



WWF

REPORT

2019

STOP THE PLASTIC FLOOD

A guide for policy-makers in Tunisia

EXECUTIVE SUMMARY

IN TUNISIA, 0.08 MT OF PLASTIC WASTE IS LEAKING INTO NATURE EACH YEAR DUE TO CHALLENGES WITH WASTE MANAGEMENT.

While its plastic goods industry is small compared to other Mediterranean countries, Tunisia is the fourth lowest consumer of plastic goods in the region on a per capita basis. However, Tunisian plastic products may leak into nature in other parts of the world, as the country exported 11% (38kt) of its plastic goods in 2016. In 2016, Tunisia generated 0.25 MT of plastic waste, of which 0.05Mt (20%) remained uncollected and 0.20MT (80%) was collected for waste treatment. 0.15MT (60%) of this waste was sent to landfills, 0.04MT(16%) openly dumped in nature, and only 0.01MT (4%) was recycled. In 2016, 8.5kT of plastic waste makes its way into the Mediterranean sea each year. Tunisia's economy loses an estimated \$20M annually due to plastic pollution, as it affects the tourism, shipping and fishing economies.

TO STOP PLASTIC POLLUTION, TUNISIA SHOULD PRIORITIZE IMPROVING WASTE MANAGEMENT CAPACITY AND MONITORING, AND ENCOURAGING CONSUMERS TO REDUCE CONSUMPTION.

In 1998, Tunisia established “ECOLEF” a public-private partnership to collect, sort and resell plastic waste to recyclers. Despite licensing 226 recycling companies to date, only 4% of all waste is recycled. Stronger incentives are needed to foster greater private sector investment in plastic waste recovery and recycling. Building new, decentralised waste treatment facilities and supporting municipalities to develop greater waste management capacities can greatly reduce open dumping. A key intervention is rehabilitating the current uncontrolled landfills to meet international sanitary and management standards for controlled landfilling. Tunisia implemented a ban on plastic bags in supermarkets and pharmacies, which reduced plastic bag consumption by almost 30% within the ban's first year. Expanding this regulation to cover all plastic bags, could lower plastic consumption by up to 10kT (4% of all waste) each year. Greater monitoring and enforcement of this plastic ban, and controlled landfilling performance, could help reduce plastic leakage into nature.

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Front cover

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1. MAPPING THE LIFECYCLE OF PLASTIC IN TUNISIA

- Value chain analysis of plastics’ lifecycle from production to waste management
- Evaluation of the main sources of plastic leakage into Nature

2. UNDERSTANDING THE IMPACT OF PLASTIC IN TUNISIA

- Overview of the impact of plastic on the country’s environment and economy
- Spotlight on the top Mediterranean hotspots

3. EVALUATING THE POLICY LANDSCAPE REGARDING PLASTIC IN TUNISIA

- Review of the existing policy landscape and initiatives to curb plastic pollution
- Roadmap to recommended future interventions

ANNEX

- The plastics value chain and stakeholders
- Glossary
- Methodology Overview
- Plastic waste system activities causing controlled and mismanaged waste

**TUNISIA IS
THE 13th LARGEST
PLASTIC GOODS
PRODUCER
IN THE REGION,
GENERATING
0.25MTs OF WASTE
YEARLY**

Country facts:



population

11.4 MILLION

REGISTERED CITIZENS (2019)

9th BIGGEST MEDITERRANEAN COUNTRY
BY POPULATION SIZE



economy

€42.6 BILLION

GDP (2019)

88th LARGEST NOMINAL GDP
IN THE WORLD (2018)

11th LARGEST ECONOMY IN THE REGION



territory

163,610 km² OF TERRITORY
BORDERING ALGERIA AND LIBYA

1,148 km OF COASTLINE
ON THE MEDITERRANEAN SEA

Plastic footprint overview:



global plastic goods production

<0.1% PRODUCED IN TUNISIA

0.32 MT PLASTIC GOODS PRODUCED (2016)



end of life management

0.25 MT/YEAR PLASTIC WASTE
GENERATED

OF WHICH 0.20 MT ARE COLLECTED

Informal sector collects 80% of the waste for
plastics recycling in Tunisia

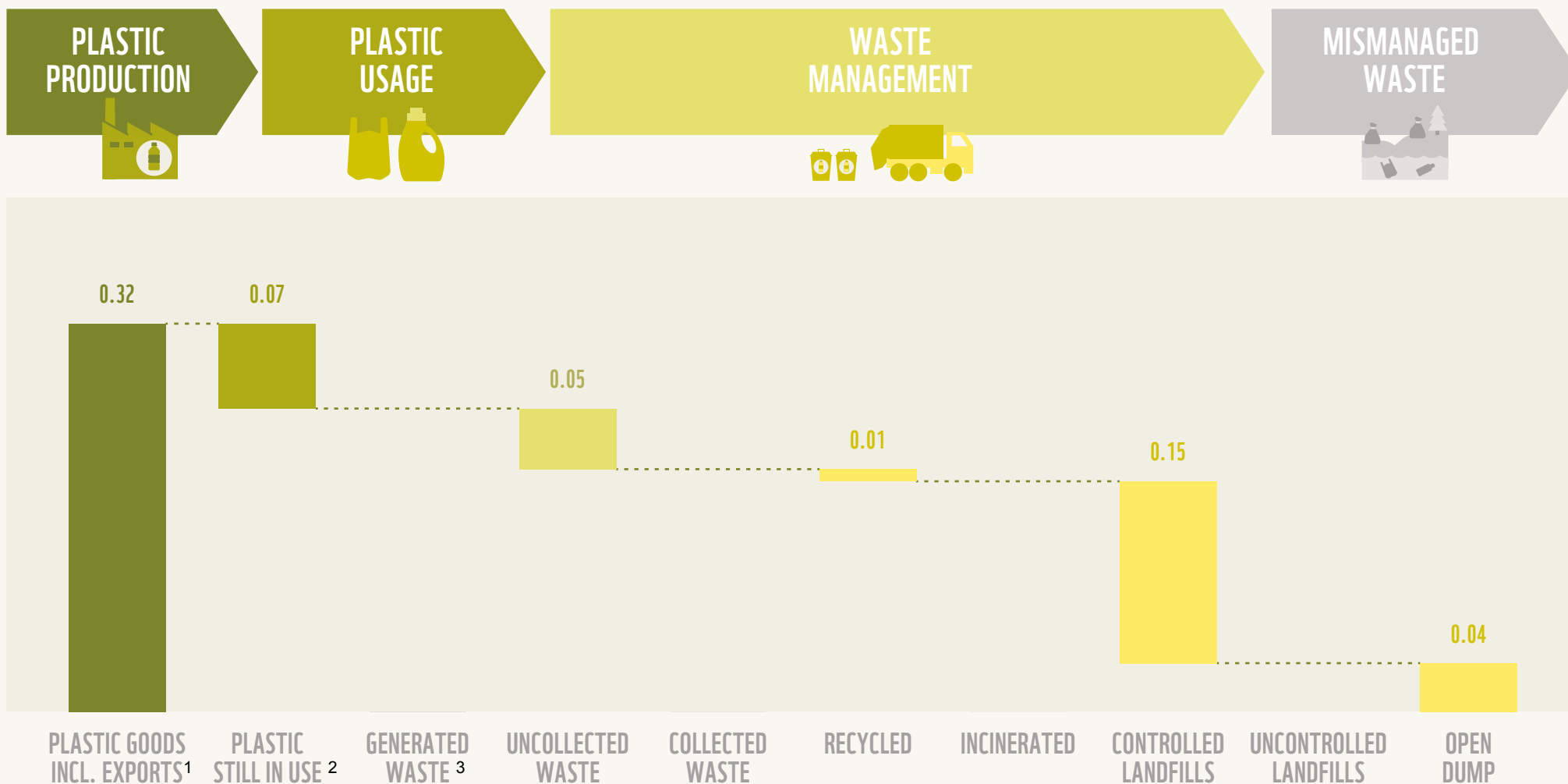
0.19 MT UNDERGOES LINEAR
WASTE TREATMENT

(primarily landfilling and open dumping)

~0.01 MT WAS RECYCLED (2016)

TUNISIA

PLASTIC LIFECYCLE



¹ Two main actors are needed to produce plastic goods for consumption: i. Virgin plastics producers; and ii. Manufacturers/converters of virgin plastic into a plastic good.

This total production figure includes all plastic products manufactured using local and imported virgin plastic material

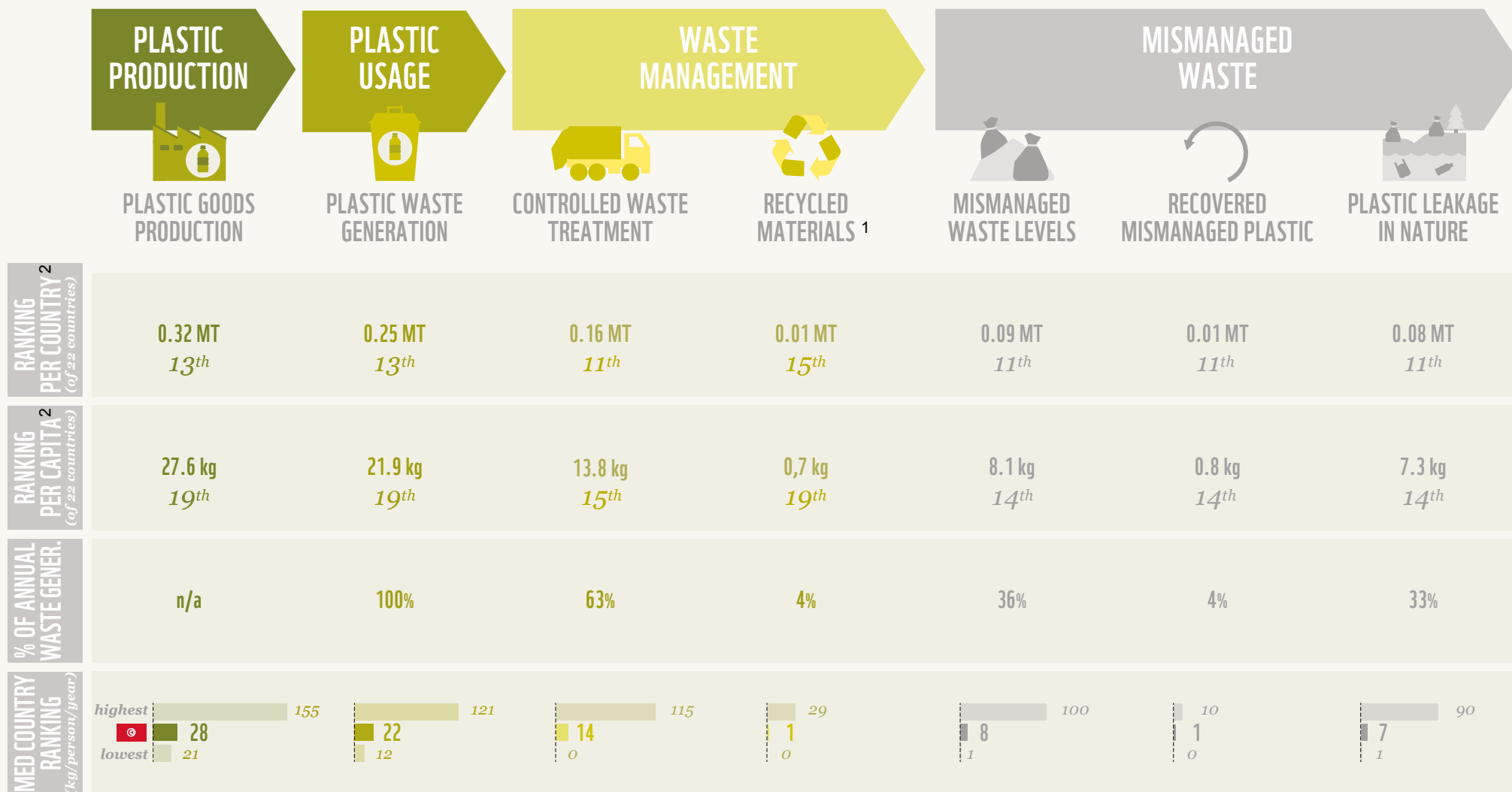
² These are plastic goods produced with a mean product lifetime greater than 1 year, and/or exported for consumption in another country

³ This figure includes waste with a mean product lifetime from 1 year (or less) to 35 years

Source: PlasticsEurope 2018, Jambeck & al (2014), World Bank (2018), European Environmental Agency, 2014, "Horizon 2020 Mediterranean Report, Tunisia Annex", GIZ Sweepnet 2014: "Country profile for MSW in Tunisia". Dalberg analysis

PLASTIC LIFECYCLE FOOTPRINT

**TUNISIA MISMANAGES
36% OF THE WASTE
GENERATED EACH YEAR**



¹ The National Agency for Waste Management (ANGED) states plastic collected for recycling decreased from 16,000 t/year (2010) to 5,600t/year (2017) due to the Tunisian Revolution

² Ranking calculated from highest to lowest amount, out of the 22 countries with coastlines on the Mediterranean
Source: Dalberg analysis, Jambeck & al (2014), World Bank (2018), GIZ Sweepnet 2014: "Country profile for MSW in Tunisia". European Environmental Agency, 2014: Horizon 2020: Mediterranean Report Annex 6: Tunisia

PLASTIC WASTE MANAGEMENT

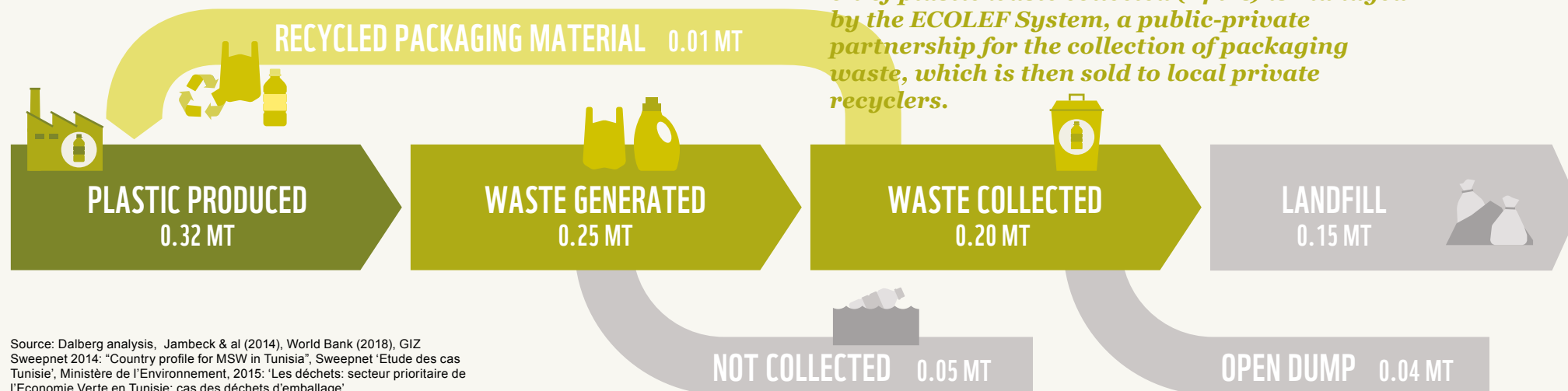
- **The Agence Nationale de Gestion des Déchets. (ANGED), created in 2001, oversees waste management in Tunisia.**
- **The operational responsibility of waste management is led by municipalities,** including collection, transport and disposal of waste
 - In **urban** areas, municipalities have achieved **80%** collection rate, however, in **rural** areas, collection is close to **0%**, leading to 0.05 MTs of waste uncollected. Part of the challenge is the dissolution of rural councils, previously in charge of rural waste collection.
 - The expenditure for **waste collection and transport constitutes 75-100% of the total solid waste management budget.**
 - **4.5%** of waste collection is outsourced from local governments to private operators in 60 municipalities.
- **Tunisia has a small separate collection system for packaging waste called ECOLEF.** ECOLEF is a public-private partnership developed in 2008 to generate value from packaging waste. It includes

180 collection micro-enterprises and 55 sorting and collection points. Waste materials are then sold to local recyclers, who recycle about 70% of collected waste.

- “Ecolef” is financed by a mandatory contribution by packaging producers, and a 5% eco-tax payed on the imported plastics
- In 2010, 14 kT of plastic were collected through this system, yet this dipped in 2011 following the revolution.
- Since 1998, the system has collected 150kT of plastic, and generated 18,000 jobs.

- **Despite this system 76% of all waste has a linear fate in landfills or open dumps.** 10 new controlled landfills are currently under construction, all with a large capacity of over 460 kT per year. Currently, waste is sent to one of 10 controlled sites, or 4 semi-controlled sites.

6% of plastic waste collected (14kTs) is managed by the ECOLEF System, a public-private partnership for the collection of packaging waste, which is then sold to local private recyclers.



Source: Dalberg analysis, Jambeck & al (2014), World Bank (2018), GIZ Sweepnet 2014: "Country profile for MSW in Tunisia", Sweepnet 'Etude des cas Tunisie', Ministère de l'Environnement, 2015: 'Les déchets: secteur prioritaire de l'Economie Verte en Tunisie: cas des déchets d'emballage'

4% OF PLASTIC WASTE IS RECYCLED IN TUNISIA, WHILE 76% HAS A LINEAR FATE BY LANDFILL OR OPEN DUMP

TUNISIA

PLASTIC DEBRIS

8.5 kT/year OF PLASTIC ENTERS THE MEDITERRANEAN SEA

SEA-BASED

Fisheries, aquaculture and shipping result in 15% (1.3kT) of this plastic debris. Items include crab pots, mussel nets, shipping containers, etc.



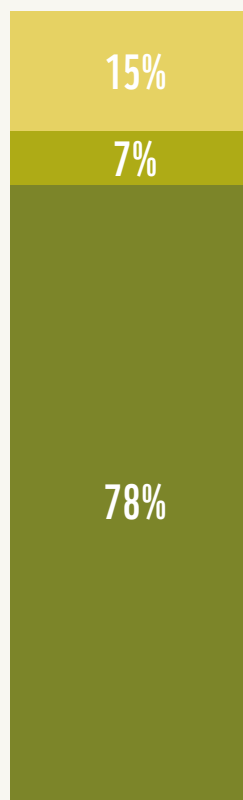
RIVERS¹

Rivers carry 7% of Tunisia's marine plastic. The Medjerda, is the primary river causing marine plastic pollution in Tunisia, particularly around its delta near Tunis.



COASTAL ACTIVITIES

Coastal activities cause 78% (6.7kT) of plastic inputs into the sea resulting from poor city waste management practices, tourism and recreational activities. The coastal cities which produce the highest amount of plastic waste per year include: Tunis (77kT), Sousse (20kT), Sfax (11kT), and Gabes (8T).



PLASTICS LIFECYCLE:
8.5 KT OF PLASTIC
LEAKED INTO THE SEA
IN 2016, AND 33%
RETURNED TO THE
COASTLINES WITHIN A
YEAR

SEABED

Sea bed plastic deposits are estimated to be nine times smaller than coastline plastic accumulation. Waste on sea beds becomes almost impossible to clean up.



COASTLINE

33% (2.8kT) of the plastic pollution leaked into the Mediterranean by Tunisia washes back onto its shores within a year, particularly affecting the coast of Bizerte and Tunis.



SEA SURFACE

56% of plastic pollution remains on the sea surface 1 year after leakage, taking up to a decade to reach its final destination. Tunisian coasts are affected by the strong currents of the Sicily Straight, which draw waste towards open waters.



¹ River leakage intensity calculated based on the total river flow of Greek rivers compared to the Po river in Italy. Source: Dalberg analysis, Jambeck & al (2014), World Bank (2018), Liubartseva et al "Tracking plastics in the Mediterranean: 2D Lagrangian model".

TUNISIA

PLASTIC IMPACT

The environmental impact of Tunisia's plastic production is one of the lowest in the Mediterranean:

- Tunisia has the 4th lowest per capita levels of plastic good consumption in the region. However, Tunisian plastic products could be leaking into nature in other parts of the world, as the country exported 11% (38kt) of its plastic goods in 2016.
- Tunisia contributed to only <1% of oil energy consumption for plastic across the region, and, having no incineration facilities <1% of carbon emissions.
- However, this does not include potentially toxic emissions from open burning, a widespread practice to manage waste

Tunisia's high degree of unsanitary waste dumping has harmful effects on people and nature:

- Uncontrolled landfill sites can release leachate and toxins, decompose, create spontaneous fires, and contaminate water supplies with harmful substances, affecting the surrounding environment and communities.

The Tunisia coast experiences higher than average daily flux of plastic, on average 6.8 kg of plastic per km of coast, each day.

- The total pollution leaked onto Tunisian Mediterranean coastlines is around 3% of the total Mediterranean coastline pollution. However, the daily flux of plastic debris per km on these coasts is higher than Mediterranean average, particularly around Bizerte, where the daily flux of plastic per km is 11.9 kg/km. This is the third highest hotspot in North Africa, after Alexandria, in Egypt, and Mostaganem in Algeria.

TUNISIA'S COASTLINE EXPERIENCES ABOVE AVERAGE DAILY PLASTIC DEBRIS FLUX PER KM OF COAST



¹ Data not available for Tunisia on the production of plastic per industry, which is used to calculate the average plastic lifetime

² Total plastic debris ending up on the country's coastlines each year, as showcased on the right-hand graph on slide 8

³ Economic impact of plastic pollution on Tourism, Fisheries, and Maritime Trade. Total excludes the cost of clean-up

⁴ Total CO₂ lifecycle emissions from production, recycling and incineration (See Annex III for further details)

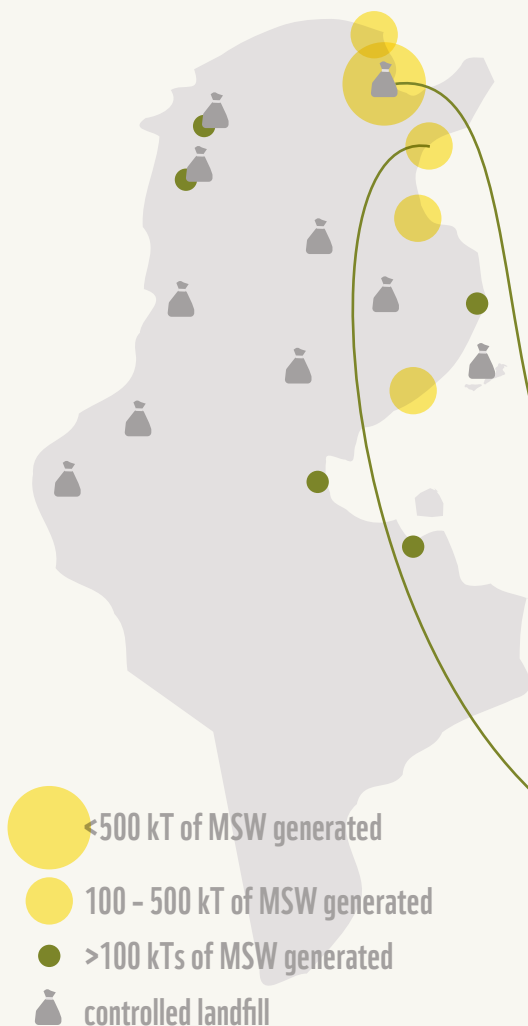
Sources: S. Liubartseva et al, 2018: "Tracking plastics in the Mediterranean: 2D Lagrangian model", Dalberg analysis.

MEDITERRANEAN HOTSPOTS

WASTE MANAGEMENT FACILITIES IN TUNISIA DO NOT SERVE LARGE COASTAL TOWNS, POPULAR WITH TOURISTS

Regional waste management overview

- Tunisia's landfills have capacity to cover 78% of total household-waste production, however, the vast majority of coastal towns landfill 0% of their MSW due to a lack of nearby landfill sites.
- Tunis, the largest producer of MSW, at 700 kTs yearly, landfills 100% of its collected waste.
- However, Sousse, Nabuel and Bizerte, the next three coastal towns by size of MSW production do not have landfilling facilities.
- The southern coast is particularly poorly served by landfilling facilities, although new landfill sites are planned in Sfax, Mendenine and Gabes.
- **8 million tourists** visit Tunisia yearly, of which **95% visit coastal resorts**. Over one year, tourists increase waste generation across Tunisia by 6%, **costing an additional \$1.3M** to manage. However, given the seasonal nature of tourism and lack of waste treatment facilities in popular results including Sousse, Mahdia and Nabuel, the impact of tourist waste generation is likely much higher in these locations.



BIZERTE
11,9 kg/km
daily plastic debris flux

- Bizerte 's coastline receives plastic in part via the artificial canal connecting the Mediterranean to Bizerte lake, which is highly polluted from regional industrial activity.
- In 2016, a 5-year programme started to clean and rehabilitate the polluted lake as part of the EU Horizon 2020 Initiative. The EIB and EBRD are financing two-thirds of the €90 million project ¹
- Hammamet is a popular tourist destination, visited by 24% of all tourists in Tunisia yearly.
- The nearby coastal town of Nabuel produces 150kT of MSW, of which 17kT of plastic waste, each yearly, but lacking landfill facilities, this is almost entirely openly dumped into uncontrolled sites.

HAMMAMET COAST
5 kg/km
daily plastic debris flux

¹ Considered a sensitive marine pollution area, Lake Bizerte is part of the Euro-Mediterranean Horizon 2020 initiative. Funds will be spent be cleaning up Lake Bizerte, improving the living conditions of the surrounding populations and reducing the main sources of pollution impacting the entire Mediterranean Sea. It is financed by the European Investment Bank (EIB), the European Bank for Reconstruction and Development (EBRD) and a grant from the European Union Delegation in Tunisia.

Sources: Horizon 2020, 2014: 'Mediterranean Report', S. Liubartseva et al, 2018: "Tracking plastics in the Mediterranean: 2D Lagrangian model". Union for the Mediterranean (2016)

PLASTIC ECONOMIC IMPACT

TUNISIA'S 'BLUE ECONOMY' LOSES OVER \$20 MILLION ANNUALLY TO THE EFFECTS OF PLASTIC POLLUTION



TOURISM
ESTIMATED IMPACT:
\$ 16.6 MILLION



FISHERIES
ESTIMATED IMPACT:
\$ 1.7 MILLION



MARITIME TRADE
ESTIMATED IMPACT:
\$ 1.6 MILLION



COST OF CLEAN-UP
ESTIMATED IMPACT:
€ 4.2 MILLION

- Plastic pollution might compromise tourist flow to particular marine areas, and threaten new private sector investment in hotel developments, etc. in these areas.
- The tourism industry often bear **the cost of clean up** to ensure locations remain attractive for tourists.
- Coastal tourism makes up 95% of Tunisia's annual GDP from tourism, and provides almost **430,000 jobs** in accommodation, transport, etc. An estimated **8 million tourists** visited Tunisia's coastal locations in 2017.
- Marine pollution can **clog boat engines and fishing nets** leading to disruption of the fishing industry. The largest cost to the industry is related to **vehicle damage and additional maintenance caused by collision with plastic debris, and delays caused by fishing nets filling up with plastic** rather than fish.
- Marine plastic pollution reduces both the **supply of, and demand for, seafood** due to animal deaths and concerns that animals have ingested plastic.
- Tunisia's maritime industry is made up of transport, port facilities and shipbuilding activities.
- Transport is particularly vulnerable to collisions with plastic pollution, entanglement of floating objects with propeller blades and clogging of water intakes for engine cooling systems. Costs are incurred by **vessel downtime, delays and additional maintenance costs**.
- **Port facilities** are also at risk of damage from plastic pollution, including **clogging port waterways, creating delays incurring clean up costs**.
- Shoreline cleaning range costing under €100 per ton collected by volunteer-led initiatives, to in excess of €18,000 per ton for dense waste and heavy fishing gears.
- McIlgorm et al. found that the **average shoreline clean-up cost estimate across studies has an average of US\$1500/ton (~€1300/ton)**.



ECONOMIC LOSS



POTENTIAL COST

THE IMPACT AND COSTS OF MARINE PLASTIC POLLUTION ARE NOT TYPICALLY BORNE BY THE POLLUTERS, BUT BY COASTAL COMMUNITIES, LOCAL MUNICIPALITIES AND DIRECTLY AFFECTED INDUSTRIES.

¹ Cost to industry is calculated based on the methodology used in McIlgorm et al, 2011., taking the proxy of cost to the fishing and shipping industries from Takehama, 1990. Sources: Union for the Mediterranean: 'Blue Economy in the Mediterranean', WEF, 2017: 'Travel and Tourism Competitiveness Report', FAO, National Aquaculture Sector Overview: Tunisia.

CURRENT POLICIES REGARDING PLASTICS

POLICY LANDSCAPE:
TUNISIA'S POLICY LANDSCAPE ON
WASTE MGMT IS LIMITED, PLACING
RESPONSIBILITY ON MUNICIPALITIES

PLASTIC PRODUCTION



Eco-Tax: An eco-tax of 5% is applied to the import of virgin plastic materials, amongst other products (lubricants, batteries, etc). 70% of this tax is dedicated to financing waste management.

Results: No data on the amount of funds collected through the tax.

PLASTIC USAGE



Decree No. 2017-357: In 2017, Tunisia banned non-biodegradable plastic bags, of 50-micron or below, in supermarkets and in pharmacies

Results: 2018 Plastic Producers' figures show plastic bags usage in supermarkets reduced by **9.4kT (94%)** in the first year of the new regulations. Plastic bags are often replaced by bio-degradable bags or baskets, but data isn't available on growth in this sector.

Draft Legislation: Ministry for the Environment and Local Affairs publicly committed to reforming current plastic bag ban to include all production, importation, selling or distribution of non-biodegradable plastic bags from December 31, 2019 onwards

WASTE MANAGEMENT



Law 97-1105: Established a programme to collect, sort and recycling packaging waste.

Results: In 1998, ECOLEF was established as public-private partnership to collect, sort and resell plastic waste to recyclers. In 2010, ECOLEF collected 14kTs of plastic.

Law 93-120: Provided fiscal incentives (VAT exemption, credit, etc.) to waste management imports and projects.

Results: 226 companies are licenced to operate waste mgmt. and recycling

National Strategy 2006-2016: The strategy set out 4 key objectives, including reducing waste generation, expanding waste treatment, improving governance and private sector participation, and raising awareness.

Results: The 2016 target for plastic recycling was 70%. In 2016, it remained around 4%.

MISMANAGED WASTE



National Solid Waste Management program with World Bank support:

aimed to develop 10 new controlled landfill sites and close 400 dump sites.

Results: Limited to date, 10 landfill sites under construction for a total capacity of 1.77 MTs yearly.

Law 2007-1866: Set up the hygiene regulations for waste management areas handled by local authorities and imposes fines.

Results: Most of Tunisia's landfill and dump sites remain uncontrolled.

EXISTING INITIATIVES

national level

municipal level

Very limited support is provided to municipal level authorities, who were given full responsibility for waste management under Law 95-68 in 1995.

■ industry

■ policy-makers

TUNISIA

POLICY ROADMAP

POLICY LANDSCAPE:
TUNISIA SHOULD LOOK TO BEST PRACTICES ACROSS THE VALUE CHAIN, INVOLVING DIFFERENT TYPE OF ACTORS

GOALS Reducing demand: less single use plastic is produced and consumed

Closing the loop: all waste is circular

No leakage: zero plastic in nature

PRIORITY



Incentivise upstream actions to develop alternatives, and design re-usable and recyclable productions

Implement new laws and monitoring to reduce consumption and **educate** consumers to make better waste management choices

Empower municipalities with better waste mgmt. capacity, and create **incentives** to invest into plastic waste recovery and recycling

Increasing monitoring against illegal dumping and **remove economic incentives** for uncontrolled landfilling

EXAMPLE BEST PRACTICE INITIATIVES

national level

Develop **design requirements** on the recyclability of plastic packaging (e.g. connecting plastic caps to bottles, etc.)

Ensure stronger enforcement of the **Eco-Tax** on plastic production, ensuring industries report on production quantities

Include non-virgin plastic material in public procurement requirements to stimulate a market for **secondary materials**

Implement **single-use item bans**, modelled off the EU directive on single-use plastics:

- plastic bags
- plastic food containers or utensils
- ban easily replicable items like plastic cotton buds
- ban the use of micro-plastics in soaps and cosmetics

Consider **deposit-refund scheme** on plastic liquid containers, to financially incentivise waste sorting

Develop EPR standards on waste mgmt., requiring producers to ensure all their plastic waste is managed adequately

Continue to grow separate collection through “**ECOLEF**” through consumer campaigns and expanded collection points

Decentralize plans for **controlled waste treatment facilities** so they are accessible by all municipalities

Enforce a **landfill tax** to reduce waste generation, and cover the cost of waste management

Use technology (e.g. satellite imagery) to identify **illegal dumping sites** and increase penalties for those placing waste within these sites. Work to rehabilitate the sites to minimize environmental damage

local level

Work with specific industries to:

- **reduce the use of unnecessary plastics**, primarily in packaging
- develop innovative predicts to provide consumers with **viable, quality alternatives** for common plastic products

Work with local business operators, including the tourism industry to further minimize the use of plastic in tourist hotspots

Develop localised consumer campaigns, such as **pay-as-you-throw** initiatives, or **green point** systems to reward customers and organisations making efforts

Target municipalities in need of support to improve cost-effective collection, sorting, and treatment, and create **localised targets for accountability**

Develop **seasonal waste management plans** for islands and coastline with particularly high tourist influx

Create **incentives** to foster greater **private sector investment** in plastic waste recovery and recycling

Create **accountability mechanisms for locally mismanaged waste**, including audits and penalties for municipalities with low efficiency

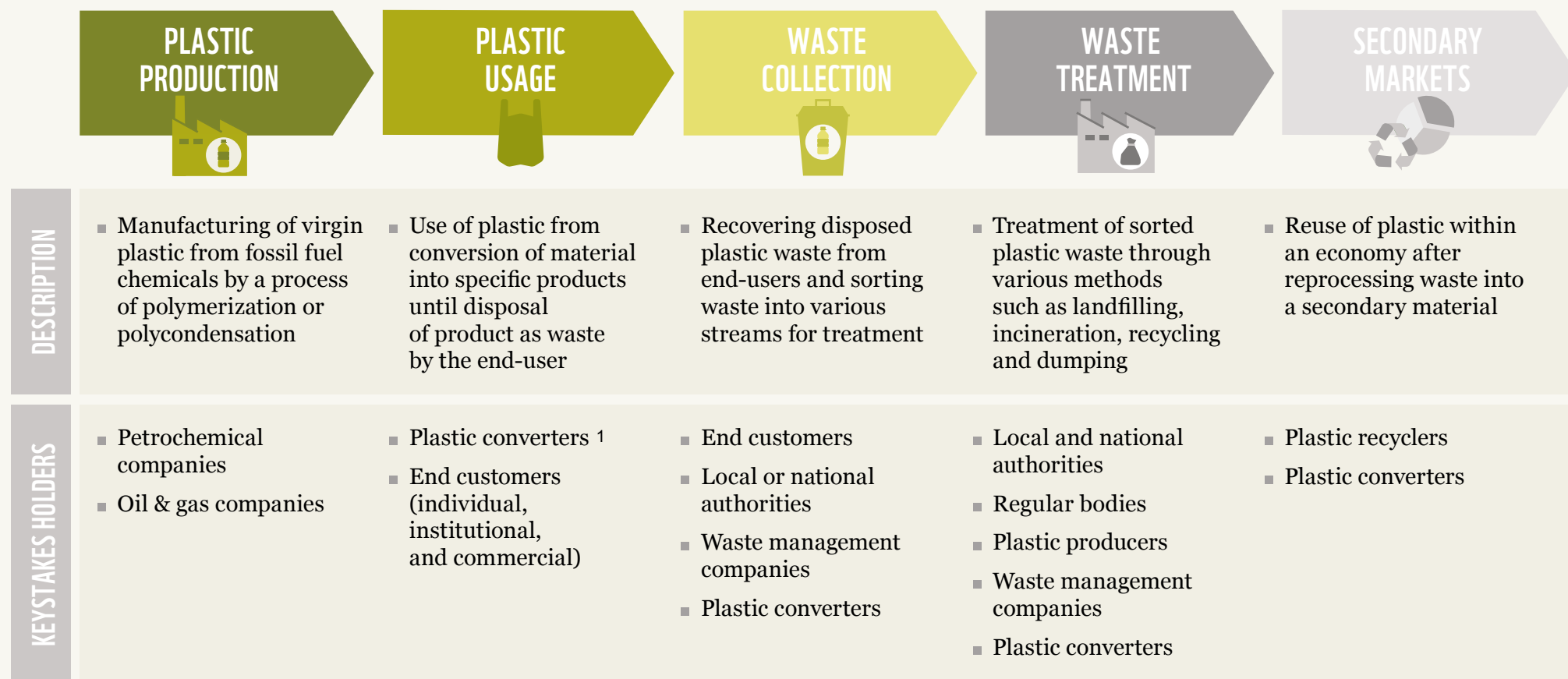
Engage local **fishing industries** to carry plastic waste that was caught in nets to shore for disposal, without incurring costs or fines

■ industry

■ policy-makers

■ consumers

ANNEX I – THE PLASTICS VALUE CHAIN AND STAKEHOLDERS



¹ Manufacturers of plastic products in all plastic markets (e.g. packaging, building and construction, transport) that convert virgin plastic into a specific products for use within the economy. These plastic products can be combined with other non-plastic materials during the conversion process

ANNEX II – GLOSSARY

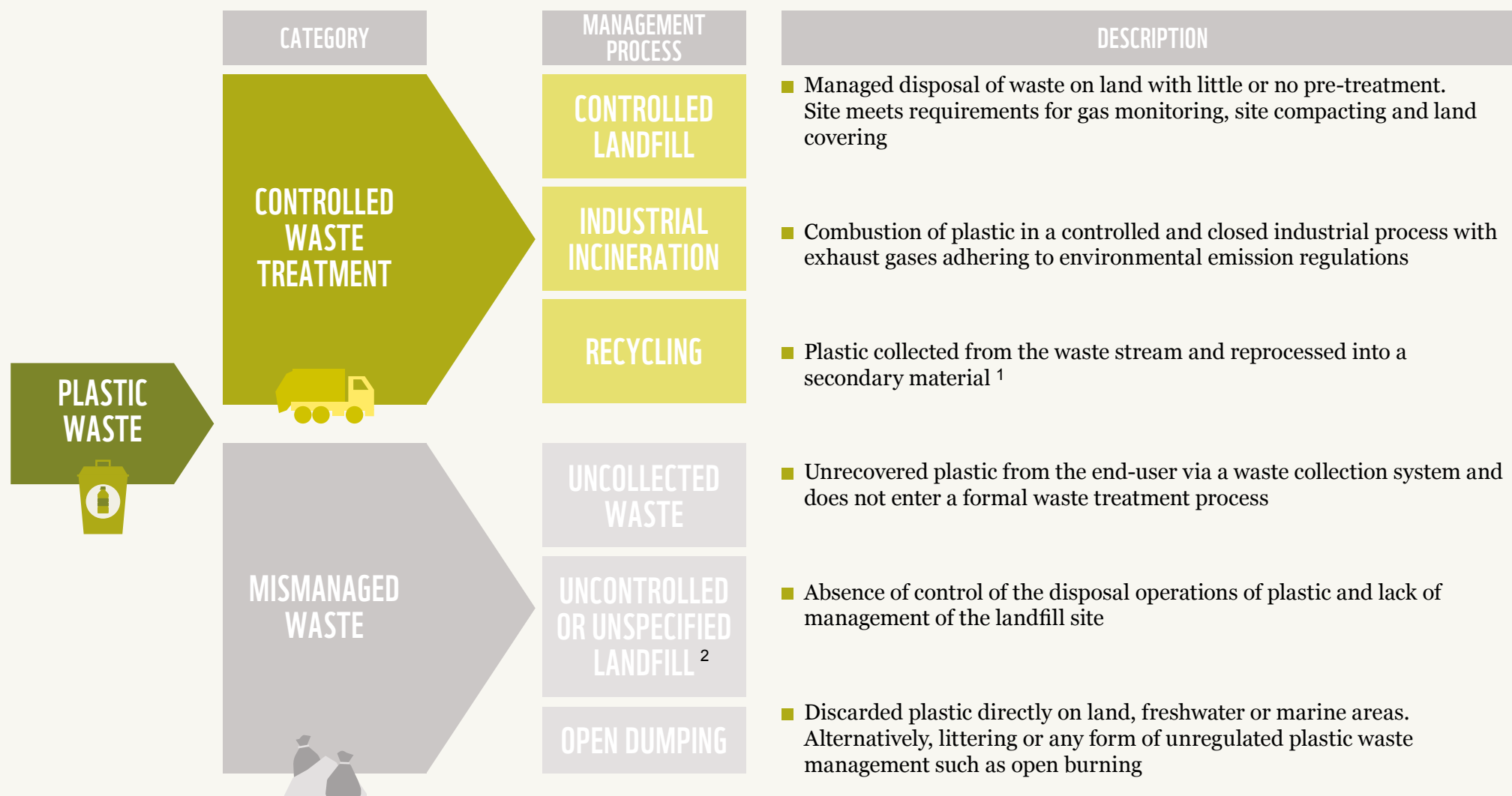
TERMS	
■ Controlled landfill	A landfilling process which is subject to a permit system and to technical control procedures in compliance with the national legislation in force.
■ Uncontrolled landfill	A landfilling process which fails to meet certain standards and technical control procedures, and therefore is at risk of leakage or contamination.
■ Open dump	Illegal land disposal sites at which solid wastes are disposed of in a manner that does not protect the environment, and are therefore susceptible to leakage, open burning, and are exposed to the elements, vectors, and scavengers.
■ Controlled waste treatment	All legally compliant waste treatment operations, including controlled landfilling, waste-to-energy (incineration) and recycling.
■ Secondary material production	The total amount of secondary plastic product extracted from the plastic recycling process, averaging at 55% of the material inputted for recycling.
■ Recycling	All plastic collected for recycling from the waste stream. This figure is not adjusted for actual material losses during reprocessing into a secondary material. These material losses result from collected plastic considered as not recyclable due to additives preventing recycling or food contamination, etc.
■ Mismanaged waste	All plastic left uncollected, openly dumped into nature, littered, or managed through uncontrolled landfills.
■ Recovered mismanaged waste	Mismanaged waste that re-enters the controlled waste management process through waste-pickers, clean up operations, or any other method.
■ Bio-degradable	A product that can be broken down by microorganisms (bacteria or fungi) into water, naturally occurring gases like carbon dioxide (CO ₂) and methane (CH ₄) and biomass.
■ Blue Economy	Represents all economic activities related to oceans, seas or coastal areas. It covers established sectors such as fisheries, shipbuilding and tourism as well as emerging industries, including ocean energy and biotechnology.

ANNEX III – METHODOLOGY FOR THE CALCULATION OF EACH DATA METRIC IN THIS GUIDEBOOK

SECTION	METRIC	METHODOLOGY
PLASTIC LIFECYCLE (MT)	■ Plastic produced	Collected national-level data on total production of PP, PET, HDPE, LDPE, PCV and PS. Plastics are used in many products that are imported and exported and limited public data exists separating these goods into their raw materials used. This plastic goods production data by country is not adjusted for international trade (import and export) of these products. If national plastic goods data unavailable, calculated based on the ratio of global plastic production to plastic waste for 2016 in the WWF global plastics report (78%).
	■ Waste Generation and Management	Collected national-level data on total plastic waste generation per annum, or total waste MSW waste generation and percent composition of plastic within MSW. Also collect national-level data on plastic management (percentages of plastic waste collected landfilled, incinerated, recycled or openly dumped). Data validated with relevant WWF national offices.
	■ Mismanaged waste	Calculated by adding the total waste which goes uncollected, openly dumped and sent to uncontrolled landfills. Data on uncollected waste is taken from the World Bank 'What a Waste 2.0' Database.
	■ Waste recovered or leaked into nature	Calculated using the proxy of 90% of mismanaged waste ending up in nature, based on the study completed by Jenna Jambeck Research Group, 2015. We assume the rest of the waste is recovered through clean-up operations, etc.
	■ Waste leaked into the Mediterranean	- For countries whose coastline are only on the Mediterranean, this figure is calculated based on the proxy that 10% of plastic waste becomes marine litter, as found in the analysis completed by Jenna Jambeck Research Group, 2015. - For countries with multiple coastlines, this figure also takes into consideration the proportion of waste generated by regions with coastlines on the Mediterranean.
	■ Waste leaked by source (sea-based, rivers, coastal)	Collected data on sea-based sources and major rivers from S. Liubartsevaa et al, 2018. Where data is missing for other major rivers, annual plastic flux is calculated as a ratio between the Po River's drainage basin, and its annual plastic flux. Coastal sources represent the remainder of annual leakage.

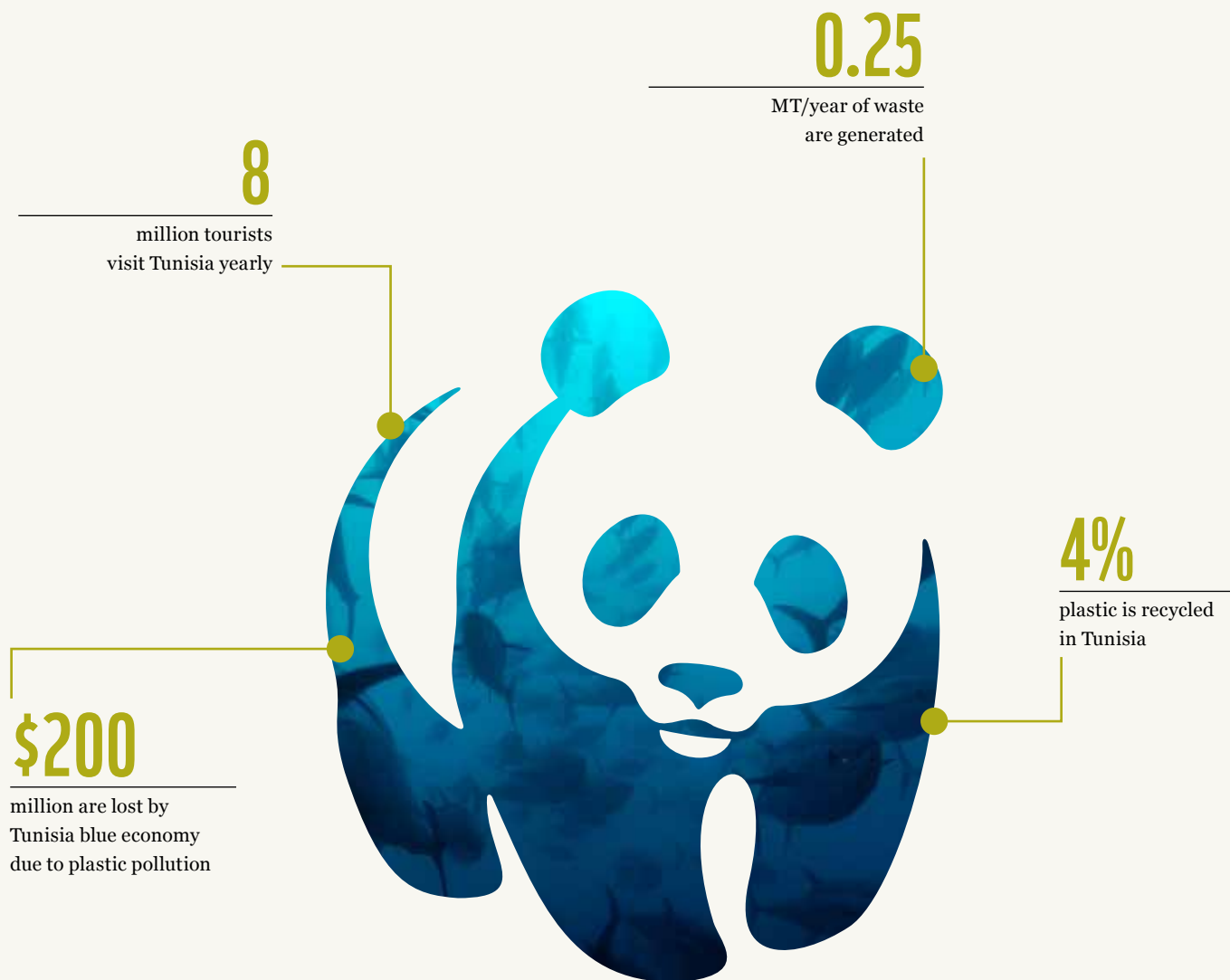
SECTION	METRIC	METHODOLOGY
PLASTIC IMPACT	Energy consumed in oil equivalent (M, barrels)	Calculated based on the weighted average of energy required to make a kilogram of global plastic (PP, PET, HDPE, PS, PCV), converted into barrel of oil equivalent.
	Average age of plastic life (years)	Calculated based on national data collected on the production of plastic per industry, and the average lifetime of plastic goods in each industry, as found in peer-reviewed research completed by Roland Geyer et al, <i>“Production, Use, and Fate of All Plastics Ever Made”</i> , 2017
	CO₂ emissions (MT)	Calculated based on the average CO ₂ emissions caused by plastic production, incineration and recycling, as reported by SITRA, 2018: <i>“The Circular Economy a Powerful Force for Climate Mitigation”</i> .
	Annual coastline plastic pollution (kT)	Calculated based on the daily plastic debris flux (kg/km) multiplied by the total length of the coastline and 365 days. This differs from the total plastic leaked into nature as it doesn't include plastic on the sea -bed and sea-surface.
	Daily plastic flux (kg/km)	Collected data from S. Liubartsevaa et al, 2018: <i>“Tracking plastics in the Mediterranean: 2D Lagrangian model”</i> .
	Economic cost of pollution (M, €)	Calculated based on the methodology used in McIlgorm et al, 2011 to estimate the cost of plastic pollution to the APAC region, which takes the proxy of cost to the fishing and shipping industries from Takehama, 1990.
	Cost of waste generated by tourists (M, €)	Calculated based on the proportion of waste generation caused by tourists, which was calculated based on national statistics on tourist arrivals and departures. The cost uses the World Bank estimated cost of \$50-100/T of waste in an advanced system.

ANNEX IV – PLASTIC WASTE SYSTEM ACTIVITIES CAUSING CONTROLLED AND MISMANAGED WASTE



¹ Not accounting for plastic losses during the recovery process

² Unless explicitly specified as "controlled" or "sanitary" landfills, we consider all other landfills as uncontrolled. Source: Dalberg analysis, Jambeck & al (2015), World Bank (2018), SITRA (2018), European Commission (2001)



Why we are here

To stop the degradation of the planet's natural environment and
to build a future in which humans live in harmony with nature.

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