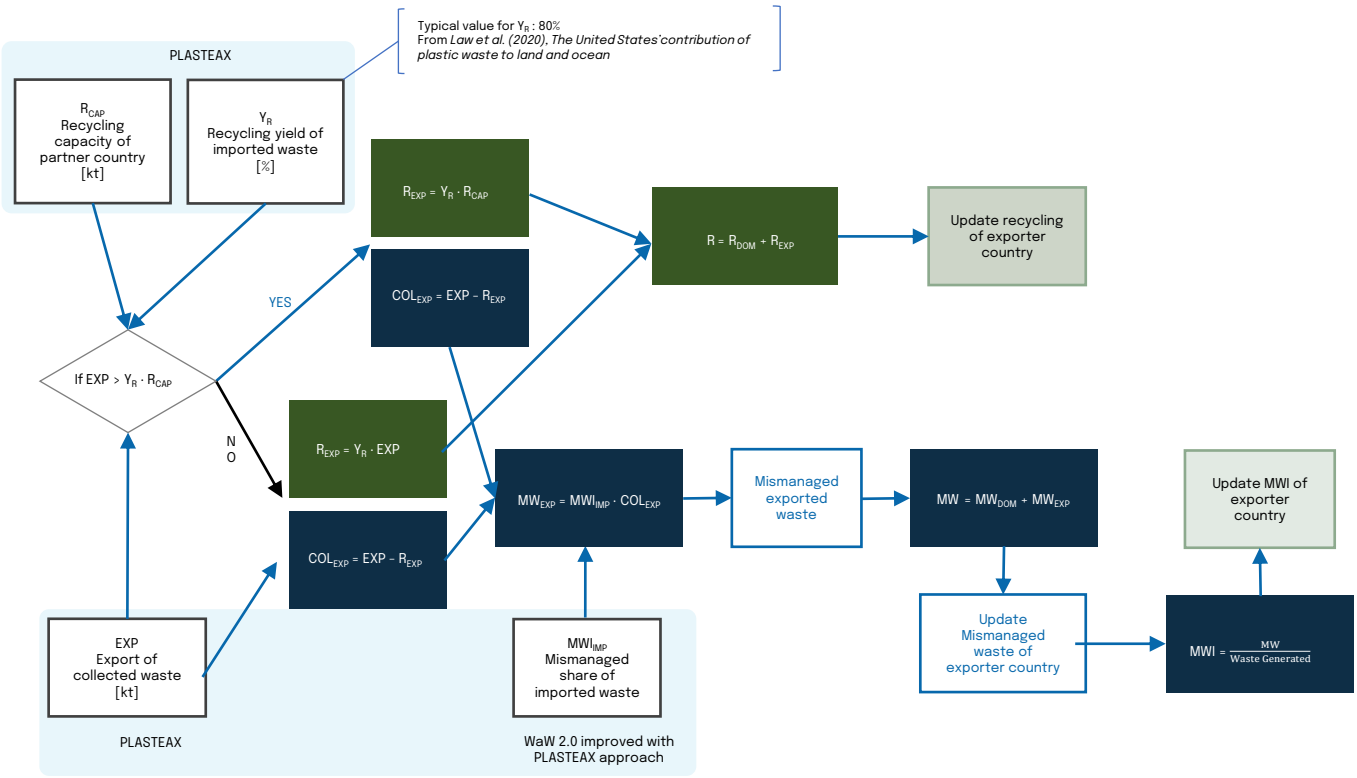
First, let us examine the scenario where (EXP) exceeds the importer country's recycling capacity.

- The importer country will recycle as much waste as it can, and the remaining waste will become the collected waste from export (COL_{EXP}).
- To update the recycling profile of the importer country, we add the contribution from the export waste.
- Then, we proceed as in the case of a NON-RECYCLER importer country to calculate the (MWI).



Now, let's consider the scenario where the importer country's recycling facility can accommodate all of the export waste.

- the importer country will recycle all of the export waste up to its recycling yield, and the remaining waste becomes the collected waste from export.
- Similar to the previous cases, we update the recycling profile of the importer country by adding the contribution from the export waste.
- Then, we proceed with the same steps as in the case of a NON-RECYCLER importer country to calculate the mismanaged waste index.



6. EA approach on WaW 2.0

As previously mentioned in the slides, our modelling approach relies on data obtained from both the PLASTEAX in-house platform and the WaW 2.0 improved with PLASTEAX approach. The latter is essentially an upgraded version of the WaW 2.0 database, and we'll provide further details on this below.

WaW 2.0: solid waste management powered by the World Bank.

- Topics: waste generation, waste collection, waste treatment and disposal, financing models, operational models, technologies, citizen engagement, environmental impact, informal sector impact.
- Geographical cover: 217 countries.

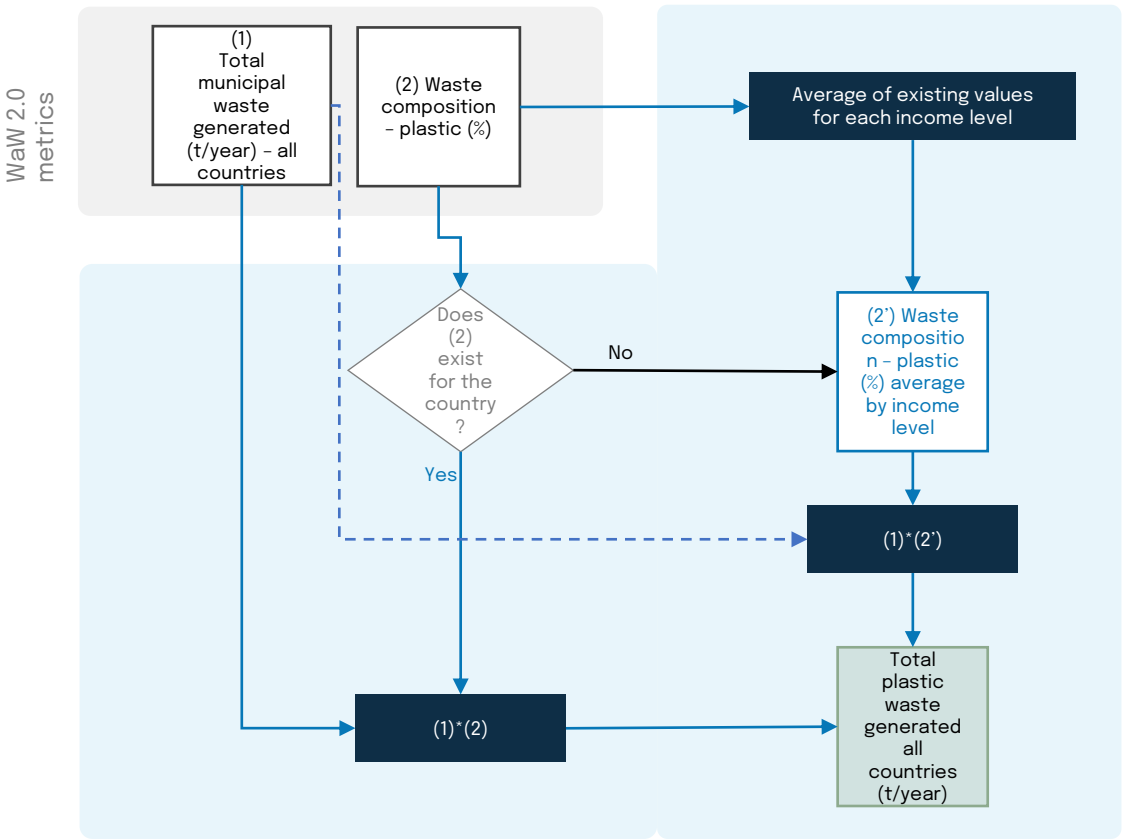
WaW 2.0 improved with PLASTEAX approach: enriched database by our environmental analysts.

- Main differences: WaW 2.0 focuses on solid waste, WaW 2.0 improved with PLASTEAX approach focuses on plastics waste.
- Additionally, the PLASTEAX approach has introduced new data fields to the existing database, which include:
  - ❑ Improperly disposed
  - ❑ Uncollected (incl. littering)
  - ❑ Domestic recycling
  - ❑ Properly disposed
  - ❑ Domestic MWI
  - ❑ (…)

Over the next few slides, we will demonstrate our modelling process for calculating some of these data fields, including plastic waste generation, proper disposal, and domestic mixed waste incineration. For collection rate, see Annex 1.

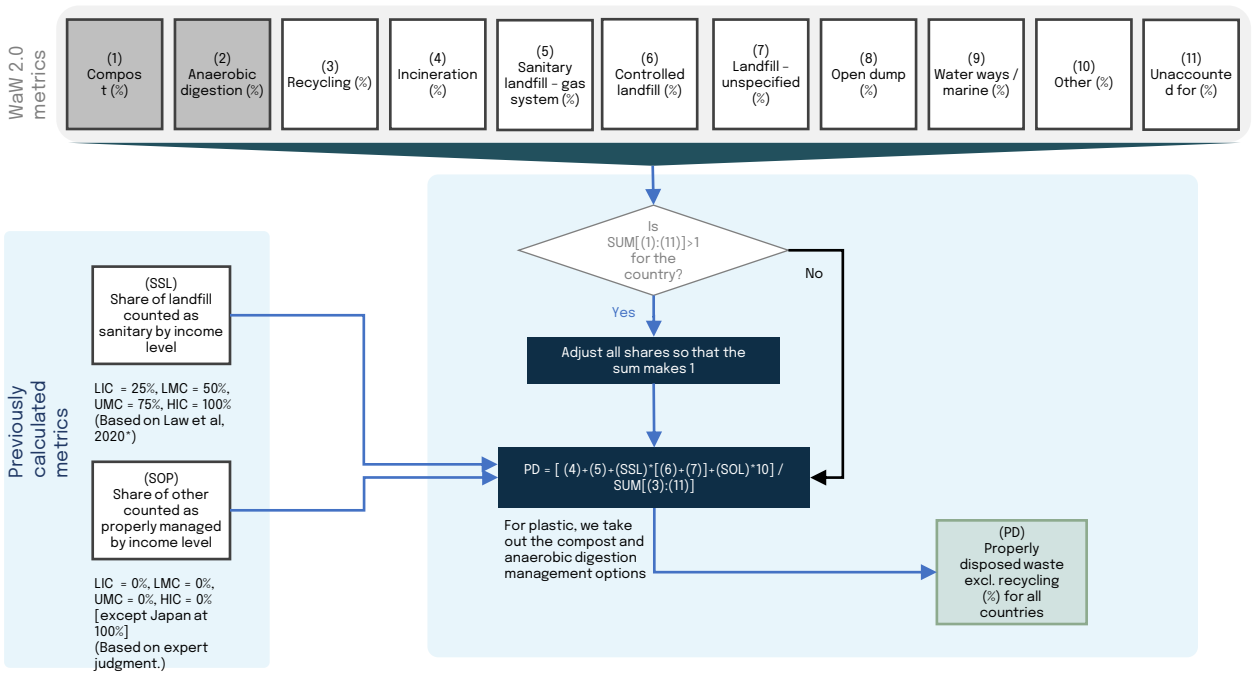
6.1. Plastic waste generated

The plastic waste generated is computed from the total municipal solid waste and its plastic composition share.



6.2. Properly disposed waste (excl. recycling)

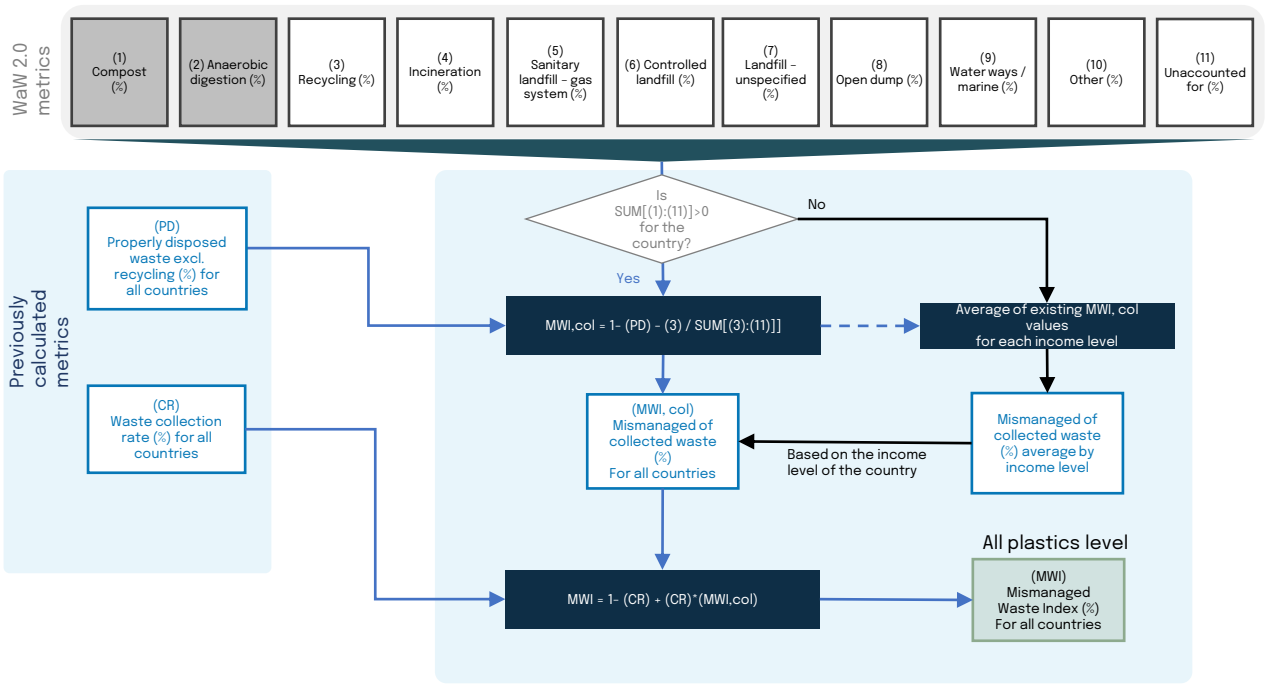
The properly disposed waste is computed as the portion of plastic waste which has been either incinerated or disposed in a sanitary landfill.



**Law, K. L., Starr, N., Siegler, T. R., Jambeck, J. R., Mallos, N. J., & Leonard, G. H. (2020). The United States' contribution of plastic waste to land and ocean. Science advances, 6(44), eabd0288.*

6.3. Domestic Mismanaged Waste Index (MWI_{DOM})

The domestic mismanaged waste index is computed as ratio between the improperly disposed (*i.e.*, neither properly disposed nor recycled) waste and the total waste generated.



7. 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, we create a forecast for the current year by modeling ahead of time. This process of anticipating the future 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 (see Annex 2).

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

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.

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

8. Identifying waste management classifications by country

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 minimize the overall volumes of plastic waste that are mismanaged.

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, the global overshoot date. Therefore, we have developed country classifications to account for such variations.

The following section elaborates on the approach we take to develop these classifications, which are essential to informing country-specific interventions for reducing their mismanaged waste index and moving towards a sustainable future.

Step1: Define the criteria that help define a country's classification

1. Consumption level: The amount of waste generated by a country based on the amount of consumption
2. Waste imported level: The amount of waste a country imports from other countries
3. Waste exported level: The amount of waste a country exports to other countries
4. Growth of waste generation: The rate at which a country's waste generation is increasing
5. Income level: based on GDP

Step 2: Determine levels for each criteria

Each criterion is assigned a level from low to high. E.g., a low consumption level indicates that a country generates low levels of waste, and the same goes for the other criteria.

Step 3: Define the country classification

Based on the levels assigned in Step 2, countries are grouped into waste management classifications. (see Annex 3)

For example:

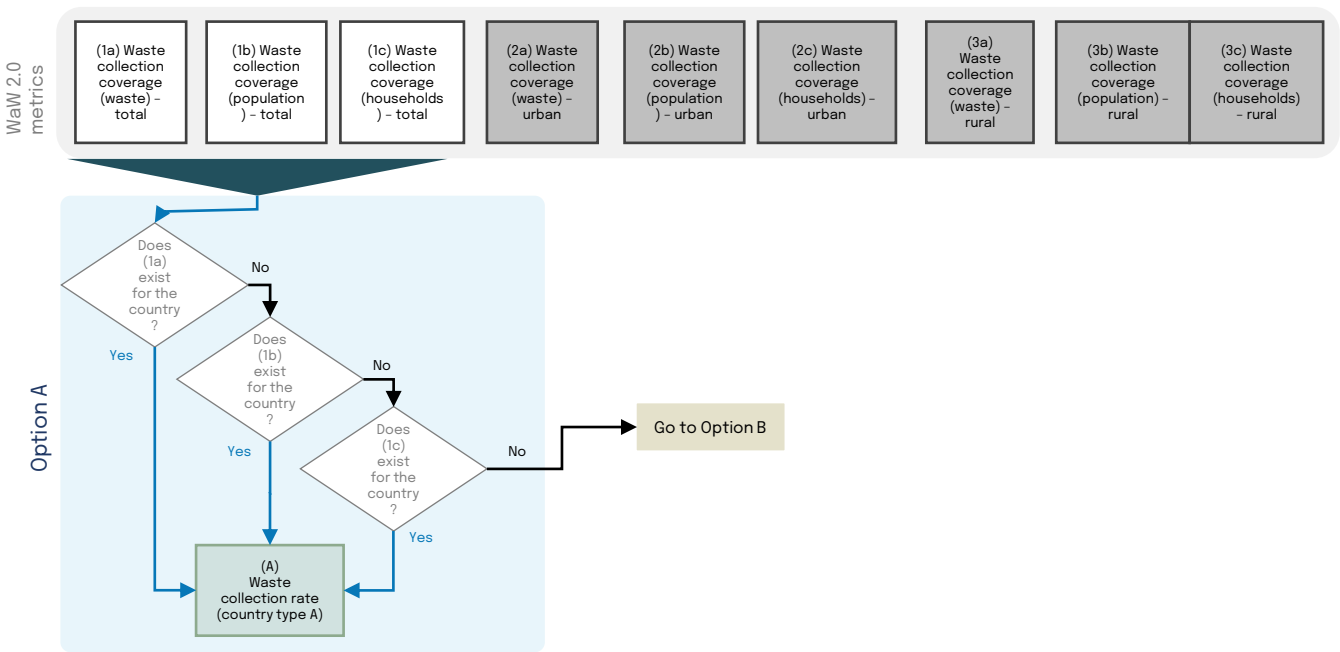
Classification 1: High consumption, high waste import, high waste export

Classification 2: High consumption, low export

Annex 1

Collection Rate (Option A)

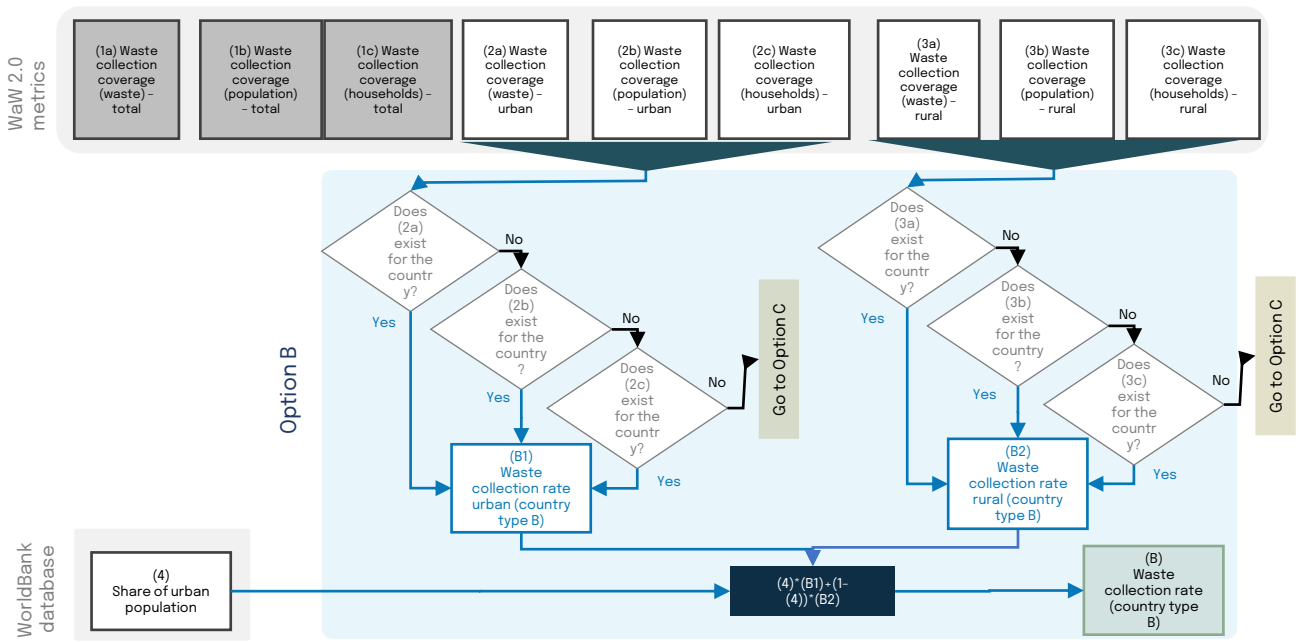
Option (A) is the first step to take in order to compute the waste collection rate for countries for which *total waste collection coverage* data is available in the WaW 2.0 database.



Annex 2

Collection Rate (Option B)

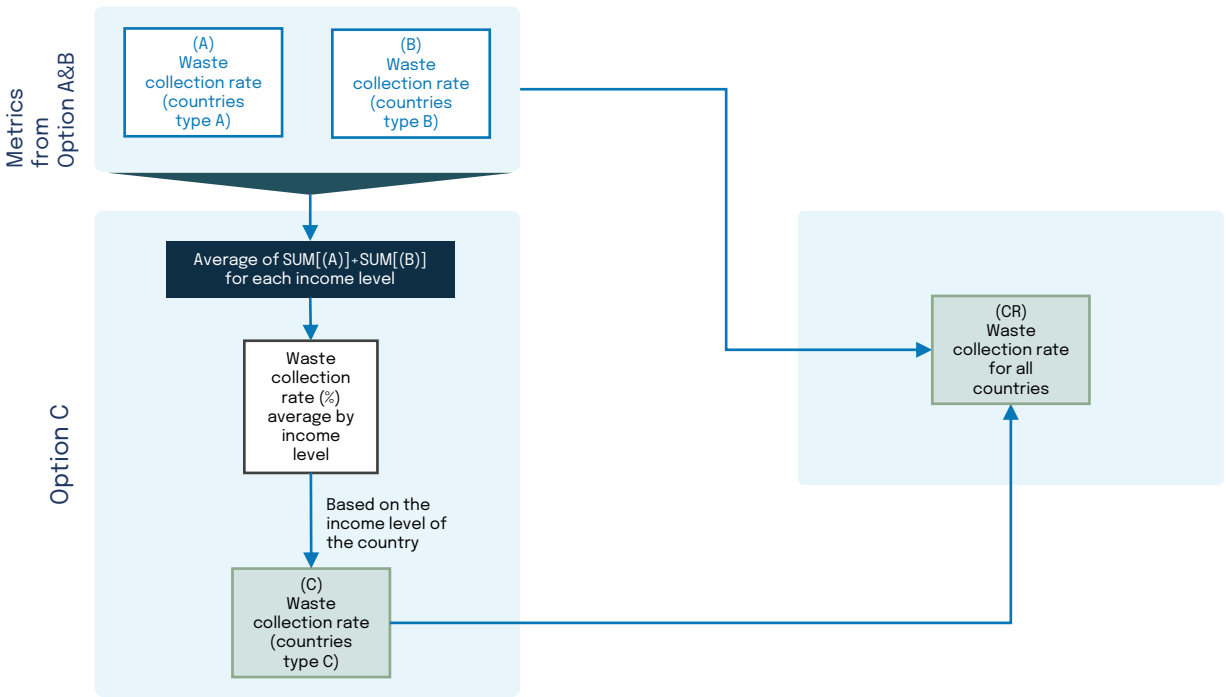
Option (B) is the second step to take to compute the waste collection rate for countries for which no total waste collection coverage data exist, but <u>both</u> *urban waste collection coverage* and *rural waste collection coverage* data are available in the WaW 2.0 database.



Annex 3

Collection Rate (Option C)

Option (C) is the last step to take to compute the waste collection rate for countries for which any data on collection coverage was missing in the WaW 2.0 database.



Contact:
contact@plasticovershoot.earth