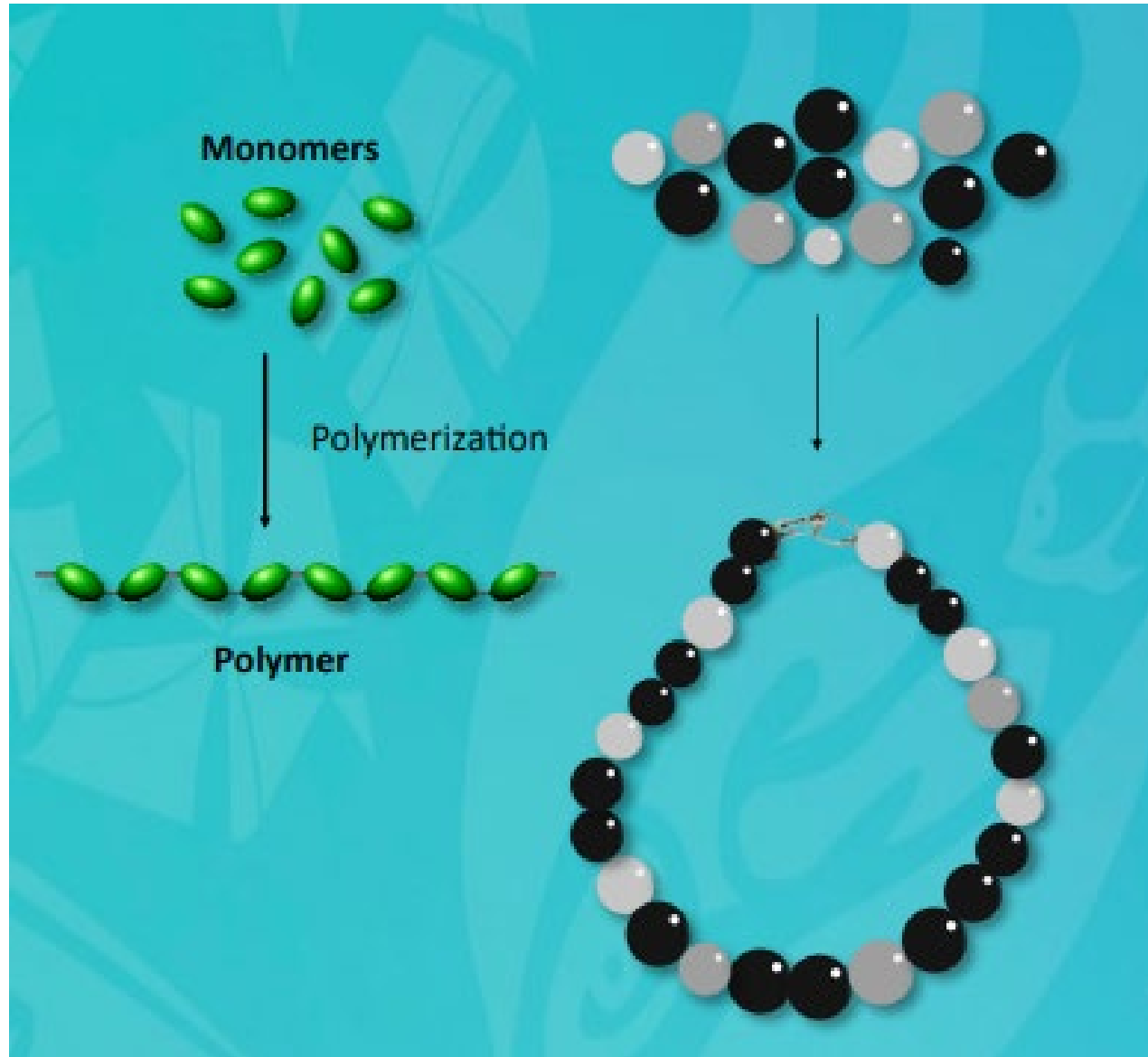


Marine plastic pollution:

Food, biodiversity loss, climate, and human rights

Professor Trisia Farrelly (ONZM, FRG)





Examples of Natural and Synthetic Polymers

NATURAL POLYMERS are made by living organisms

SYNTHETIC POLYMERS are made by chemical reactions in a lab



DNA



RUBBER



VINYL



POLYESTER



CELLULOSE



WOOL

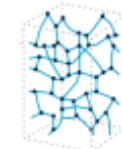


TEFLON

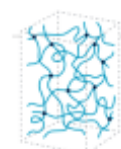


POLYCARBONATE

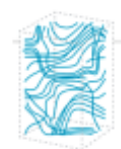
Structural differences between thermosets, elastomers, and thermoplastics



Thermosets



Thermoplastics



Elastomers

Virgin plastics or Primary Plastic Polymers (PPP):

‘Plastic materials made of synthetic and semi-synthetic polymers that are used for the first time to create plastic products in any form.’ This ...includes ...[all PPPs] made from bio-based and fossil-based feedstocks.

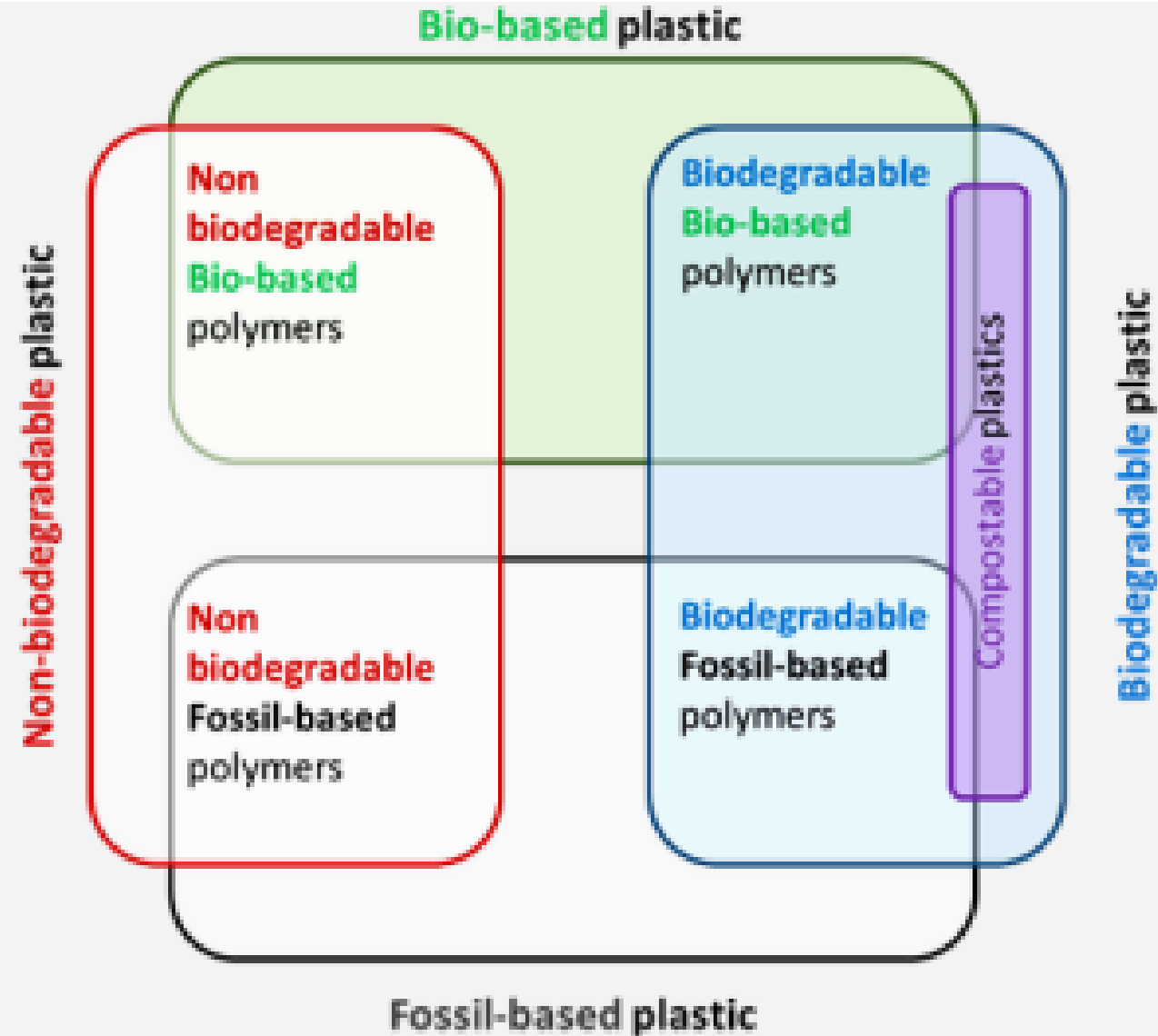
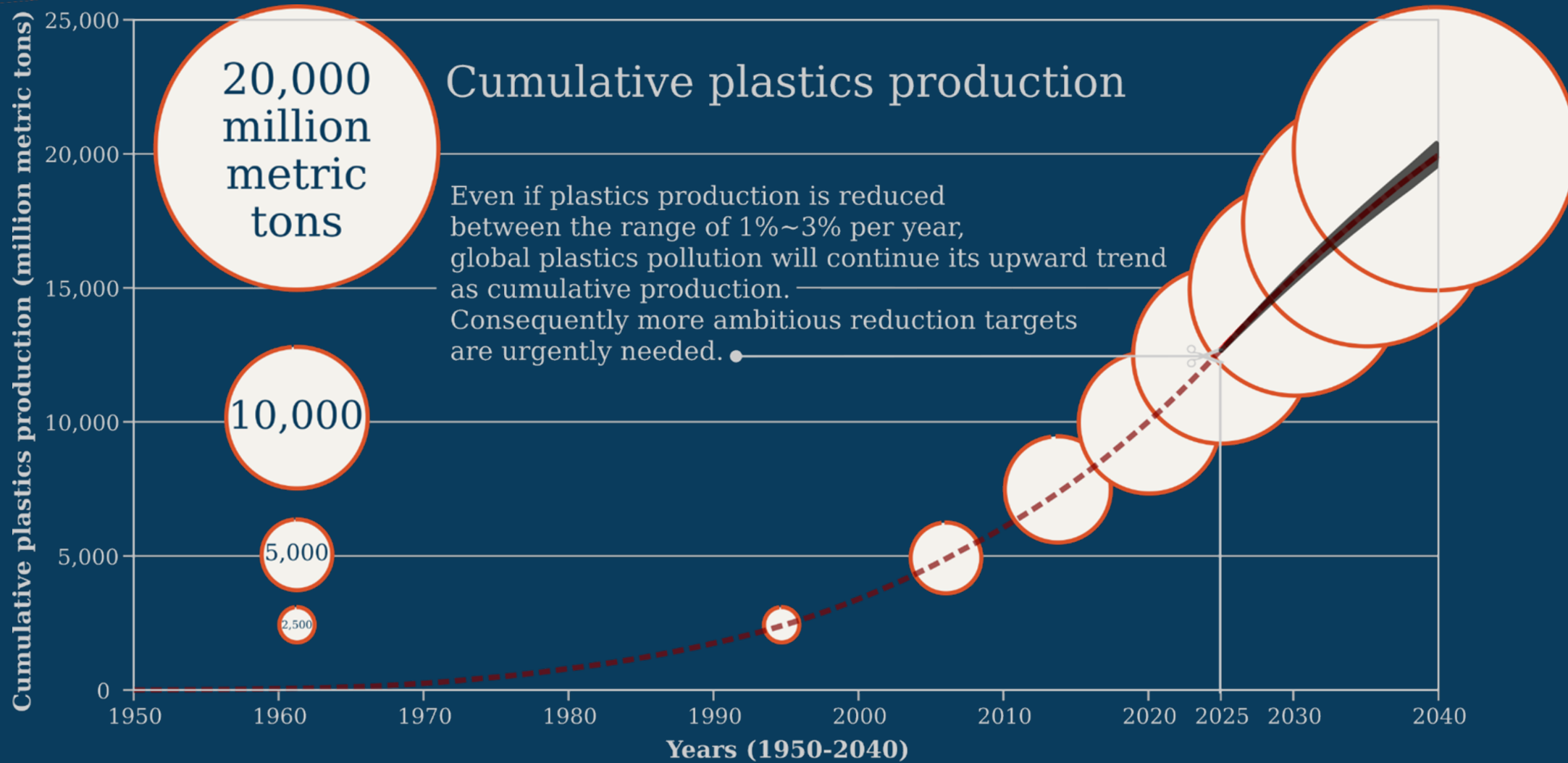
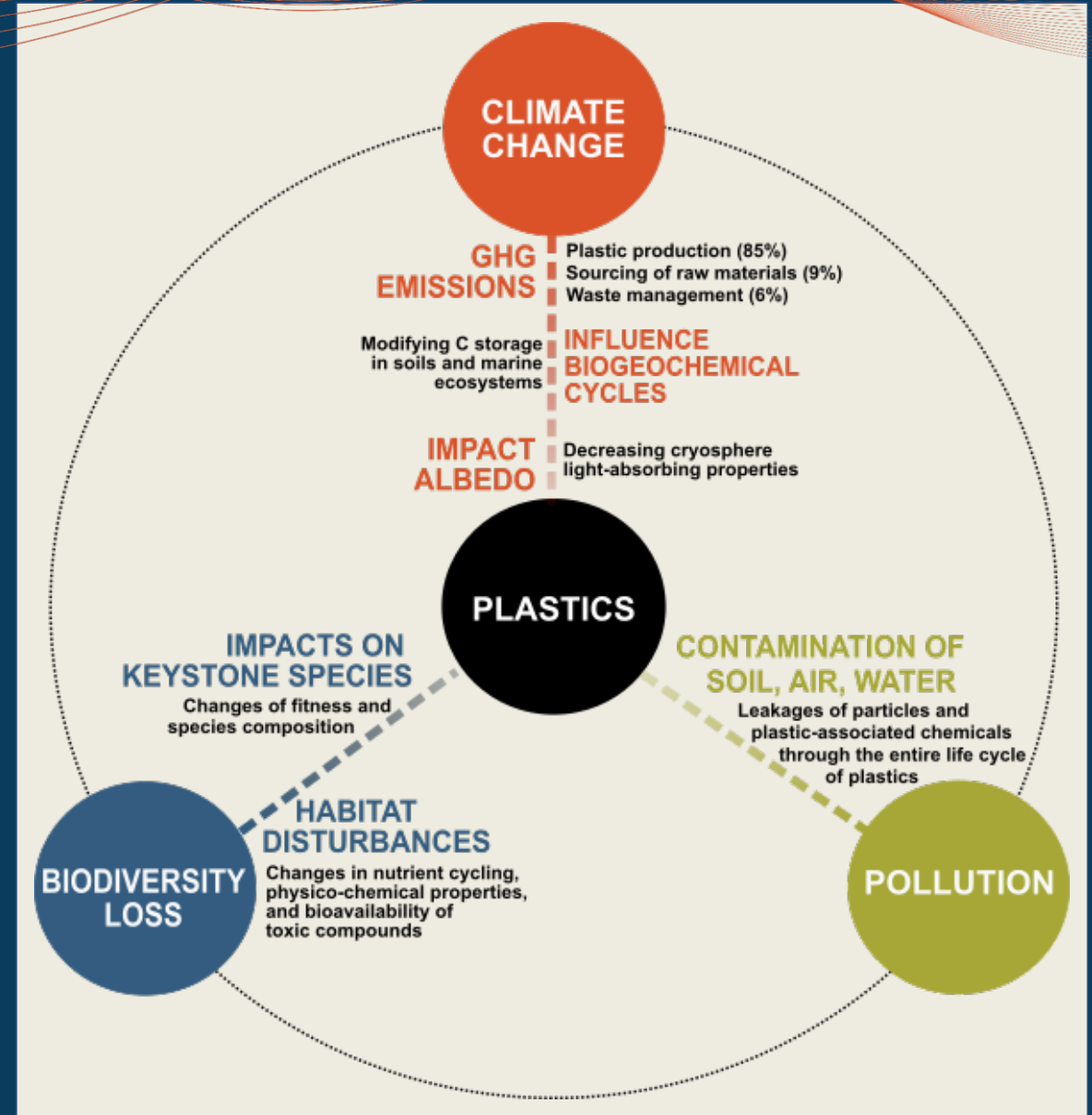


Fig 1. Categories of bio-based, fossil-based, biodegradable, and non-biodegradable plastics. The conflated term 'bioplastics' comprises i) fossil-based biodegradable polymers, ii) bio-based biodegradable polymers and iii) bio-based non-biodegradable polymers.¹¹



Plastics are integral to the Triple Planetary Crisis





Plastic pollution at each life stage

Stages	Pollution
 Resources (oil extraction & bio-based feedstock)	CO ₂ , CH ₄ , fracking water, oil spills, chemicals, fertilizers and pesticide
 Polymer production	pellet/nurdle loss, loss of flakes and powder, CO ₂ , CH ₄ , hazardous air pollutants, micro-/nanoplastics pollution, airborne microplastics, monomers and polymers, non-intentionally added substances (e.g. formaldehyde) and other chemicals
 Product manufacture	(airborne) micro-/nanoplastics pollution, pellet/nurdle loss, microfibres, general microplastics/ paint fragments in wastewater, loss of flakes and powder, monomers and polymers, chemicals
 Transport & trade	micro-/nanoplastics pollution (pellet loss, airborne microplastics, litter, fragmentation), unintentional releases of pellets, flakes and powders, monomers and polymers, chemicals
 Commercial, industrial & consumer use	e.g. tire dust, paint dust, microfibres, cigarette butts, single-use plastics, fishing gear, agricultural plastics, microplastics, littering (e.g. food packaging), monomers and polymers, endocrine-disrupting and other chemicals
 Waste management & recycling	microplastics, particulates, heavy metals, CO ₂ , CH ₄ , monomers and polymers, chemicals
 Removal & remediation	micro-/nanoplastics, monomers and polymers, microfibres, endocrine-disrupting and other chemicals



Ohio, USA



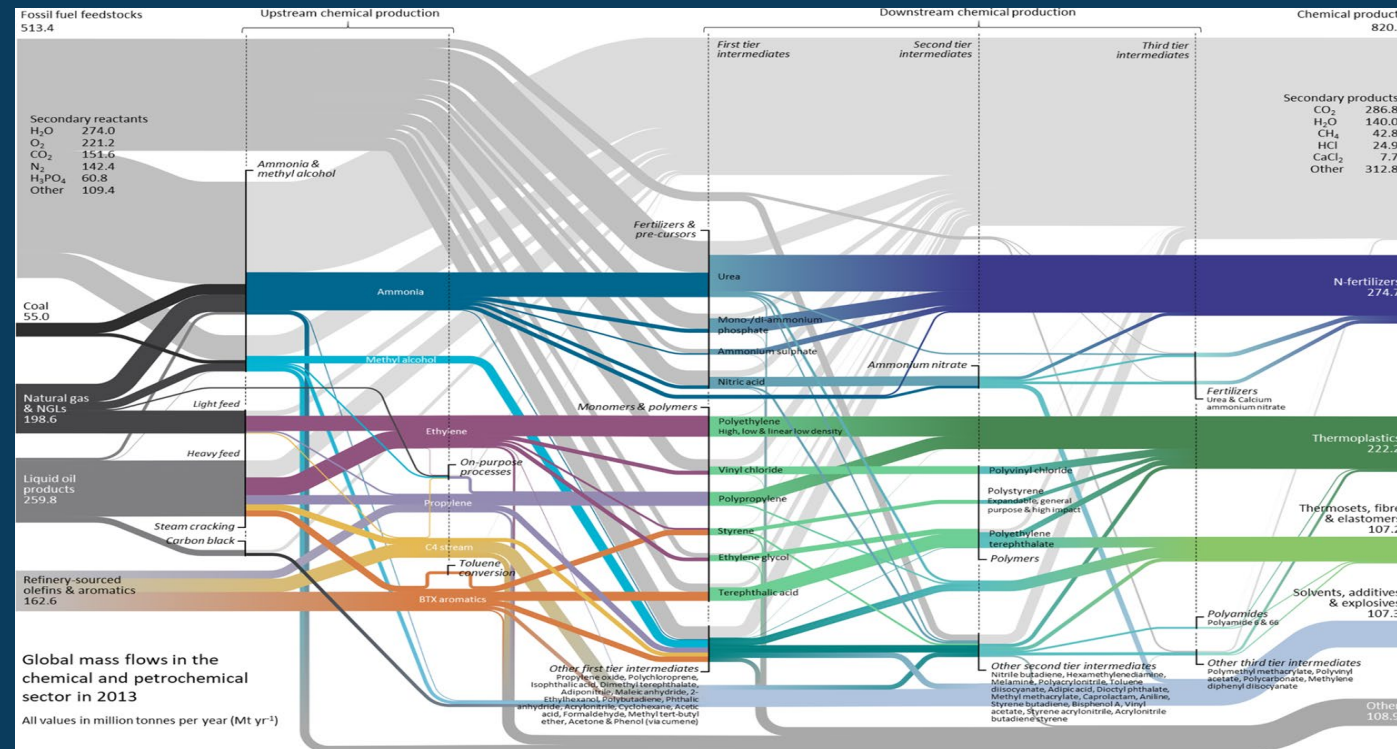
Sri Lanka



Kenya

Plastic are a complex mix of **chemicals**

16,000 chemicals are used in plastics production and products, and many are **hazardous, persistent** and **cumulative**.



High complexity
Low transparency

(Levi and Cullen, 2018)





A photograph of a beach heavily littered with plastic waste and driftwood. In the foreground, numerous clear plastic bottles, some with blue or red caps, are scattered among sticks and debris. A large, clear plastic bottle lies horizontally in the lower left. To its right, a green plastic bottle is partially visible. Further back, more plastic fragments and bottles are mixed with brown driftwood. The beach extends to the ocean in the background, where the blue water meets a clear sky. A rocky cliff is visible on the left side of the frame.

19-20 million tons of plastic waste
enters aquatic environments every
year



Concentrations of microplastics (<5mm length and diameter) are higher in deep water.



Landfill waste is another source of GHG emissions





today

90% OF SEABIRDS
HAVE FRAGMENTS OF PLASTIC
IN THEIR STOMACH

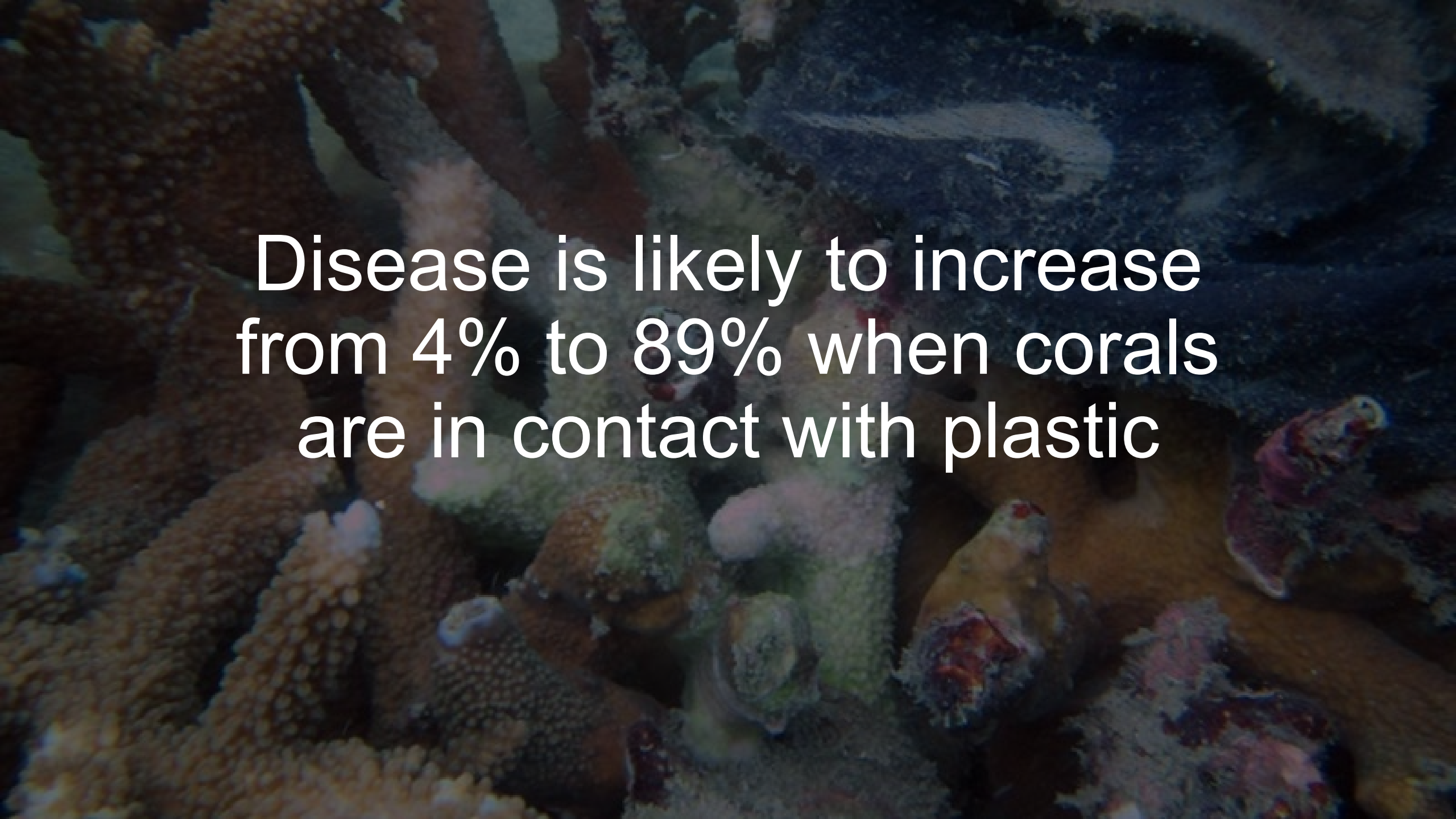
by 2050

THIS NUMBER MAY RISE TO **99%**

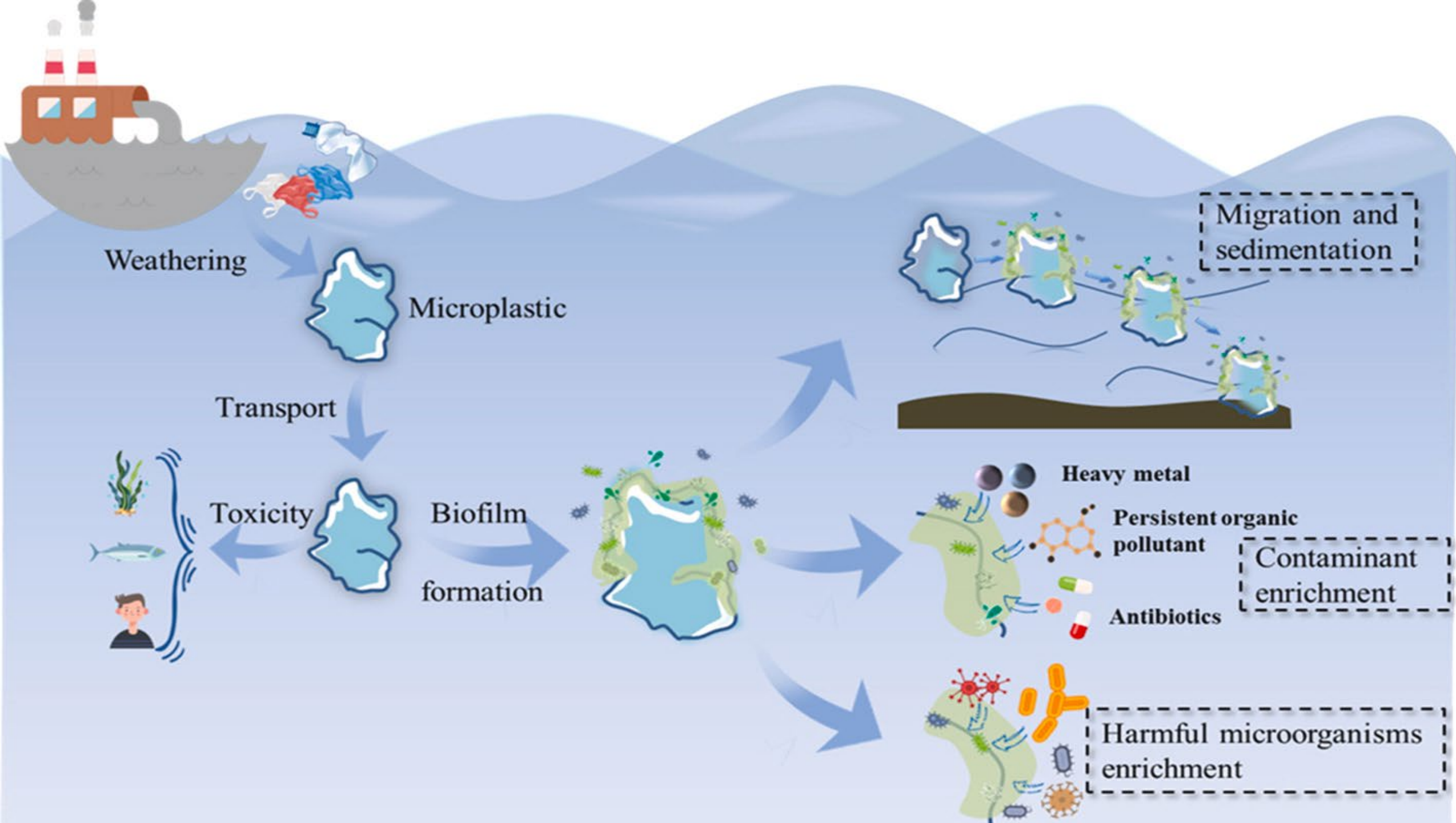


Marine plastic pollution has impacted at least 267 species worldwide including 86% of all sea turtle species, 44% of all seabird species and 43% of all marine mammal species.

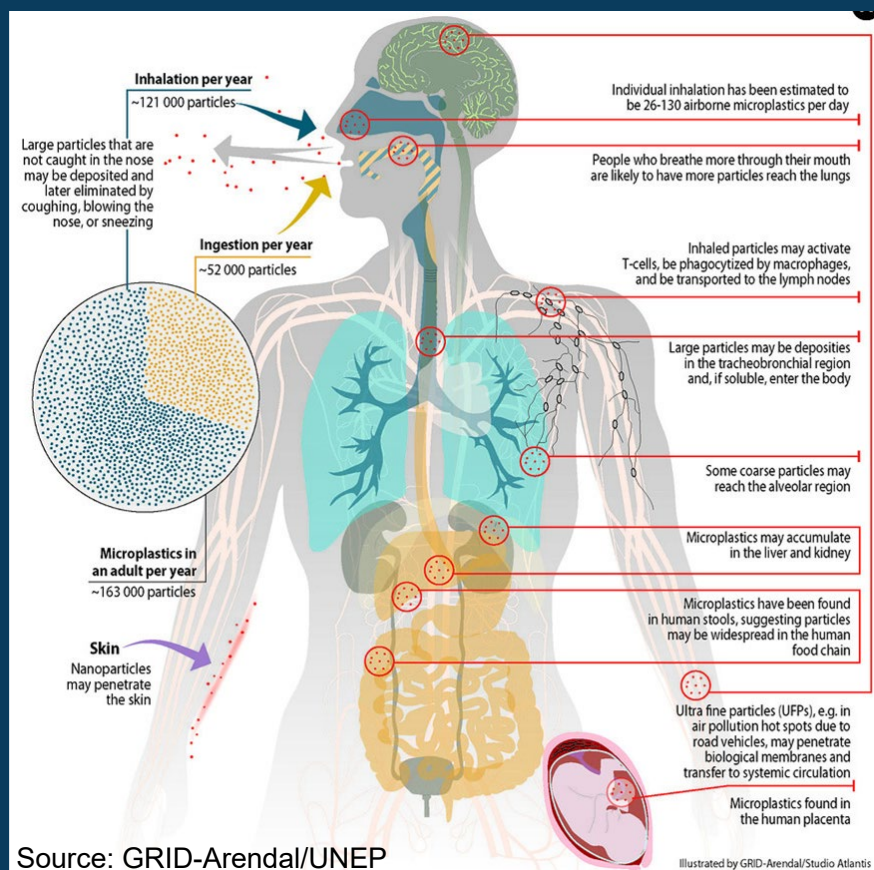




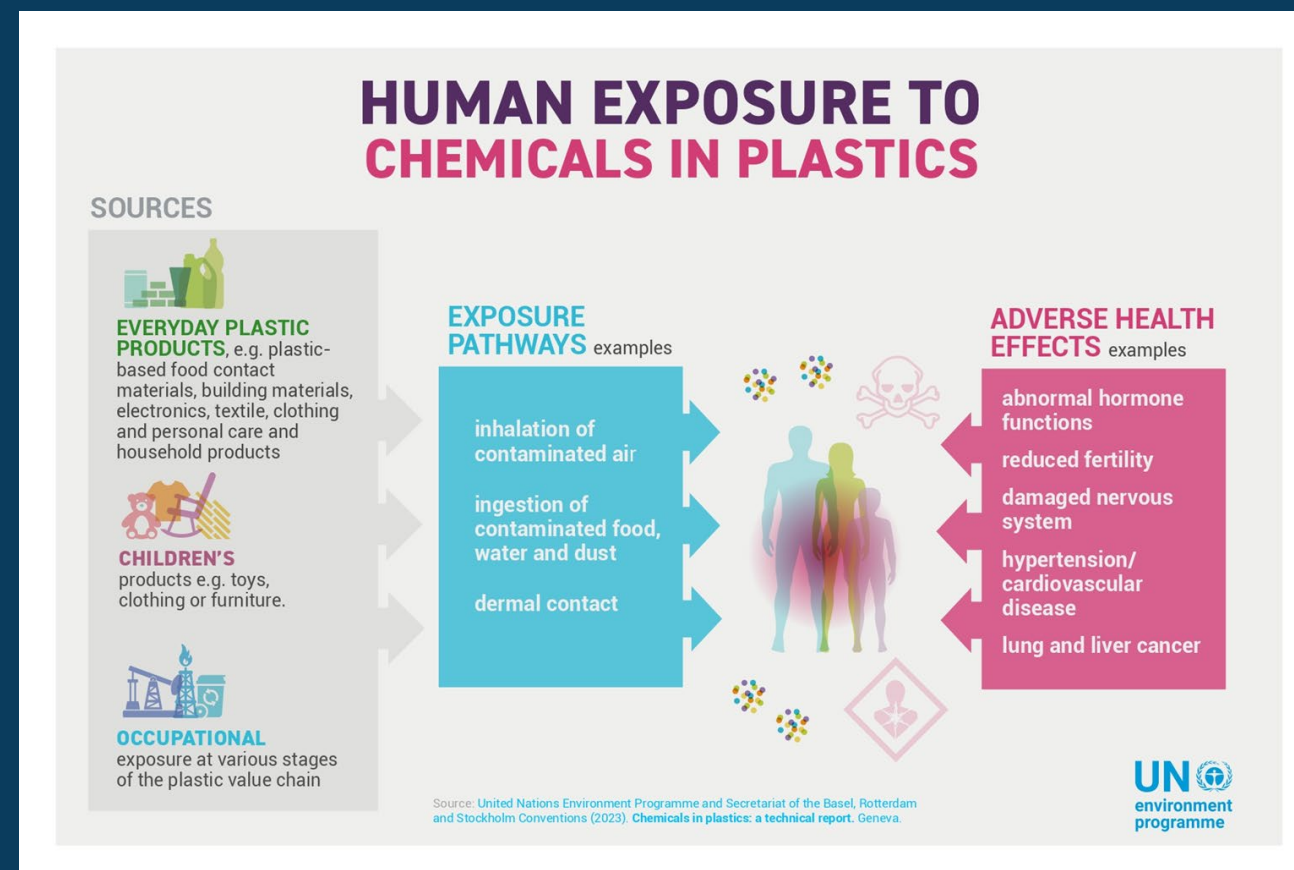
Disease is likely to increase
from 4% to 89% when corals
are in contact with plastic



Microplastics and human health

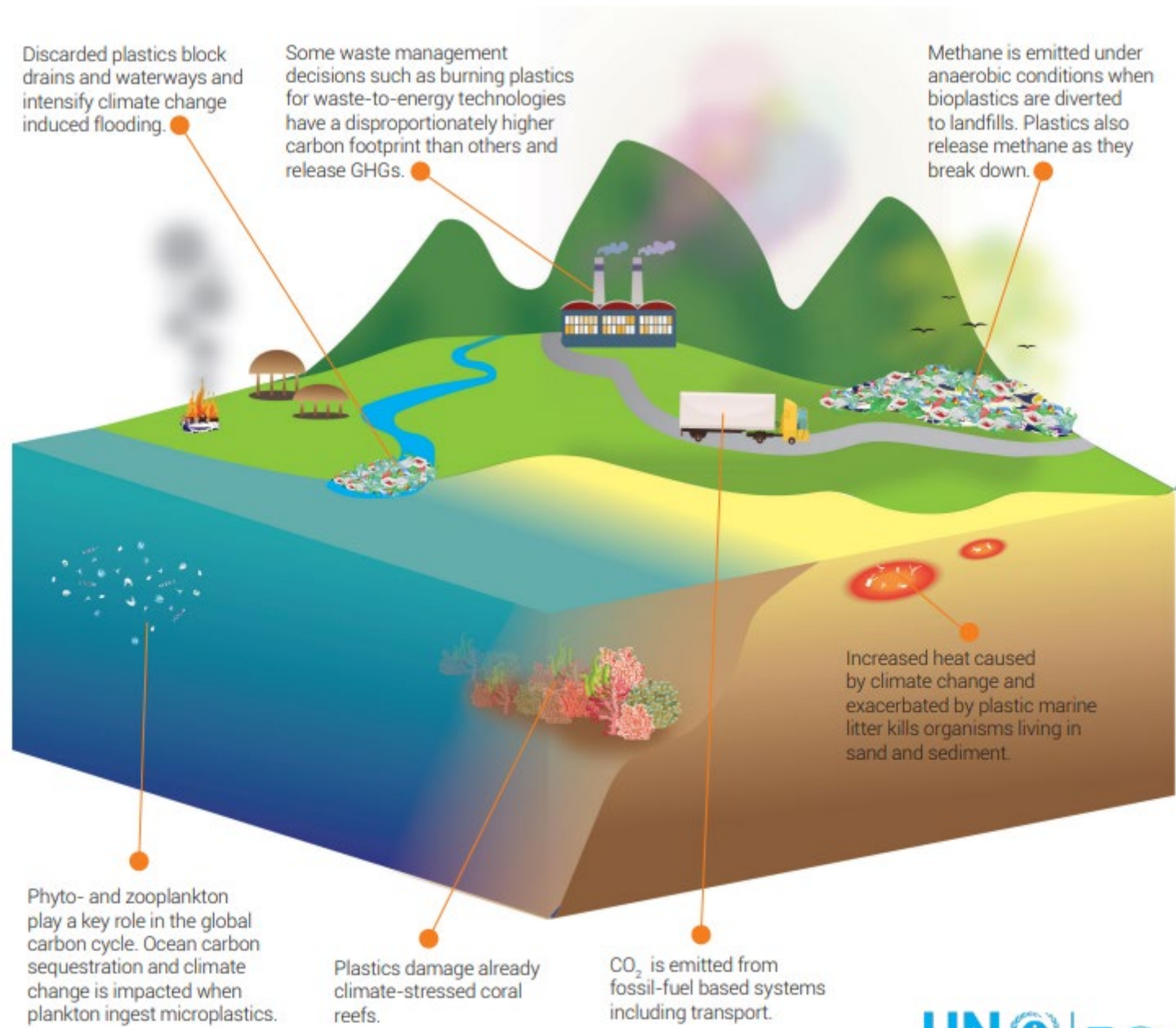


Plastics chemicals & human health



“...global **production of primary plastics** generated about 2.24 gigatonnes of carbon dioxide equivalent (GtCO₂e) in 2019, representing **5.3% of total global GHG emissions ...**”









A CLEAN, HEALTHY, AND SUSTAINABLE ENVIRONMENT IS A HUMAN RIGHT

On October 8, 2021, the UN Human Rights Council (HRC), in resolution 48/13, **recognized for the first time** that having a clean, healthy, and sustainable environment is a human right. "Bold action is now required to ensure this resolution...will protect people and nature," (UN High Commissioner for Human Rights)



Plastics pollution threatens human rights²

THE RIGHT TO A HEALTHY ENVIRONMENT

since plastics pollution
contaminates all
elements of the natural
environment.

THE RIGHT TO THE ENJOYMENT OF THE HIGHEST ATTAINABLE STANDARD OF PHYSICAL AND MENTAL HEALTH

since plastics and their
additives have the potential
to harm human health all
along their life cycle, and that
eco-anxiety has increased
alongside the rapidly growing
scale and impacts of global
plastics pollution.



Scientists' Coalition

for an
Effective
Plastics
Treaty

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Effective
Plastics
Treaty

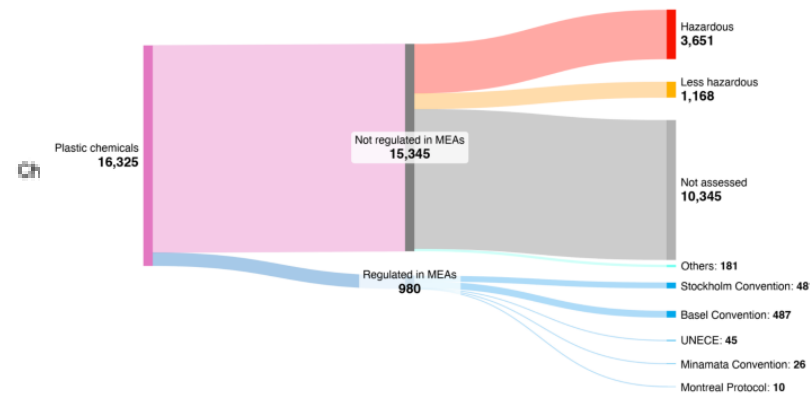


Supporting UN member states with solutions-based robust science for a just and effective global plastics treaty since INC-1.

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Problem: Unregulated plastic chemicals and products of concern

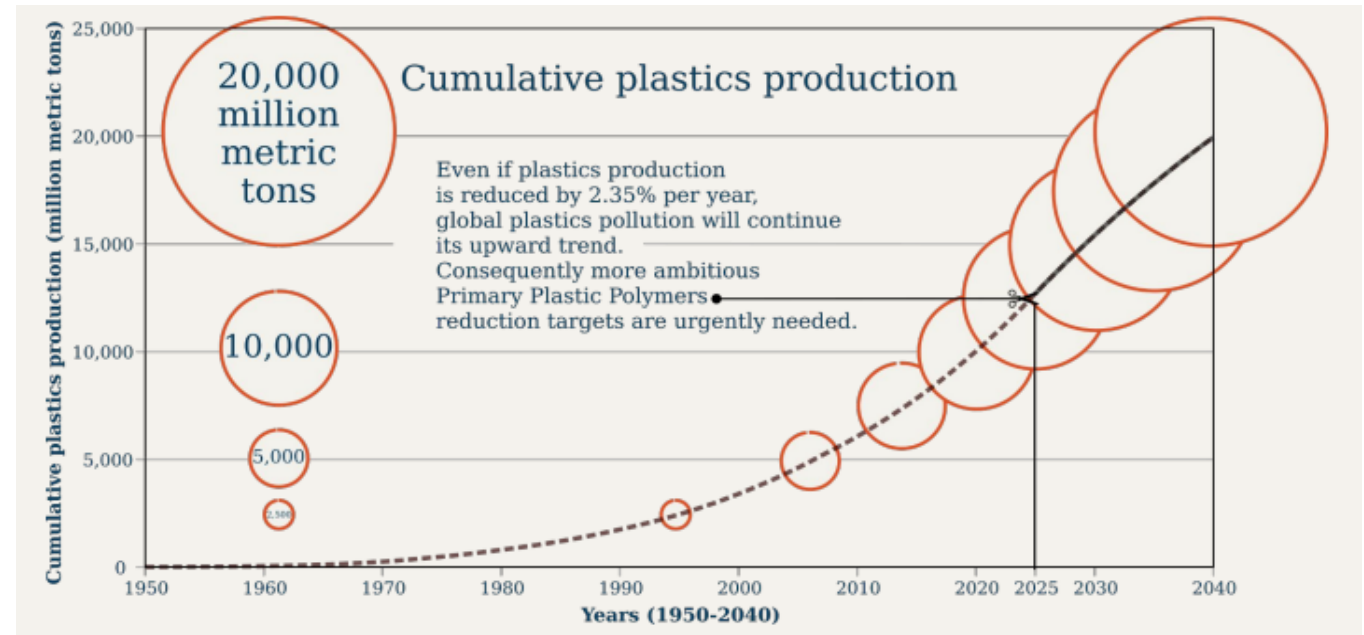


There are 16,000 total chemicals estimated to be used in plastics. To assess them efficiently, they must be evaluated using hazard assessment and chemical grouping. This includes biodegradable and bio-based plastics.

Solution: Simplify & phase out hazardous and unsustainable plastic chemicals & products; & establish globally harmonised hazard-based safety, sustainability, essential use, and transparency criteria.

Problem: Recycling and other waste management efforts cannot offset escalating global plastics production

Globally, only 9% of all plastic waste has ever been recycled.



Solution: Ambitious plastic production reduction targets

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Problem: Current solutions seldom address the whole plastics lifecycle and planetary boundaries



Solution: Address climate, biodiversity pollution & human rights violations across the full plastics lifecycle.

A safe(r) circular economy for plastics in the Pacific Region

Plastics pollution, including marine litter, is a global social, economic, and environmental emergency requiring urgent attention. Plastics are produced from fossil fuels, and once released into the environment, they never disappear. Instead, they degrade into physical and chemical forms, leading to the contamination of all biophysical systems. If we carry on business-as-usual this will culminate to 1.1 billion tonnes having entered the world's oceans by 2030.¹

¹ Borrelle, S.B. et al., (2020). Science 369, (6510), 1515-1518.

Small Island Developing States, which include Pacific Island nations, have strong cultural, economic, and social ties to their ocean. While traditionally self-sufficient, the current economy has made Pacific communities import dependent. They are threatened by the transboundary movement of plastics (trade, tourism, the fishing industry, and marine litter that flows in on ocean currents), and by climate change exacerbated by the full life cycle impacts of plastics.

Pacific nations are currently ill-equipped to manage the costly and harmful impacts of the externally generated problem of plastic pollution. Fortunately, robust policy and best practice solutions exist to prevent negative impacts on future generations.

Recommendations:

Develop a plastic pollution policy framework that supports a safe(r) circular economy for plastics in the Pacific region. A safer circular economy for plastics will help protect Pacific Islands peoples and their marine and terrestrial environments from the chemical and physical harms of plastics, including marine litter. It will protect communities from the harmful impacts on livelihoods, food security and culture. It will also support state obligations to adopt and implement legal and institutional frameworks that protect the right to a healthy environment for current and future generations.



The plastic pollution crisis can only ever be addressed if countries collectively commit to dramatically reducing the global supply of hazardous and unsustainable plastic chemicals, polymers, and products.

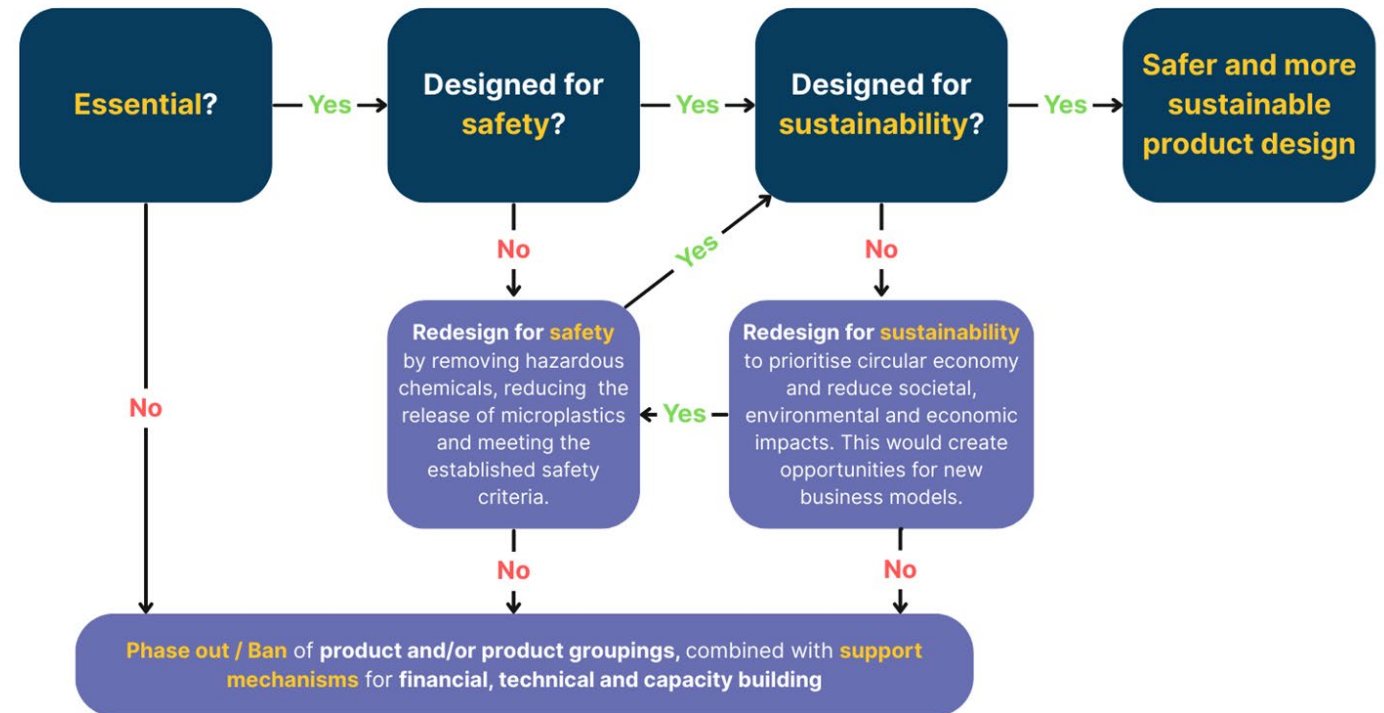
Essential Use Concept

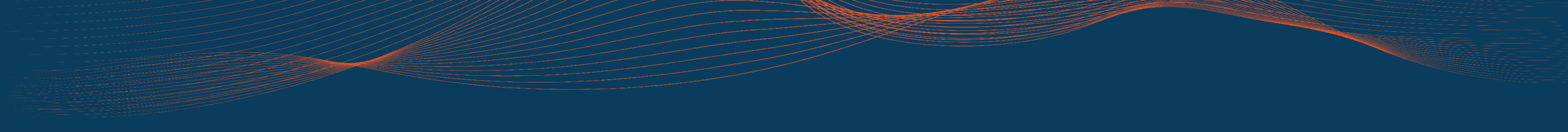
To phase out “*the most harmful [plastics]*” unless their use is “*necessary for health, safety or is critical for the functioning of society*” and “*if there are no alternatives that are acceptable from the perspective of human health and the environment*”

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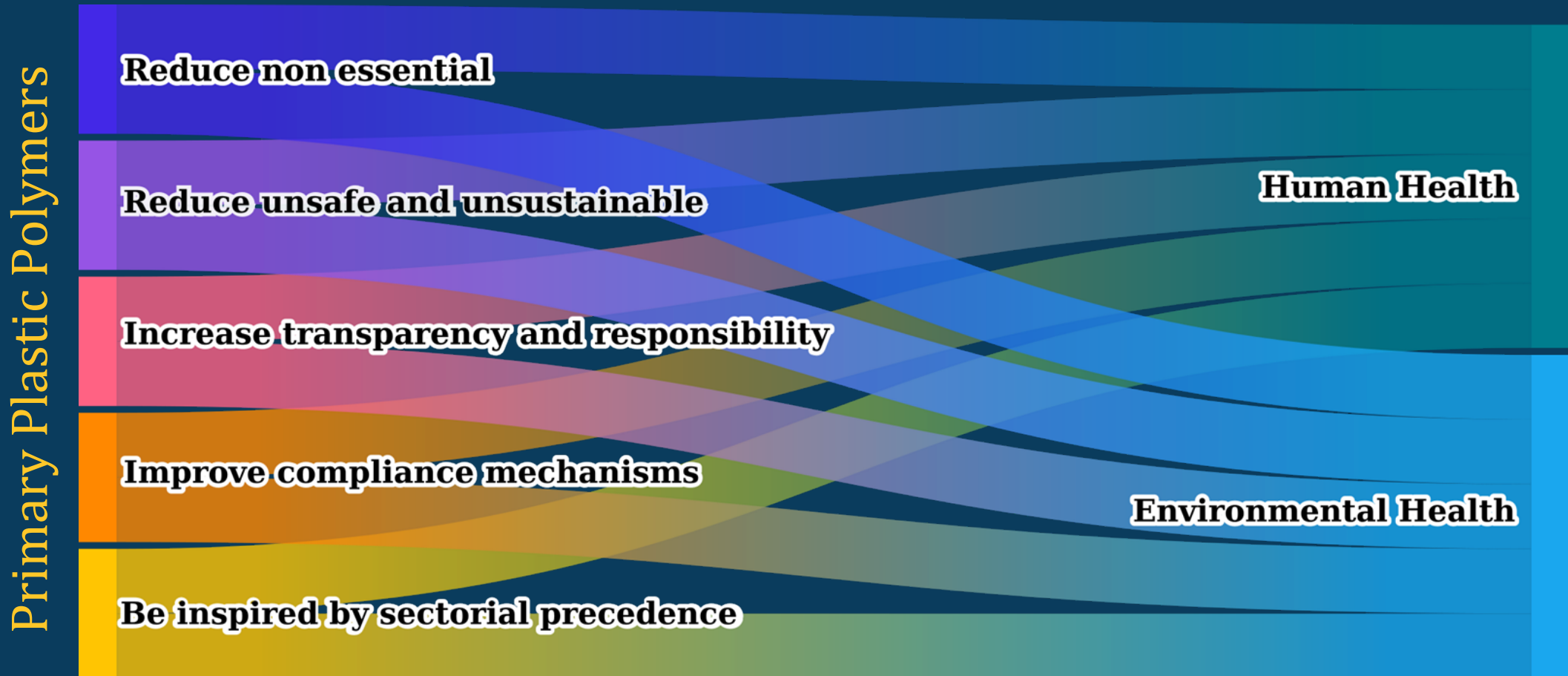
Is the product...





A hazard-based approach is vital, because the alternative, a risk-based approach, incorrectly assumes it is possible to derive safe levels of hazardous chemicals throughout the full life cycle of plastics.

The Scientists' Coalition position - The path forward



The future of humanity depends on ambitious legally binding global and national plastics production reduction targets.



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scientists.coalition@ikhapp.org

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