

The Limits to Growth: Sustainability and the Circular Economy

Lecture 2: Challenges I: Natural Resources and Environmental Pollution

Prof. Dr. Benjamin Leiding
M.Sc. Anant Sujatanagarjuna
M.Sc. Nelly Nicaise Nyeck Mbialeu

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SUSTAINABILITY

Introduction

Sustainability

„Development that meets the needs of the present without compromising the ability of future generations to meet their own needs.“

Introduction

Sustainability - Origins

*„Wie eine sothane [solche] Conservation und Anbau des Holzes anzustellen / daß es eine continuirliche beständige und **nachhaltende** Nutzung gebe / weiln es eine unentbehrlieche Sache ist / ohne welche das Land in seinem Esse nicht bleiben mag“ - Hans Carl von Carlowitz (1713)*

Introduction

Sustainability - Origins

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→ “continuously enduring and sustainable use”

Introduction

Sustainability - Origins

„Sowing and planting of trees had to be regarded as a national duty of every landowner, in order to stop the destructive over-exploitation of natural resources“ - John Evelyn (1662)

Introduction

Sustainability - Origins

- Carl von Carlowitz and *Sustainability*
 - Coined the term at a time when Europe was in need of vast quantities of wood (mining, ore-smelting, ship building, etc.)
→ Fear of timber scarcity
- Growing population → Fear of food-shortage if food production cannot keep up with reproduction
 - World population in 1700 → ca. 0.6 billion people
 - World population in 1800 → ca. 1.0 billion people
- Industrial revolution (ca. 1760 – 1840) fostered environmental degradation → society chose prosperity rather than sustainability

Biocapacity

Definition

Is „the locally available carrying capacity of the ecosystem for generating resources and absorbing wastes“

Ecological Footprint

Definition

„The ecological footprint for a particular population is defined as the total area of productive land and water ecosystems required to produce sufficient resources and assimilate wastes“

- 1.) W.E. Rees (1992) – Ecological footprint and appropriated carrying capacity: what urban economics leaves out. Environmental Urbanization.
- 2.) W.E. Rees, M. Wackernagel (1994) – Ecological footprints and appropriated carrying capacity: measuring the natural capital requirements of the human economy.
- 3.) D. Yue, J. Guo, C. Hui (2013) – Scale dependency of biocapacity and the fallacy of unsustainable development - <https://doi.org/10.1016/j.jenvman.2013.04.022>

Sustainability Implications

Sustainability →

Sustainability Implications

Sustainability → Consume less

A LACK OF RESOURCES

We only have one planet

Resources



*"I am afraid of losing my child
to a resource war because of a
climate collapse"*

→ *"Our parents will die of old
age, our children will die of
climate change"*

We only have one Planet

Resource Wars

“Resource wars are violent conflicts that are largely driven by competition for control over vital or valuable natural materials, such as oil, water, land, timber, animals (or animal products), gold, silver, gems, and other key minerals.”

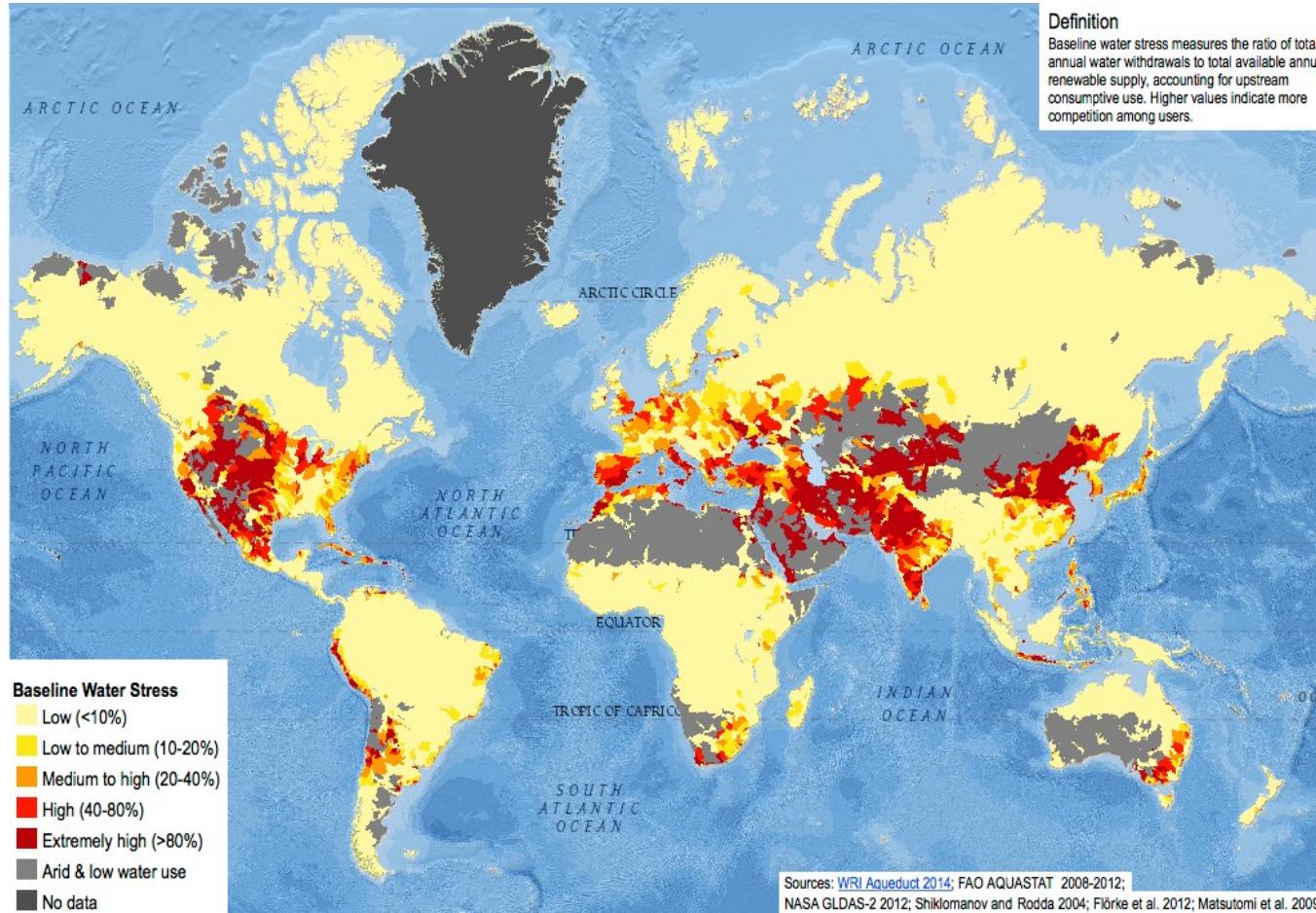
We only have one Planet

Resource Wars – Oil, etc.



We only have one Planet

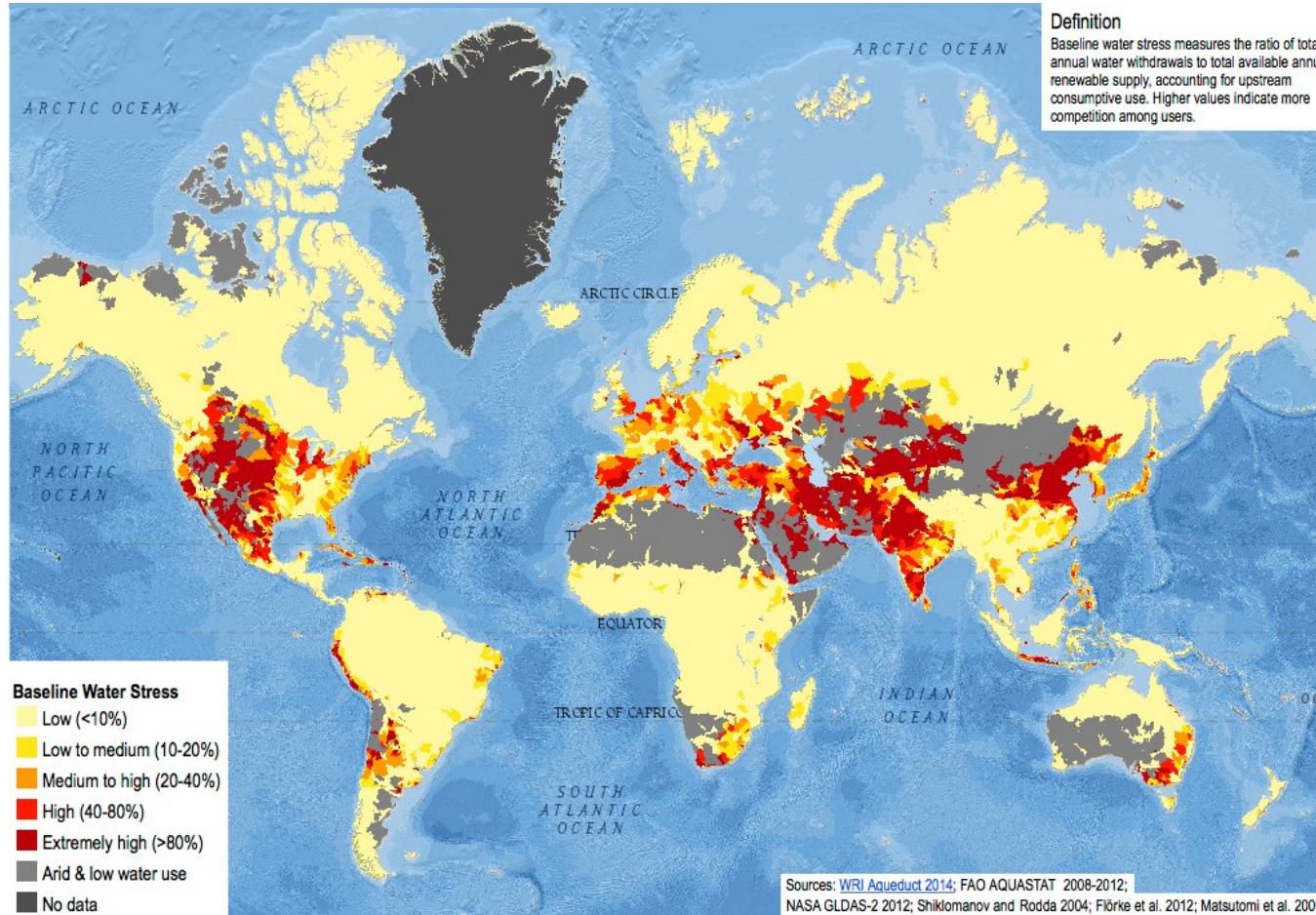
Resource Wars – Water



1. Sampa – https://commons.wikimedia.org/wiki/File:Baseline_water_stress.jpg – CC BY-SA 4.0.
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We only have one Planet

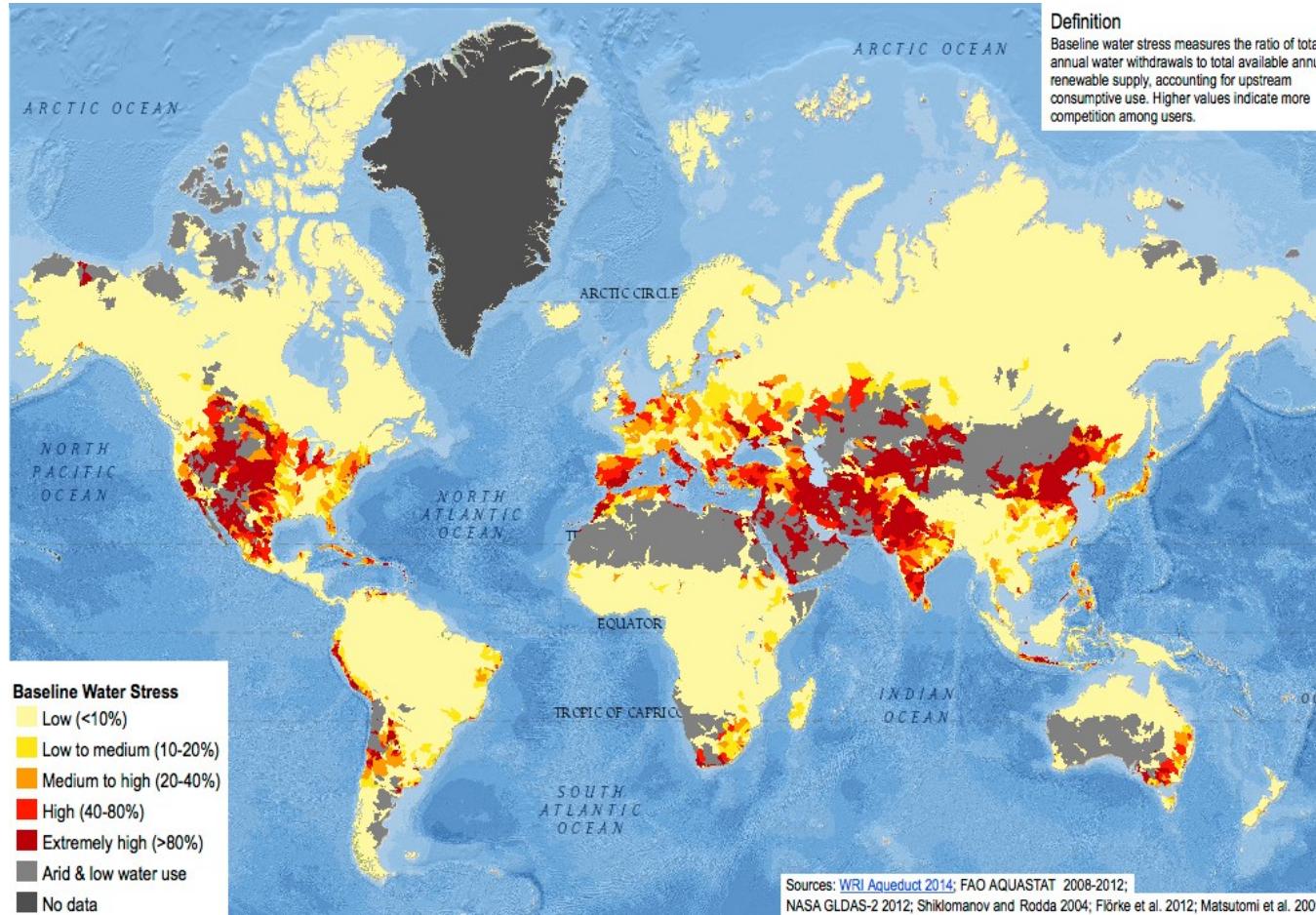
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We only have one Planet

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ENVIRONMENTAL POLLUTION

Environmental Pollution

Definition

„Pollution, also called **environmental pollution**, the addition of any substance (solid, liquid, or gas) or any form of energy (such as heat, sound, or radioactivity) to the environment at a rate faster than it can be dispersed, diluted, decomposed, recycled, or stored in some harmless form.

The major kinds of pollution, usually classified by environment, are air pollution, water pollution, and land pollution.”

Environmental Pollution

Waste



1. "Landfill at Upernivik" by ulalume - <https://www.flickr.com/photos/96649248@N00/43867280734> - CC BY-NC-ND 2.0.

2. Christian Hüpfer - <https://flic.kr/p/aKXw2F> - CC BY-SA 2.0.

Environmental Pollution

Fossil Fuels

- 3 of the 10 dirtiest European coal plants are located in Poland
- In which country/countries are the other 7 dirtiest coal plants located?
 - 7 of the 10 dirtiest European coal plants are located in **GERMANY**



1. <https://ember-climate.org/insights/research/top-10-emitters-in-the-eu-ets-2021/>

2. John Englart - <https://www.flickr.com/photos/takver/11308053925/> - CC BY-SA 2.0.

3. John Englart - <https://www.flickr.com/photos/takver/51658831095/> - CC BY-SA 2.0.

Environmental Pollution

Horrible Waste Management - Example 1



Environmental Pollution

Horrible Waste Management - Example 1



Environmental Pollution

Horrible Waste Management - Example 1

→ 2 generations profited from cheap nuclear energy

Environmental Pollution

Horrible Waste Management - Example 1

- 2 generations profited from cheap nuclear energy
- 40,000 generation will have to live with the waste

Environmental Pollution

Horrible Waste Management - Example 2



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Environmental Pollution

Horrible Waste Management - Example 2

- We are consuming about 2000 tiny pieces of plastic every week.



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Wijnand de Wit and Nathan Bigaud for the WWF (2019) – No Plastic in Nature: Assessing Plastic Ingestion from Nature to People.

Environmental Pollution

Horrible Waste Management - Example 2

- We are consuming about 2000 tiny pieces of plastic every week.
- That is a credit card every week!
- That's approximately 21 grams a month, or just over 250 grams a year.



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Environmental Pollution

Global Flows of Plastic Packaging Materials in 2013

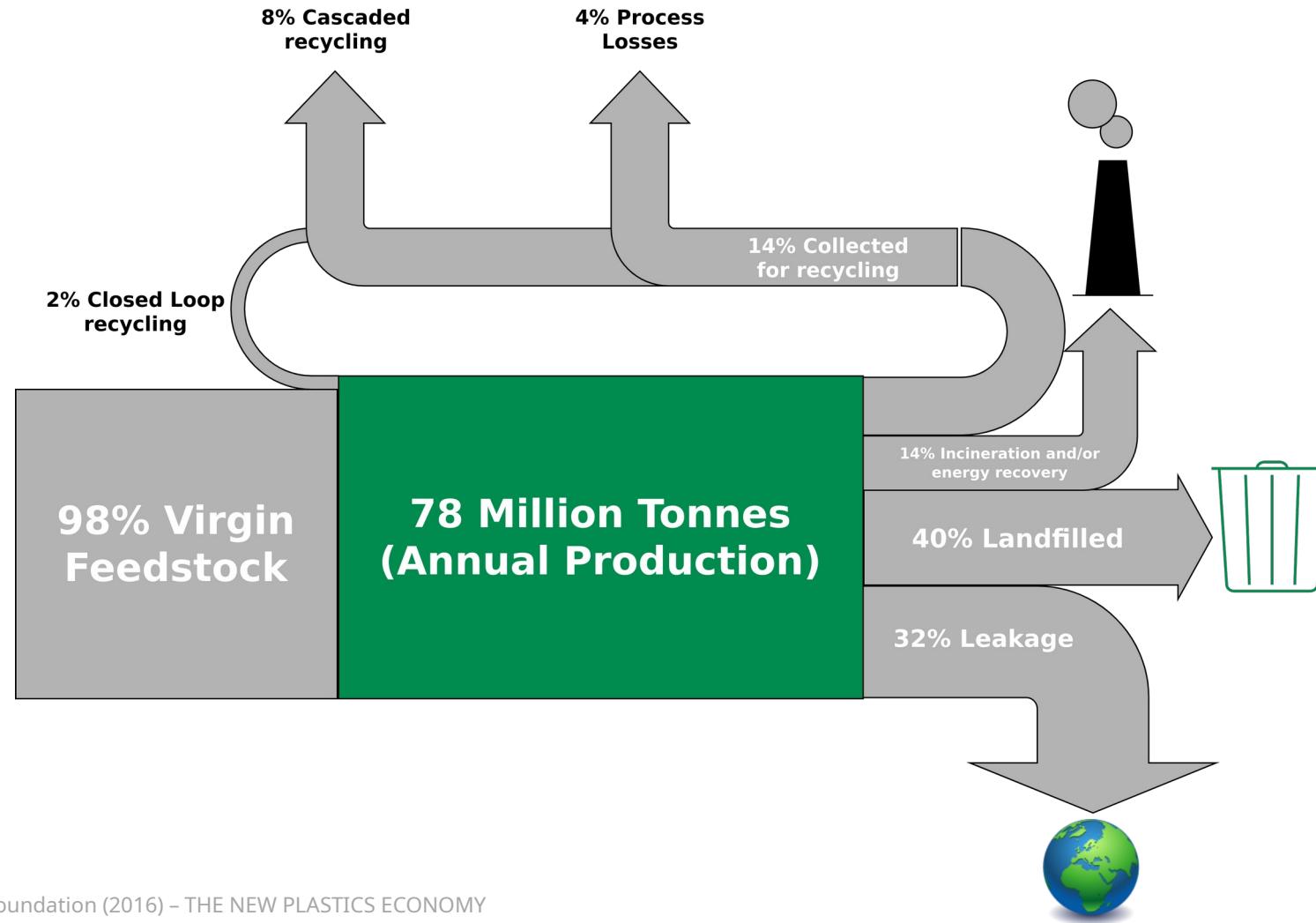


Figure adapted from: Ellen MacArthur Foundation (2016) – THE NEW PLASTICS ECONOMY

Environmental Pollution

Global Flows of Plastic Packaging Materials in 2013

- In 2050, there will be more plastic than fish in the ocean (by weight)

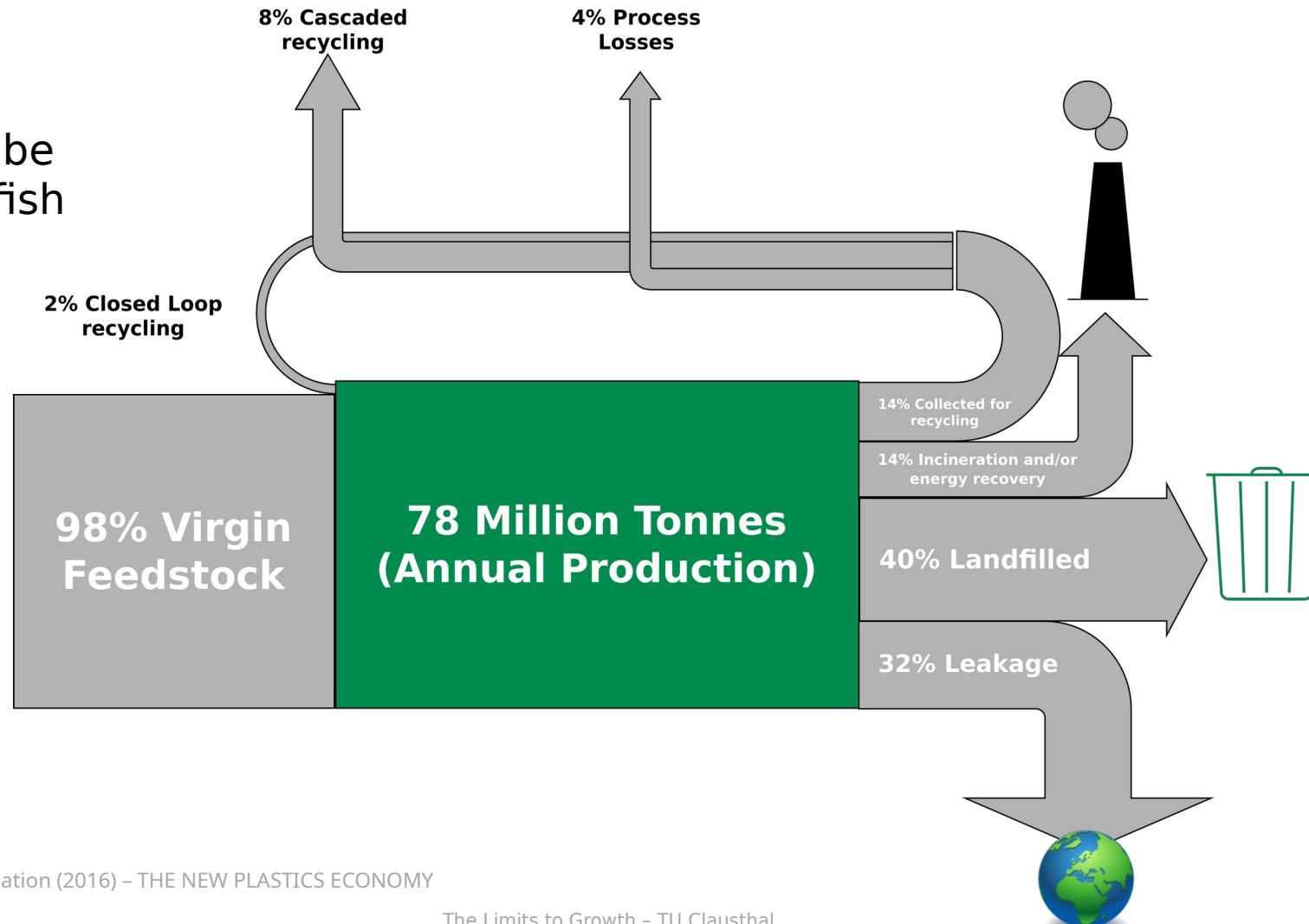


Figure adapted from: Ellen MacArthur Foundation (2016) – THE NEW PLASTICS ECONOMY

Environmental Pollution

The Limits to Recycling

- Recycling often requires a lot of energy
- Some materials cannot be recycled at all (yet)
- Impurities are challenging
- Often requires a lot of manual labor
- Recycled material often with lower quality than input material
- False sense of safety!

Environmental Pollution

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I am not saying you should stop recycling!

Environmental Pollution

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I am not saying you should stop recycling!

→ Recycling is great but it is better to make sure that we do not have to recycle anything.
→ Buying less (e.g., only the essentials) is way more effective.

*"We buy things we don't need, to impress people we don't like." -
Tyler Durden / Chuck Palahniuk*

CONCLUSION

Conclusion

- Basic concepts and definitions of sustainability and related to sustainability, resources, environmental pollution
- The limits to recycling

Additional Resources

- Baccini et al. (2012) – Metabolism of the Anthroposphere: Analysis, Evaluation, Design
- Podcast *How to Save a Planet* – “Sacrifice Zones: ProPublica Takes Us Inside America’s Toxic Hotspots (2022) – [Link](#)

Questions?