

Module VIII

Environmental Pollution



Lecture 11 (03 September 2024)
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Land or soil pollution

Dumping of solid wastes and waste water alter the structure, density, fertility of the soil and kill the microorganisms that exist in the land mass. Land pollution not only makes the soil unfit for use also become a source of ground water pollution.

Causes

- Accidental Spills
- Acid rain (Which is caused by air pollution)
- Intensive farming
- Deforestation
- Genetically modified plants
- Nuclear wastes
- Industrial Accidents
- Landfill and illegal dumping
- Land Erosion



Effects of Land Pollution

- Risk of seeping into the ground water causing contamination – affect plant & animal
- Runoff from contaminated land can lead to water pollution
- Land may become unfit for crop production
- Toxins may contaminate food chain & ultimately enter human body causing disease

Air pollution

Air pollution is the introduction of chemicals, particulate matter, or biological materials into the atmosphere that cause harm or discomfort to humans or other living organisms, or cause damage to the natural environment or built environment.

Sources of air pollution

- **Natural sources**
 - Emission of natural gases
 - Volcanic eruptions
 - Decomposition of organic matter
 - Dust storms
 - Forest fires
- **Human-induces sources**
 - Industrial activity
 - Construction activity
 - Mining activity
 - automobiles

- **Stationary sources**
 - Those have a relatively fixed location
- **Mobile sources**
 - Emitters of air pollutants that move from place to place while yielding emissions. These includes automobiles , trucks, buses, aircrafts, ships and trains.

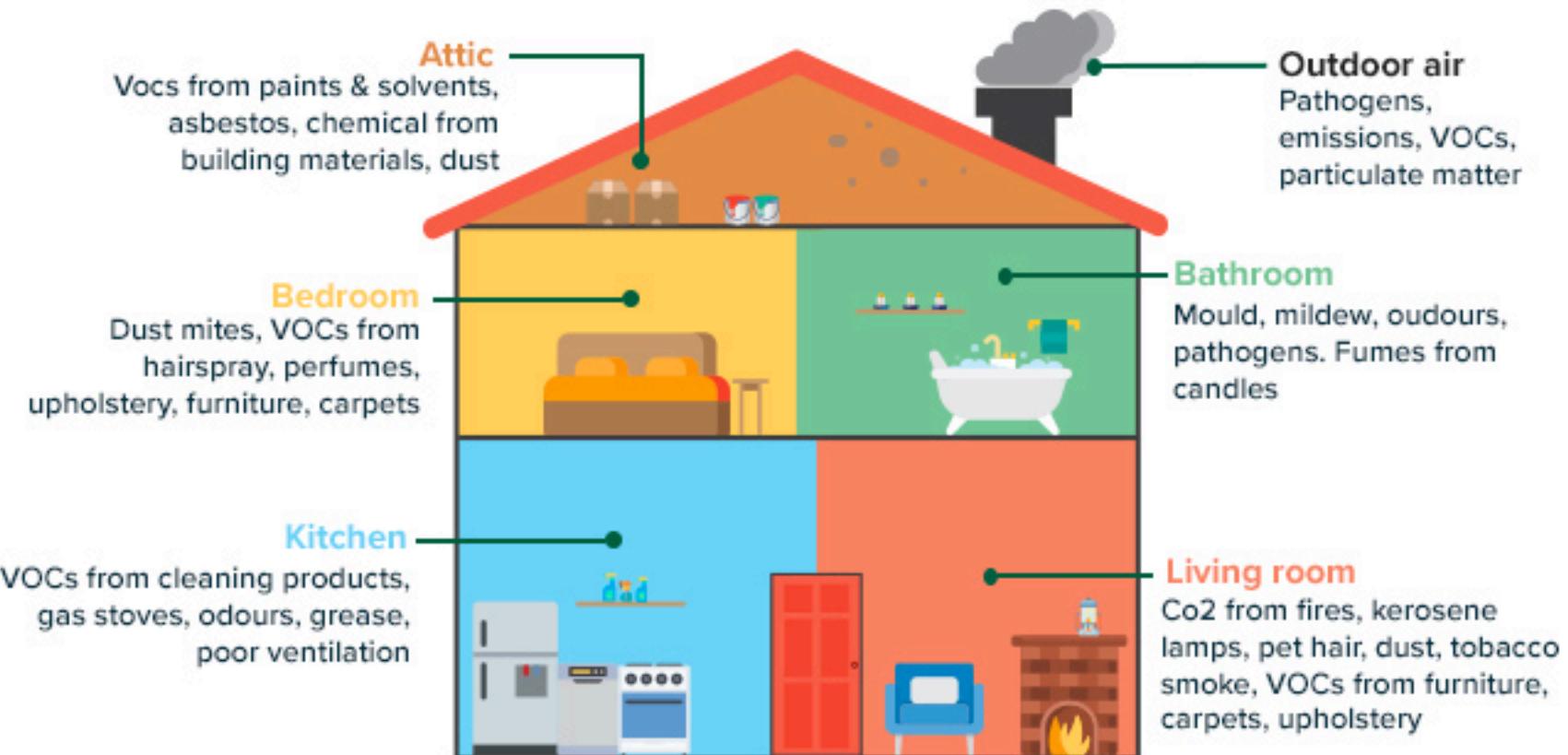
Major kinds of air pollution

- Primary pollutants
 - From the original sources: volcanoes, motor vehicles, factory combustion, dust, open burning
- Secondary pollutants:
 - Form from chemical reactions between primary pollutants or other elements of atmosphere like water vapor. Chemical reactions may include photochemical reactions, acid rain etc.
- Conventional pollutants:
 - Typical sources as sulfur oxide, carbon monoxide, particulates, nitrogen oxide, ozone and lead.
- Unconventional pollutants:
 - Less volume , greater toxicity than Conventional pollutants, e.g., asbestos, benzene, mercury etc.

Causes of air pollution

- Burning fossil fuels in power stations and exhaust fumes from cars, trucks and buses
- Waste burnt from chemical and other industries
- Bare soil in agricultural areas picked up and carried by the wind
- Increased use of automobiles
- Increased use of chemicals, especially CFCs

Causes of indoor air pollution



Effects of air pollution

- Reduced visibility (haze, mist, fog, smog)
- Poor air quality
- Formation of acid rain
- Increase the earth's temperature
- Depletes the ozone layer in the stratosphere, leading to ozone holes
- Increase ultraviolet radiation that reaches the surface
- More heat radiated from the surface
- Leads cloud formation and precipitation in areas already short of water, drought

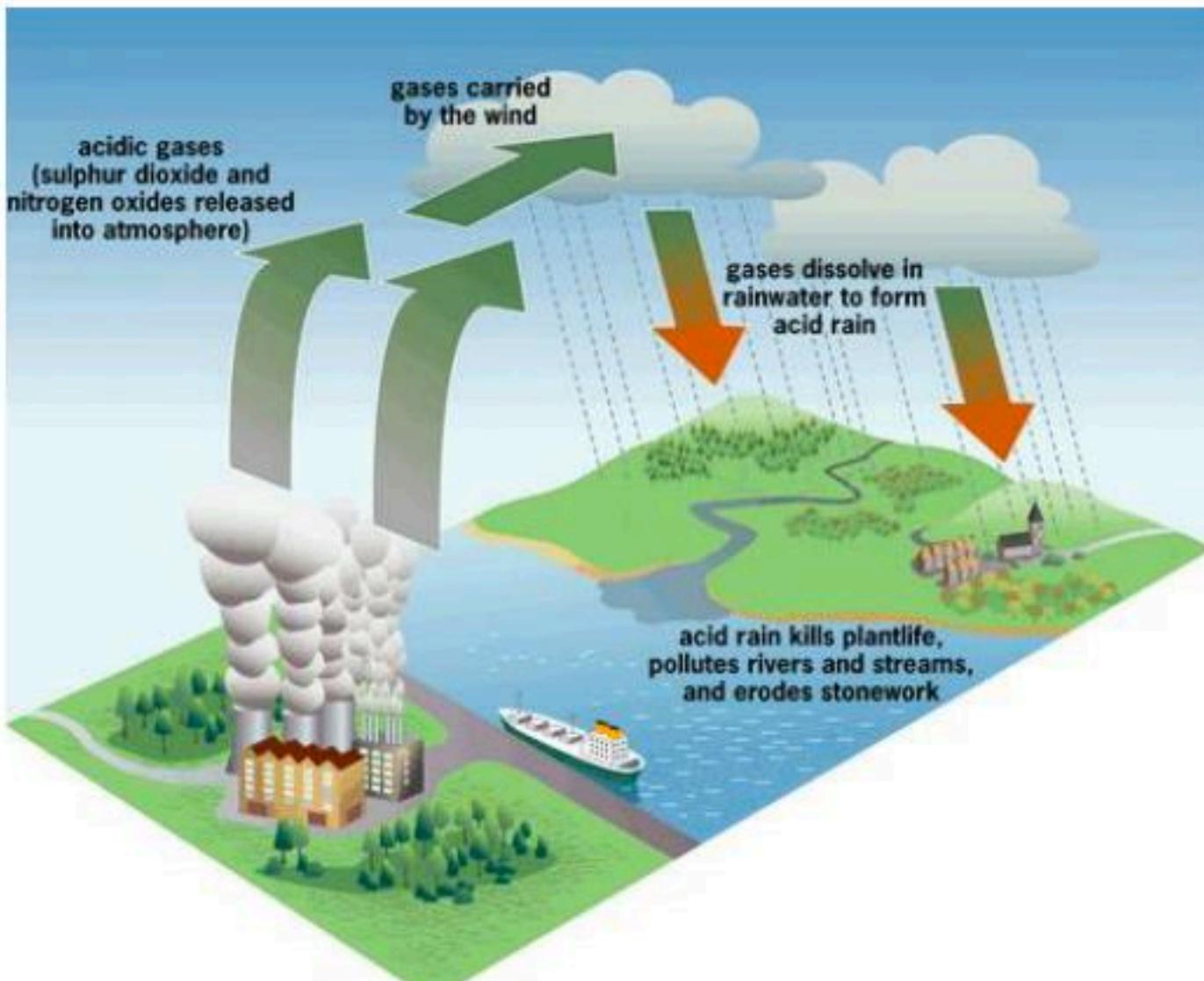
Effects of air pollution continued...

- Health problem particularly asthma, bronchitis and other respiratory problems
- Increased risk of cancer in people, especially skin cancer
- Increased acidity in lakes leading to death of fish and plant life
- Increased acidity in soils reducing crop yield and killing trees
- Rising sea levels
- Changes in world weather (more storm and drought)
- Less food supply, in extreme cases leading to famine

Acid Rain

- Acid rain encompasses both wet(rain, snow, fog) and dry acidic depositions that occur in areas where major emissions of sulfur oxides (SO_x) and nitrogen oxides (NO_x) result from burning fossil fuels.
- Pure rain fall has a pH about 5.6 where 1 is highly acid and 7 is neutral. Acid rain is defined as precipitation in which the pH is below 5.6.
- Acid rain damages not only forests and lakes but also many building materials, including steel, paint, plastics, cement, galvanized steel and several type of rock, especially limestone, sandstone and marble.

Acid Rain Cycle





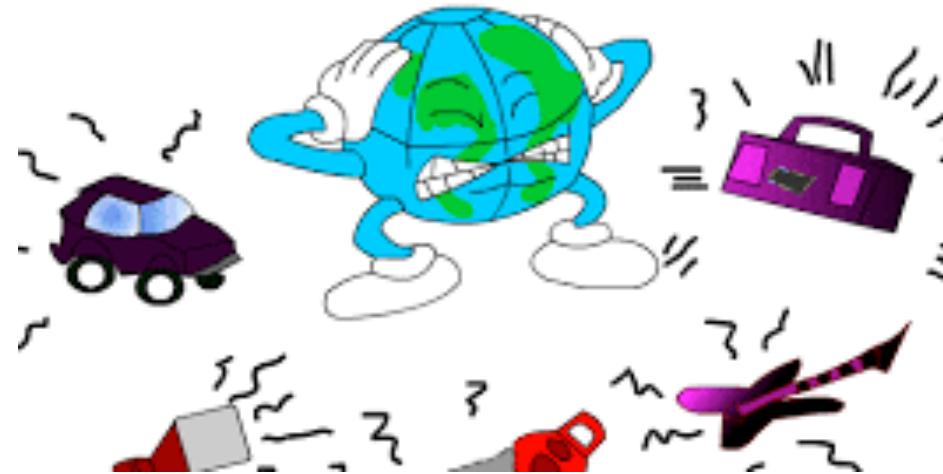
Smog

- There are two major types of smog.
 - *Photochemical smog* which is sometimes called L.A. type smog or brown air. Solar radiation is particularly important for the formation of photochemical smog. It involves both NO and hydrocarbons. The development of these type of smog is directly related to automobiles use.
 - *Sulfurous smog* which is sometimes referred to as London-type smog, grey air or industrial smog. Sulfurous smog is produced primarily by burning coal or oil at large power plants. Sulfur oxides and particulates combined under certain meteorological conditions to produce a concentrated sulfurous smog.

- **Brown air smog:** combination of primary and secondary pollutants.
- **Gray air smog:** results from burning of heavy sulfur rich fuel oil and coal. Formerly a problem of US cities, now more of a problem in some Eastern European and Asian cities. Asian brown cloud covers a wide range from China to India.
- **Urban climate:** usually triggered by rapid night time cooling in valleys or basins where air movement is restricted.
- **Indoor air pollution:** kitchen smoke, dust mites, carpet fibers, mold, detergent, aerosols etc.

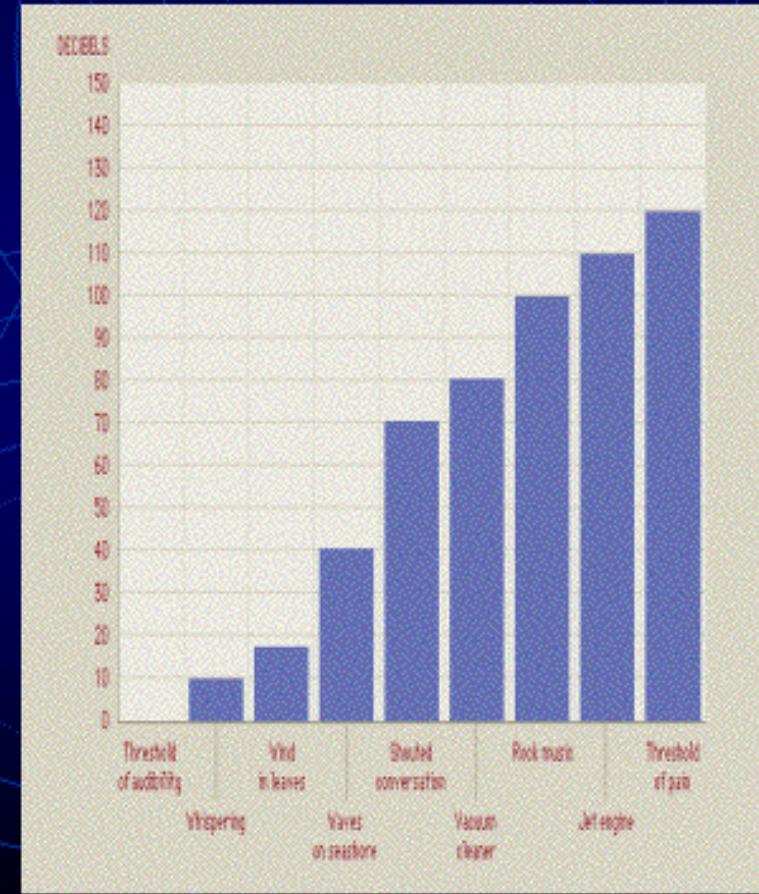
Noise pollution

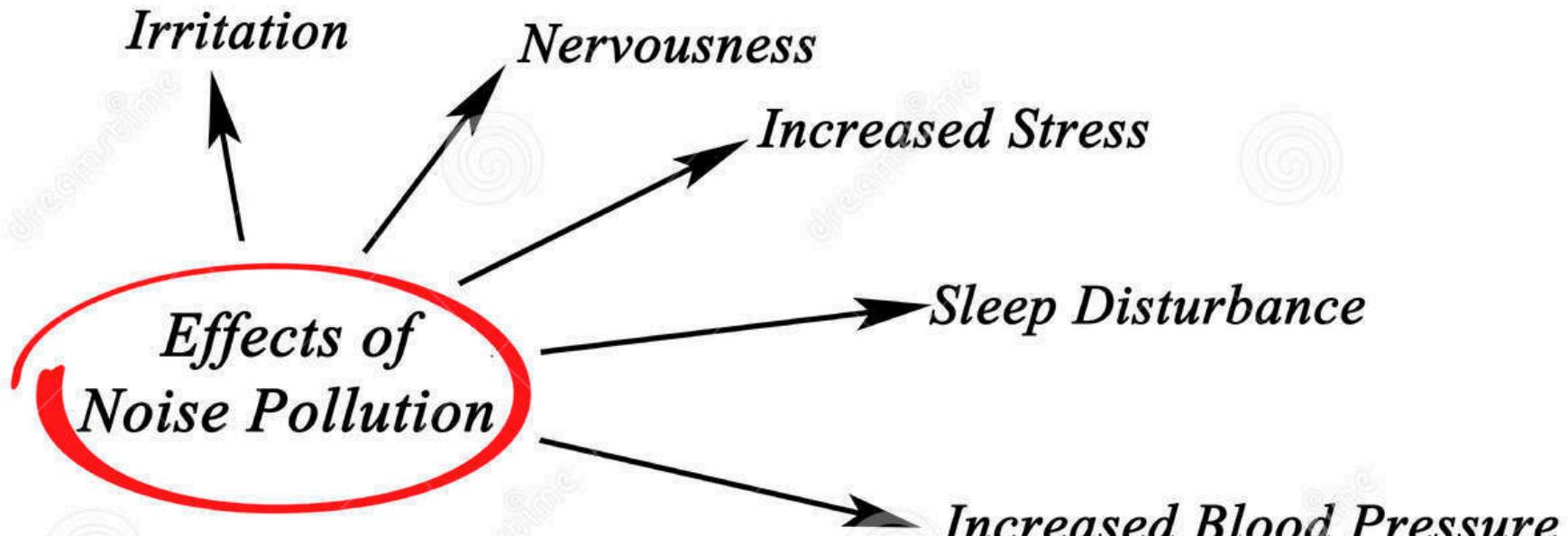
- Sound is a physical phenomenon recognized as a physiological response by the hearing organ. Sound is a series of alternative waves traveling in a medium such as air from a vibrating body.
- Noise can be defined as disturbing sound. It is an undesirable phenomenon and considered as an environmental pollutant.



Sources of Noise Pollution

- Outside
 - Construction
 - Road traffic
 - Airports
 - Factories
- Inside
 - Phones
 - TV's / Radios
 - Appliances
 - Power tools / lawnmower
- Main source is due to increasing population and urbanization





**NOISE
POLLUTION**

**CAN
KILL TOO**

S/N	Category of areas	Standard determined at day (in dB)	Standard determined at night (in dB)
1	Silent zone	45	35
2	Residential Area	50	40
3	Mixed area. (mainly residential also used for commercial and industrial purposes)	60	50
4	Commercial area	70	60
5	Industrial area	75	70

Noise levels in major cities in Bangladesh

City	Highest	Lowest
Dhaka	132dB	47dB
Sylhet	131dB	50dB
Khulna	132dB	42dB
Barishal	131dB	54dB
Rangpur	130dB	46dB
Rajshahi	133dB	56dB
Mymensingh	131dB	54dB
Chattogram	133dB	47dB

Source: Department of Environment

Effects on Humans: Psychological



- Annoyance-noise is uncontrollable
- Anxiety
- Aggression
- Depression
 - Effect working conditions
 - Effect social interaction



**KEEP
CALM**

AND

REDUCE.....

NOISE POLLUTION

KeepCalmAndPosters.com

**You Cannot
Get Real Peace
Without
Keeping Quiet**



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Control of Noise Pollution

Planting of Trees

- Planting of trees and shrubs along roads, hospitals, educational institutions help in noise reduction to a considerable extent.

Legislative measures

- Strict legislative measures need to be enforced to control the nuisance of noise pollution some of the measures are
 - A) Minimum use of loud speakers, near silence zones.
 - B) Banning Pressure horns in automobiles
 - C) Framing a separate noise pollution act.

Waste management

- Waste management is the **collection, transport, processing, recycling or disposal, and monitoring** of waste materials. The term usually relates to materials produced by human activity that cause health hazards or environmental pollution.
- **Purpose of waste management:** is generally undertaken
 - to reduce the effect of waste on health, the environment or aesthetics.
 - to recover resources from waste.

Waste management can involve solid, liquid, gaseous or radioactive substances, with different methods and fields of expertise for each.

Waste management practices differ for developed and developing nation, for urban and rural areas, and for residential and industrial producers. Management for non-hazardous residential and institutional waste in metropolitan areas is usually the responsibility of local government authorities, while management for non-hazardous commercial and industrial waste is usually the responsibility of the generator.

Waste management concepts

Integrated waste management

- The dominant concept today in managing waste is known as integrated waste management (IWM).
- The 3R's of IWM are reduce, reuse and recycle
- Reduce consumption, reuse material again and again.... a glass bottle carrying cold drinks can be used to keep oil in kitchen, once the bottle is broken grind it and make another bottle or glass product, i.e. recycle.
- Waste hierarchy - The waste hierarchy refers to the "3 Rs" reduce, reuse and recycle, which classify waste management strategies according to their desirability in terms of waste minimization. The aim of the waste hierarchy is to extract the maximum practical benefits from products and to generate the minimum amount of waste.

- At least 50% reduction by weight of **urban waste** is possible by:
 - Better design of packaging to reduce waste, an element of source reduction (10% reduction)
 - Establishment of recycling programs (30% reduction)
 - Large-scale composting programs (10% reduction)

Methods

- **Composting** is a biochemical process in which organic materials such as kitchen scraps decompose to a rich, soil like material. Composts can be used as fertilizers as a source of nutrients.
- **Incineration:** combustible waste is burned at temperature high enough ($900\text{-}1000^{\circ}\text{C}$) or ($1650\text{-}1830^{\circ}\text{F}$) to consume all combustible material, leaving only ash and non-combustible to dispose of in a landfill. This process reduces the volume of solid wastes to 20-30% of original volume.
- **Open dumping:** in many places of our country, solid waste is accumulated in open dumps where refuse was piled up without being covered or otherwise protected.

- Open dumps creates health hazard, polluting air and sometimes polluting groundwater and surface water.
- **Landfill:** disposing of waste involves burying the waste and remains and is a common practice in most countries.
- Properly designed and well managed landfill can be a hygienic and relatively inexpensive method of disposing of waste materials.
- May cause leaching leading to ground water contamination.

Module IX

Plastic Pollution_I



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Department of Social Relations
EAST WEST UNIVERSITY

Let's Check What we Know and What we don't know?

Where is your first (baby) toothbrush?

How long does it take for plastics to biodegrade?

Plastic Pollution

Microplastic Microfiber Microbeads Nanoplastics

Microplastics vs Nanoplastics

More Information Online WWW.DIFFERENCEBETWEEN.COM

DEFINITION

Microplastics

Microplastic materials are very small pieces of plastic that can pollute the environment

Nanoplastics

Nanoplastics are polymer materials that contain less than 100 nanometer particle size

PARTICLE SIZE

Less than 5 millimeter particle size

Less than 100 nanometer particle size

HARM ON ENVIRONMENT

Considered as a harmful pollutant in the environment

There is little information on adverse health effects of these materials in organisms, including humans

Plastic Pollution

[https://www.youtube.com/watch?
v=fA2p4VDCvHM&t=248s](https://www.youtube.com/watch?v=fA2p4VDCvHM&t=248s)

[https://www.youtube.com/watch?
v=afDOG0MJsY0&t=276s](https://www.youtube.com/watch?v=afDOG0MJsY0&t=276s)

What are the Different Types of Plastic?

7 types of plastic exist in our current modern

Polyethylene Terephthalate (PET or PETE or Polyester)



Commonly used as beverage packaging

High-Density Polyethylene (HDPE)



Made of solid, strong, easy to recycle and safe as food packaging

Polyvinyl Chloride (PVC)



Non-food plastic material

Low-Density Polyethylene (LDPE)



Safe for food and beverage, resistant to chemical reactions.

Polypropylene (PP)



Safe to be used repeatedly for food and beverages

Polystyrene (PS)



Not recommended for food packaging

Other (O)



Specifically for all plastics that have not been mentioned and other coated plastics or combinations.

Every single category of plastic could leach hazardous materials if put in an extreme situation such as extreme heat.

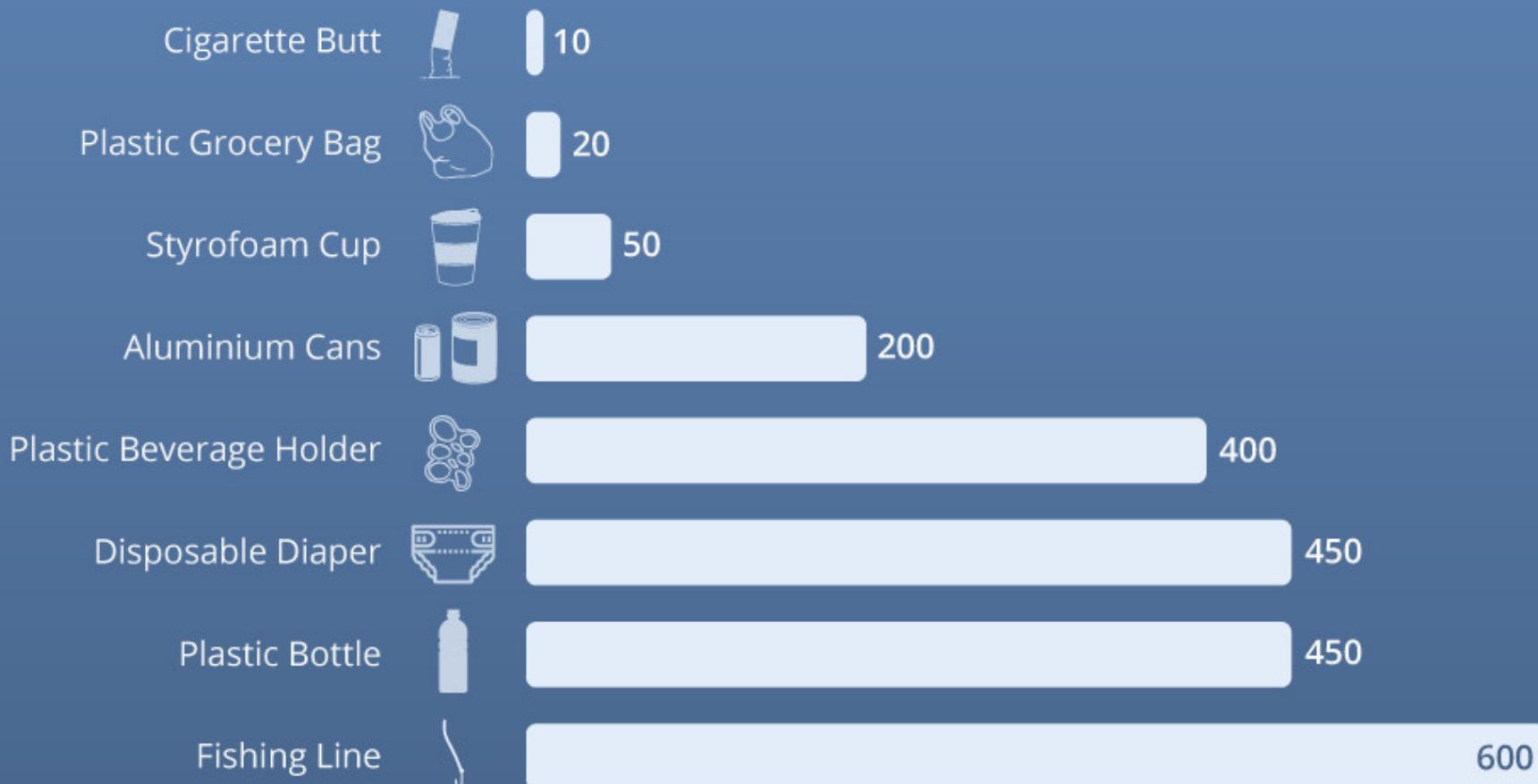


3 types of plastic that are considered as safer options for food, Terephthalate (PET), High-Density Polyethylene (2-HDPE), and Polypropylene (5-PP).



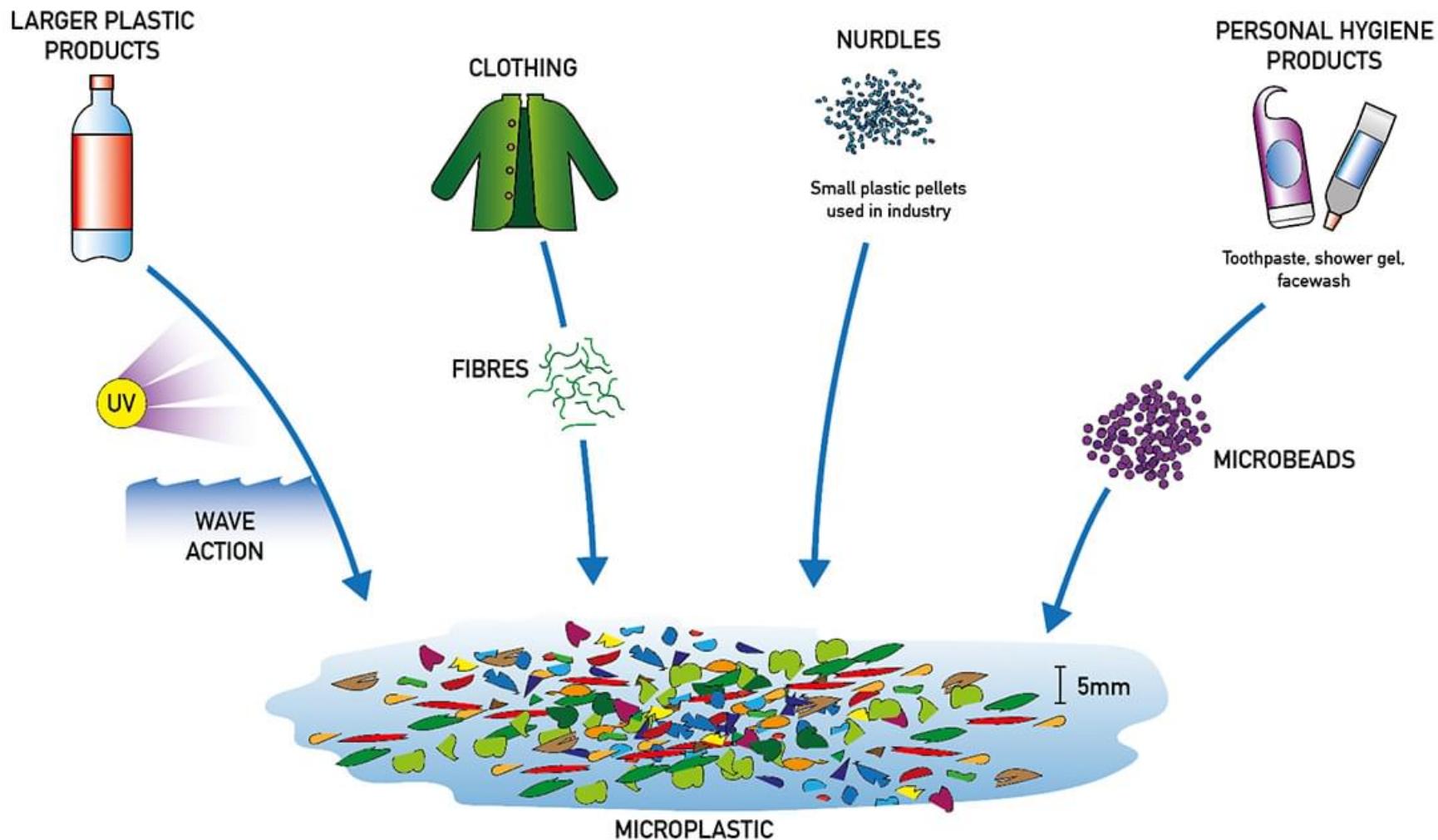
Plastic Can Take 500 Years To Bio-Degradate In The Ocean

Estimated number of years for selected items to bio-degrade in a marine environment*



* Exact time varies by product type and marine conditions. Cigarette butts and grocery bags are an upper estimate.

Sources: NOAA, Woods Hole Sea Grant



What are the microplastics (& Nanoplastic), microfiber, and microbeads?

Microplastics are plastic pieces that measure less than five millimetres.

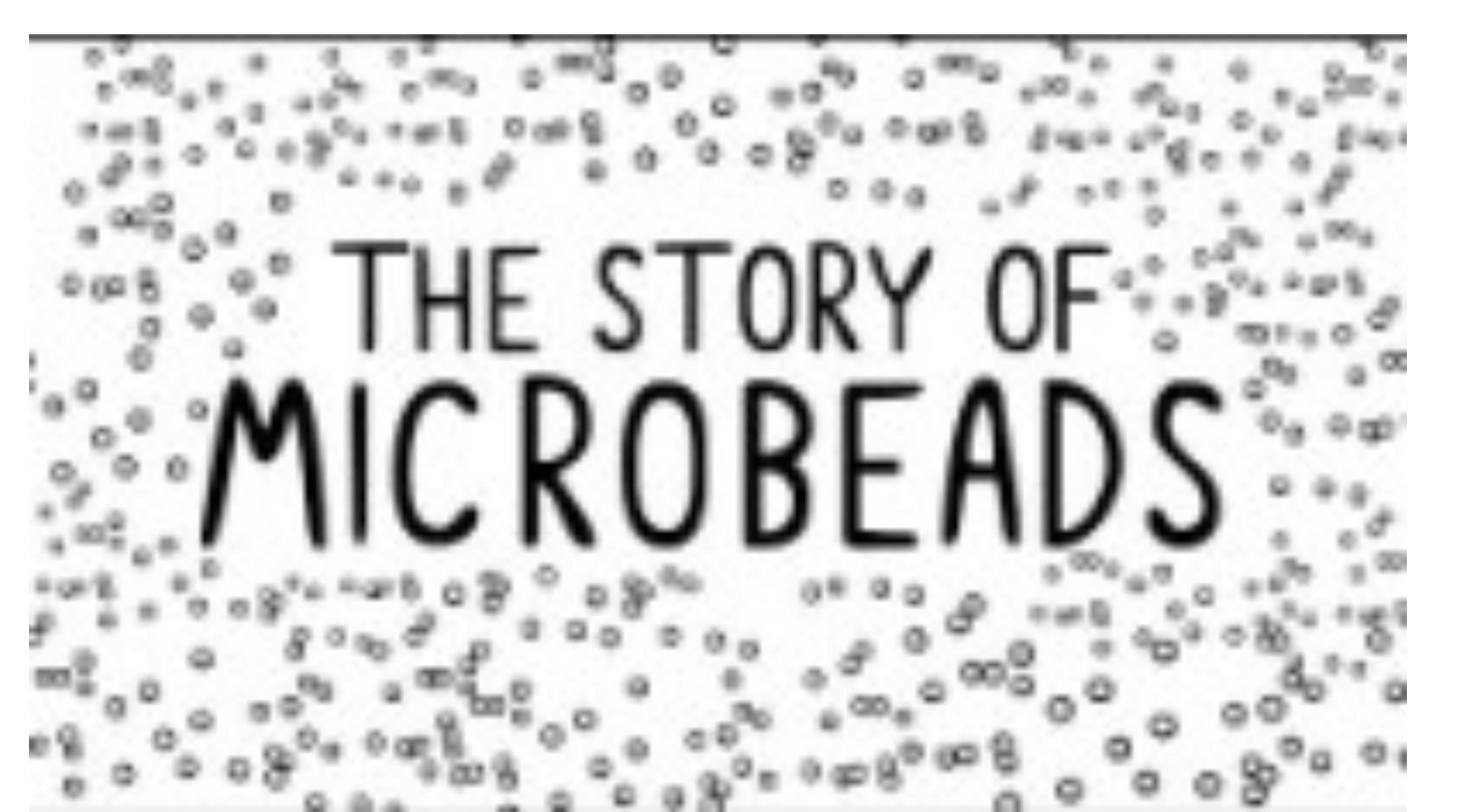
Natural processes including sunlight cause plastic to become brittle, fragment and break. But fragmentation doesn't stop there: microplastics can keep breaking up until they are like dust particles. This is called **Nanoplastic**, and it's difficult to measure as it is impossible to separate from the environment.

What are the microplastics (& Nanoplastic), microfiber, and microbeads?

Microbeads are extremely small piece of material manufactured for various applications, especially one made of plastic and used in personal care products, cosmetics, and detergents.

Some of the big companies have all made pledges to phase out the most common kind of microbead from products.





THE STORY OF MICROBEADS

The Story of Microbeads: https://www.youtube.com/watch?v=uAiGd_JqZc

Microplastics and Human Health

Microplastics found in human blood for first time

Exclusive: The discovery shows the particles can travel around the body and may lodge in organs



Microplastics and Human Health

The scientists analysed blood samples from 22 anonymous donors, all healthy adults and found plastic particles in 17.

Half the samples contained PET plastic, which is commonly used in drinks bottles, while a third contained polystyrene, used for packaging food and other products.

A quarter of the blood samples contained polyethylene, from which plastic carrier bags are made.

- *The big question is what is happening in our body*
- *Are the particles retained in the body*



Your Bottled Water Probably Has Plastic In It. Should You Worry?:

<https://time.com/5581326/plastic-particles-in-bottled-water/>

**Microplastic in human body?
Where does it came from?**

Microplastics and Human Health

We ingest microplastics both from the food we eat (fish and shellfish are particularly high in particles, but even sea salt, honey and beer are culprits), and from the way we eat (you're probably eating parts of that plastic fork, cup, or plate).

We also ingest them through breathing. Microplastics are in the air; an experiment conducted in Paris found up to 60 fibers per square meter indoors, and up to 1.5 fibers per square meter outdoors. One study estimated we are exposed to up to 68,000 particles of microplastic a year just from the dust that falls on our meals.

Which countries or regions produce most plastic/ single use plastic / mismanage plastics?

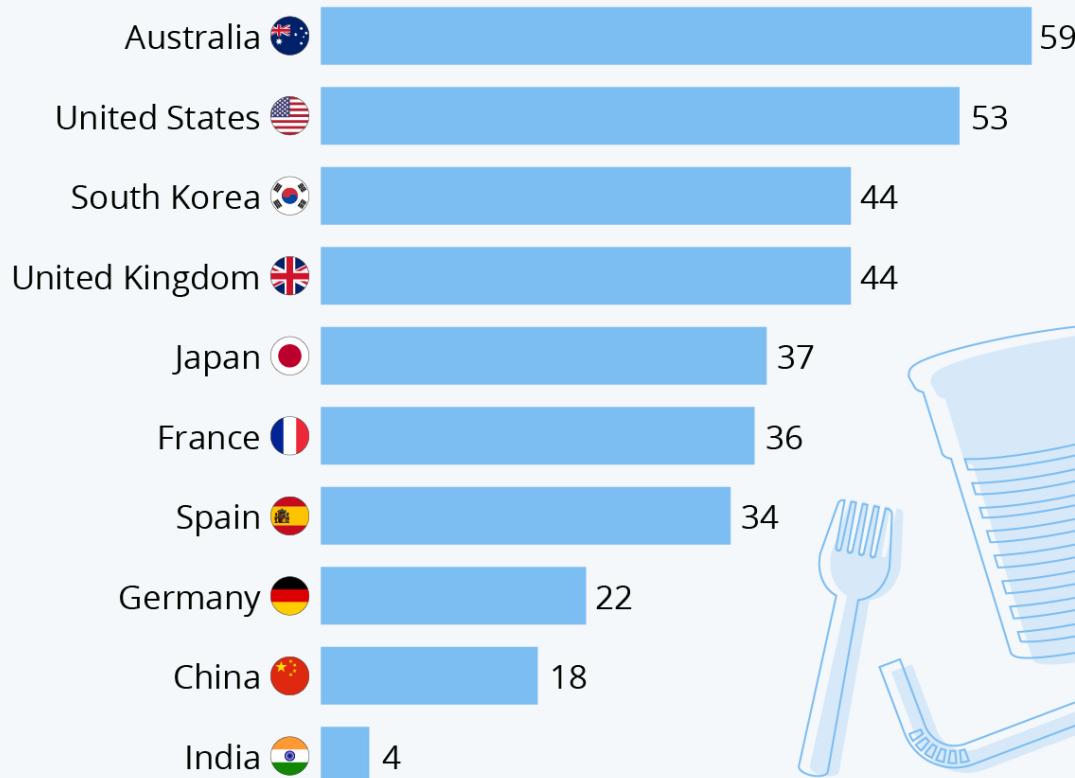
The world now produces more than 380 million tonnes of plastic every year, which could end up as pollutants, entering our natural environment and oceans.

Not all of our plastic waste ends up in the ocean, most ends up in landfills.

Around 3% of the global plastic waste enters the ocean.

How Much Single-Use Plastic Waste Do Countries Generate?

Single-use plastic waste generated per person
in selected countries in 2019 (in kilograms)

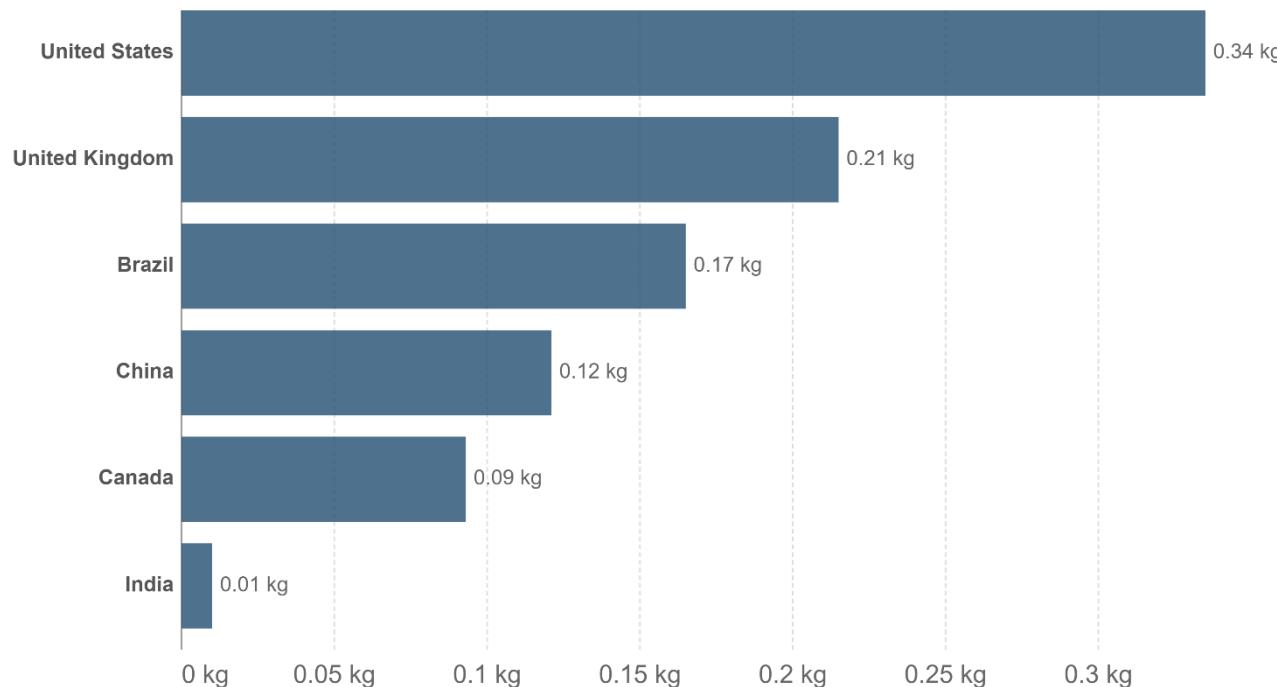


Source: The Plastic Waste Makers Index by The Mindaroo Foundation



Plastic waste generation per person, 2010

Daily plastic waste generation per person, measured in kilograms per person per day. This measures the overall per capita plastic waste generation rate prior to waste management, recycling or incineration. It does not therefore directly indicate the risk of pollution to waterways or marine environments.



Source: Jambeck et al. (2015)

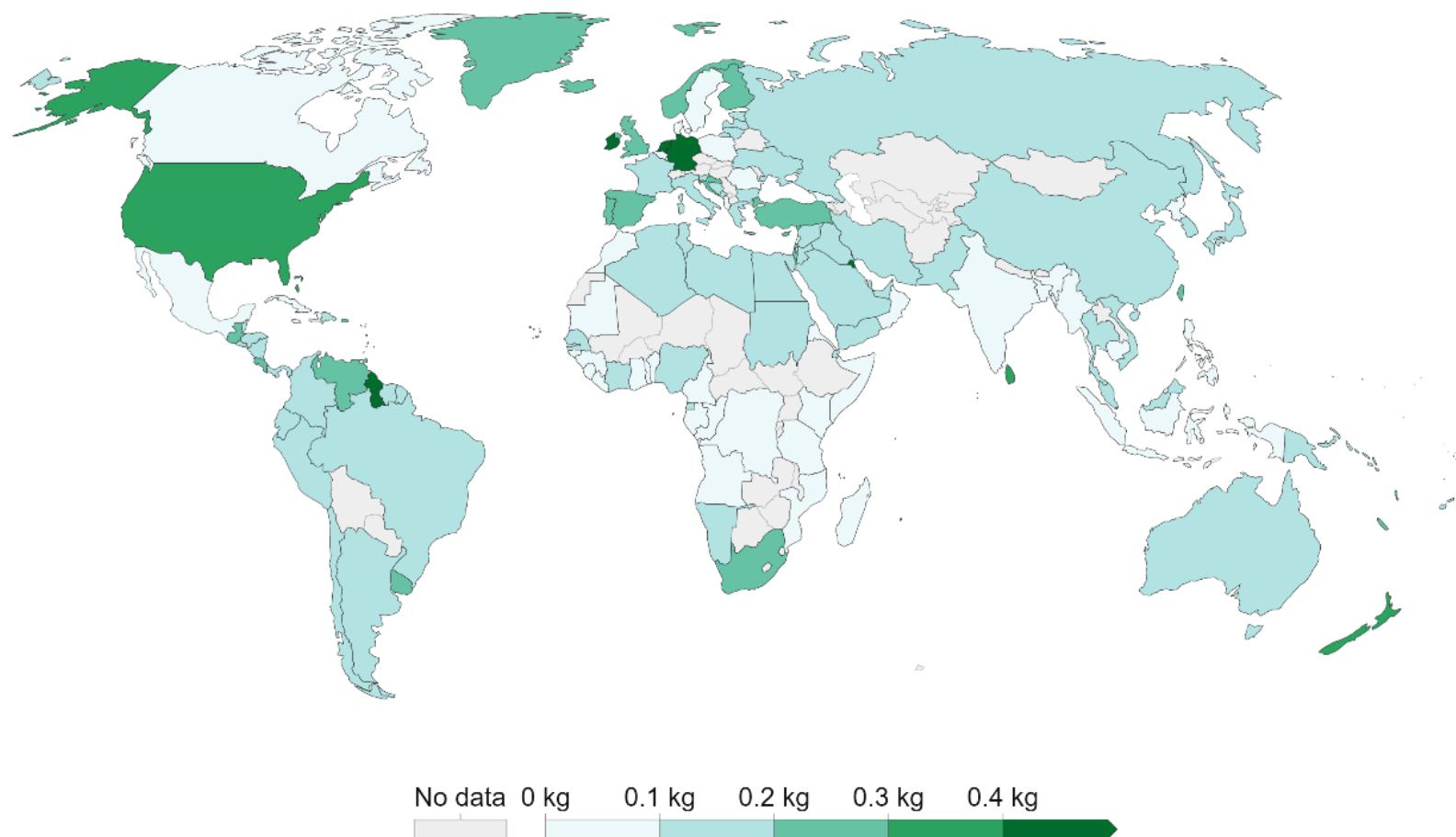
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Here we see differences of around an order of magnitude: daily per capita plastic waste across the highest countries – Kuwait, Guyana, Germany, Netherlands, Ireland, the United States – **is more than ten times higher than** across many countries such as India, Tanzania, Mozambique and Bangladesh.

These figures represent total plastic waste generation and do not account for differences in waste management, recycling or incineration. They therefore do not represent quantities of plastic at risk of loss to the ocean or other waterways.

Plastic waste generation per person, 2010

Daily plastic waste generation per person, measured in kilograms per person per day. This measures the overall per capita plastic waste generation rate prior to waste management, recycling or incineration. It does not therefore directly indicate the risk of pollution to waterways or marine environments.

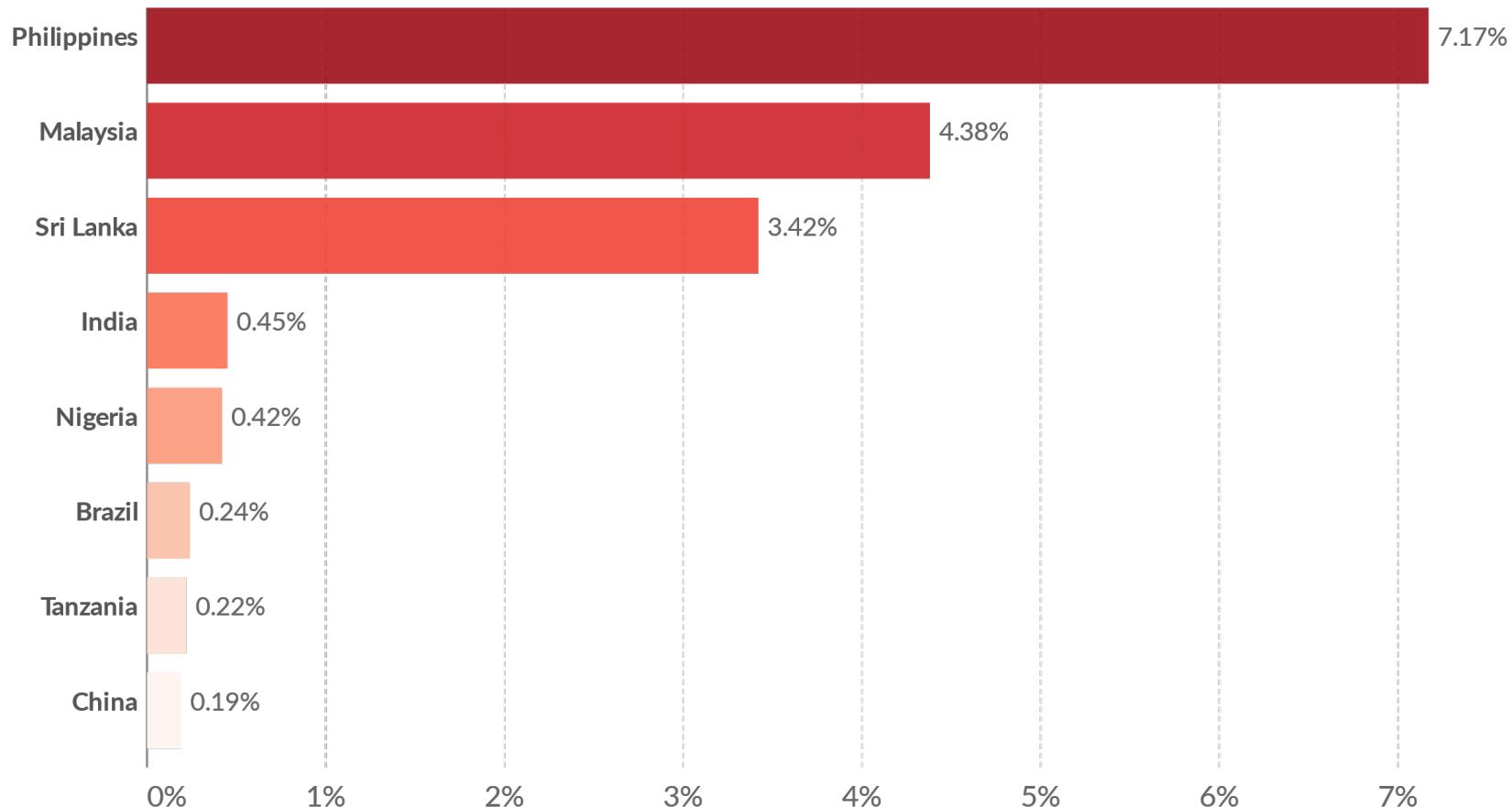


Source: Jambeck et al. (2015)

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Probability of mismanaged plastic waste being emitted to ocean, 2019

Mismanaged plastic waste is defined as "plastic that is either littered or inadequately disposed. Inadequately disposed waste is not formally managed and includes disposal in dumps or open, uncontrolled landfills, where it is not fully contained."



Source: Meijer et al. (2021). More than 1000 rivers account for 80% of global riverine plastic emissions into the ocean. Science Advances. CC BY

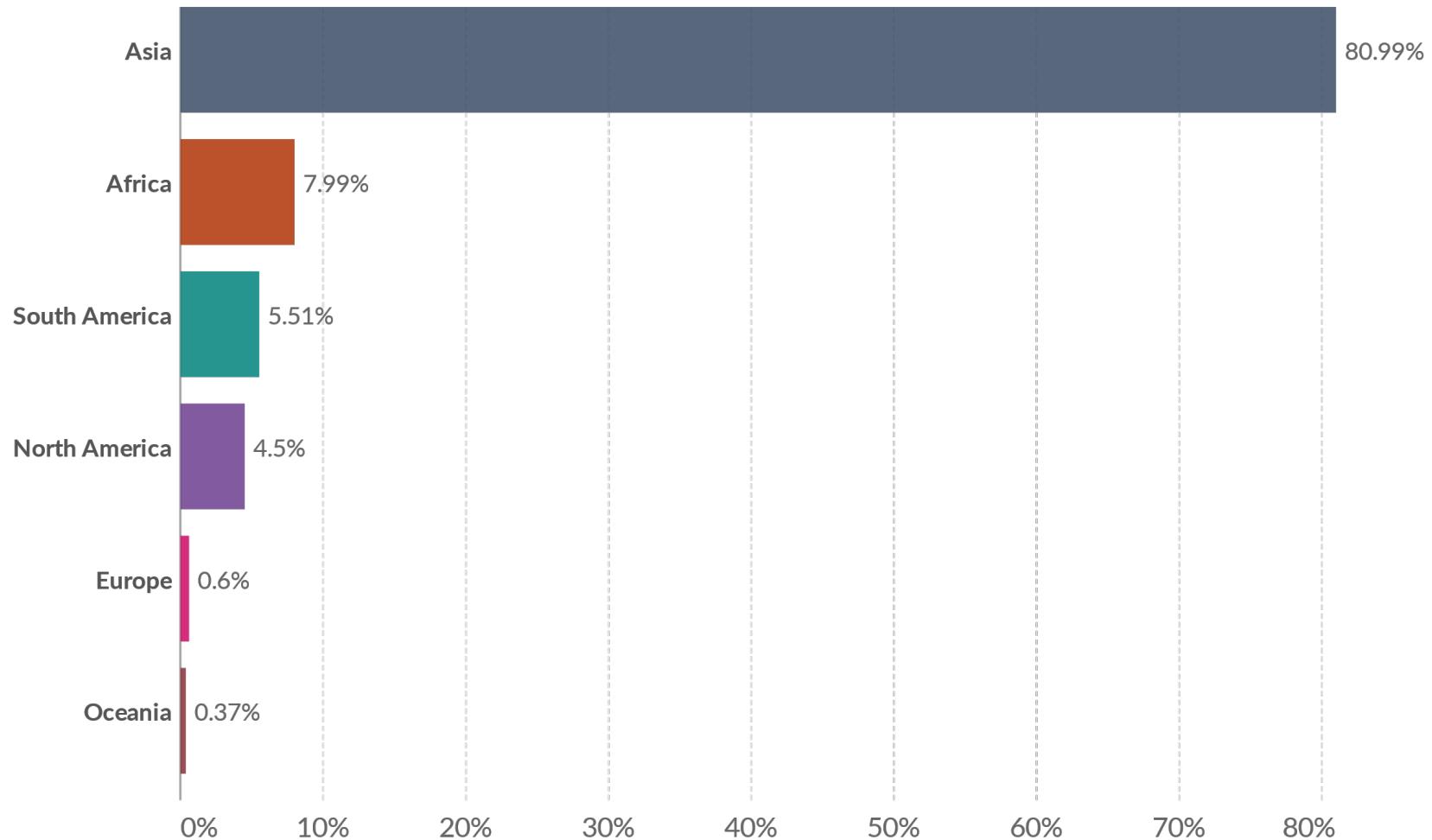
Bangladesh is the tenth largest contributor of mismanaged plastic waste in the world in 2010. About 87 % of the plastic waste generated was inadequately managed.

The Ganges River, which runs through Bangladesh and into the Bay of Bengal, was estimated to be the second largest river source of plastic inputs into the ocean worldwide in 2015.

CPD

Share of global plastic waste emitted to the ocean, 2019

Our World
in Data



Source: Meijer et al. (2021). More than 1000 rivers account for 80% of global riverine plastic emissions into the ocean. Science Advances. CC BY

Which sector produce most of the global plastics?

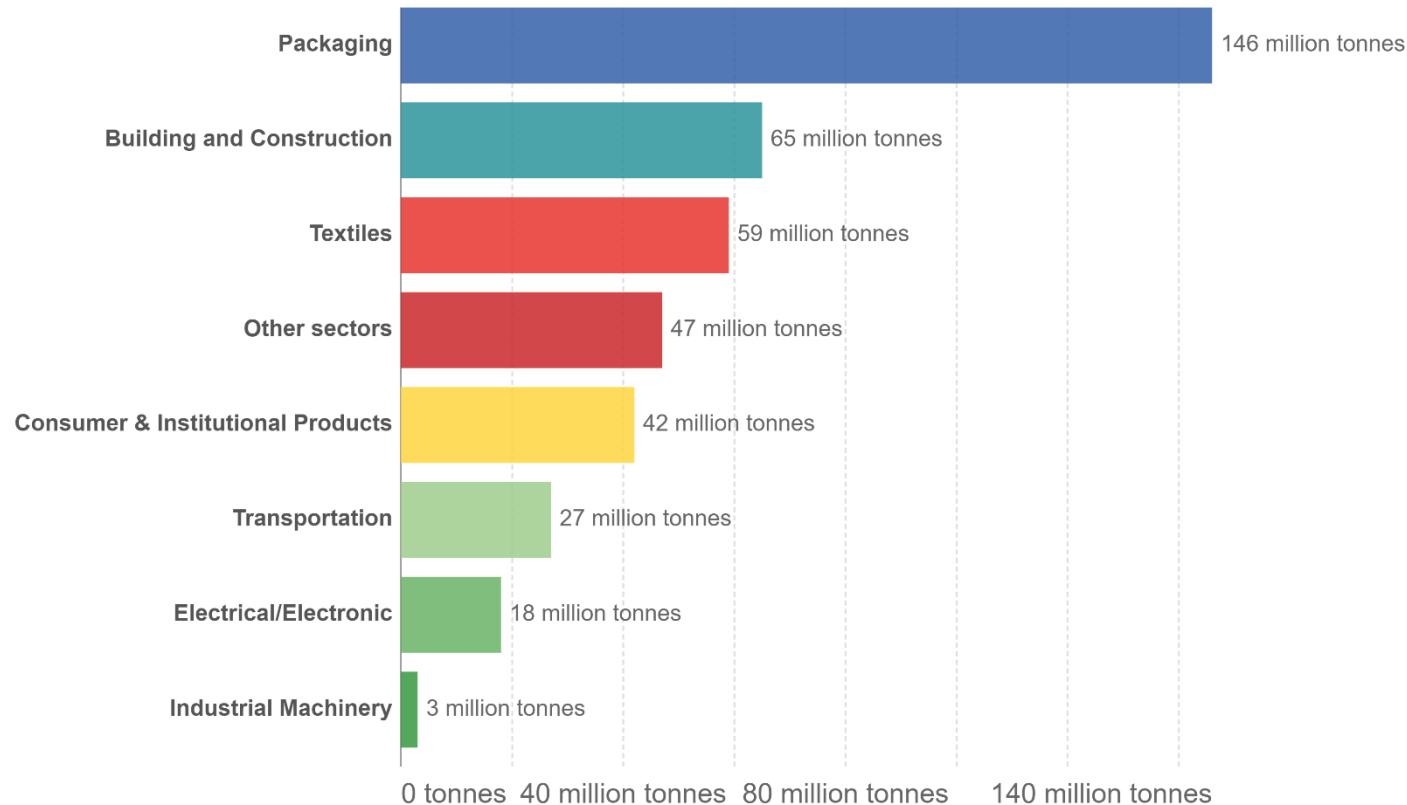
Packaging was the dominant use of primary plastics, with 42 percent of plastics entering the use phase.⁶

Building and construction was the second largest sector utilizing 19 percent of the total. Primary plastic production does not directly reflect plastic waste generation (as shown in the next section), since this is also influenced by the polymer type and lifetime of the end product.

Primary plastic production by industrial sector, 2015

Our World
in Data

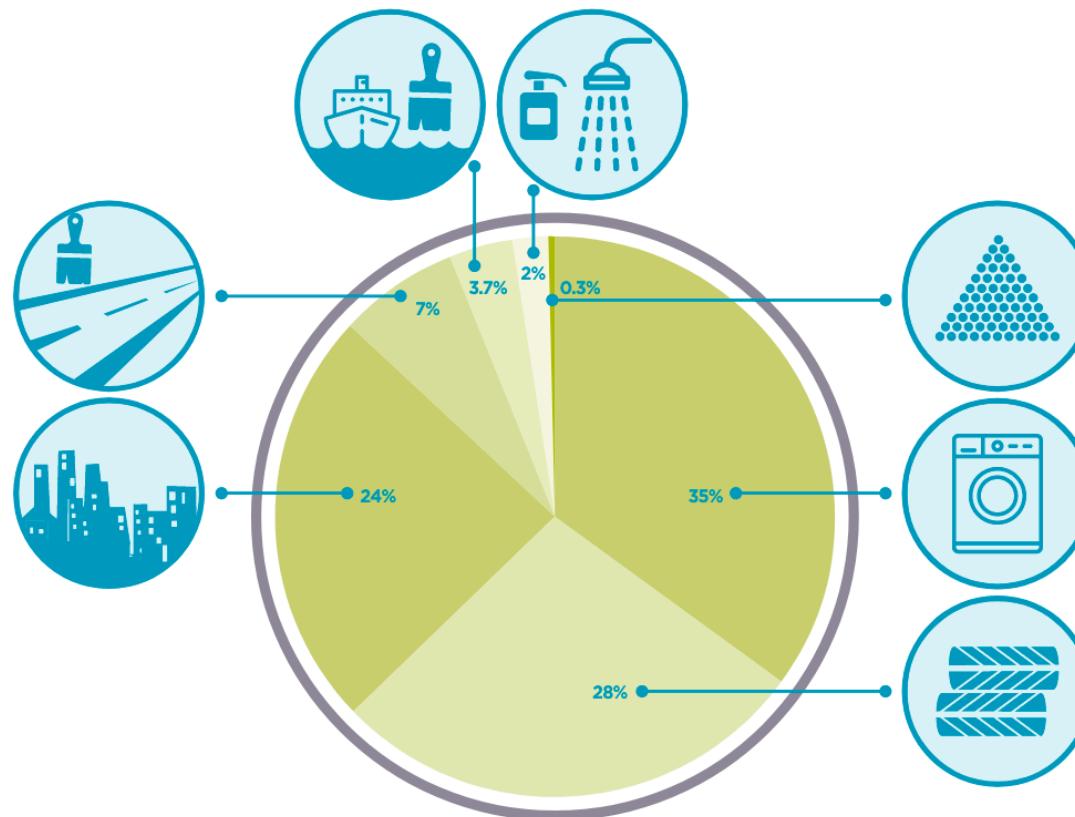
Primary global plastic production by industrial sector allocation, measured in tonnes per year.



What are the major sources of plastic in the ocean and rivers (open water)?

GLOBAL RELEASES OF PRIMARY MICROPLASTICS TO THE WORLD OCEANS

BY SOURCE (IN %).



SYNTHETIC
TEXTILES



TYRES



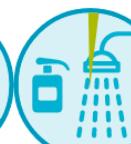
CITY DUST



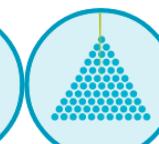
ROAD
MARKINGS



MARINE
COATINGS



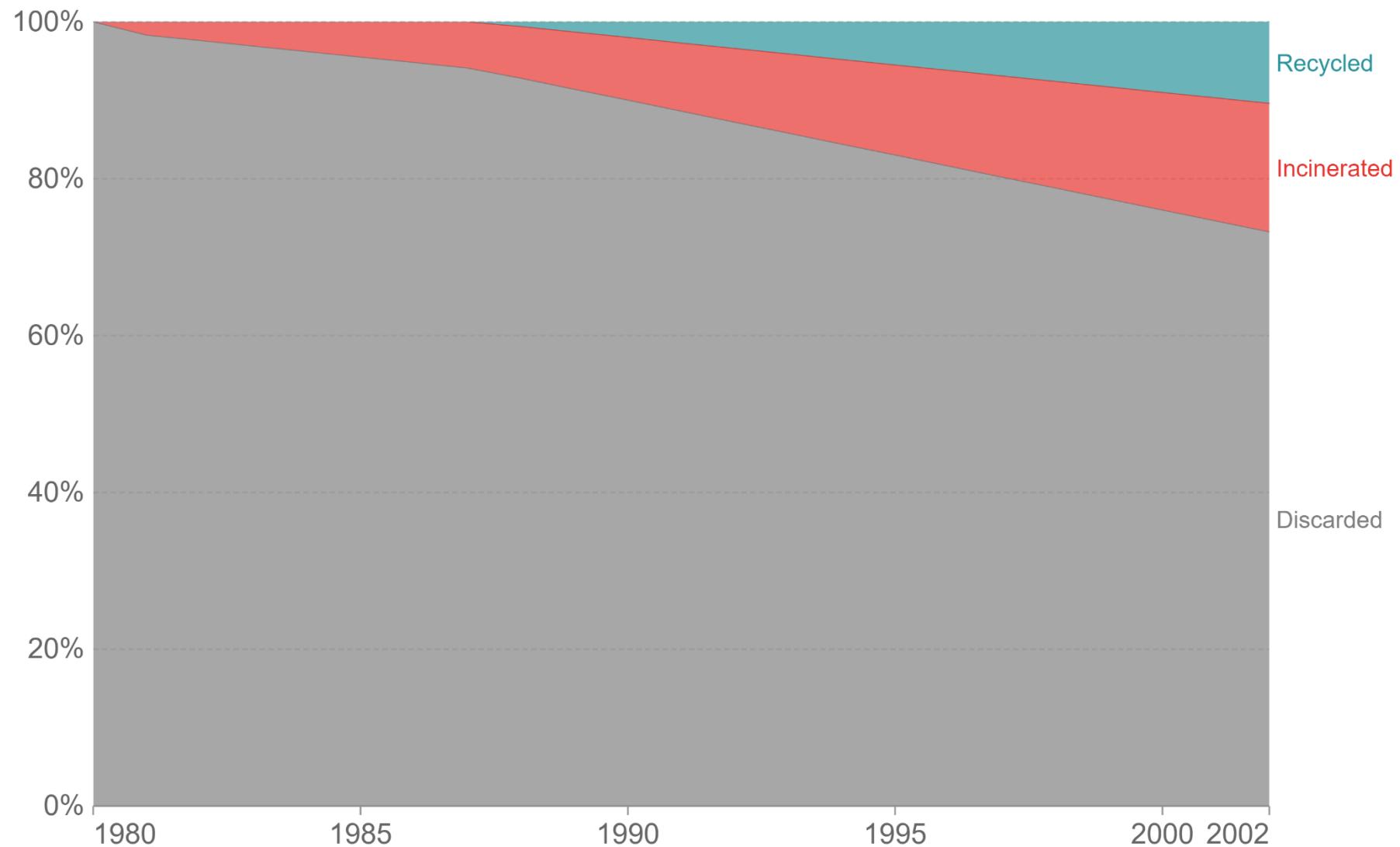
PERSONAL
CARE
PRODUCTS



PLASTIC
PELLETS

Global plastic waste by disposal, 1980 to 2002

Estimated share of global plastic waste by disposal method.

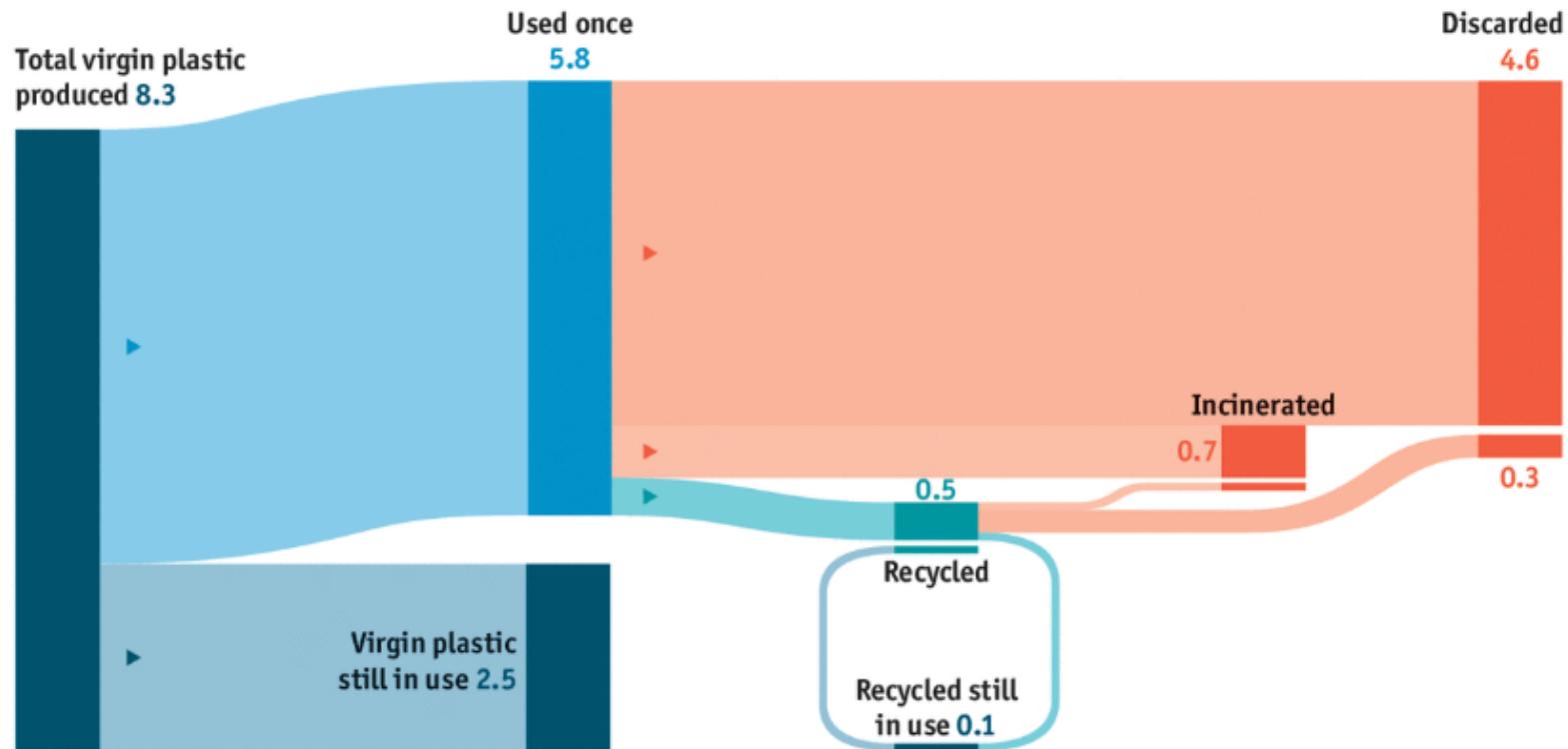


Plastic Recycling Fallacy:

Only 9% of the world's plastic is recycled.

The end of all things

Global plastic production and use, 1950-2015, tonnes, bn



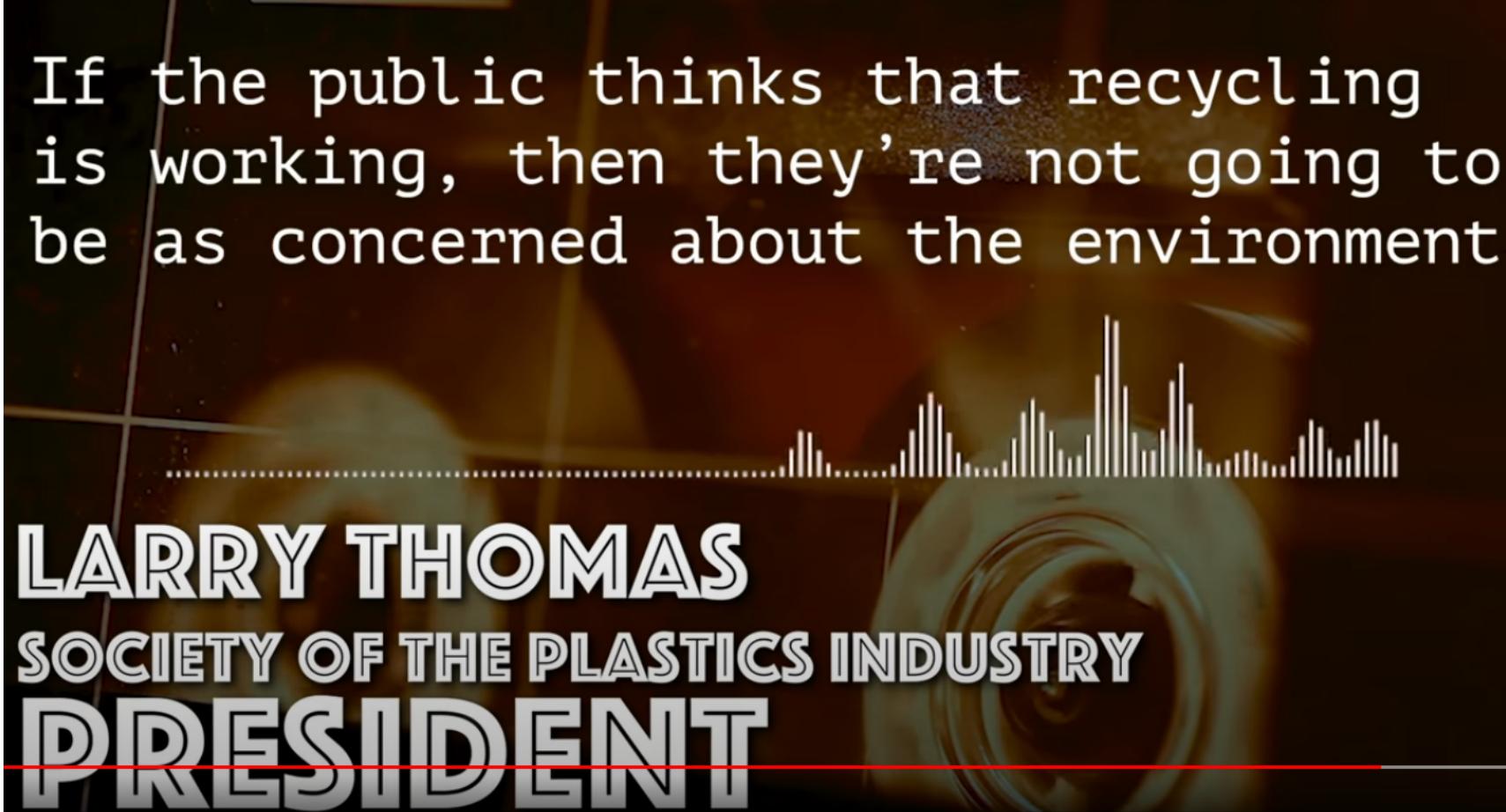
Source: "Production, use, and fate of all plastics ever made" by R. Geyer et al., *Science Advances*

Plastic Recycling Fallacy:



Common Products	Common Products	Common Products	Common Products	Common Products	Common Products	Common Products
Water Bottles Soda Bottles Peanut Butter Jars	Milk Jugs 5 gal Buckets Shampoo Bottles Laundry Detergent Containers	Vinyl Tubing/Pipe Siding Auto Product Containers	Laundry Basket Bread Bags Squeeze Bottles Plastic Film	Yogurt Containers Coffee Cup Lids Straws Kitty Litter Bucket Amber-Colored Pill Bottles	Styrofoam Cups Solo Cups Egg Carton To-Go Containers	Toys Sippy Cups CD/DVDs Sunglasses
RECYCLE	RECYCLE	TRASH	TRASH	RECYCLE	TRASH	TRASH

Resin Identification Code



If the public thinks that recycling
is working, then they're not going to
be as concerned about the environment

LARRY THOMAS
SOCIETY OF THE PLASTICS INDUSTRY
PRESIDENT

Plastic Solution

Mubarak Ahmad Khan, a scientific adviser to the state-run Bangladesh Jute Mills Corporation (BJMC) and leader of the team that developed the new 'sonali' - the Bengali word for golden-bags.



Plastic Solution?

Plastic-eating bacteria: Genetic engineering and environmental impact

By Scott Dutfield published March 23, 2022

Discover how plastic-eating bacteria were discovered and re-engineered to help tackle the world's plastic problem.



© Apr 27, 2022

Plastic-eating Enzyme Could Eliminate Billions of Tons of Landfill Waste

These tiny, plastic-munching caterpillars can clean up our world – but there's a catch

 **Joshua Bote**
USA TODAY

Published 10:57 a.m. ET March 6, 2020 | Updated 3:35 p.m. ET March 8, 2020



Scientists Discover “Superworms” Capable of Munching Through Plastic Waste

TOPICS: Plastic Popular Recycle University Of Queensland

By UNIVERSITY OF QUEENSLAND JUNE 14, 2022

SUSTAINABILITY • EDITORS' PICK

The Race To Develop Plastic-Eating Bacteria

Scott Carpenter Former Contributor @
I cover the energy industry, focusing on climate and green tech

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Mar 10, 2021, 05:00am EST

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Scientists have discovered bacteria that are able to biodegrade plastics from polymers back into

Plastic Solution? !

- Banning Straws and Bags Won't Solve our Plastic Problem
- We can't just ban bad products—we must invest in alternatives.
- We need to invest in redesigning plastics so that they can be readily broken down into their molecular units and remanufactured into new plastics of the same quality, the essence of a closed loop system.
- We need better recycling technology that can address the major obstacle of recycling plastics: about 25 percent of plastics collected are contaminated and therefore unusable.
- We need to reinvest government budgets in the infrastructure and associated policies needed for these systemic solutions.
- Circular Economy!