The Limits to Growth: Sustainability and the Circular Economy

Lecture 2: Challenges I: Natural Resources and Environmental Pollution

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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.”

Report of the World Commission on Environment and Development: Our Common Future (1987) – http://www.un-documents.net/our-common-future.pdf

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 unentbehrliche Sache ist / ohne welche das Land in seinem Esse nicht bleiben mag" – Hans Carl von Carlowitz (1713)*

Hans Carl von Carlowitz (1713) – Sylvicultura oeconomica

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 unentbehrliche Sache ist / ohne welche das Land in seinem Esse nicht bleiben mag" – Hans Carl von Carlowitz (1713)*

→ "continuously enduring and sustainable use"

Hans Carl von Carlowitz (1713) – Sylvicultura oeconomica

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)

John Evelyn (1662) – Essay: „Sylva“

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”

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

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”*

XR Strategiepapier 2022 – Pusteblumen und Hype. Bilder: Sebastian Höhn, Joe Pohl, Sandra Doneck, Alessandro Brönnimann

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.”

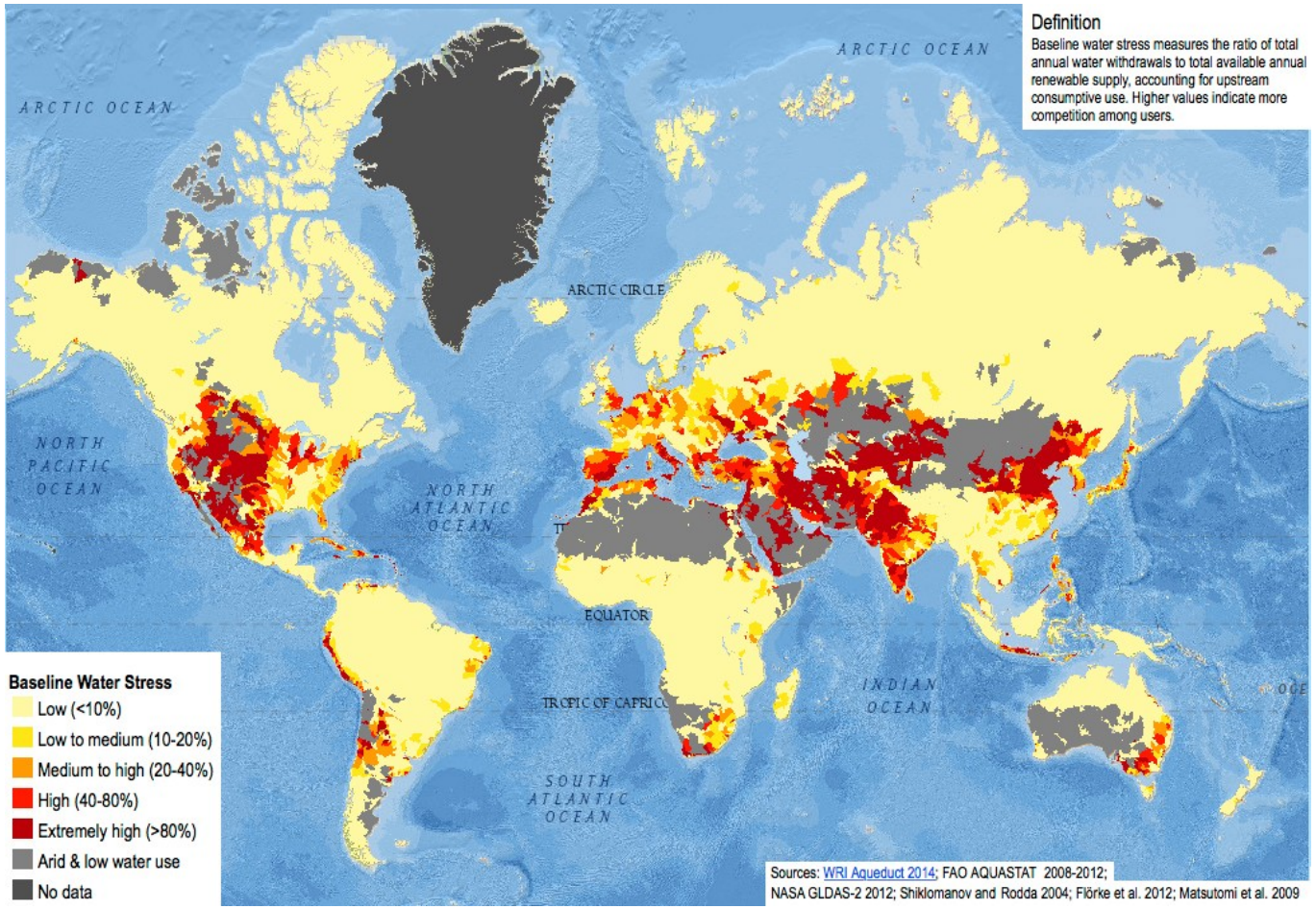
Michael T. Klare, Barry S. Levy, Victor W. Sidel (2011) – The Public Health Implications of Resource Wars – Link.

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.
2. Kgbo – https://commons.wikimedia.org/wiki/File:Closed_Wivenhoe_Dam_and_spillway,_August_2020.jpg – CC BY-SA 4.0.
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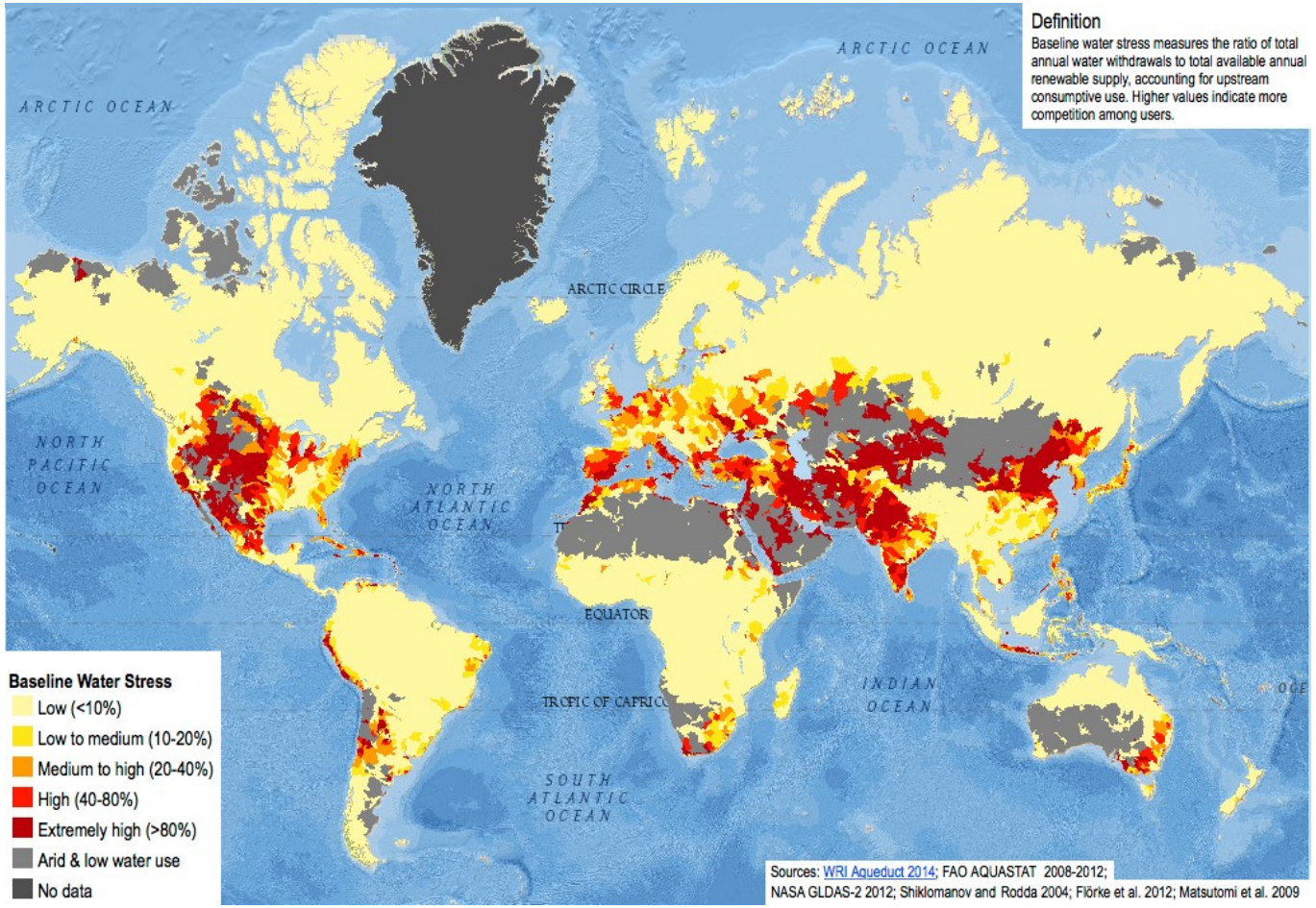
We only have one Planet

Resource Wars – Water



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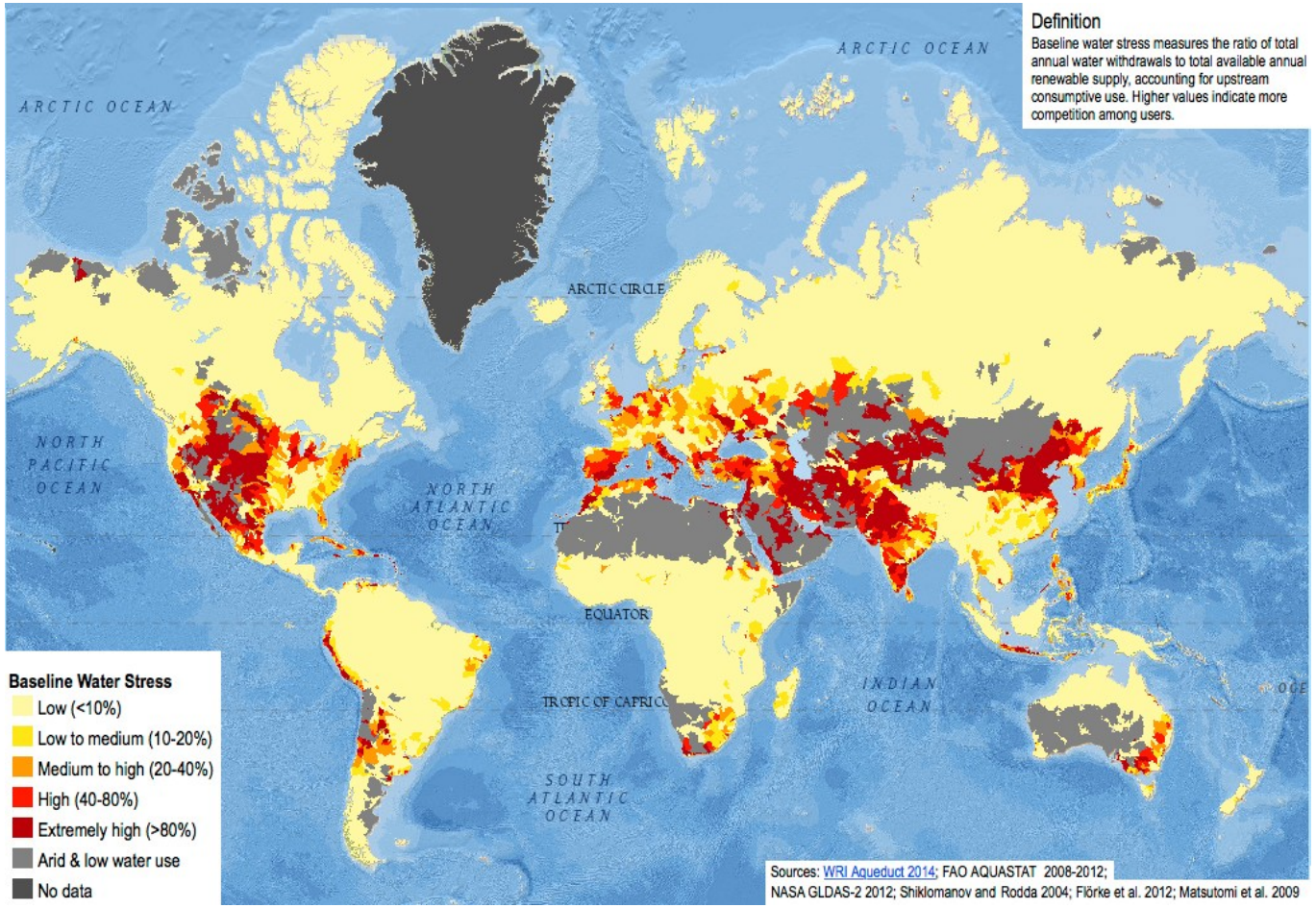
We only have one Planet

Resource Wars – Water



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3.Arian Zwegers – https://www.flickr.com/photos/azwegers/6226842732 – CC BY 2.0.

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.”

Nathanson, Jerry A.. "pollution". Encyclopedia Britannica, 22 Feb. 2022, https://www.britannica.com/science/pollution-environment. Accessed 11 April 2022.

Environmental Pollution

Waste

1. "Landfill at Upernavik" 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

https://www.spiegel.de/wissenschaft/technik/endlager-suche-was-wie-viel-und-wohin-damit-die-deutsche-atommuell-bilanz-a-7a153ba3-029a-4e55-adaf-3312b7427d9e

Environmental Pollution

Horrible Waste Management – Example 1

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

https://www.spiegel.de/wissenschaft/technik/endlager-suche-was-wie-viel-und-wohin-damit-die-deutsche-atommuell-bilanz-a-7a153ba3-029a-4e55-adaf-3312b7427d9e

Environmental Pollution

Horrible Waste Management – Example 2

Environmental Pollution

Horrible Waste Management – Example 2

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

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.

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

Environmental Pollution

Global Flows of Plastic Packaging Materials in 2013

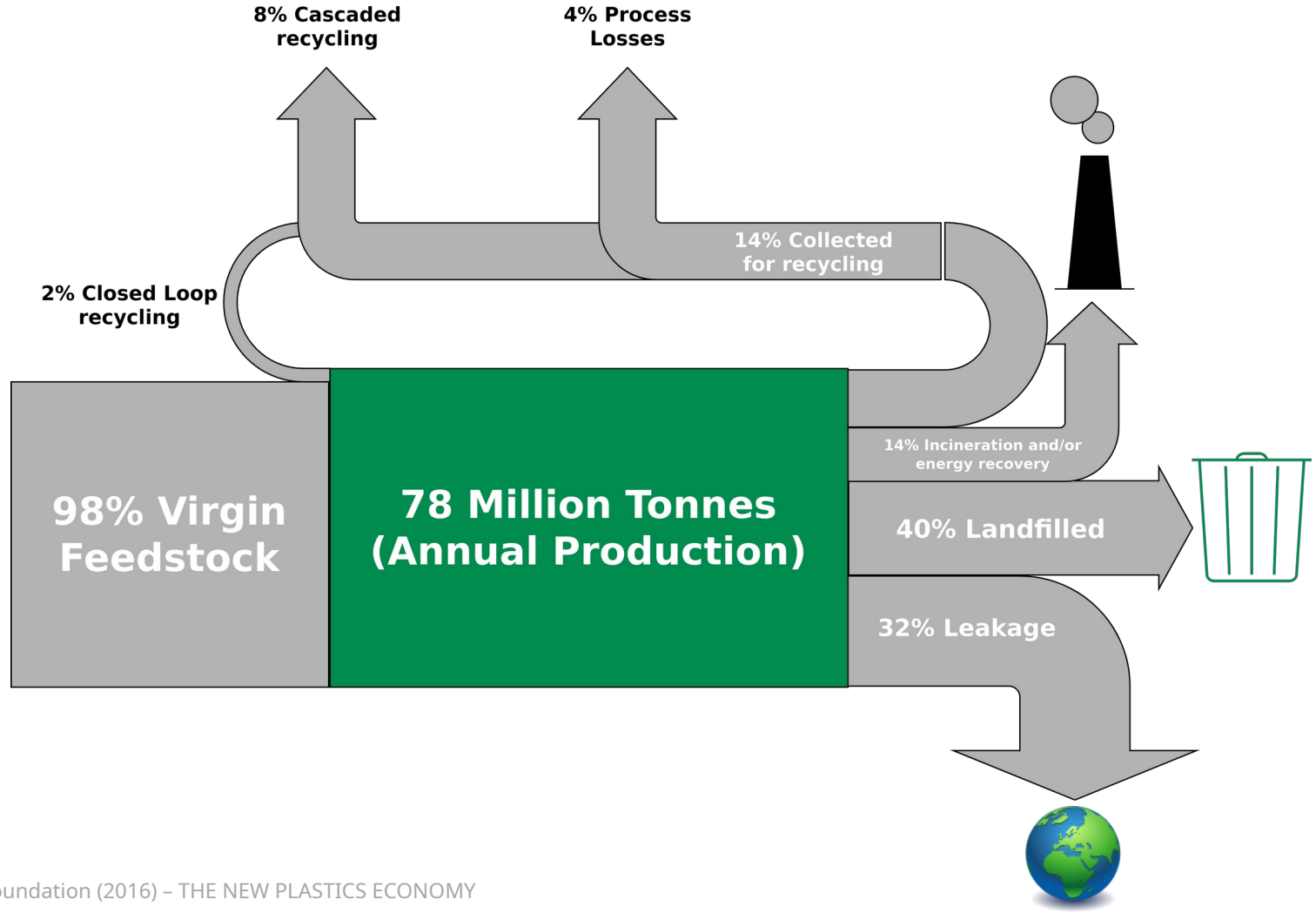

Figure adapted from: Ellen MacArthur Foundation (2016) – THE NEW PLASTICS ECONOMY

Environmental Pollution

Global Flows of Plastic Packaging Materials in 2013

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

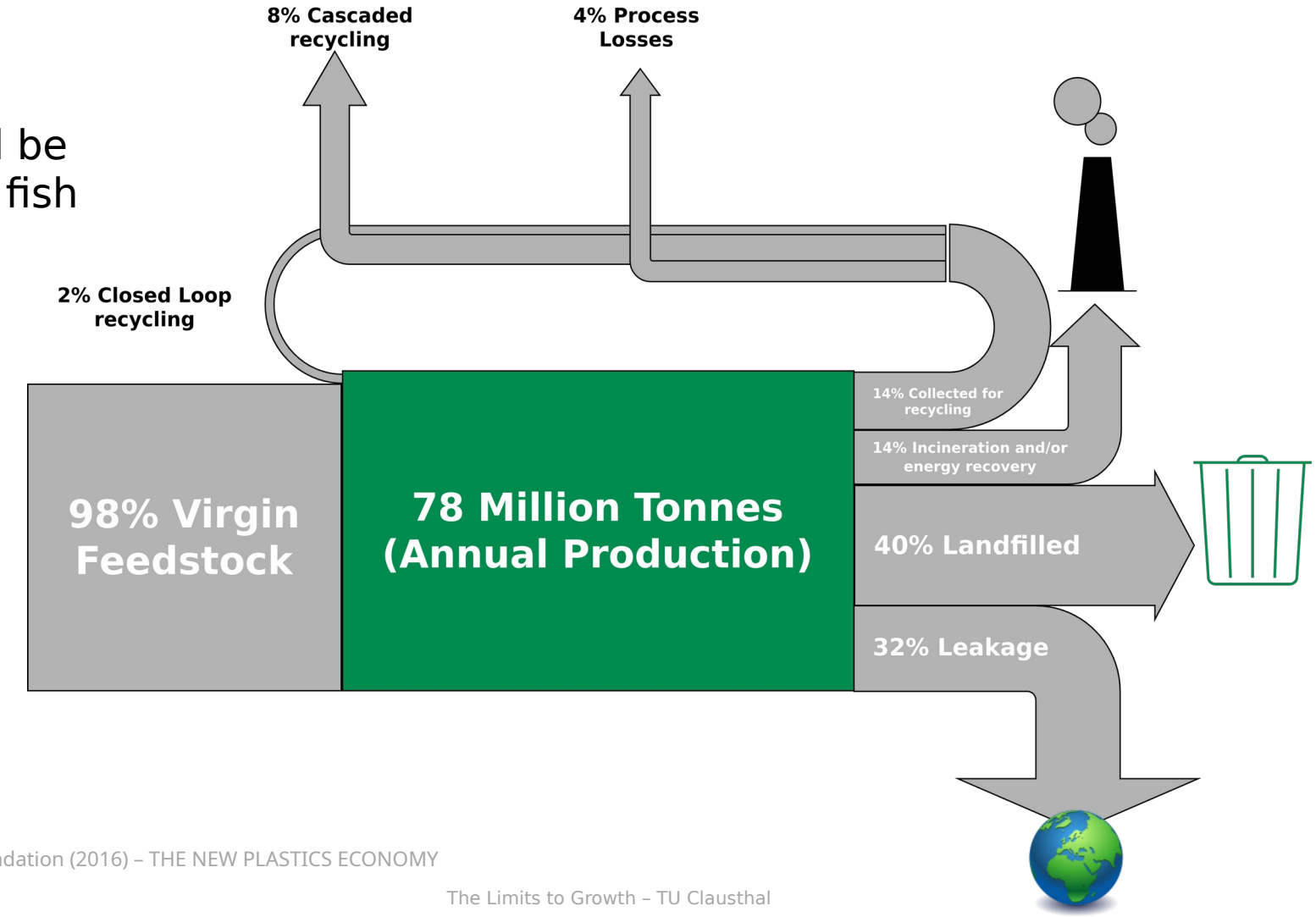

Figure adapted from: Ellen MacArthur Foundation (2016) – THE NEW PLASTICS ECONOMY

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 <u>not</u> saying you should stop recycling!

Environmental Pollution

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I am <u>not</u> 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?