

TOPIC 5.11-5.12

# INTRODUCTION TO SUSTAINABILITY AND ECOLOGICAL FOOTPRINTS

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**Enduring Understanding:** When humans use natural resources, they alter natural systems. Humans can mitigate their impact on land and water resources through sustainable use.

**Learning Objectives:** Explain the variable measured in the ecological footprint. Explain the concept of Sustainability.

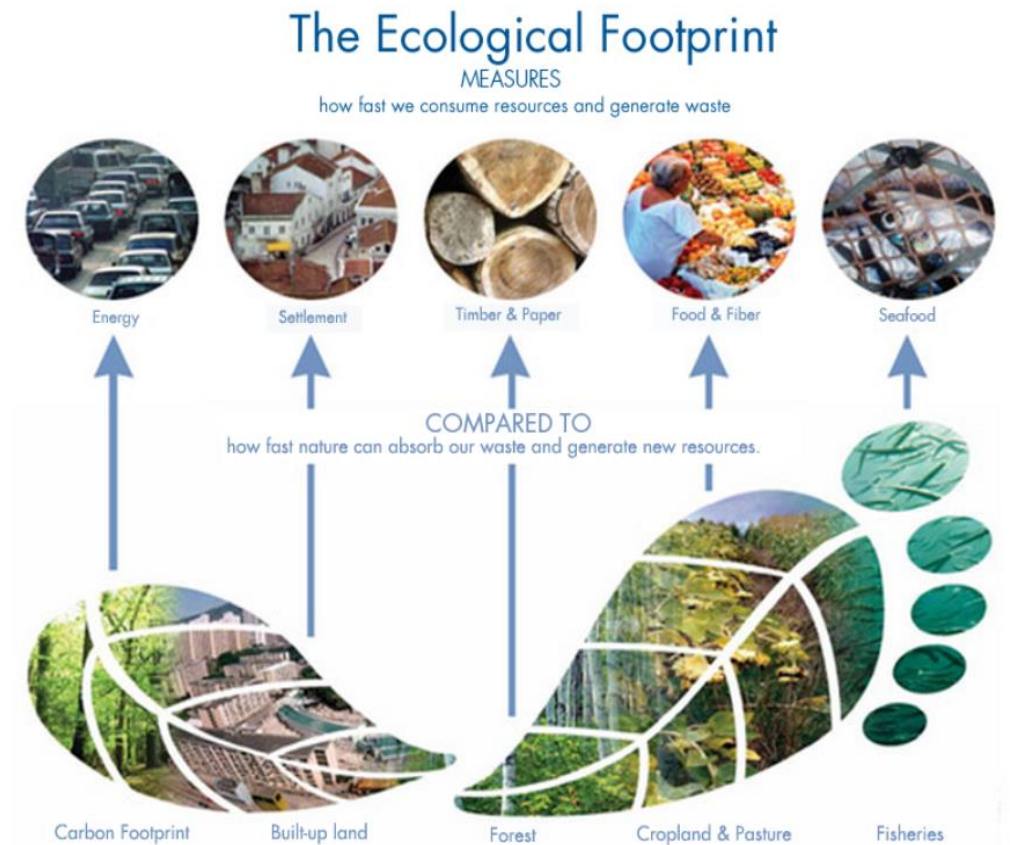
# Our Island Earth Review

- We are dependent on healthy functioning ecosystems for:
  - Maintaining abiotic conditions on Earth within a range of tolerance for species
  - Providing us with necessary natural resources
  - Providing ecosystem services.
- Rising population size and affluence threaten the ability of ecosystems to function
  - More people = more resources needed just to meet basic human needs.
  - More affluence = more resource consumption per person
  - More resource consumption = more wastes produced which must be absorbed by the environment.



# Ecological footprints

- **Ecological footprints** a way to measure human demands of the environment. A measure of environmental impact.
- Expressed as the cumulative area of biologically productive land and water required to:
  - produce resources an individual or population consumes
  - dispose of, or recycle, the wastes a person or population produces.
  - Often measured in Hectares of land or water required to meet these demands.
    - 1 ha = 10,000 m<sup>2</sup> = 2.5 acres
    - About the area inside a 400m running track



## [Measure Your Footprint](https://www.footprintnetwork.org/resources/footprint-calculator/)

<https://www.footprintnetwork.org/resources/footprint-calculator/>

# How big is your ecological footprint?

## Measure Your Footprint

<https://www.footprintnetwork.org/resources/footprint-calculator/>

- Knowing the size of our individual ecological footprints makes us more aware of our resource consumption and helps identify areas where we can reduce our footprint.
- **Results Part 2:**
  - Land type (Built up land, Forest Products, Crop Lands, Grazing lands, Fishing grounds and Carbon footprint)
  - Categories of Consumption (Food, Shelter, Mobility, Goods, Services)
  - Ecological Footprint: How big was your ecological footprint (# of hectares)?
    - There are 12.2 billion biologically productive hectares on Earth and approximately 7.8 billion people.
    - Based on the above, how many biologically productive acres are there, on average, per person
    - Carbon footprint makes up a large percentage of many peoples footprint

# How big is your ecological footprint?

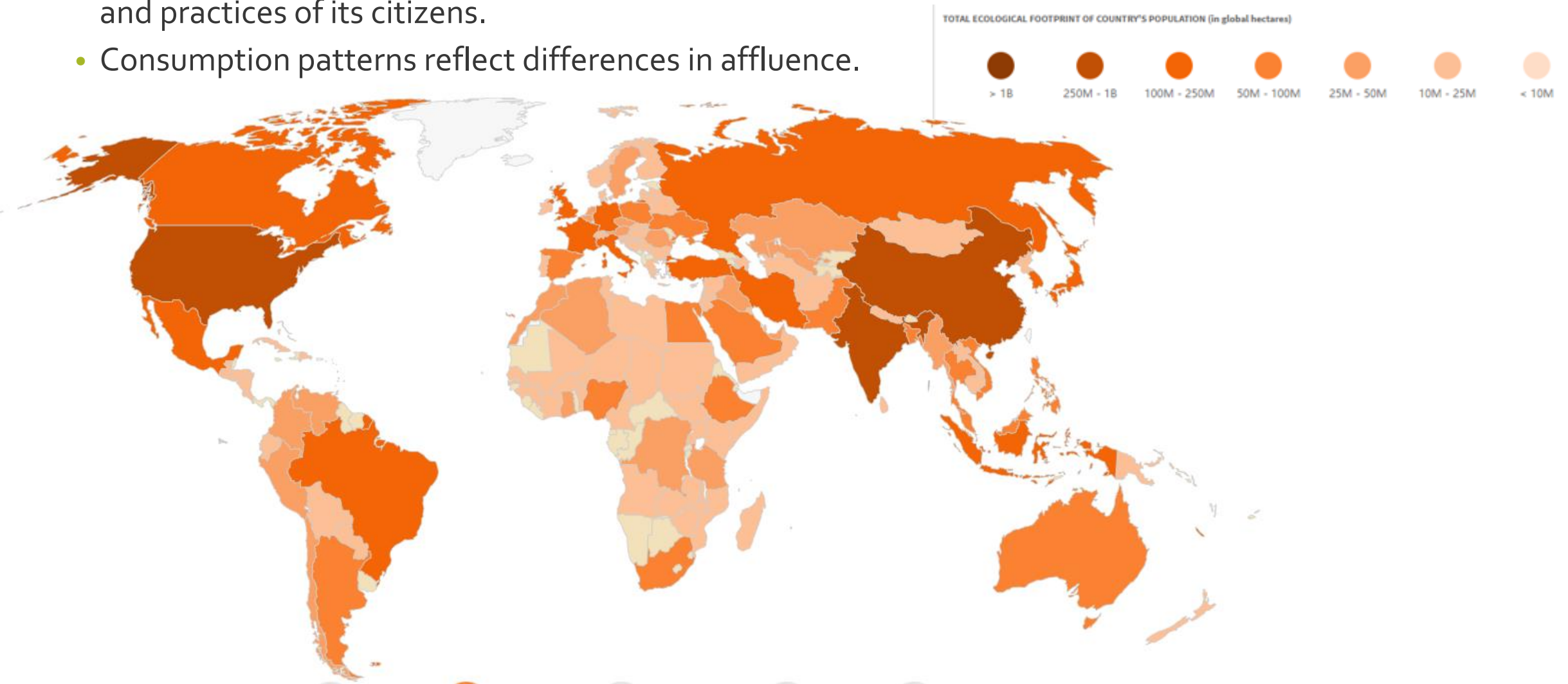
**Measure Your Footprint**

<https://www.footprintnetwork.org/resources/footprint-calculator/>

- We can use average footprint size of people to estimate the total amount of land needed to support everyone.
- **Results Part 1:**
  - Number of Earths required if everyone on Earth had a footprint the size of yours.
    - At a global average footprint of 2.7 hectares, and 7.8 billion people, how much biologically productive land is required to meet the needs of everyone on earth?
  - Overshoot day is the day of the year on which your consumption of resources / waste production would exceed the Earth's annual ability to provide resources / absorb wastes.
    - Globally, this occurred on Aug 22 of this year (2020).

# Ecological Footprints Around the World

- The environmental impacts of countries is a result of both population size and the consumption levels and practices of its citizens.
- Consumption patterns reflect differences in affluence.





# Ecological Footprints Around the World

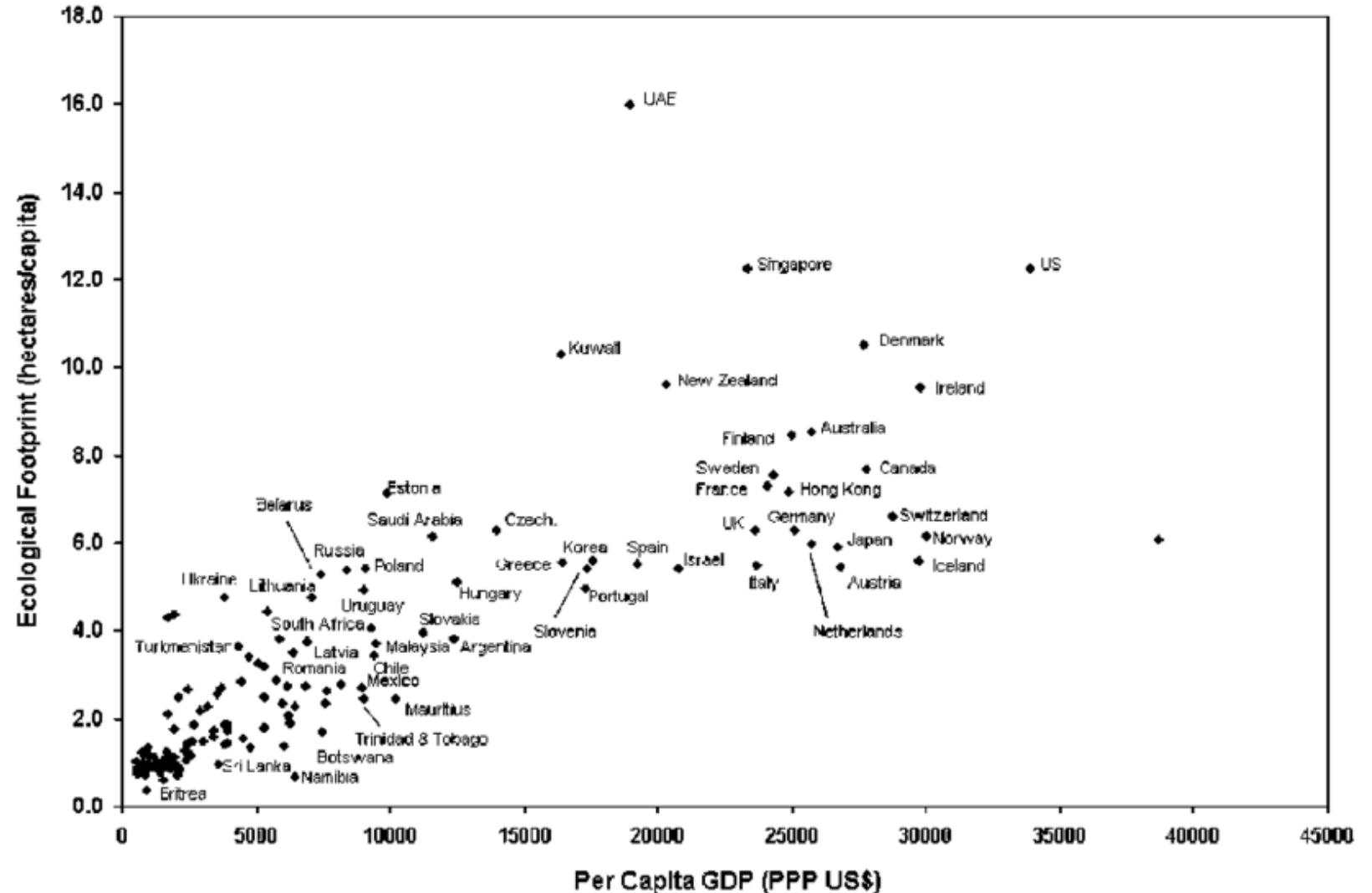
## The Most Typical Human

[Human](https://www.youtube.com/watch?v=_9Hr4ZwJSag)  
[https://www.youtube.com/watch?v=\\_9Hr4ZwJSag](https://www.youtube.com/watch?v=_9Hr4ZwJSag)



# Relationship Between Affluence and Ecological Footprints

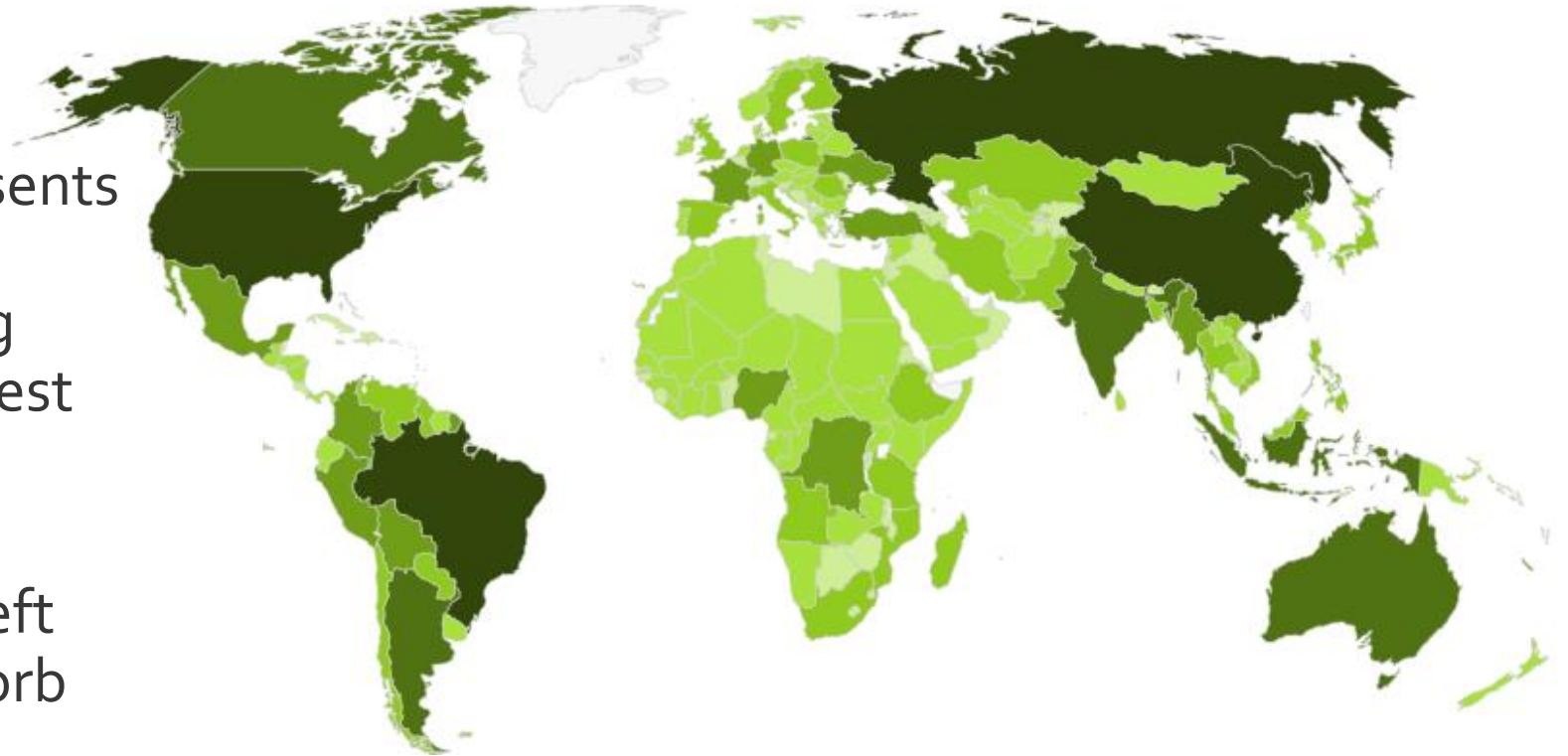
- **Gross Domestic Product (GDP)** is the monetary value of all finished goods and services made within a country during a specific period.
- **GDP** provides an economic snapshot of a country, used to estimate the size of an economy and growth rate.
- **GDP per capita** is the country's GDP divided by population size (\$/person)





# Biocapacity

- If the Ecological footprint measures the *demand* we place on the environment, **Biocapacity** measures the available *supply* of resources and capacity to absorb wastes.
  - A city, state or nation's biocapacity represents the productivity of its ecological assets, including cropland, grazing land, forest land, fishing grounds, and built-up land.
  - These areas, especially if left unharvested, can also absorb much of the waste we generate, especially our carbon emissions.

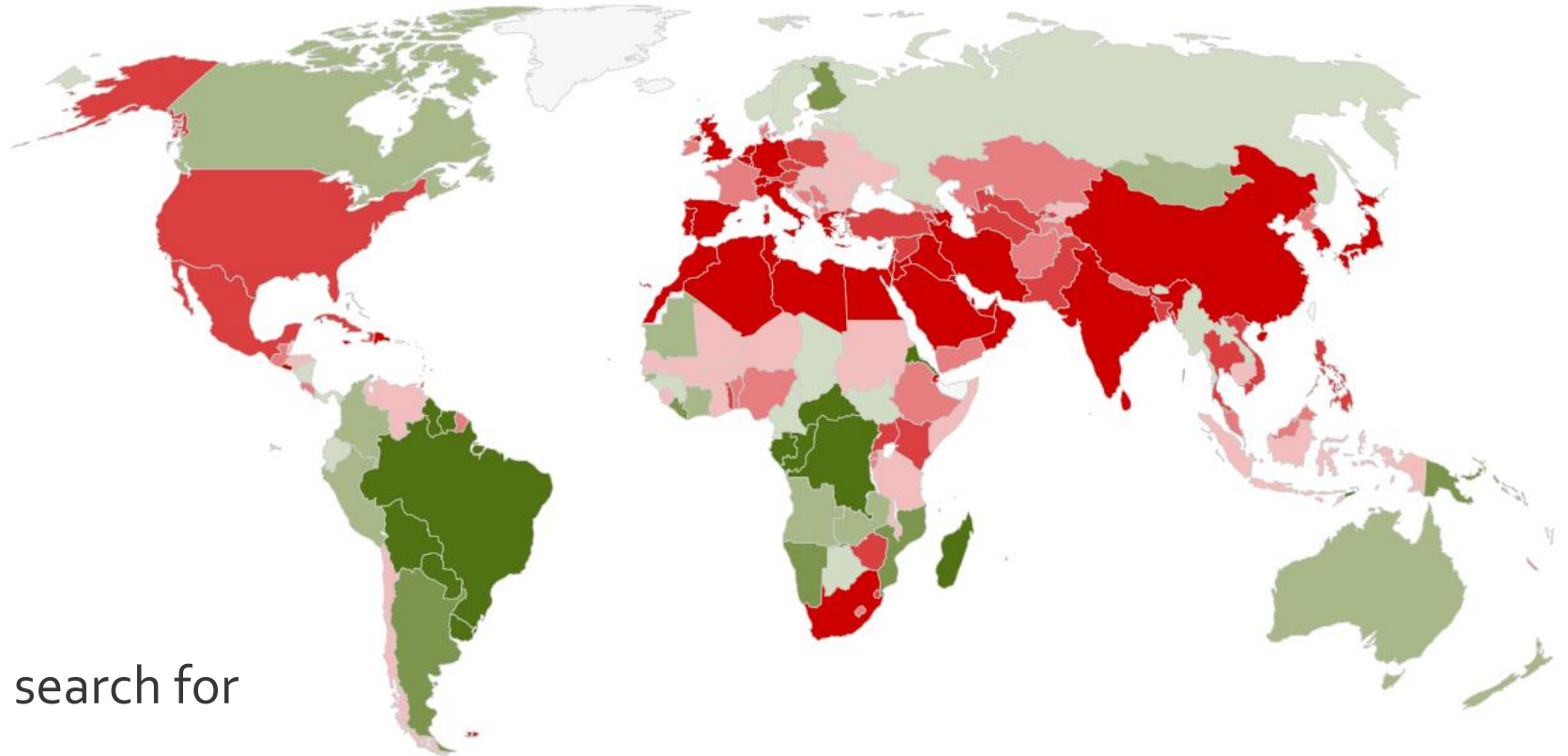


BIOCAPACITY OF COUNTRY (in global hectares)



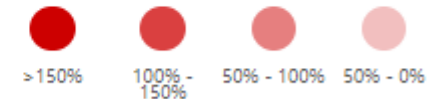
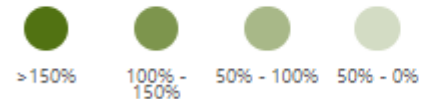
# We are exceeding the biocapacity of Earth.

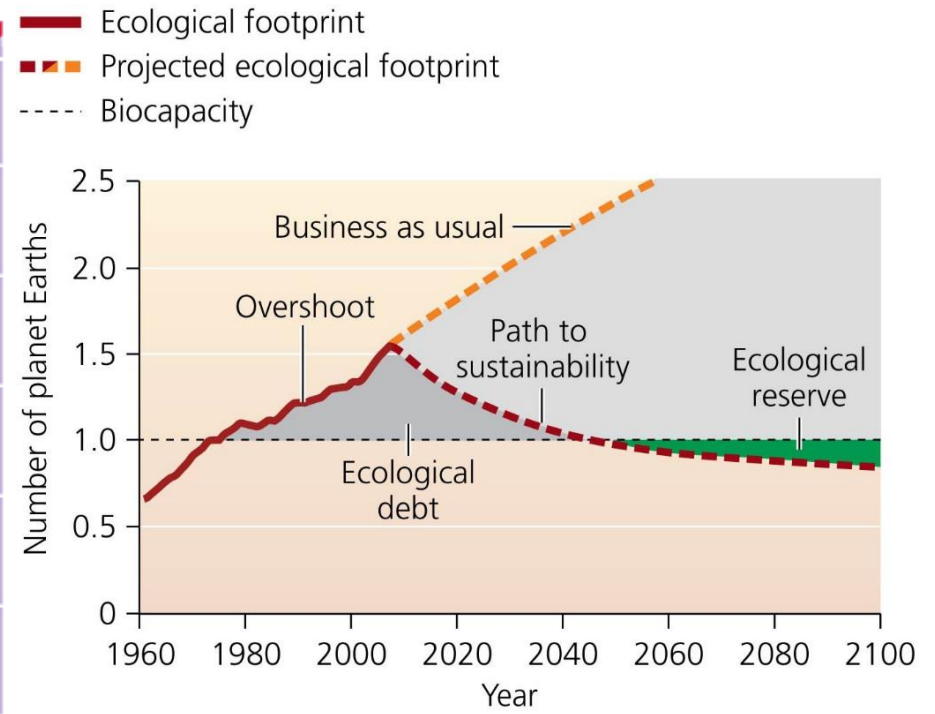
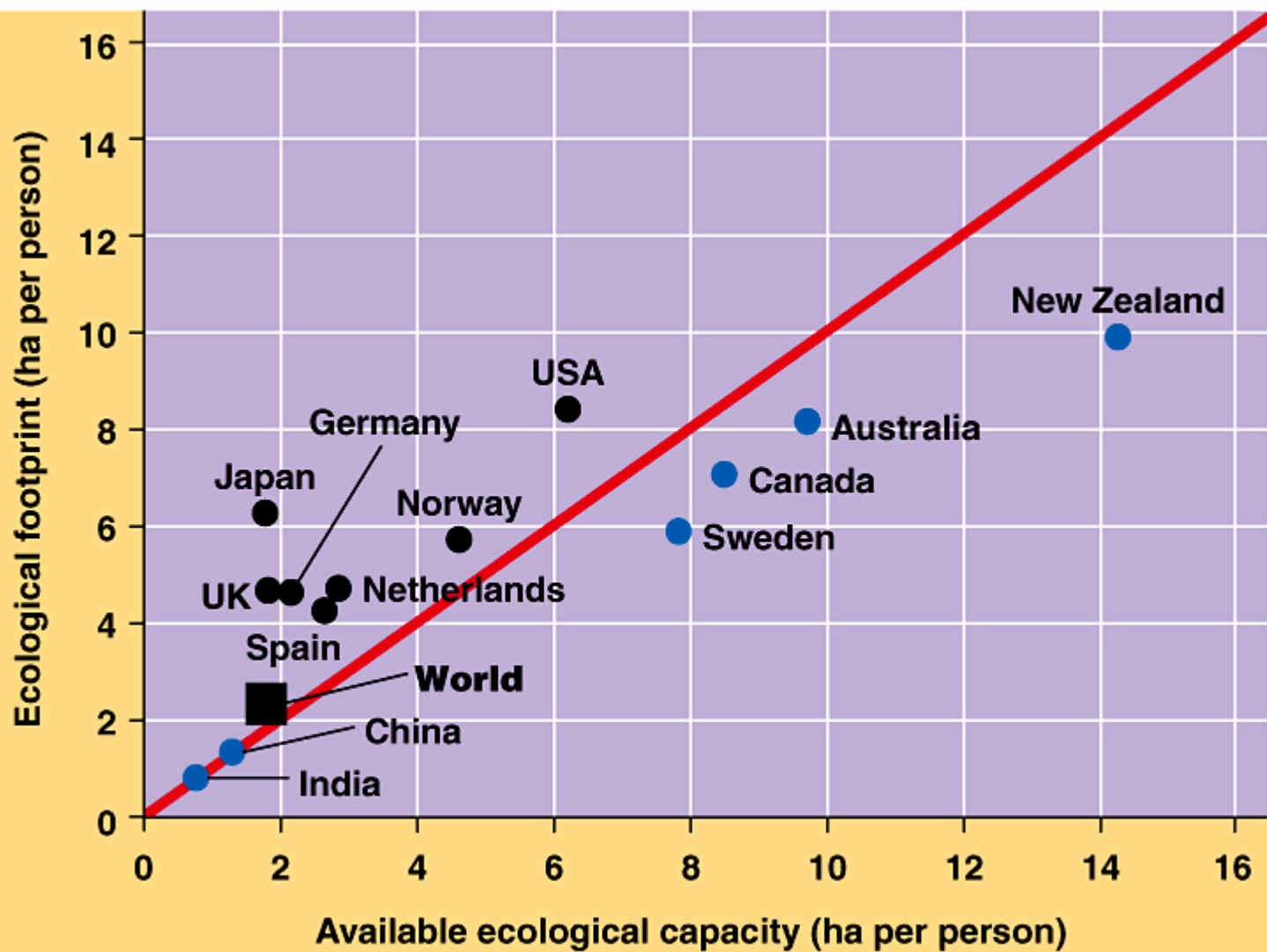
- Exceeding Biocapacity is ***unsustainable***.
  - We are using resources faster than the environment can produce them
  - We are generating wastes faster than the environment can absorb them
  - As result our Environment is changing in a variety of ways.
  - Earth is in an ***Environmental Deficit***
- Environmental Science is the search for ***sustainable*** solutions
  - More efficient resource use and waste management.
  - Slowed population growth.
  - Stabilization and maintenance of environmental processes.



BIOCAPACITY CREDITORS  
BIOCAPACITY GREATER THAN FOOTPRINT

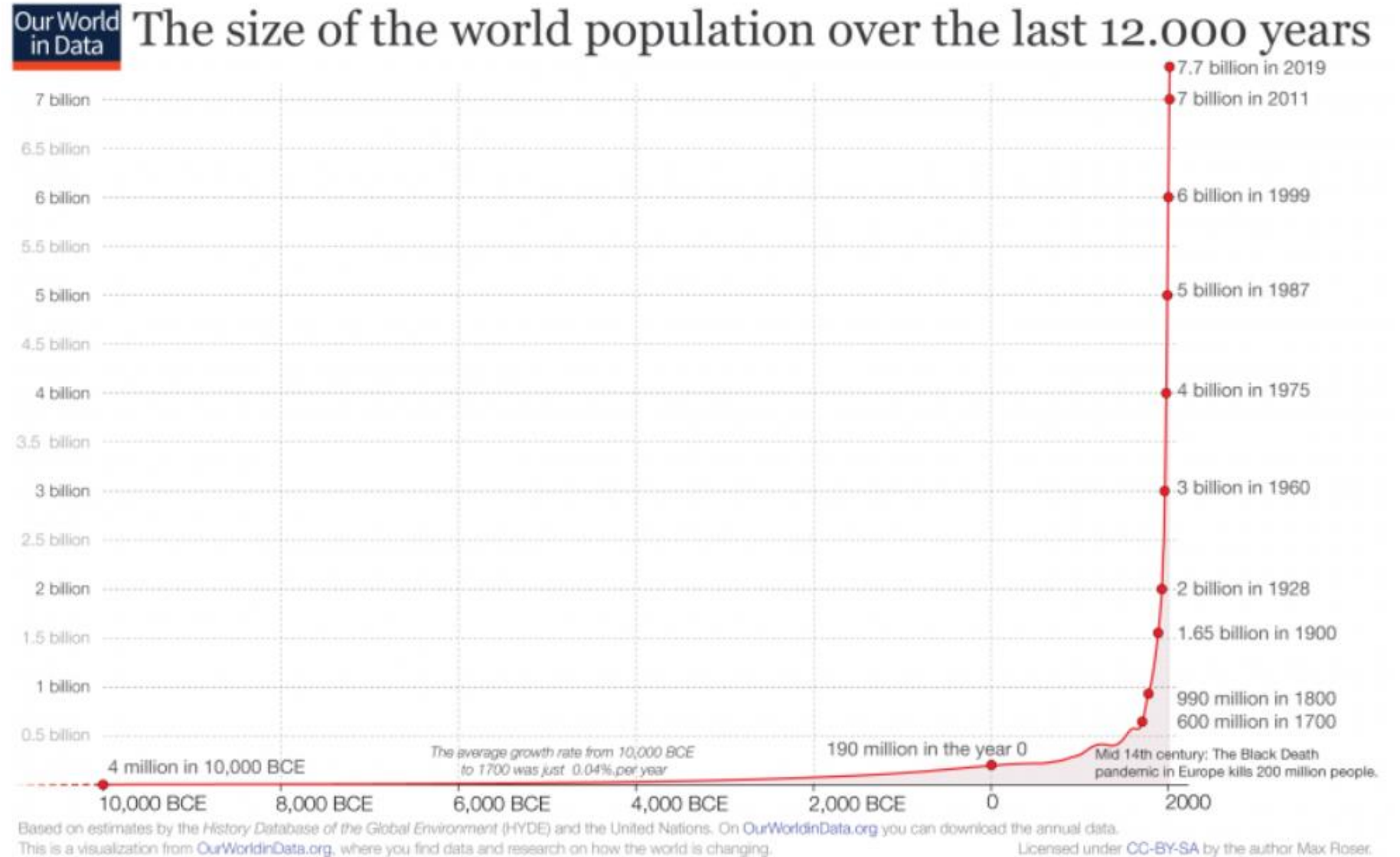
BIOCAPACITY DEBTORS  
FOOTPRINT GREATER THAN BIOCAPACITY





# Environmental Indicators of Unsustainable Ecological Footprints

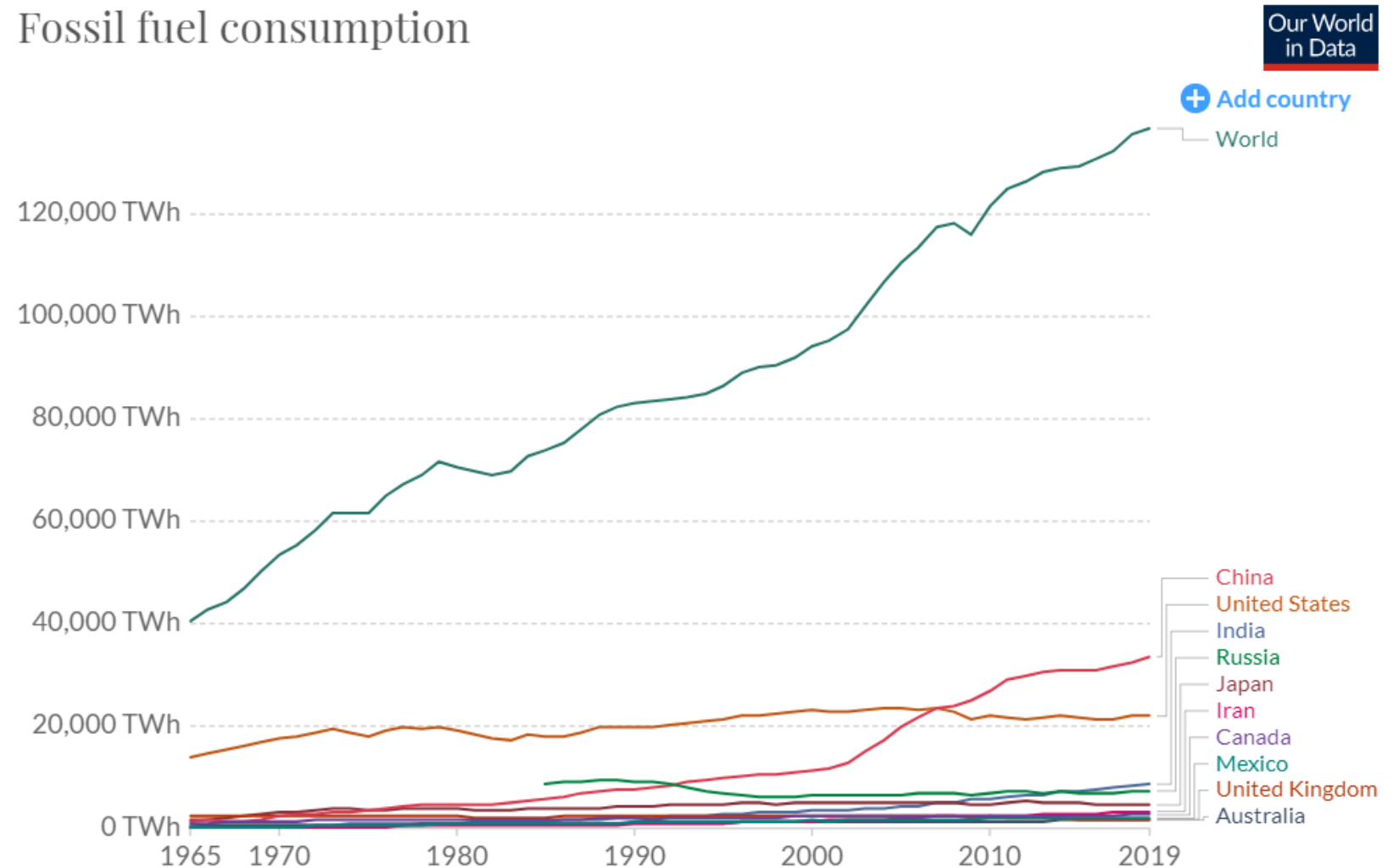
- Human Population Growth



# Environmental Indicators of Unsustainable Ecological Footprints

- Consumption of ....

Fossil fuel consumption



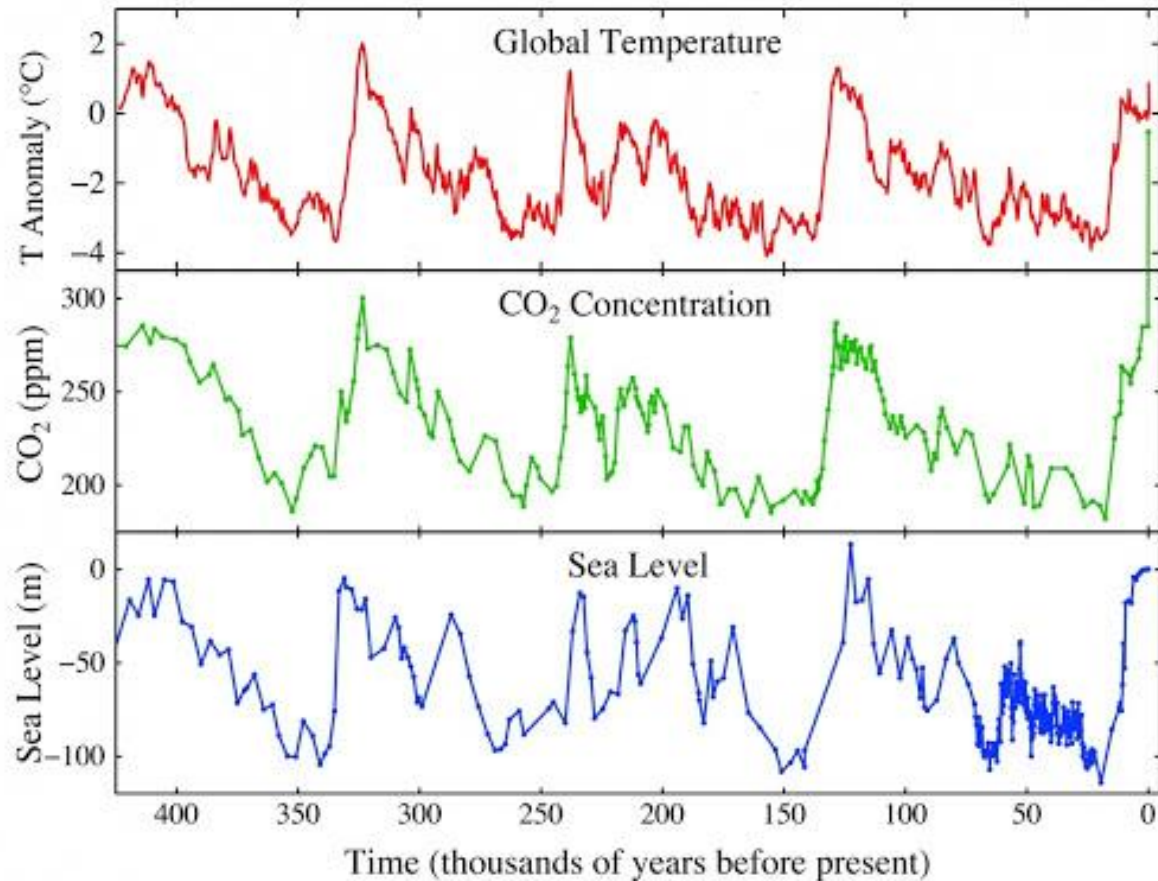
Source: Our World in Data based on BP Statistical Review of World Energy

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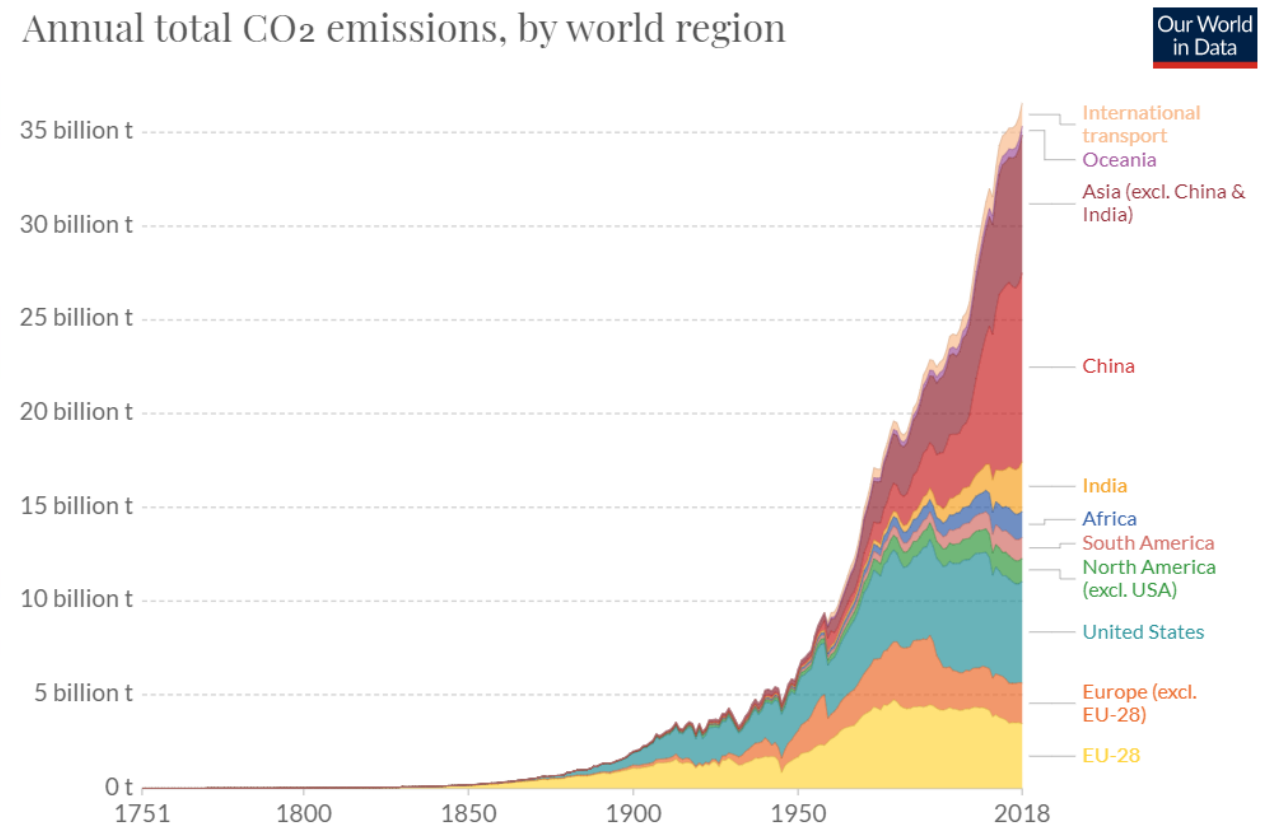


# Environmental Indicators of Unsustainable Ecological Footprints

- **Atmospheric CO<sub>2</sub> levels and emissions**



Annual total CO<sub>2</sub> emissions, by world region



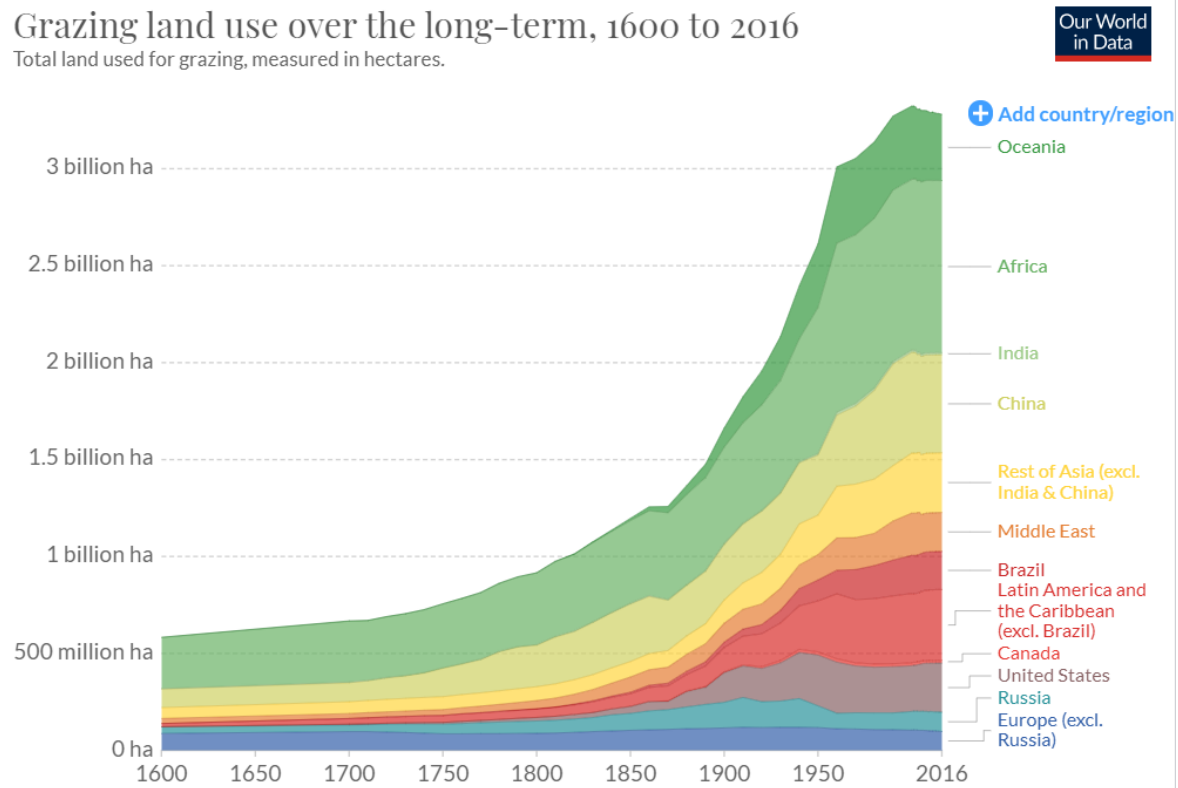


# Environmental Indicators of Unsustainable Ecological Footprints

## • Food Production

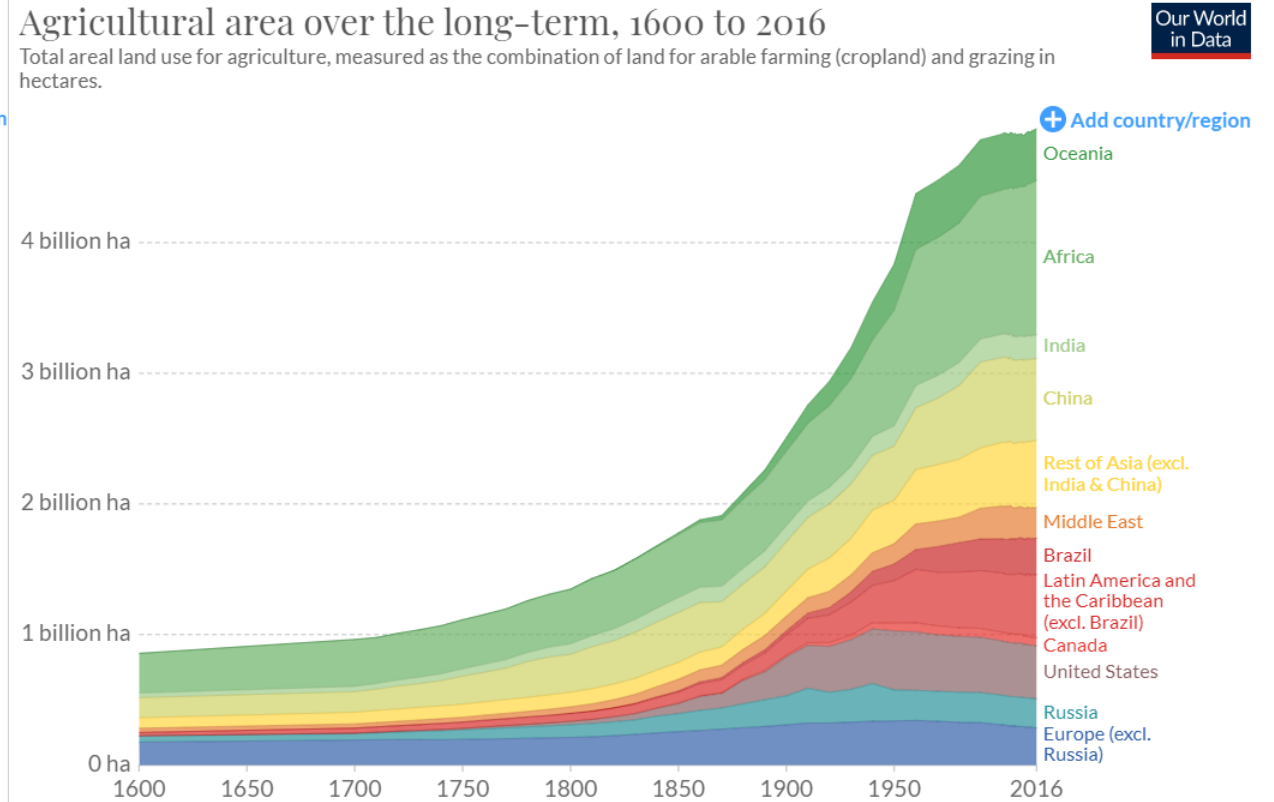
### Grazing land use over the long-term, 1600 to 2016

Total land used for grazing, measured in hectares.



### Agricultural area over the long-term, 1600 to 2016

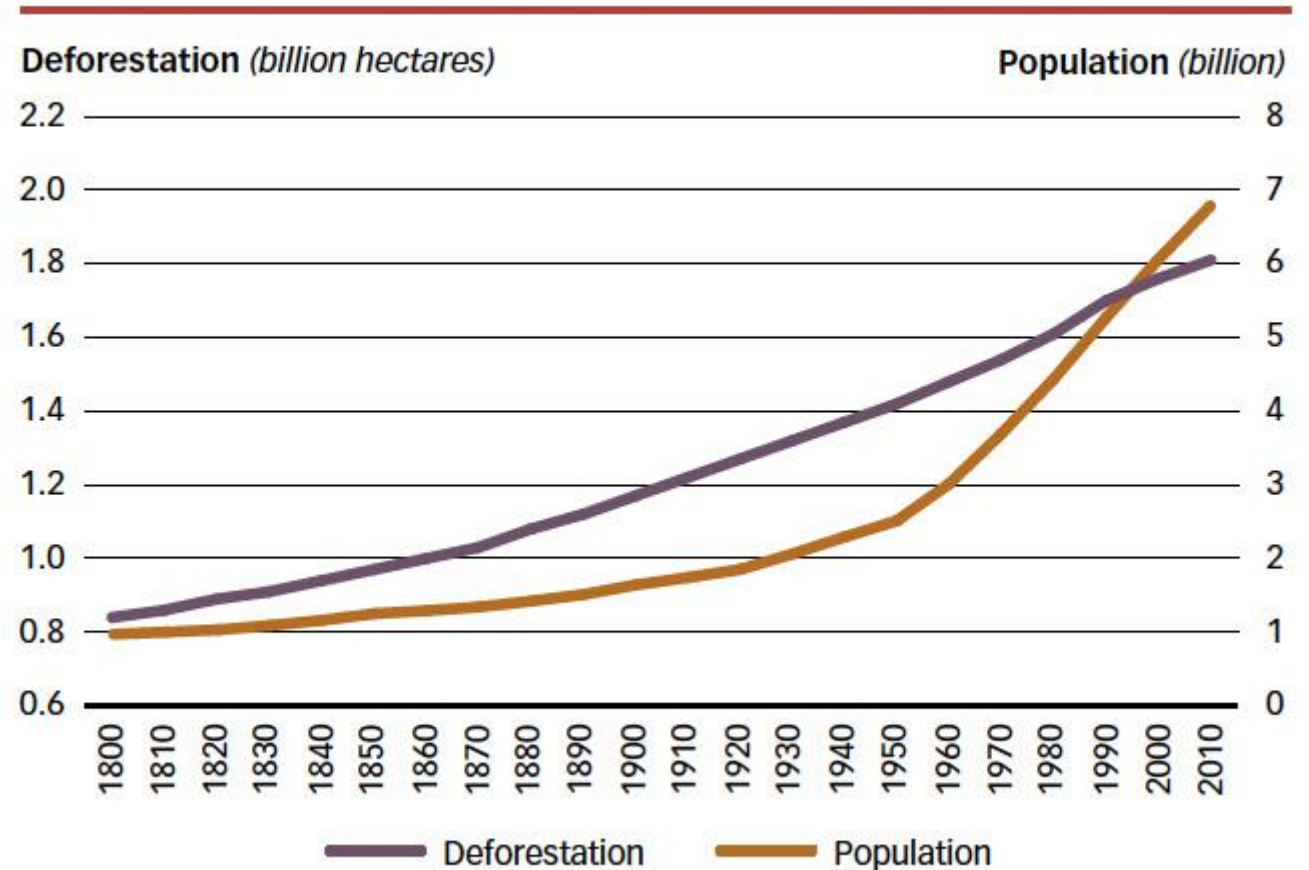
Total areal land use for agriculture, measured as the combination of land for arable farming (cropland) and grazing in hectares.



# Environmental Indicators of Unsustainable Ecological Footprints

- Deforestation

**Figure 1:** World population and cumulative deforestation, 1800 to 2010



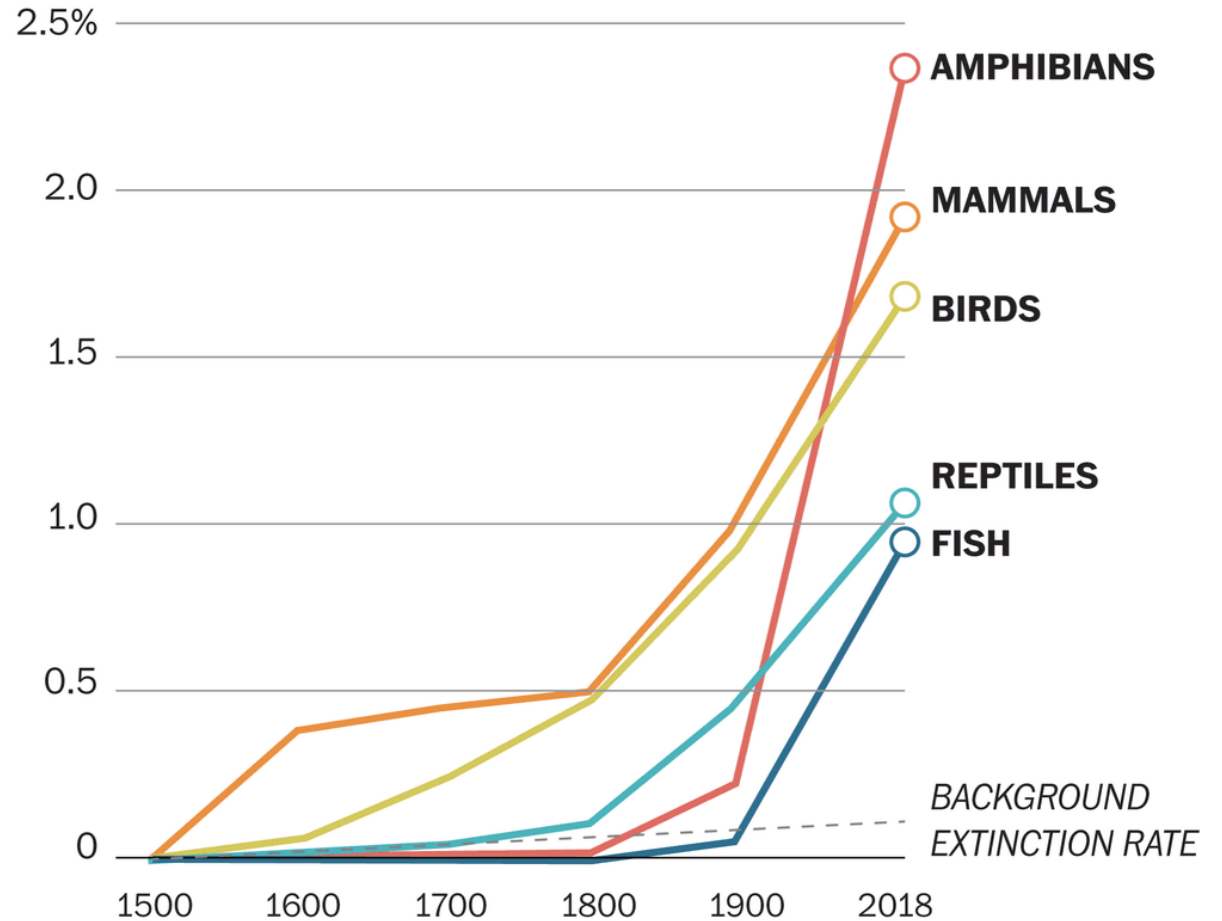
Sources: Williams, 2002; FAO, 2010b; UN, 1999.

# Environmental Indicators of Unsustainable Ecological Footprints

- **Biological Diversity**

## A manmade catastrophe

Cumulative percent of vertebrate species driven to extinction by human activity



Source: IPBES Global Assessment

THE WASHINGTON POST