
# Module 1

*Sustainability & Climate change: historical perspective and their relationship with Arts*

Short Learning Program of “Art & Design & sustainability with special focus on environment and climate change. Cooperation partnerships in higher education.



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EINA Centre Universitari de Disseny i Art de Barcelona Adscrit a la UAB
AbERTA
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# Lesson 3

## Topic 1

Sustainability Assessment and Ecological Footprint

## Essential Questions

What are the sustainability assessment tools and their importance?

What is the concept of Ecological Footprint?

How can you assess the Ecological Footprint of your activities/behaviors?

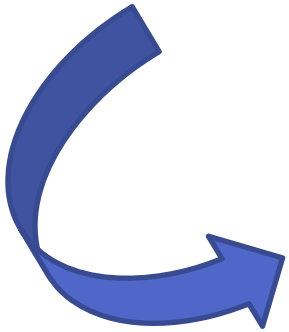
# *I. Sustainability Assessment Tools*

# *Definitions and Concepts*

# Sustainability assessment:

## concept and aim

**Despite the existence of several non-consensual definitions, interpretations, and methods, the term 'sustainability assessment' (SA) is often used to refer to a systematic and comprehensive approach:**



**to characterize the sustainability "state"**
**covering the environmental, social, economic, and institutional/governance dimensions**

# Sustainability assessment: Approaches

**(i) ex ante (before the event) – forward-looking**

**predict the potential effects of an activity prior to its implementation**

**and**

**(ii) ex post (after the event)**

**current implemented situation**

(Pope et al., 2004; 2017)

# Sustainability assessment:

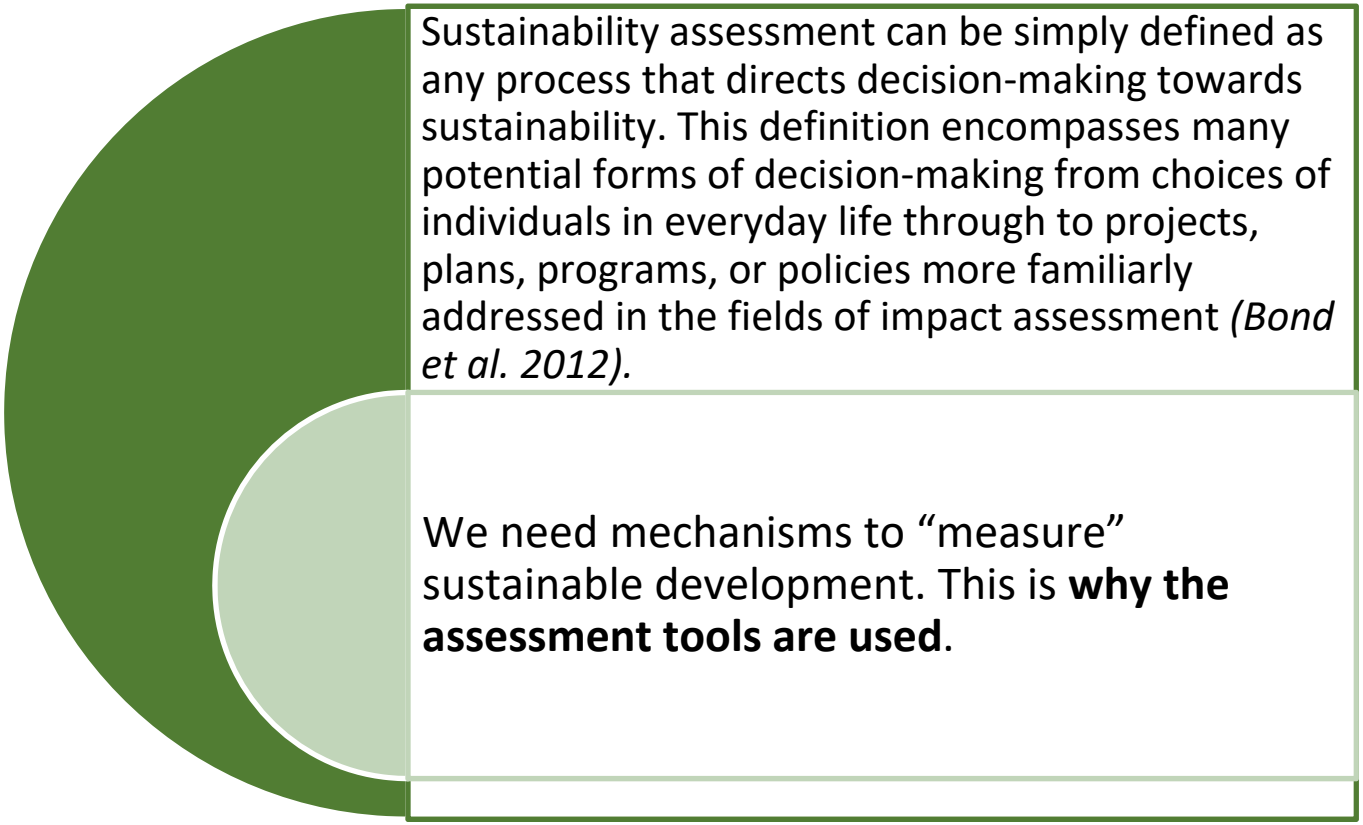
## scope

Can support different levels of decision-making and policy processes, playing a role in the strategic and operational levels of planning and project processes, including:

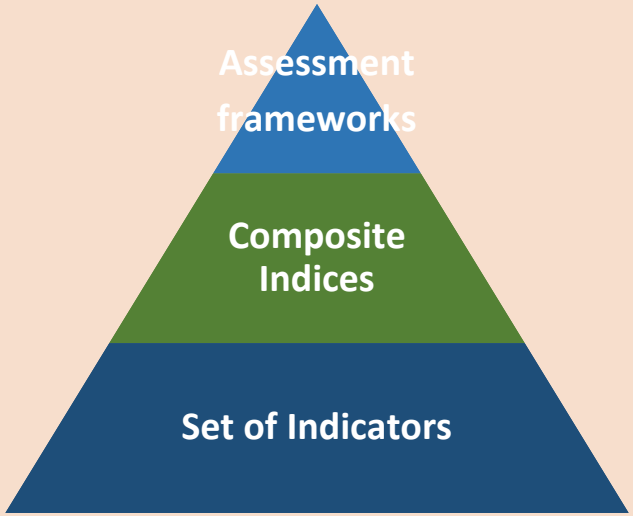
- Policies, Plans, Programs (PPPs) – e.g. Strategic Environmental Assessment (SEA), Sustainability Appraisal
- Projects – e.g. Environmental Impact Assessment (EIA)
- Organizations, services, products, activities/operations… – e.g. EMS,…

# Sustainability Assessment tools:

## Definition and concept



# Diversity of sustainability assessment tools

| Sustainability Assessment Tools | Concept |
|---|---|
|  | How to monitor indicators to assess sustainable development in a relevant and useful manner (Krajnc & Glavic 2005) |
| | Indicators can be aggregated to an index to facilitates the understanding and interpretation of indicators of a given phenomenon (Tanguay et al. 2010) |
| | Qualitative or quantitative bits of information that assess organizational performance and bring together multiple areas of sustainability that are generally comparable (GRI & ISO 2014; GRI 2011) |

**Indicators are one of the approaches most used, playing a central role in the sustainability assessment** *(Ramos 2019).*

# Indicators vs Indices

**Indicators** **are one of the tools most used, playing a central role in the SA of decision-making processes, in particular to communicate sustainability performance to stakeholders.**

UN (1996), Meadows (1998), Sala (2015) and Pope et al. (2017)

***A special sign** that conveys "**value added messages**", potentially resulting from numerous factors, in a simplified and useful manner*

***An indicator can be derived from a single variable to reflect some environmental, social-cultural, economic, institutional attribute or from an aggregation of several variables, to reflect composite results – indices***

# *II. Ecological Overshoot*

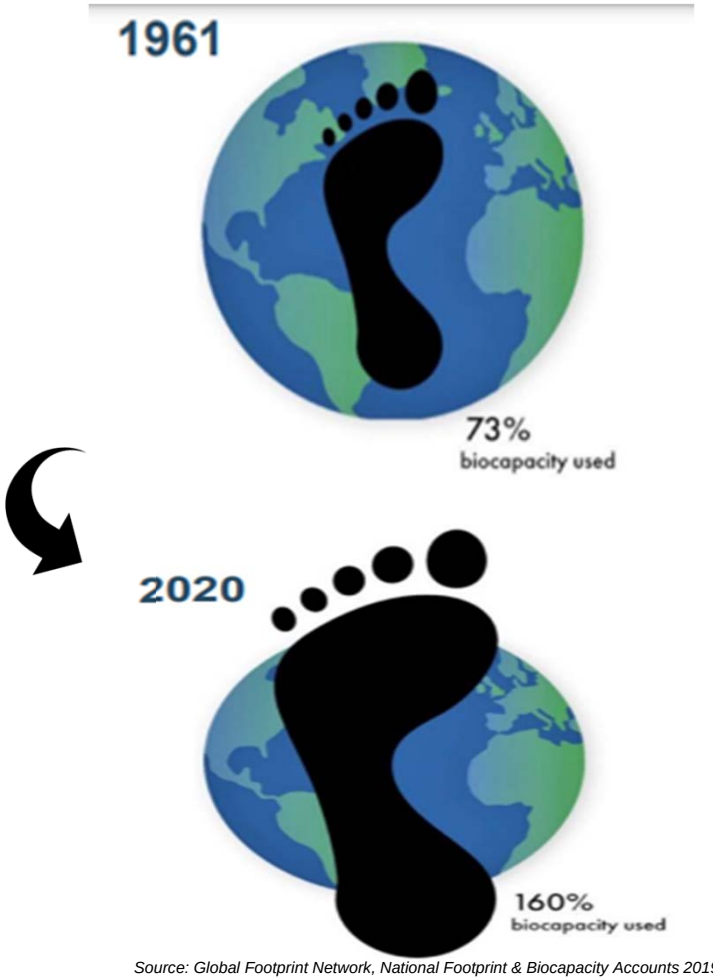
# *Definitions and Concepts*

# Ecological Overshoot: Concept

**Ecological overshoot occurs when human demand exceeds the regenerative capacity of a natural ecosystem. In other words, when humanity's Ecological Footprint exceeds what the planet can regenerate.**

*Source: https://www.footprintnetwork.org/2015/04/21/earth-day-2015-tipping-point/*

**In 1961, humanity used only 73% of the biological resources that Earth could renew that year. In 2020, humanity used 160% of what Earth's biocapacity could renew that year. That's as much as if we lived on 1.6 planets, but we only have 1 planet.**




*Source: Global Footprint Network, National Footprint & Biocapacity Accounts 2019 Edition*
*data.footprintnetwork.org*

# What is the Earth Overshoot Day?

**Earth Overshoot Day marks the date when humanity's demand for ecological resources and services in a given year exceeds what Earth can regenerate in that year.**

*Source: https://www.footprintnetwork.org/2013/08/24/earth-overshoot-day-2013-around-world/*

?

## What happens after Earth Overshoot Day?

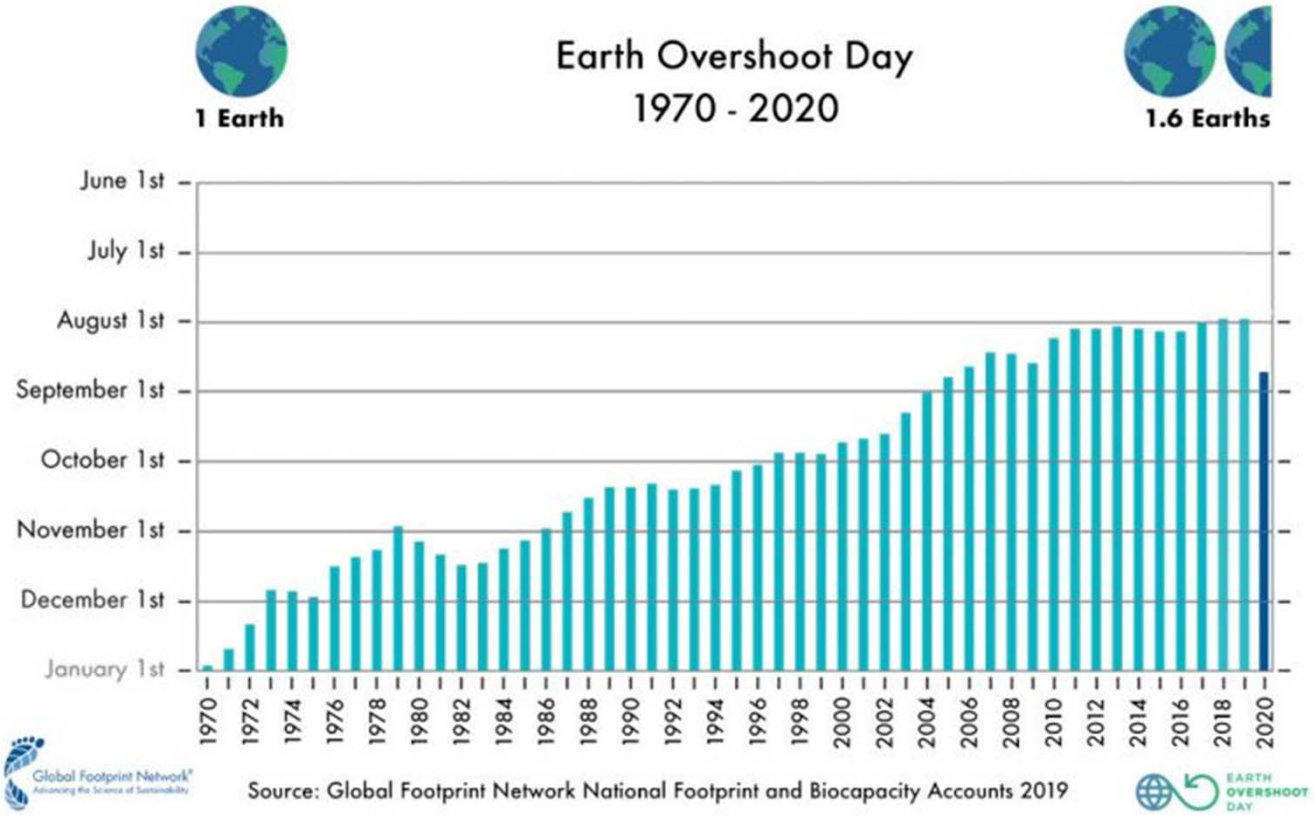
**For the rest of the year, the earth will be "overdrawn", meaning we will be depleting the oceans and land and building up waste such as carbon dioxide.**

# Earth Overshoot Day 2020

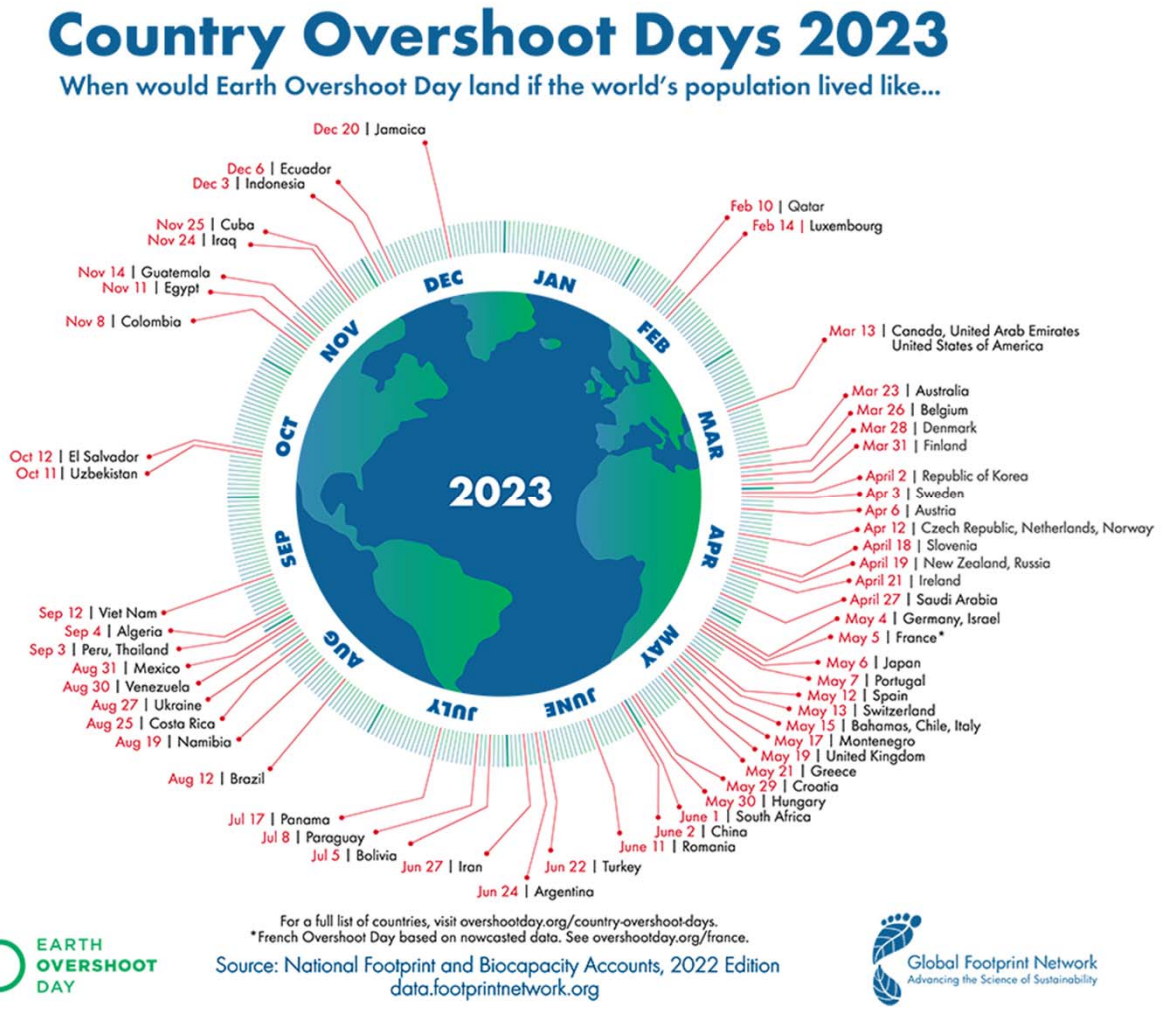
**Humanity is using 1.6 Earths.**

Therefore in 2020,
Earth Overshoot Day
fall on
**August 22nd,**

more than 3 weeks
later than in 2019

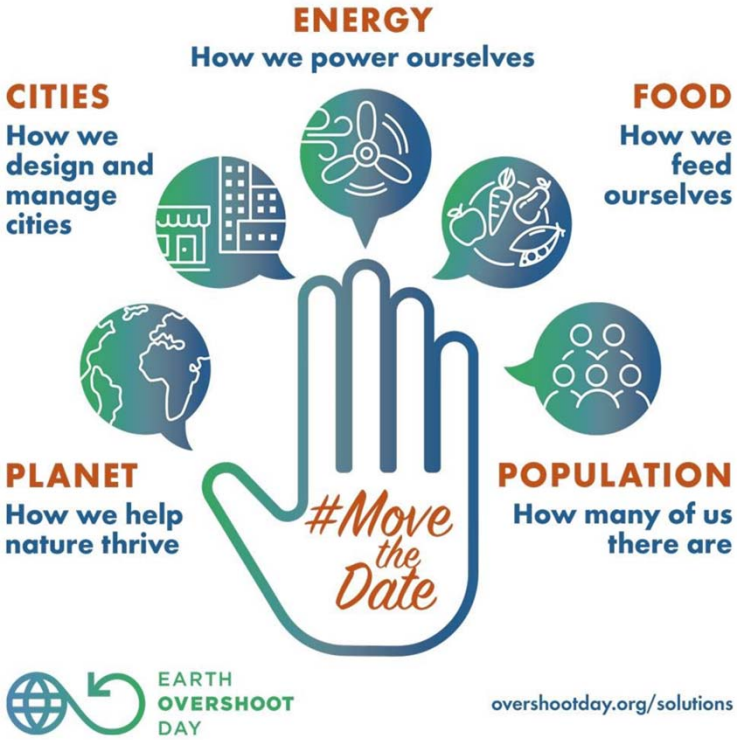




**COVID-19 caused humanity's Ecological Footprint to contract, demonstrating that shifting resource consumption patterns in a short timeframe is possible. However, true sustainability that allows all to thrive on Earth can only be achieved by design, not by disaster like the pandemic.**


Country Overshoot Days 2023
When would Earth Overshoot Day land if the world's population lived like...
Dec 20 | Jamaica
Dec 6 | Ecuador
Dec 3 | Indonesia
Nov 25 | Cuba
Nov 24 | Iraq
Nov 14 | Guatemala
Nov 11 | Egypt
Nov 8 | Colombia
Oct 12 | El Salvador
Oct 11 | Uzbekistan
Sep 12 | Viet Nam
Sep 4 | Algeria
Sep 3 | Peru, Thailand
Aug 31 | Mexico
Aug 30 | Venezuela
Aug 27 | Ukraine
Aug 25 | Costa Rica
Aug 19 | Namibia
Aug 12 | Brazil
Jul 17 | Panama
Jul 8 | Paraguay
Jul 5 | Bolivia
Jun 27 | Iran
Jun 24 | Argentina
Jun 22 | Turkey
June 11 | Romania
June 2 | China
June 1 | South Africa
May 30 | Hungary
May 29 | Croatia
May 21 | Greece
May 19 | United Kingdom
May 17 | Montenegro
May 15 | Bahamas, Chile, Italy
May 13 | Switzerland
May 12 | Spain
May 7 | Portugal
May 6 | Japan
May 5 | France*
May 4 | Germany, Israel
April 27 | Saudi Arabia
April 21 | Ireland
April 19 | New Zealand, Russia
April 18 | Slovenia
Apr 12 | Czech Republic, Netherlands, Norway
Apr 6 | Austria
Apr 3 | Sweden
April 2 | Republic of Korea
Mar 31 | Finland
Mar 28 | Denmark
Mar 26 | Belgium
Mar 23 | Australia
Mar 13 | Canada, United Arab Emirates
United States of America
Feb 14 | Luxembourg
Feb 10 | Qatar
DEC
JAN
FEB
MAR
APR
MAY
JUNE
JULY
AUG
SEP
OCT
NOV
2023
EARTH
OVERSHOOT
DAY
For a full list of countries, visit overshootday.org/country-overshoot-days.
*French Overshoot Day based on nowcasted data. See overshootday.org/france.
Source: National Footprint and Biocapacity Accounts, 2022 Edition
data.footprintnetwork.org
Global Footprint Network
Advancing the Science of Sustainability

# How to move Earth Overshoot Day?

**Through wise, forward-looking decisions, we can turn around natural resource consumption trends while improving the quality of life for all people.**




**While our planet is finite, human possibilities are not.**

# Accelerate Solutions: Examples of Transportation

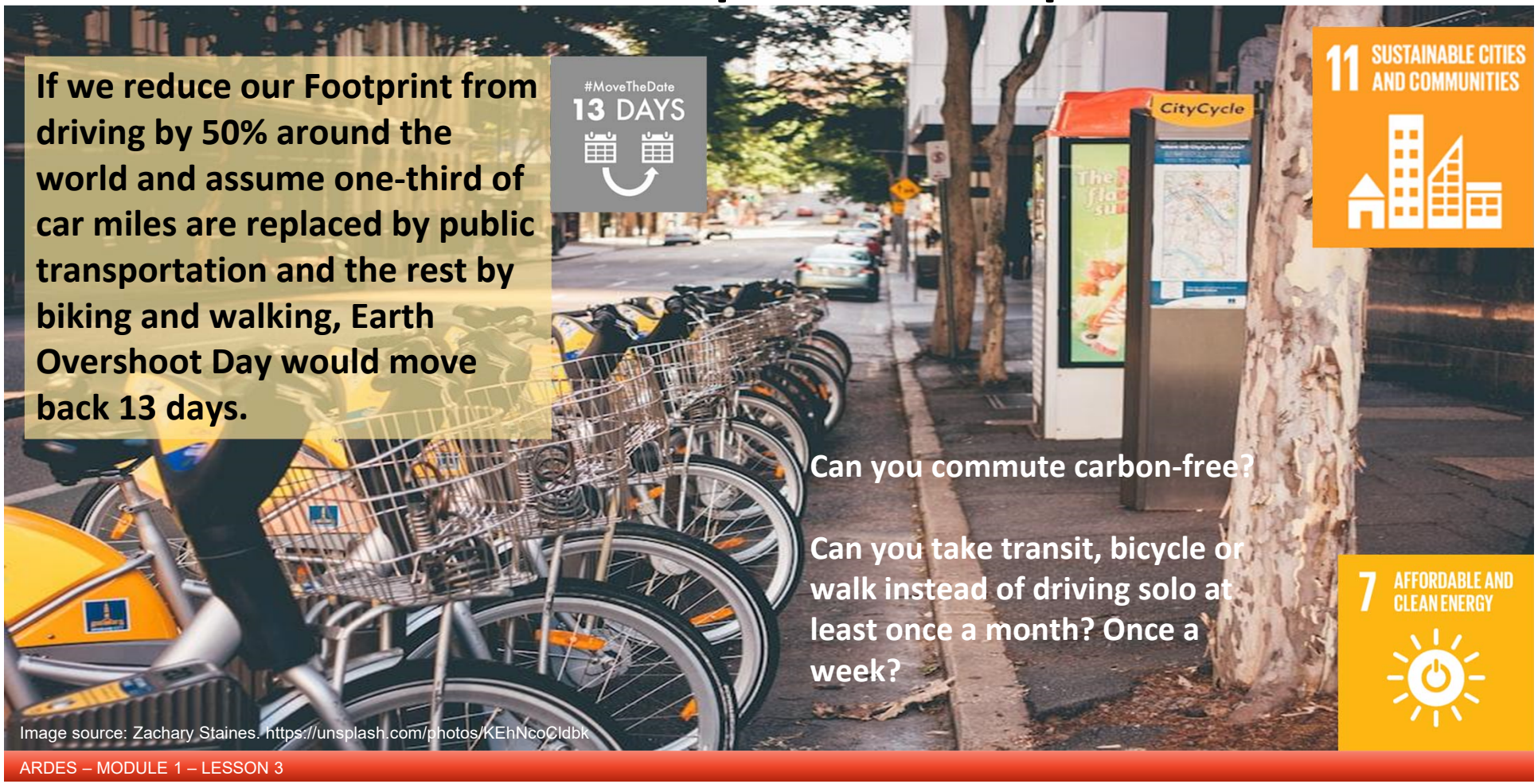
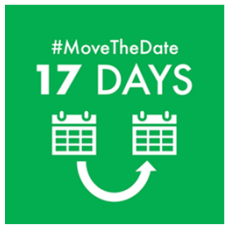



Image source: Zachary Staines. https://unsplash.com/photos/KEhNcoCldbk

# Accelerate Solutions: Examples of Food

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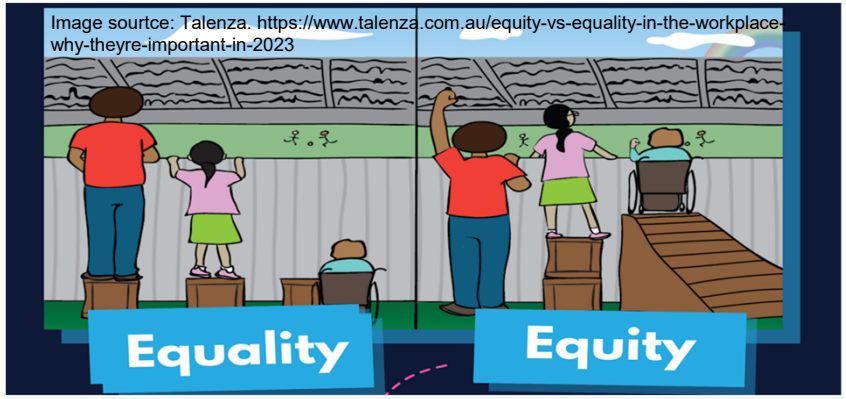
**Can you try a new vegetarian recipe once a month? Once a week?**

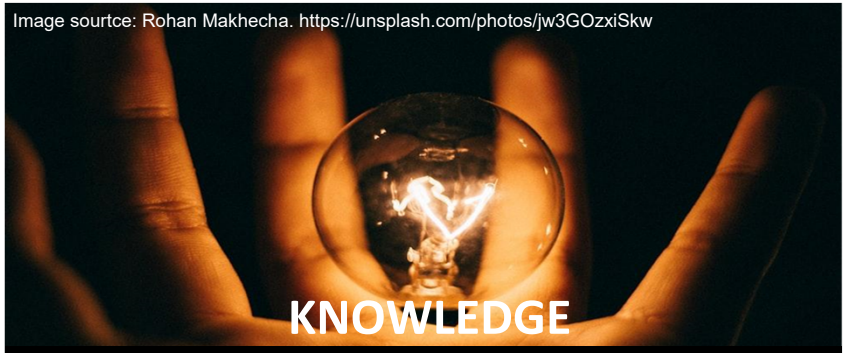
**Can you be a smarter shopper and reduce food waste?**


Image source: @gettyimages. https://unsplash.com/photos/_1y82ZS1t08




We need to ensure intra and inter generational equity


We need to cooperate to find the best solution




We need to know how to manage what we have


We need to ensure development rather than growth

# *III. Ecological Footprint*

# *Definitions and Concepts*

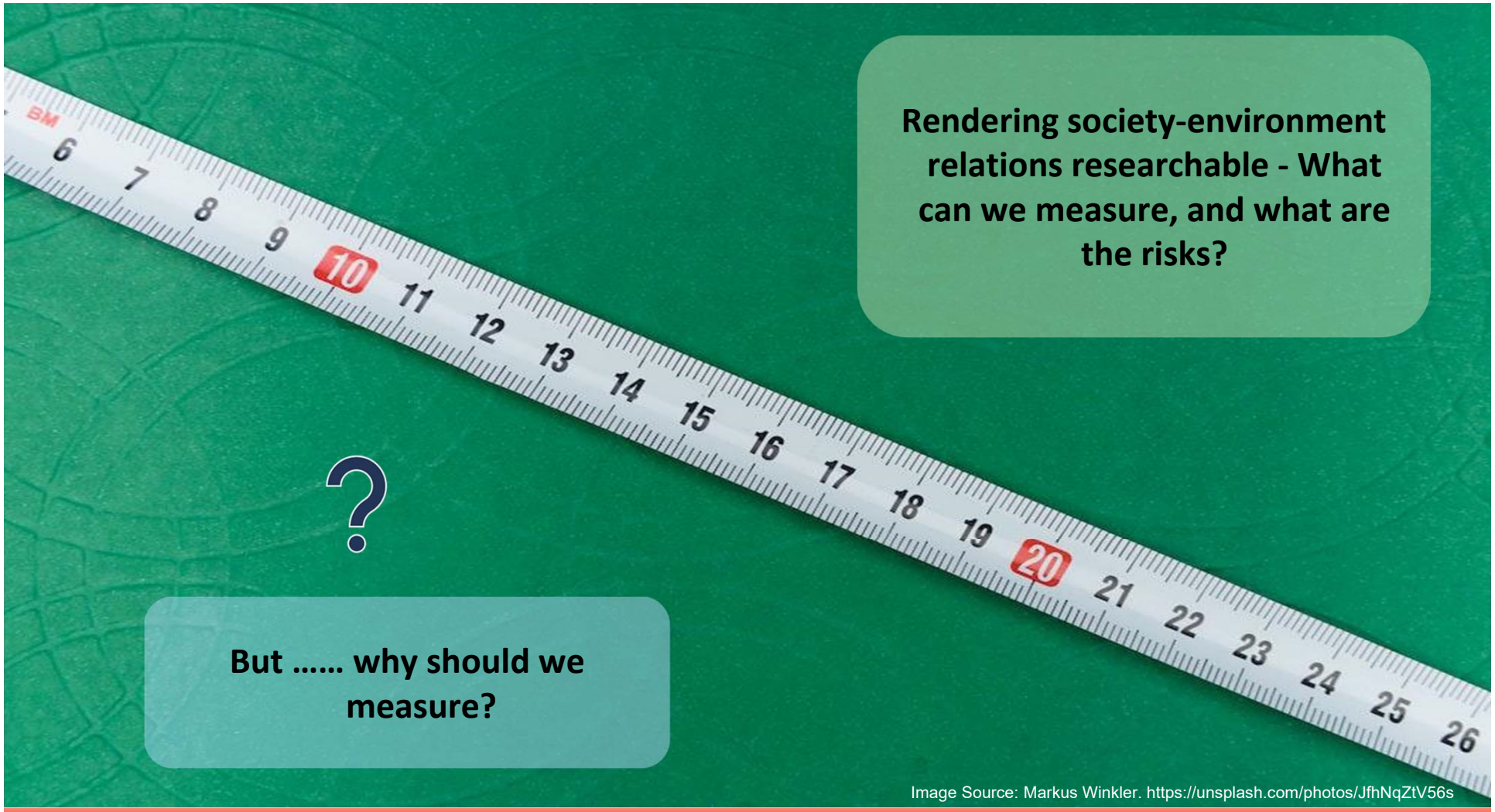



Image Source: Markus Winkler. https://unsplash.com/photos/JfhNqZtV56s

# Introducing Footprint Indicators

The New York Times Magazine

Magazine | ON LANGUAGE

## Footprint

By WILLIAM SAFIRE FEB. 17, 2008

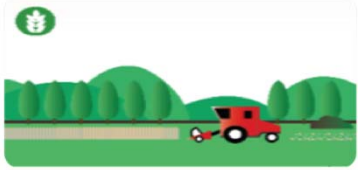
"**The word *footprint*** has taken on meaning," writes Michel Berger of Oakland, Calif., responding to a recent query in this space, "beyond that of simple circumstantial evidence that someone has walked by, as in Daniel Defoe's 1719 novel 'Robinson Crusoe.' Where are those footprints headed?"

Such metaphoric meaning of the term dates back to the early 1990s and has its origins in the birth of a specific methodology called "Ecological Footprint."

Since the turn of the 21st century, the term "footprint" has become very popular and entered our daily vocabulary as a metaphor for the impact humans place on the environment.

Built-up areas infrastructures

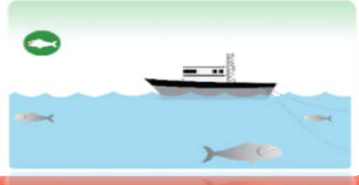

Carbon sequestration



Cropland

Grazing land

Forest land



Fishing grounds

# THE STORY OF TODAY

# DAILY ECOLOGICAL FOOTPRINT








Source: Galli, A., et al. (2020). EUSTEPs Students' teaching module. Unit 4: "Ecological Footprint - Introduction". https://www.eusteps.eu/resources/student-educator-teaching-material/

# Why EF…?

**MY INDIVIDUAL ECOLOGICAL FOOTPRINT**

daily

EF = 125 $m^2$


EF = 4.5 hectares

Source: Galli, A., et al. (2020). EUSTEPs Students' teaching module. Unit 4: "Ecological Footprint - Introduction". https://www.eusteps.eu/resources/student-educator-teaching-material/

**BUT……I AM NOT ALONE ON THIS PLANET…**

Image source: https://vasco-translator.com/articles/languages/what-is-the-most-spoken-language-in-the-world/

**I AM SHARING IT WITH ABOUT OTHER 7.8 BILLION PEOPLE!!!**

# Ecological Footprint:
# An Ecological Balance Sheet For Countries

The Ecological Footprint is an environmental accounting tool that identifies the extent to which human activities exceed **two types of environmental limits:**

- resource production
- waste absorption

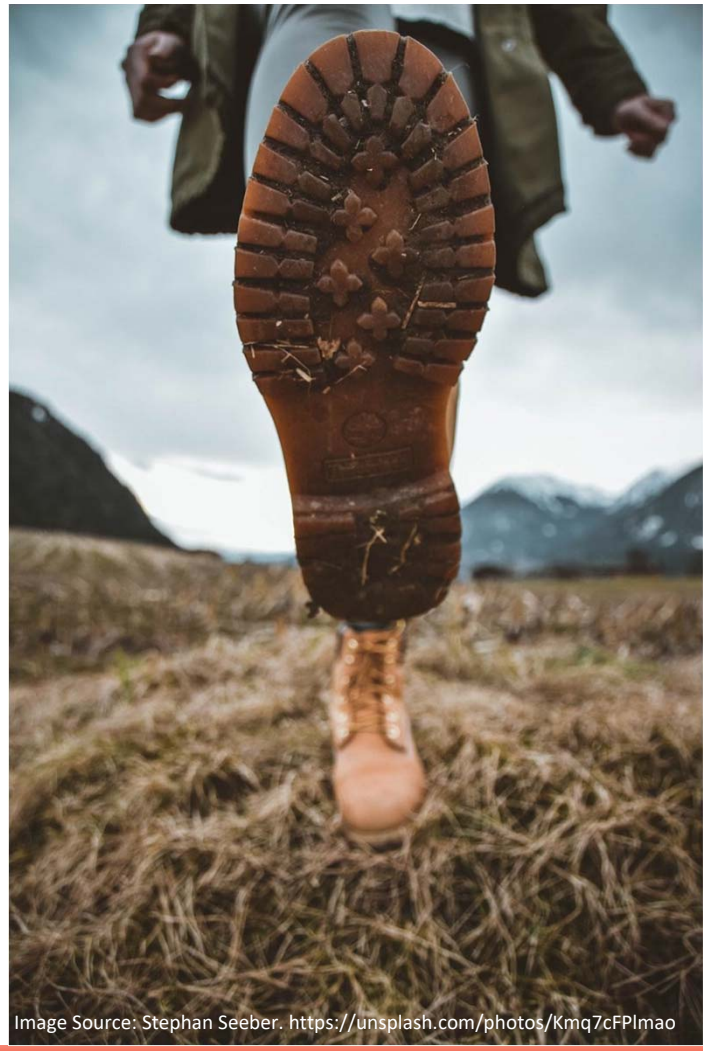
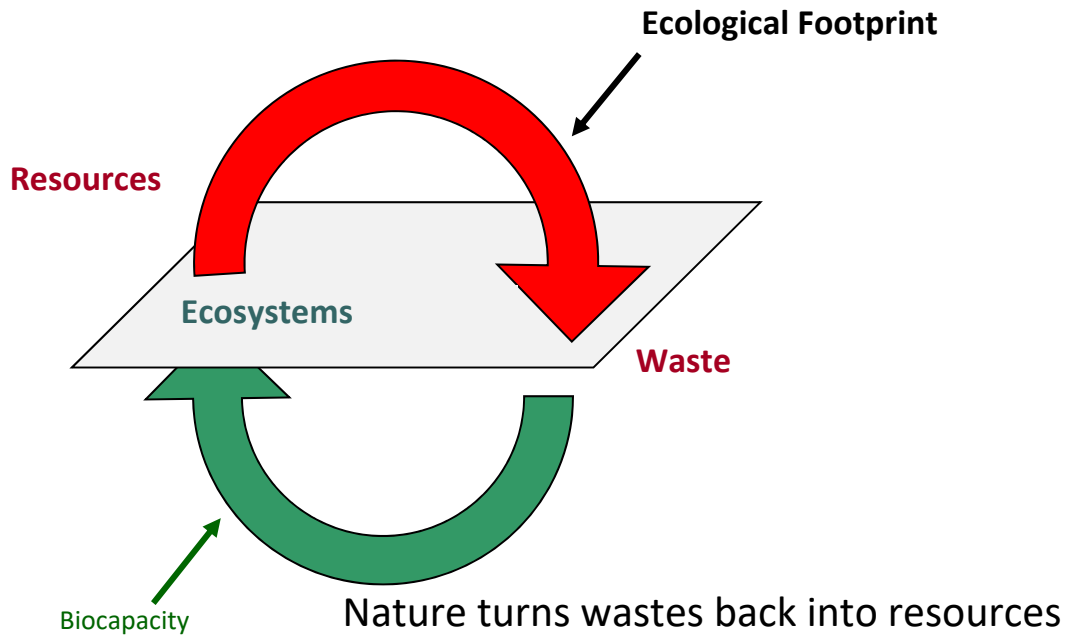


Image Source: Stephan Seeber. https://unsplash.com/photos/Kmq7cFPlmao

Societies use resources (food, energy, etc.) and produce wastes.

## ECOLOGICAL FOOTPRINT: An Ecological Balance Sheet For Countries




Source: Galli, A., et al. (2020). EUSTEPs Students' teaching module. Unit 4: "Ecological Footprint - Introduction". https://www.eusteps.eu/resources/student-educator-teaching-material/

# The Ecological Footprint

**The Ecological Footprint measures the amount of biologically productive land and water (fishing grounds) area required to:**

- **produce all the resources an individual, population or activity consumed**
- **to absorb the wastes they generated, given prevailing technology and resources management practices**

*Source: Wackernagel and Rees (1996)*

Image Source: Grant Durr. https://unsplash.com/photos/abLBPUgWTWM

**The final Ecological Footprint of an individual or a country is the sum of all these different types of land, irrespective of where they are located.**

# Biocapacity

Measures the amount of **biologically productive land and sea area** available to provide the ecosystem services that humanity consumes.

The biocapacity represents the **natural capital** that provides the basic life-support services, expressed as the **available regenerative capacity of the biosphere**.

The biocapacity represents the **ability of the biosphere** to produce crops, timber, livestock as well as to absorb carbon dioxide.

The total biocapacity of a Nation (or planet) is calculated as the sum of the biocapacity supplied by each land type.

**It depends on natural conditions but also on dominant agriculture and forestry practices.**

Image Source: Louis Maniquet: https://unsplash.com/photos/71QXQUSC_Do

# Assessing Countries' Ecological Balance

**Biocapacity:**
How much bioproductive area is **available to us**?


**Ecological Footprint:**
How much bioproductive area do we **demand**?

Source: Galli, A., et al. (2020). EUSTEPs Students' teaching module. Unit 4: "Ecological Footprint - Introduction". https://www.eusteps.eu/resources/student-educator-teaching-material/

## Biocapacity

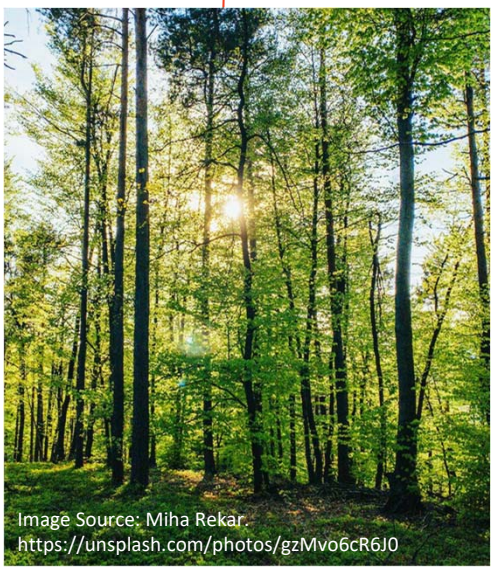


Image Source: Miha Rekar.
https://unsplash.com/photos/gzMvo6cR6J0

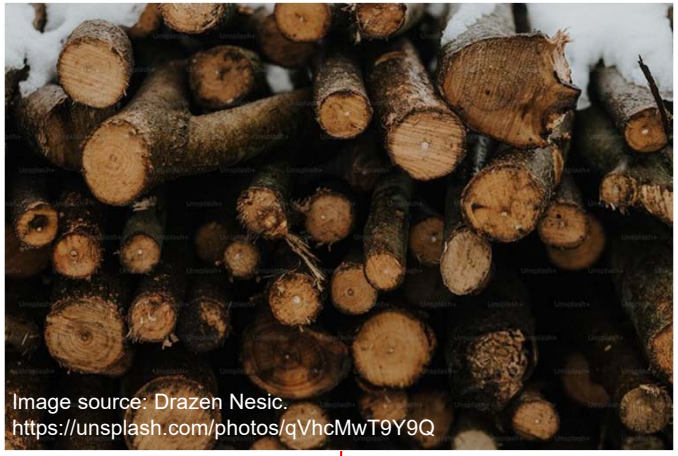
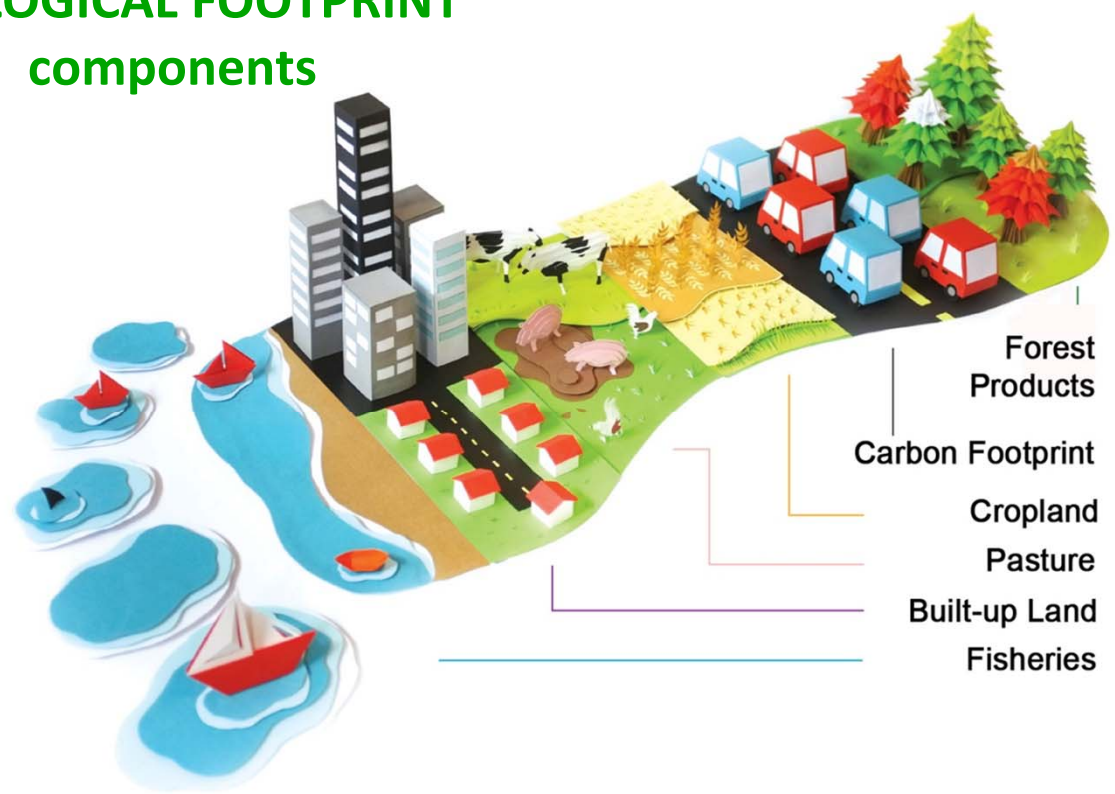


Image source: Drazen Nesic.
https://unsplash.com/photos/qVhcMwT9Y9Q

## Ecological Footprint

Source: Galli, A., et al. (2020). EUSTEPs Students' teaching module. Unit 4: "Ecological Footprint - Introduction". https://www.eusteps.eu/resources/student-educator-teaching-material/

# ECOLOGICAL FOOTPRINT components




**CARBON**
$CO_2$ emissions associated with use of fossil fuels, electricity and energy intensive commodities, converted into biologically productive areas (such as forest land) necessary for their sequestration.

**GRAZING LAND**
The area of grasslands used to raise livestock for meat, diary, hide and wool products. It includes all grassands used to provide feed for animals, including cultivated pastures, wild grasslands and prairies.

**FOREST**
The area of forests required to support the annual harvest of fuel wood, pulp and timber products.

**FISHING GROUNDS**
The area of marine and inland waters required to support annual catches of aquatic species (fish and seafood).

**CROPLAND**
The area required to grow all crop products required for human consumption (food and fiber) and for livestock feeds, fish meals, oil crops and rubber.

**BUILT-UP LAND**
The area of land covered by human infrastructure such as transportation, housing, industrial structures and reservoirs for hydroelectric power generation.

Source: Galli, A., et al. (2020). EUSTEPs Students' teaching module. Unit 4: "Ecological Footprint - Introduction". https://www.eusteps.eu/resources/student-educator-teaching-material/

# Unit: hectare-equivalent or Global hectare

**The Ecological Footprint is an indicator of human appropriation of Earth's photosynthetic capacity, although expressed in hectare-equivalents.**

The release of 1 t of $CO_{2eq}$ does not mean that this amount has actually been released (no molecule called $CO_{2eq}$). Rather, it means that various GHGs with the equivalent global warming potential of 1 t of $CO_2$ have been released.

Similarly, having a per capita Ecological Footprint of 1 gha doesn't mean that 1 ha of physical land are used. It rather means that the capacity of 1 hectare-equivalents (or gha) is needed to produce (via photosynthesis) the renewable resource provisioning services consumed and to sequester the carbon dioxide emitted

Source: Galli, A., et al. (2020). EUSTEPs Students' teaching module. Unit 4: "Ecological Footprint - Introduction". https://www.eusteps.eu/resources/student-educator-teaching-material/

# Unit: hectare-equivalent or Global hectare

Fore example, if this hectare is twice as productive as a world average, biologically productive hectare. Then it is worth 2 gha.


2 gha

For example, if this hectare is half as productive as a world average, biologically productive hectare. Then it is worth ½ a gha.


½ gha

Source: Galli, A., et al. (2020). EUSTEPs Students' teaching module. Unit 4: "Ecological Footprint - Introduction". https://www.eusteps.eu/resources/student-educator-teaching-material/

# Scale of Application

Various methodological approaches but same rationale

Cities

Individuals


Countries and regions

World | Humanity

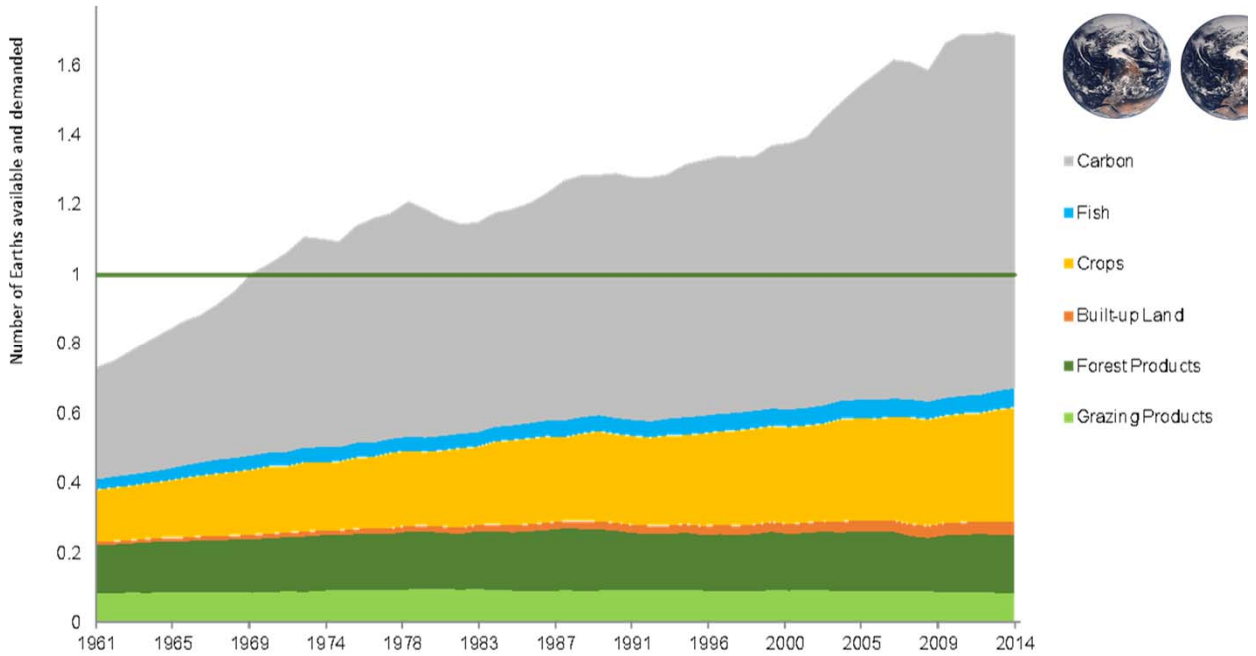
Ecological Footprint allows looking and acting locally in the context of the global situation

Source: Galli, A., et al. (2020). EUSTEPs Students' teaching module. Unit 4: "Ecological Footprint - Introduction". https://www.eusteps.eu/resources/student-educator-teaching-material/

# Looking at the Earth as a single system: Showing our society's overall direction


Image Source: Nick Tiemeyer. https://unsplash.com/photos/tNGcZlycLtQ

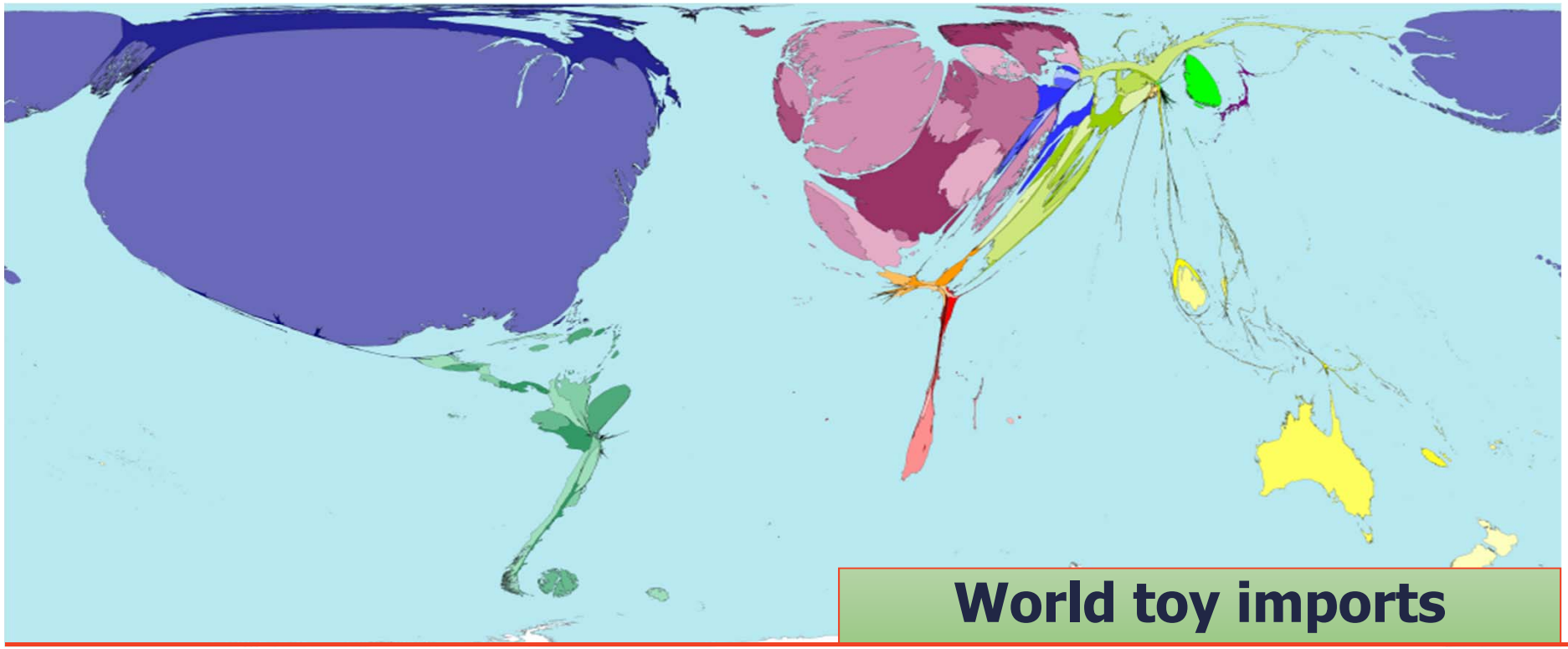
# Humanity's Ecological Footprint and biocapacity, 1961 – 2014




Source: Galli, A., et al. (2020). EUSTEPs Students' teaching module. Unit 4: "Ecological Footprint - Introduction". https://www.eusteps.eu/resources/student-educator-teaching-material/

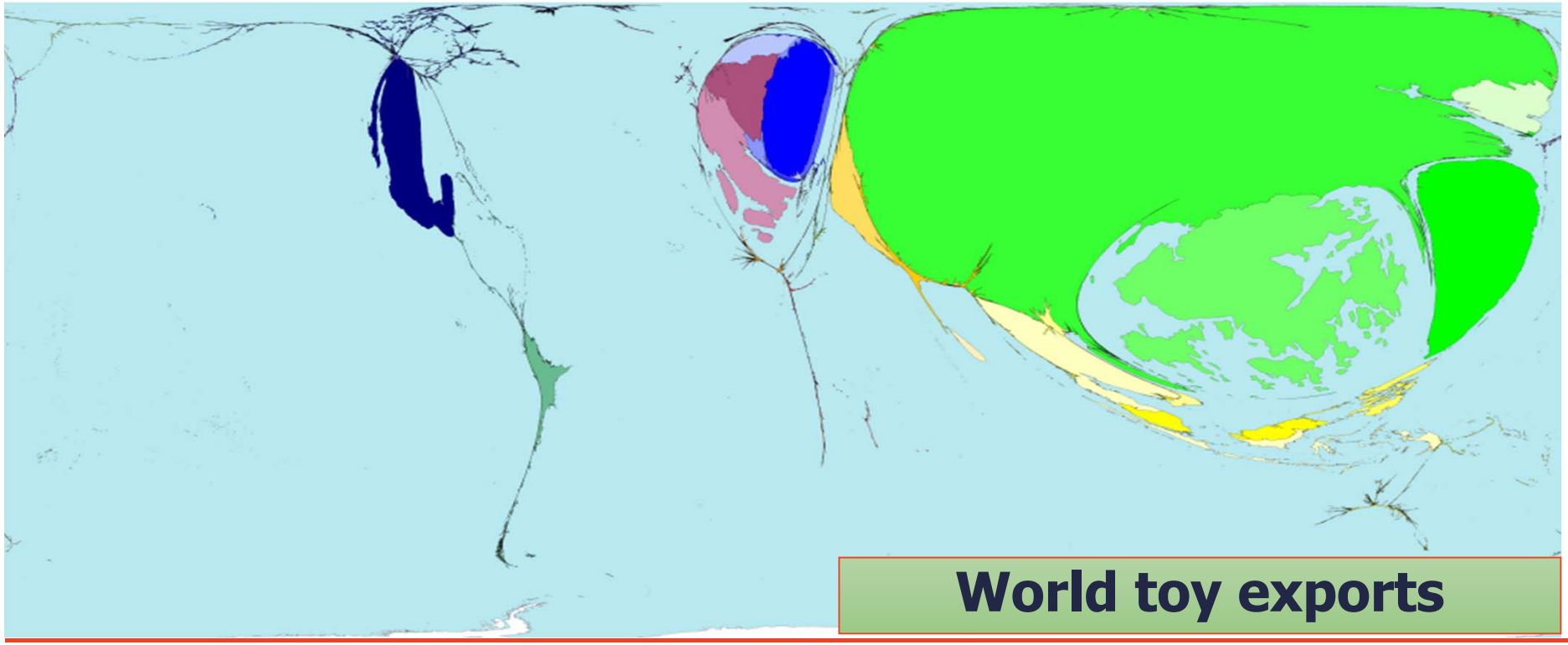
# Why using a consumer approach?

## Not everything that is consumed in the West…




Source: Galli, A., et al. (2020). EUSTEPs Students' teaching module. Unit 4: "Ecological Footprint - Introduction". https://www.eusteps.eu/resources/student-educator-teaching-material/

**… is being produced in the West.** Environmental impacts are often manifesting far away from the places in which their root causes (i.e., their drivers) are taking place.




Source: Galli, A., et al. (2020). EUSTEPs Students' teaching module. Unit 4: "Ecological Footprint - Introduction". https://www.eusteps.eu/resources/student-educator-teaching-material/

# Ecological Footprint: input data

## CROPLAND FOOTPRINT

Represents the area required to grow all crop products, including livestock feeds, fish feed, oil crops and rubber.

It is calculated by using data on production, import and export of ≈400 primary and derived agricultural products.

Source data is FAO

## GRAZING LAND FOOTPRINT

Measures the area of grassland used in addition to crop feeds to provide feed for livestock, including cultivated pastures, wild grasslands and prairies.

It is calculated by using data on production, import and export of ≈150 animal and dairy products (including live animals).

Source data is FAO

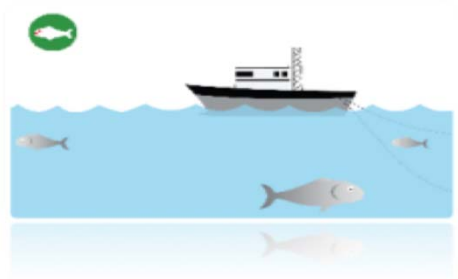
Source: Galli, A., et al. (2020). EUSTEPs Students' teaching module. Unit 4: "Ecological Footprint - Introduction". https://www.eusteps.eu/resources/student-educator-teaching-material/

## FOREST FOOTPRINT

Measures the annual harvest of fuel wood and timber to supply forest products.

It is calculated by using data on production, import and export of ≈30 in between timber and wood fuel products.

Source data is FAO



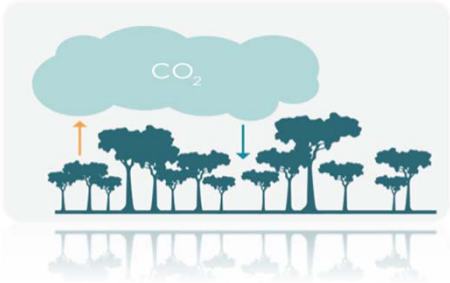
## FISHING GROUNDS FOOTPRINT

Measures the area of marine and inland water used to provide the primary production needed to sustain aquatic species (including fish meals).

It is calculated by using data on production, import and export of ≈1500 fish products.

Source data is FAO

Source: Galli, A., et al. (2020). EUSTEPs Students' teaching module. Unit 4: "Ecological Footprint - Introduction". https://www.eusteps.eu/resources/student-educator-teaching-material/




## CARBON FOOTPRINT

Measures the uptake land to accommodate the carbon dioxide emissions due to consumption of fossil fuels, electricity and energy intensive products

It is calculated by using data on emissions from ≈45 industrial sectors as well as import and export of ≈625 manufactured commodities.

Source data is IEA and UN COMTADE

## BUILT-UP LAND FOOTPRINT

Measures the area of land covered by human infrastructure: transportation, housing, industrial structures and reservoirs for hydroelectric power generation.

Source data is CORINE, GLC, SAGE, etc

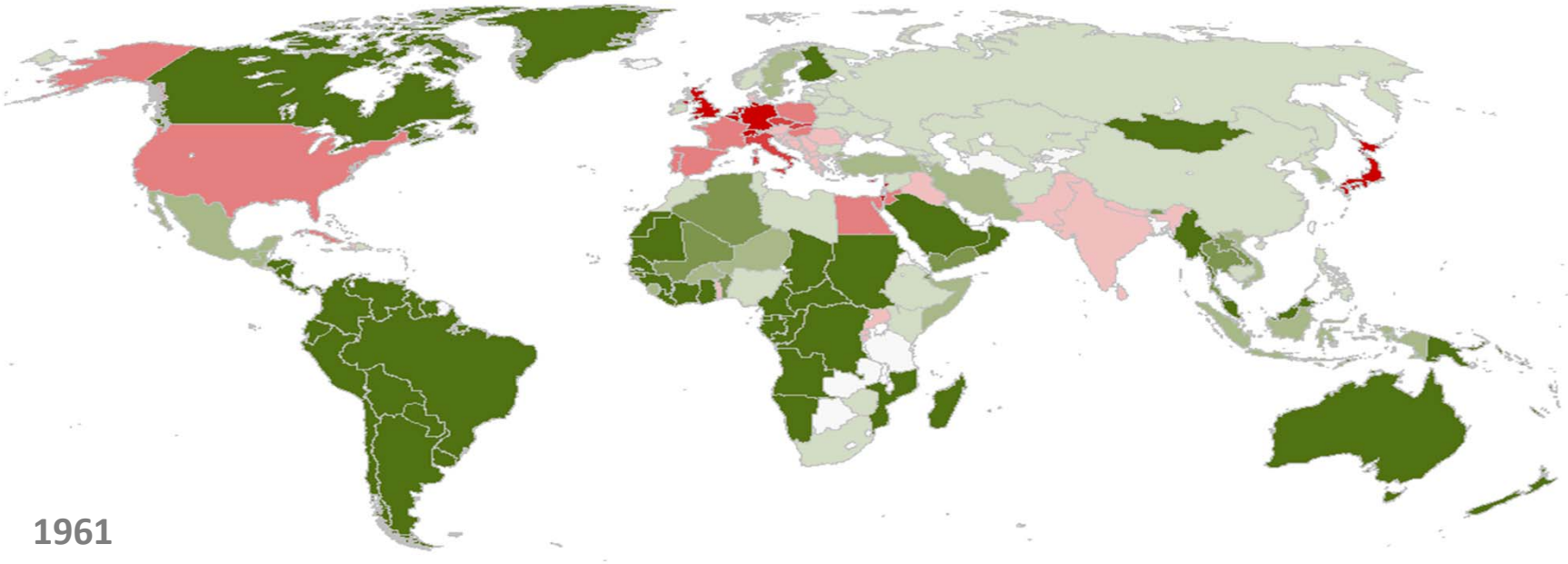
Source: Galli, A., et al. (2020). EUSTEPs Students' teaching module. Unit 4: "Ecological Footprint - Introduction". https://www.eusteps.eu/resources/student-educator-teaching-material/

# Outcomes: National Footprint Accounts - NFA

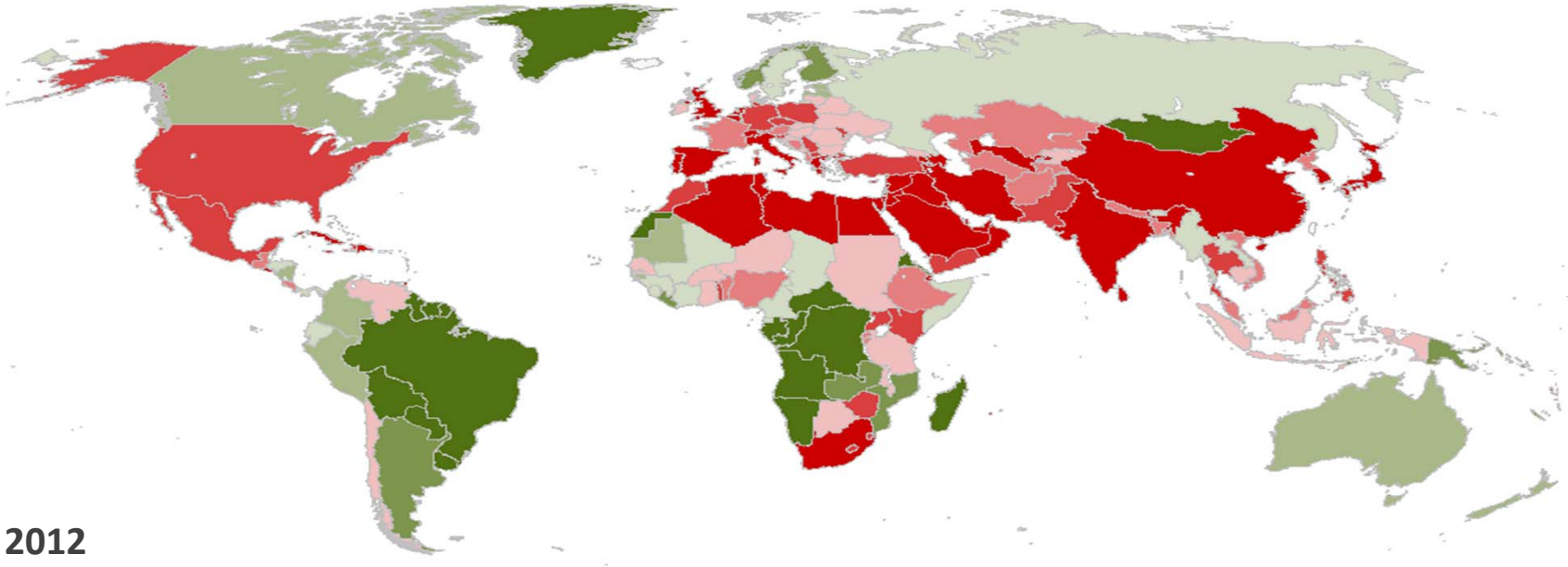
- **Every year** Global Footprint Network releases an updated version of the NFA, which is based on the most up-to-date Footprint methodology
- **Each edition** of the NFA tracks EF and BC values for almost 200 countries (and the World), over five decades (1961-2014) and with different level of aggregation:
  1. Aggregate national EF and BC values (most known)
  2. EF and BC values by land type
  3. EF values by variable
  4. EF values for all individual products
  5. Values are provided both per capita and total
  6. Results in both ha and gha (not for totals)

Global Footprint Network

Website: https://www.footprintnetwork.org/




Data from the National Footprint Accounts 2016 Edition. www.footprintnetwork.org



**2012**

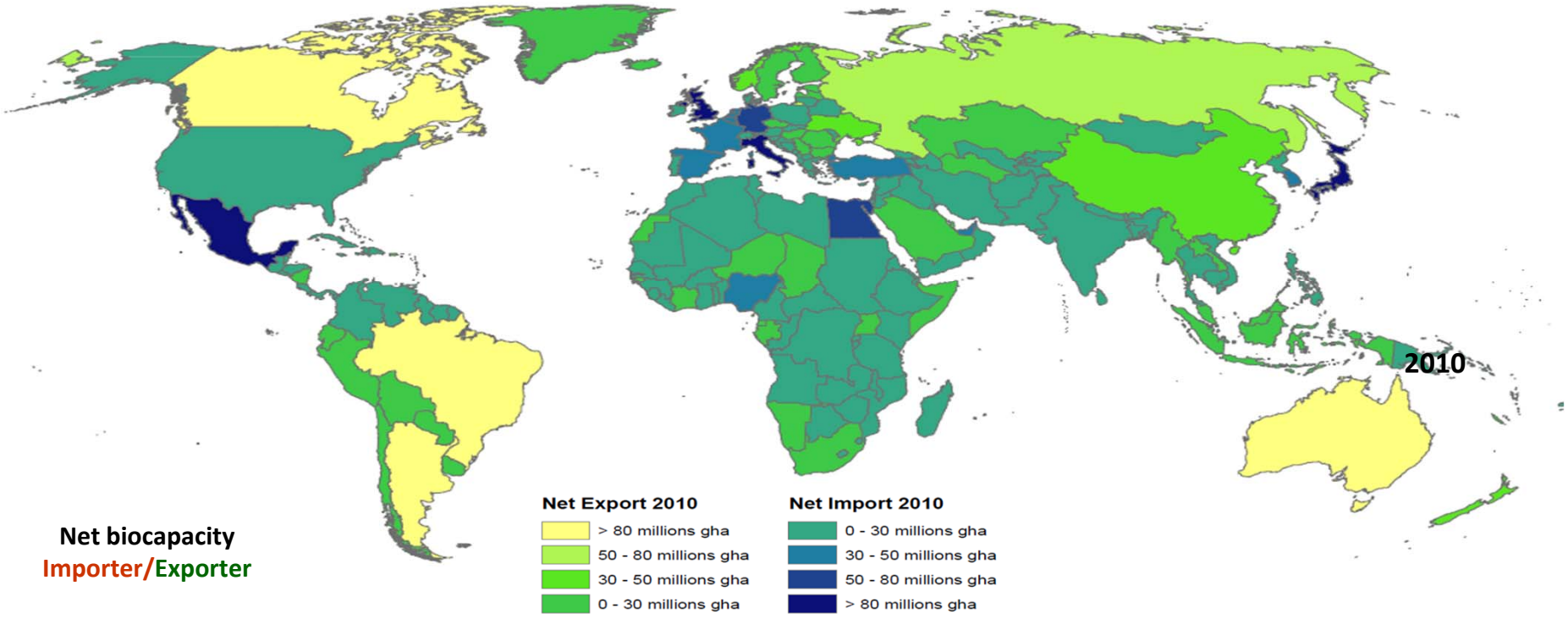
**Ecological Footprint of consumption excceeds biocapacity**

- > 150 %
- 100 - 150 %
- 50 - 100 %
- 0 - 50 %

**Biocapacity exceeds Ecological Footprint of consumption**

- 0 - 50 %
- 50 - 100 %
- 100 - 150 %
- >150 %

Data from the National Footprint Accounts 2016 Edition. www.footprintnetwork.org




**Net biocapacity**
**Importer/Exporter**

**Countries are highly interconnected and depend on each other**

Source: Updated from Galli et al., 2014

Cropland
Footprint

Fish
Footprint

Forest
Footprint

Grazing
Footprint

Source: Lazarus et al, 2015

# On the Usefulness of Ecological Footprint Accounting

## What did we learn from this? What can we do?

**Globally, the human metabolism has become "faster" than the planet capacity to regenerate key resources and ecosystem services.**

**This affects the health of ecosystems and biodiversity and puts at risk human well-being**

**Countries around the world are telecoupled and overconsumption in a country causes resource depletion somewhere else**

**As such, local resource management and governance cannot be blind to such global teleconnections and their consequences**

Source: Galli, A., et al. (2020). EUSTEPs Students' teaching module. Unit 4: "Ecological Footprint - Introduction". https://www.eusteps.eu/resources/student-educator-teaching-material/

# *IV. The link between Ecological Footprint and the SDGs*

# Ecological Footprint and SDGs

Ecological Footprint has link with most of the SDGs, however, its link with SDG12 (Responsible consumption and Production) is more highlighted:


Image Source: https://www.overshootday.org/kids-and-teachers-corner/what-is-an-ecological-footprint/


Image Source: https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Archive:SDG_12_-_Responsible_consumption_and_production_%28statistical_annex%29&oldid=567329

# SDG 12 and its targets



**Goal 12: Ensure sustainable consumption and production patterns**

Targets (selected):

- By 2030, achieve the sustainable management and efficient use of natural resources
- By 2020, achieve the environmentally sound management of chemicals and all wastes throughout their life cycle, in accordance with agreed international frameworks, and significantly reduce their release to air, water and soil in order to minimize their adverse impacts on human health and the environment
- By 2030, substantially reduce waste generation through prevention, reduction, recycling and reuse
- Encourage companies, especially large and transnational companies, to adopt sustainable practices and to integrate sustainability information into their reporting cycle
- Promote public procurement practices that are sustainable, in accordance with national policies and priorities
- By 2030, ensure that people everywhere have the relevant information and awareness for sustainable development and lifestyles in harmony with nature

Source: Schmidt et al. 2019


# How EF informs progresses on SDG12

EF allows comparing the impact of a country's production and consumption activities vs. the ecological budget available (globally or nationally).

It offers a framework to assess the **appropriation of ecological assets** due to both **production and consumption activities** thus offering a way to track progresses on **SDG12**

It also allows comparing the impact of production and consumption activities against the regeneration of the planet thus **complementing** the **"efficiency"** side of human production and consumption activities with the **"one-planet-consistency"** side (whether they fit within planetary limits)

EF clearly shows that **overall, the human enterprise is operating well beyond safe planetary limits**

# Activity 1 - Summary

| Name of Activity | Setting | Aim | Time (h) |
|---|---|---|---|
| A1. Calculating your Personal Ecological Footprint (optional) | Individual and Group work<br><br>Online and Classroom | **Aim:** This activity aims to calculate the Ecological Footprint (EF) of a person's daily life and identify possible solutions to reduce it. | 4 |

# Activity 1 - Instructions

Answer questions about your daily life activities and behaviors by completing the 'Ecological Footprint Calculator.' This activity consists of 2 parts:

## PART 1 - Individual Work

**Step 1-** To run the personal calculator, access the "Ecological Footprint Calculator" (https://www.footprintcalculator.org/home/en), and click on "Take the first step" (select your preferred language from those available in the calculator). Then, answer the questions based on your daily life activities/ behaviors.

Notes:
- Run the calculator in English or select a preferred language from the top-right corner of the Calculator homepage.
- To improve the accuracy of each question, click "Add details" when this option is available (this step is optional). Remember to click the "SAVE" button after entering the details.
- The results of your calculation will appear on the "Summary" page. For more detailed results, visit the "See Details" or "Facts and Figures" pages.

**Step 2-** After obtaining the results, open the Table of Activity, transfer the results of your personal EF to the Table, and answer the questions. Each question should be directly answered in the Table of Activity.

# Activity 1 - Instructions

## PART 2 - Group Work

**Step 3-** After completing the Table of Activity, share your individual Footprint result in the Forum/ Class. Then, address the following bullet points with a comment on the results obtained by at least one other participant:
Suggest one more solution that could help another participant reduce her/his EF.
Share what would be needed to achieve a one-planet lifestyle.

**Note:**
The comments and replies should be constructive and based on critical analysis. Comments should be between 150 to 200 words.

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# Module 1 - Lesson 3 - Topic 1

## Material Development

Bacelar-Nicolau, Paula[1],
Bidarra, José[1],
Caeiro, Sandra[1],
Mapar, Mahsa[1],
Veiga, Pedro Alves[1],

**Collaborating authors**
Anastasiades, Tasos[2],
Contino, Andrea[4],
Costa, Tània[3],
De Balanzó, Rafael [3],
Englezou, Demetra[2],
Garriga, Javier[3],
Hadjipapa-Gee, Sofia[2],
Hillenius, Mirjam[4],
Mihai-Yiannaki, Simona[2],
Pujadas, Anna[3].

[1]Universidade Aberta; [2]European University Cyprus; [3]EINA Centre Universitari de Disseny i Art de Barcelona; [4]Documenta SL.

## Coordination

Universidade Aberta (UAb)

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