

Environmental Geography

GGS 103

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Learning Objectives:

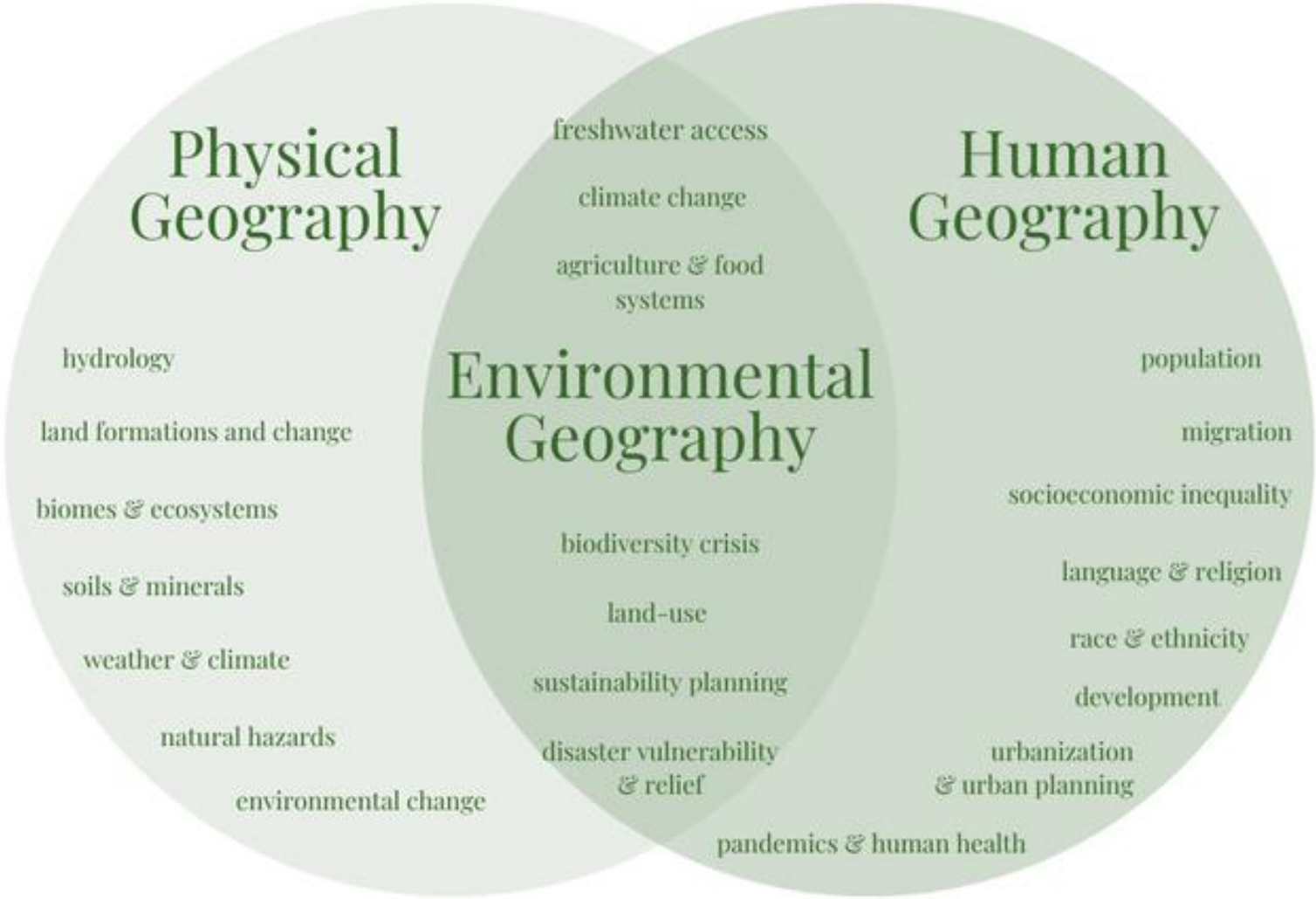
By the end of this lecture, students should be able to:

- **Define** concepts & theories related to human-environment interaction
- **Explain** how humans use and manage natural resources and land
- **Apply** human–environment interaction concepts to real-world examples
- **Analyze** how human activities lead to environmental consequences
- **Evaluate** sustainability using ecological footprint and carrying capacity
- **Synthesize** how culture influences human-environment interactions
- **Assess** environmental inequality using environmental justice concepts

Lecture Outline:

1. Foundations of Environmental Geography: Human-Environment Interaction
2. Human Actions: How Humans Use, Change and Manage the Environment
3. Measuring Human Impact on the Environment
4. The Anthropocene and Environmental Consequences of Human Actions
5. The Relationship Between Natural Environment and Culture
6. Uneven Environmental Impacts and Society

Human and Environmental Geography



Venn diagram illustrating how human geography connects with physical geography to create the field of environmental geography.

Environmental Geography

From a human geography perspective…

- The study of how humans and the natural environment interact
    - *How do humans shape the natural environment—and how does the natural environment shape human life?*

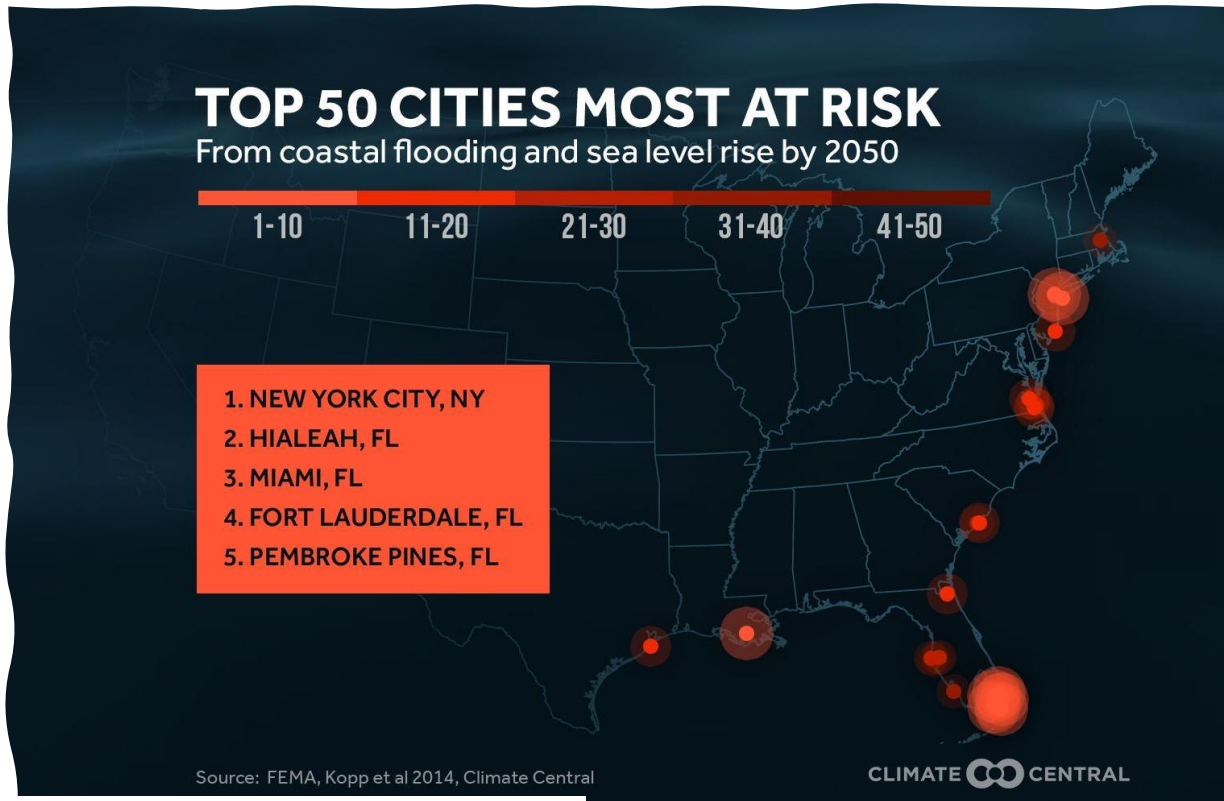
- **Human-Environment Interaction:**
    - Humans **depend** on the environment
      (food, water, resources)
    - Humans **adapt** to environmental conditions
      (climate, terrain)
    - Humans **modify** the environment
      (cities, agriculture, industry)



Drone aerial view of deforestation in the amazon rainforest in Brazil.



Aerial view over Sao Paulo cityscape with buildings invading the forest.



Map of U.S. cities most at risk from projected coastal flooding and sea level rise.

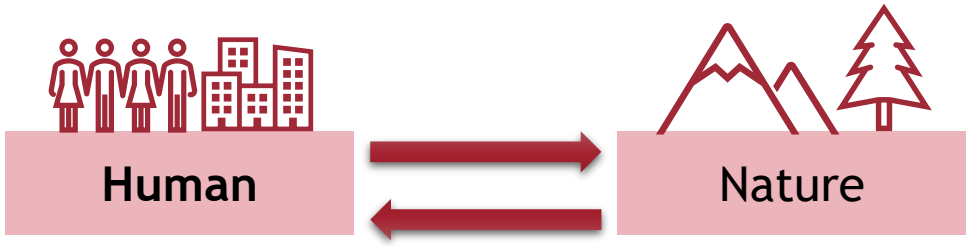
Theories of Human-Environment Interaction

- **Environmental Determinism:**
  - The physical environment (e.g., climate, terrain) **controls** human culture and societal development
    - *Example*: People in very cold climates develop different lifestyles than those in tropical regions



The environment limits human choice and determines behavior.

- **Possibilism:**
  - The environment offers human culture many ways to develop, and **choices** are guided by culture, innovation and technology
    - *Example*: Building cities in deserts using modern technology, irrigation, and air conditioning (e.g., Dubai or Las Vegas)



Humans adapt from opportunities set by the environment.

Human-Environment Interactions: *Dependence*

- Humans **depend** on the natural environment for living necessities
  - Water (drinking, agriculture)
  - Food (crops, livestock, fishing)
  - Natural Resources (wood, minerals, energy)

- Changes in the environment directly affect human life
  - Drought → Food shortages
  - Resource depletion → economic challenges



Fresh water used for agricultural practices.



Examples of natural resources.

Human-Environment Interactions: *Adaptation*

- Humans **adjust** to how they live to fit the environmental conditions
  - Climate (hot, cold, wet, dry)
  - Landforms (mountains, coasts, deserts)
  - Natural Hazards (floods, storms, drought)



Winter dwelling (igloos) in an Eskimo village.



Saudis wearing robes to stay cool in extreme heat (desert climate), comply with Islamic modesty standards, and honor cultural identity.



Houses on stilts to combat flooding in Cambodia.

Human-Environment Interactions: *Modification*

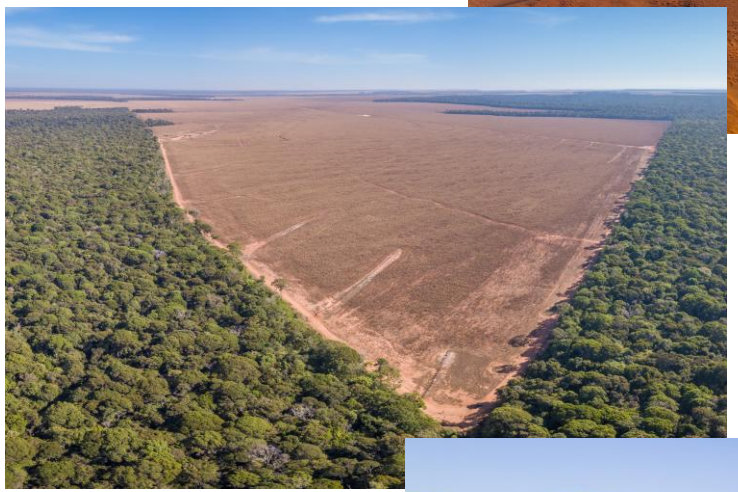
- Humans **change** the environment to suit their needs
  - Building cities and roads
  - Mining for resources
  - Deforestation

- Why do humans modify the environment?
  - Access resources
  - Support growing populations
  - Increase comfort and economic activity

- Impacts can be positive and negative →
  - Improves quality of life vs. environmental issues



Pivot irrigation (agriculture) in the Saudi desert.



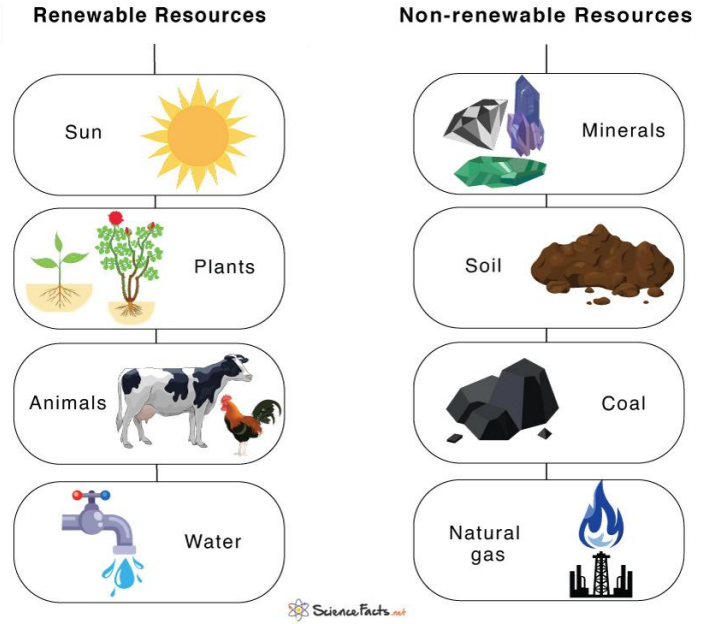
Deforestation – the clearing of forests and trees.



River damming – constructing barriers to store water, providing benefits like hydropower, flood control, irrigation, and water supply.

Human Actions in the Environment

- **Use of Natural Resources:** Materials from the earth humans use to meet needs and support economic activity
  - Types:
    - **Renewable:** can be replenished (solar, wind, water)
    - **Non-renewable:** limited supply (coal, oil, natural gas)
  - Connection to Human-Environment Interaction:
    - Dependence → we rely on these resources
    - Modification → we extract and use them
  - Key issue:
    - Overuse can lead to depletion and environmental damage

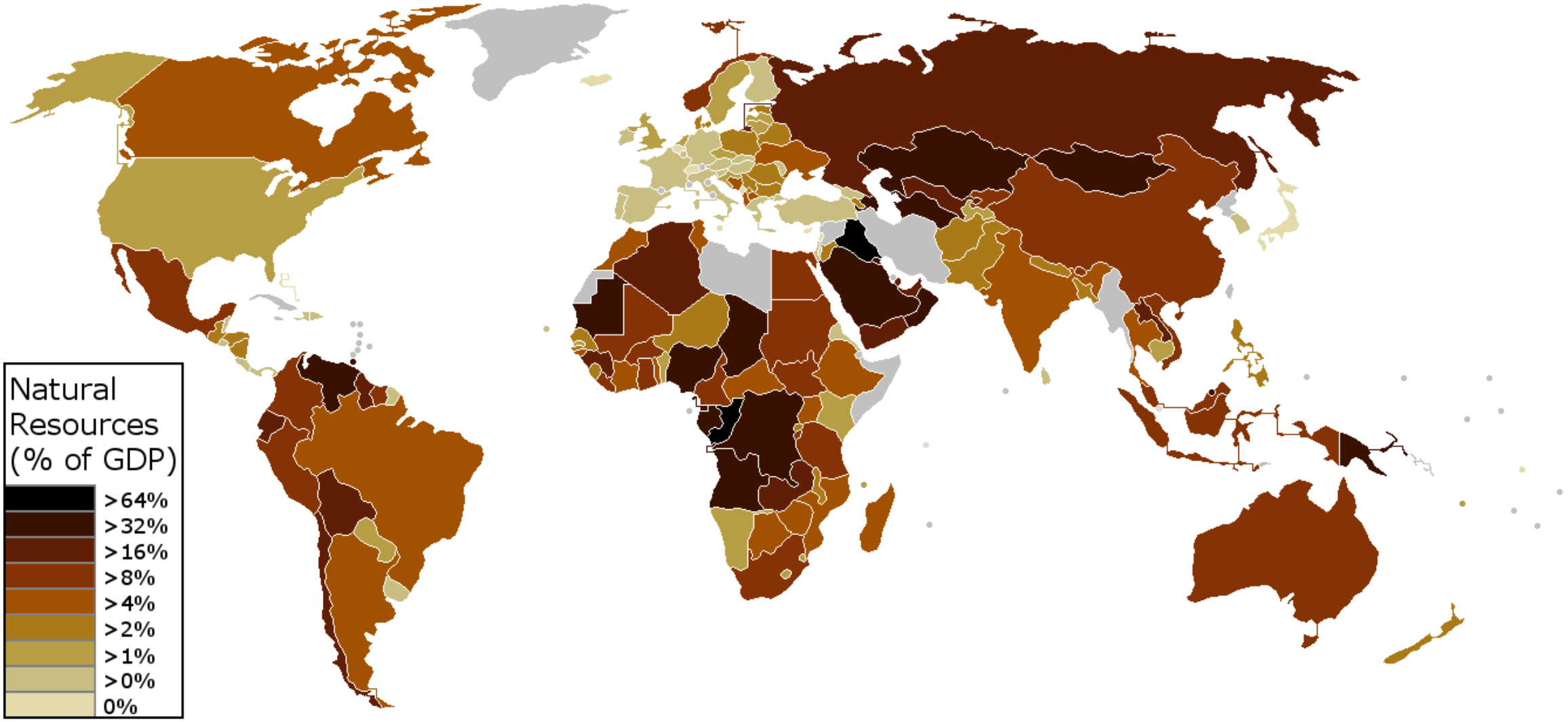


Examples of the different types of natural resources.



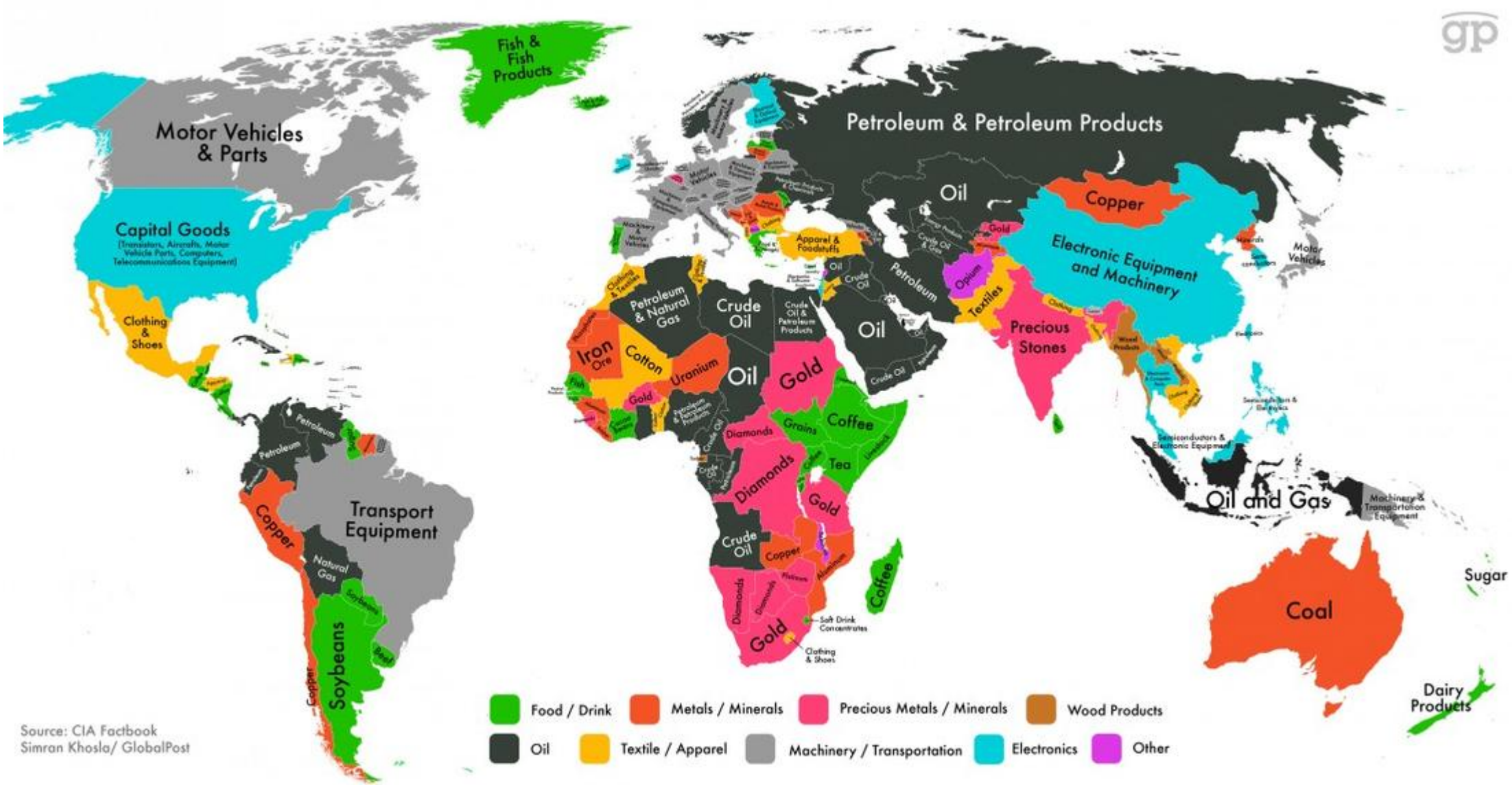
Mining operations at a metal processing facility.

Human Actions in the Environment: *Natural Resources*



World map showing contribution of natural resources to countries' GDP. Map from:
https://www.reddit.com/r/MapPorn/comments/2d460d/contribution_of_natural_resources_to_gdp_1357x617/

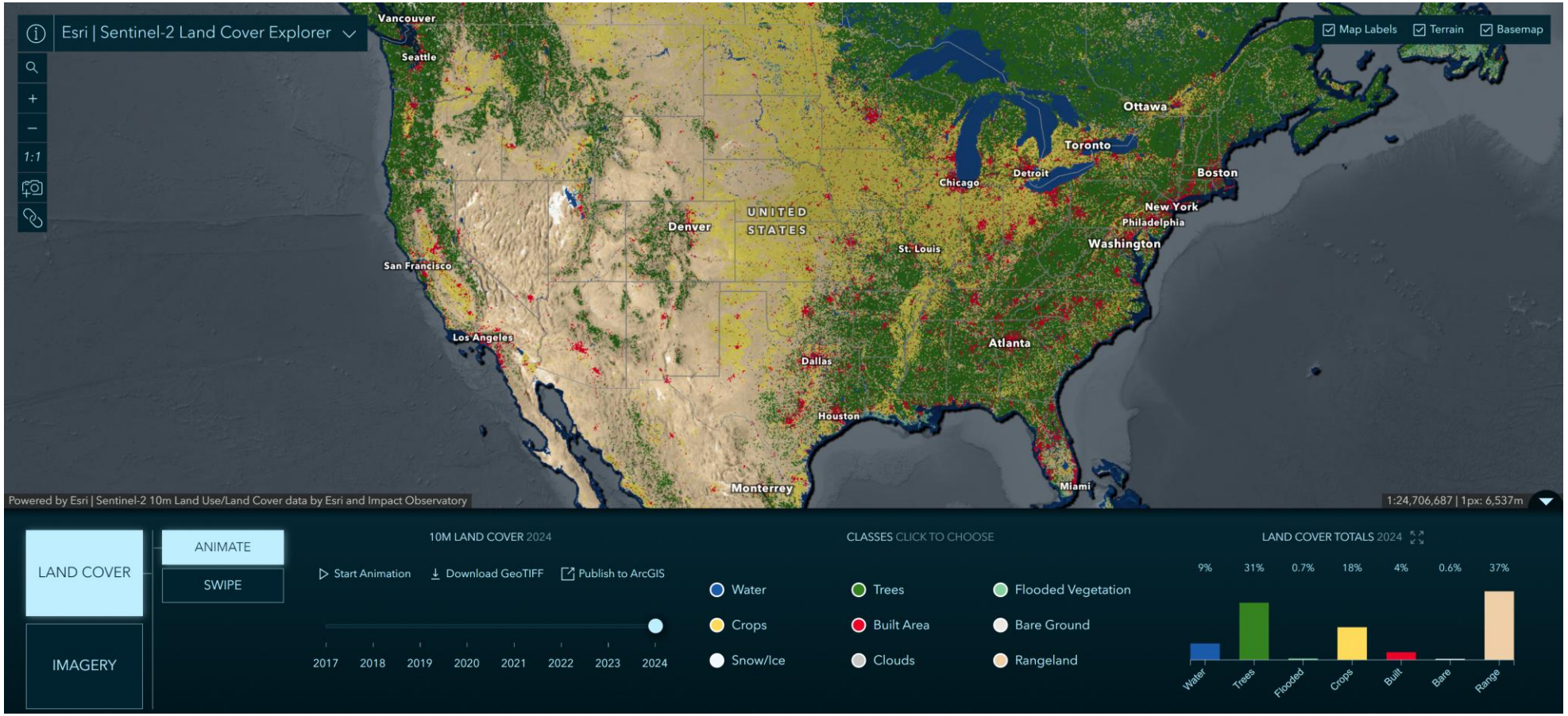
Human Actions in the Environment: *Natural Resources*



Top resources produced by each country, but not all necessarily natural resources.
From: https://dhsworldgeo.weebly.com/lesson-9-resources.html

Human Actions in the Environment

- **Change in Land-Use:** Modifying the land *over-time* for certain usage
  - Can lead to environmental consequences



Interactive land-cover explorer:
https://livingatlas.arcgis.com/landcoverexplorer/

Human Actions in the Environment

- **Managing Resources → Sustainability:** Using resources in a way that meets current needs without depleting them for the future, ensuring long-term availability
  - Renewable energy use
  - Water conservation efforts
  - Sustainable agriculture
  - Green cities

- Connection to Human-Environment Interaction:
  - Management strategy for how we use resources
  - Helps reduce negative impacts of human modification



Wind turbines used for renewable energy.



Sustainable agriculture methods.



Reducing waste: Recycling plastics.

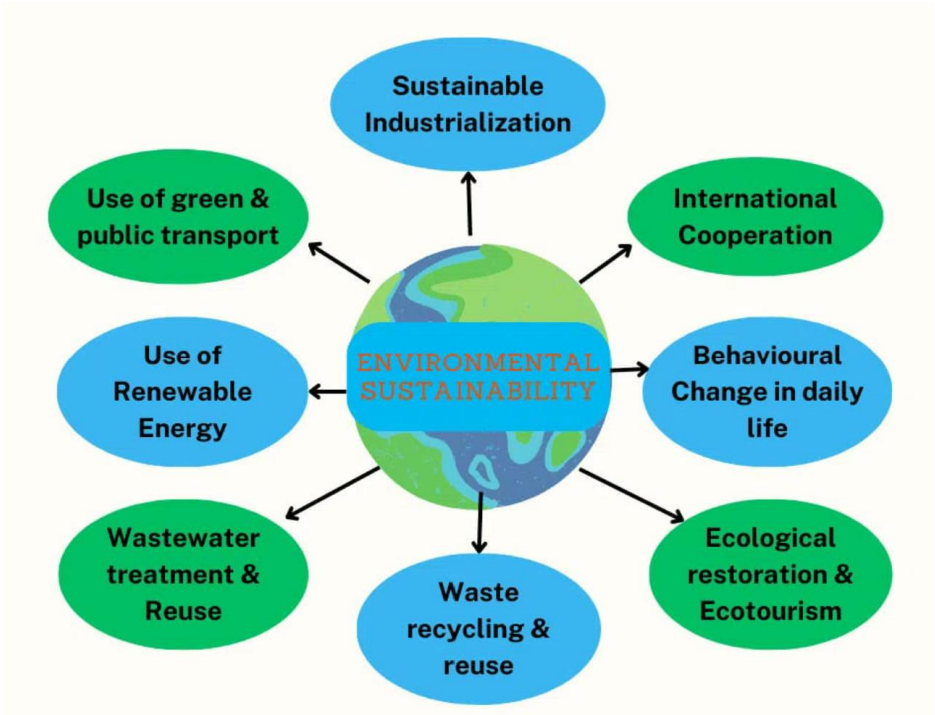
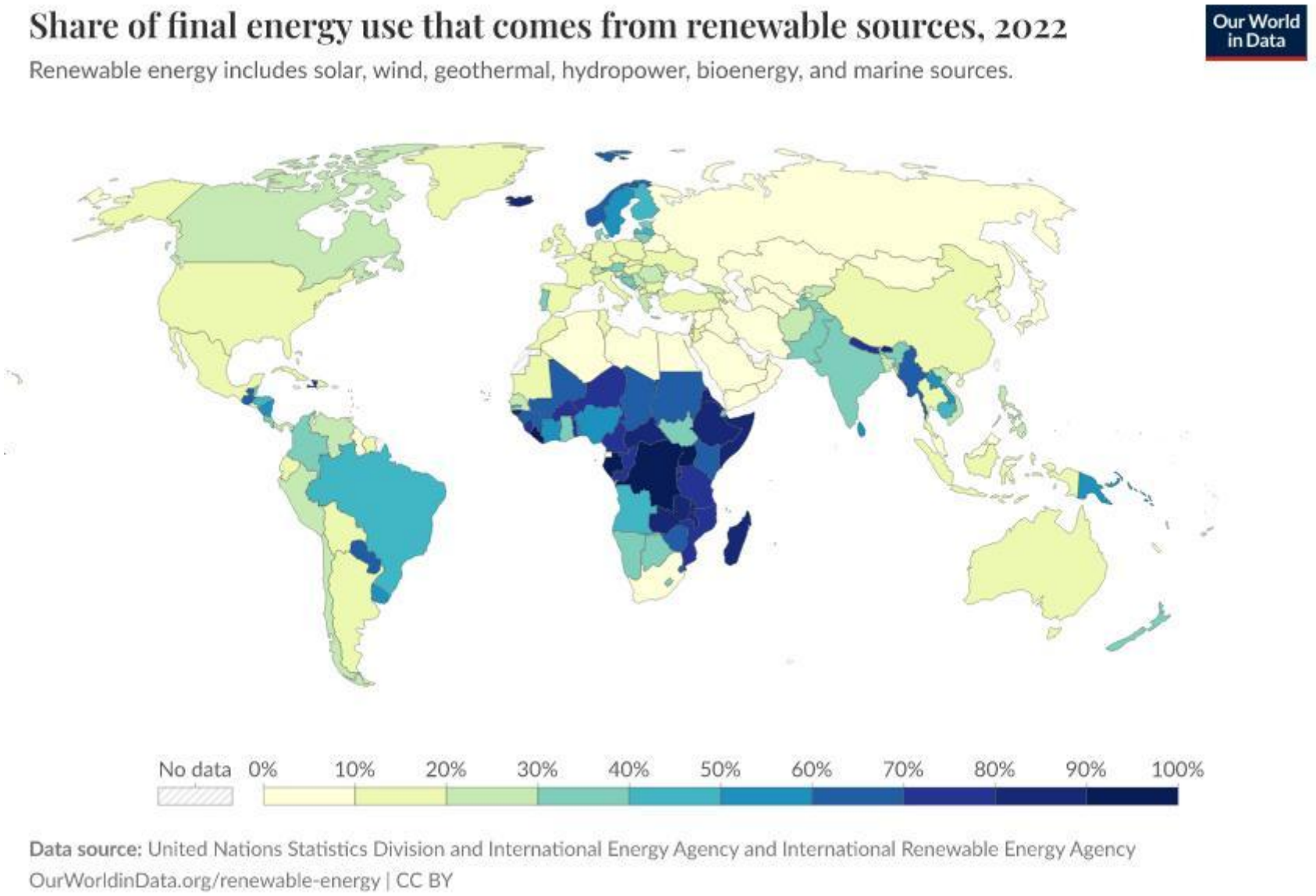


Diagram of key components of Environmental Sustainability, highlighting actions needed to protect the planet's resources and ecosystems.

Human Actions in the Environment: *Sustainability*



Human impact on the environment is uneven across the world and often leads to unsustainable resource uses

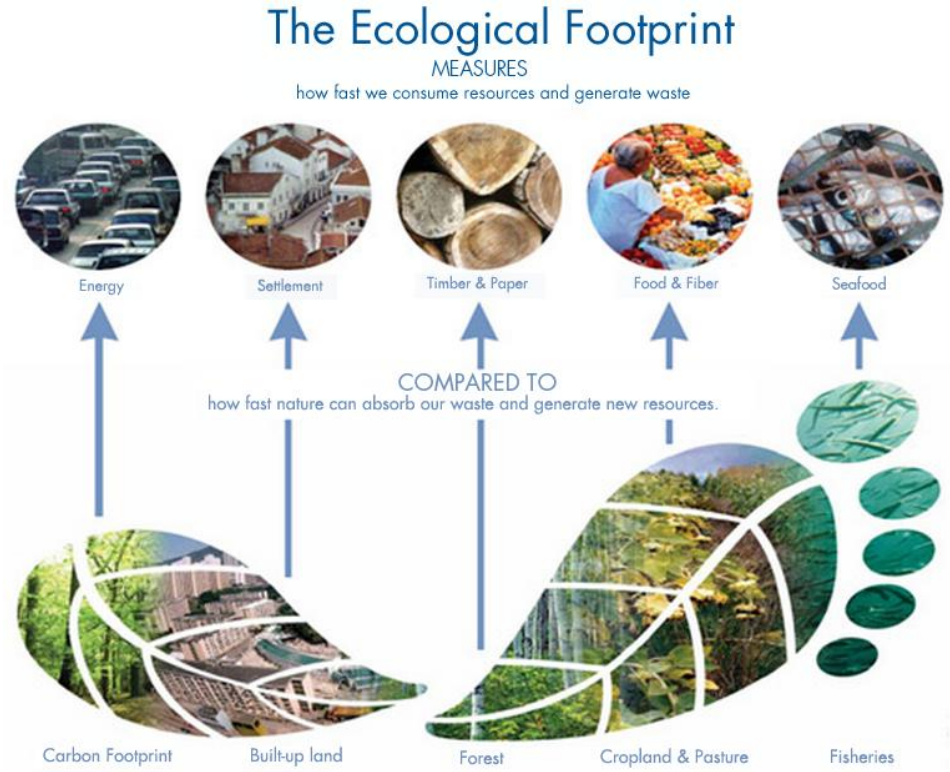
Global map of percentage of energy from renewable resources.

Ecological Footprint

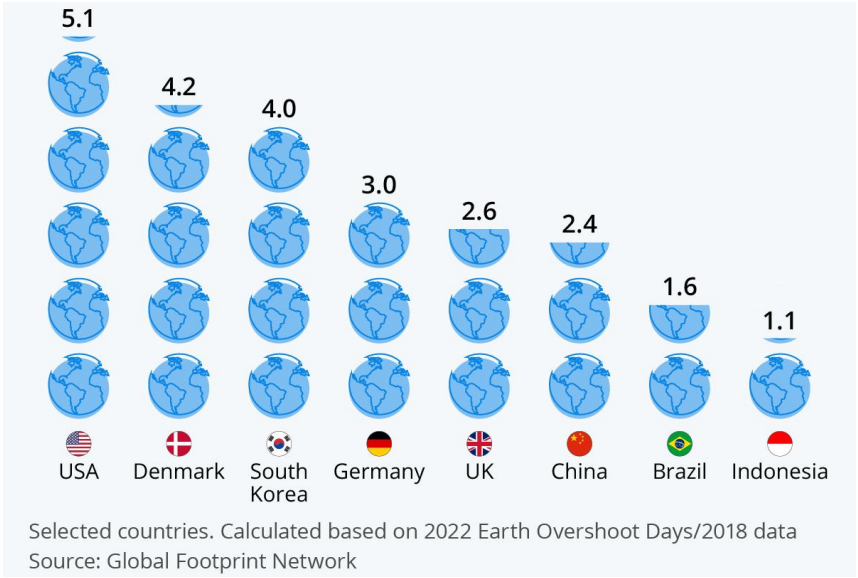
- **Ecological footprint:** the amount of land and resources needed to support a person's lifestyle
- Measures energy use, food consumption, water use, waste production and other resources

- If everyone lived like people did in high-income countries, then we would need multiple Earths….
  - Calculate this yourself! https://www.footprintcalculator.org/home/en

- Large ecological footprints are **not sustainable long-term**

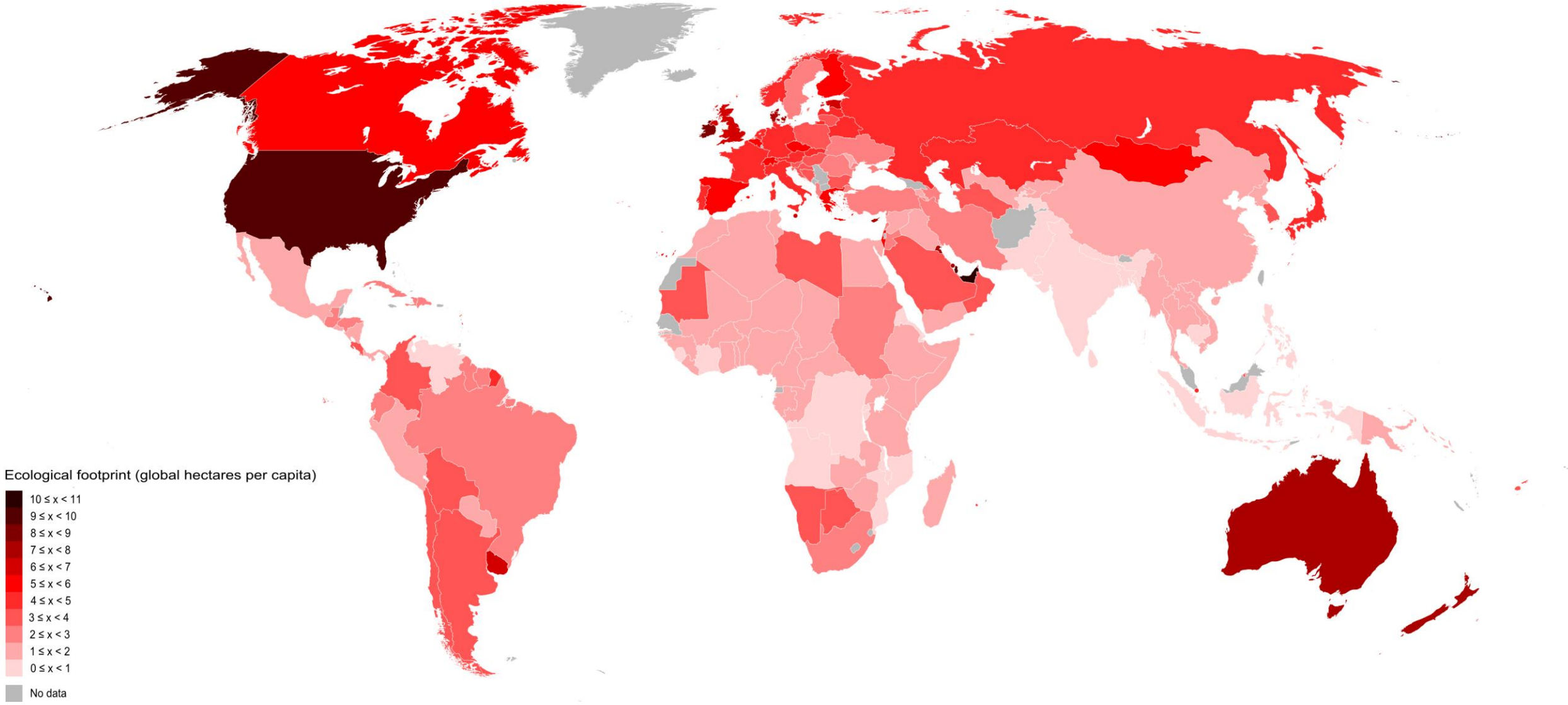


Infographic describing an ecological footprint.



The world is not enough: number of Earths and its resources needed if the world's population lived like the following countries.

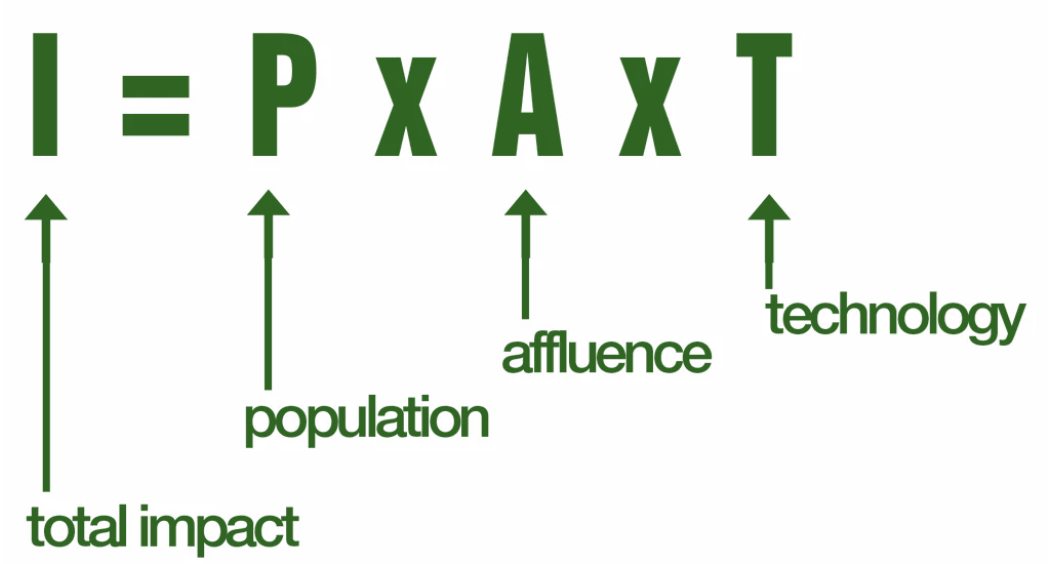
Ecological Footprint



Global map of the calculated ecological footprint by country.

IPAT Framework

- Formula introduced in 1970s that models human impact as a product of **population, affluence, and technology**
  - **Impact (I):** The overall environmental impact, such as pollution, resource depletion, or ecological damage.
  - **Population (P):** The total number of people in a given area.
    - *More people = greater resource use*
  - **Affluence (A):** The level of consumption per person, often measured by GDP per capita or resource usage.
    - *Wealthier life-styles = more consumption and using energy/resources*
  - **Technology (T):** The efficiency of resources required to meet consumption, or the impact per unit of consumption (e.g., carbon intensity).
    - *Less efficient technology = greater environmental damage*



IPAT formula.

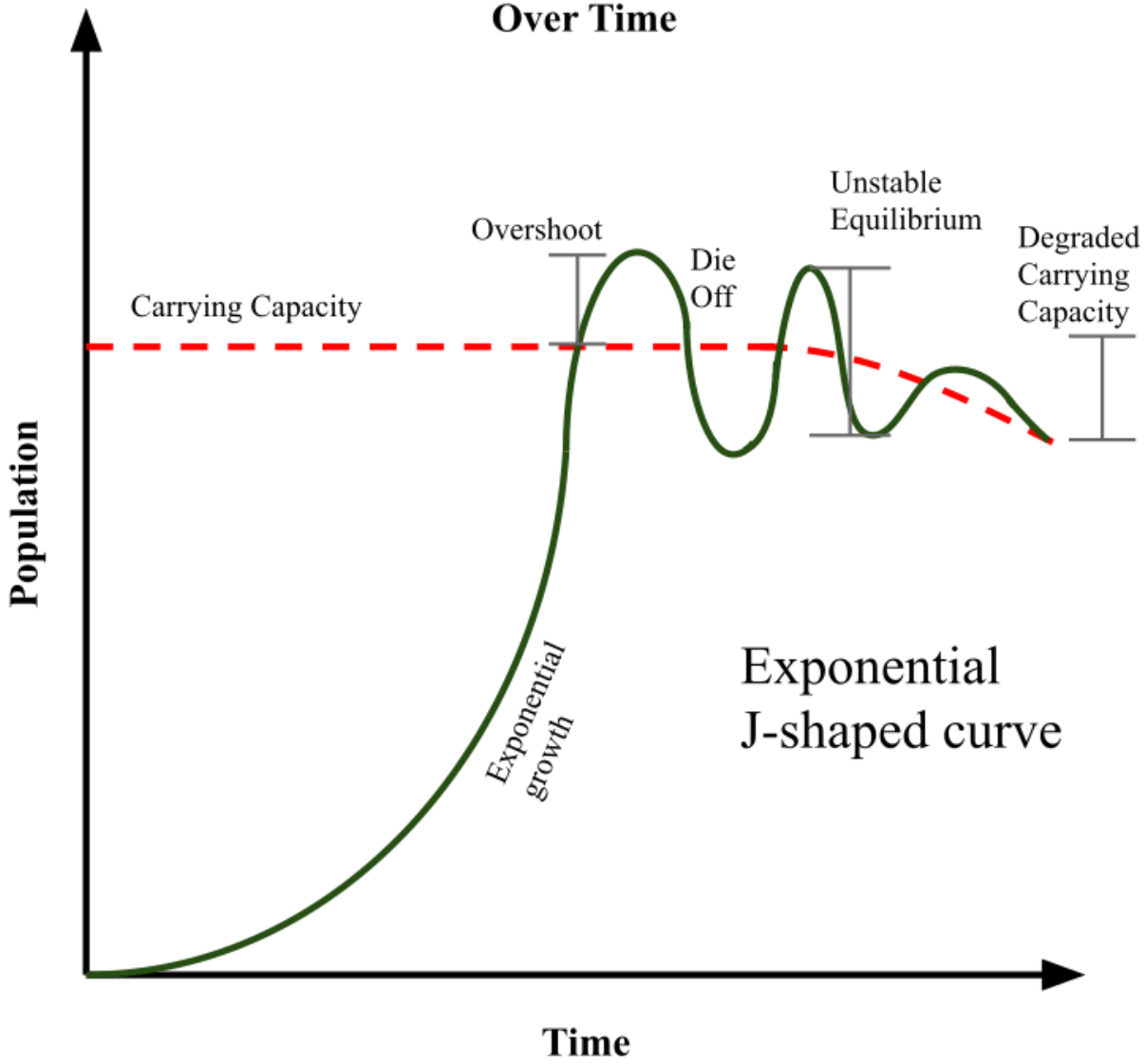


https://www.youtube.com/watch?v=Z1haK55QKJ8

Carrying Capacity

- **Carrying Capacity:** The maximum population a species can sustain in a given environment
- Depends on food, water, habitat and other resources
- Exceeding it = environmental degradation, consequences and stress on human systems

Figure 1: Exponential Growth of Population Size Over Time



Carrying capacity is the amount of organisms within a region that the environment can support sustainably

Overshoot occurs when the population growth exceeds the carrying capacity, leading to a die off for the individuals in the population

Unstable equilibrium is the fluctuation of the population above and below the carrying capacity, changing based on the relationship between natality and mortality

Degraded carrying capacity may be due to resource destruction during an overshoot, carrying capacity is not static

Graphical representation of carrying capacity.

Tragedy of the Commons

- **Tragedy of the Commons:** an economic theory stating that individuals will overexploit shared, finite resources, leading to their depletion and total collapse
  - Commons = resources shared by everyone (land, water, forests, etc.)
  - Problem: Individuals using too much of a shared resource = depletion
  - Solution: Regulate or privatize resources



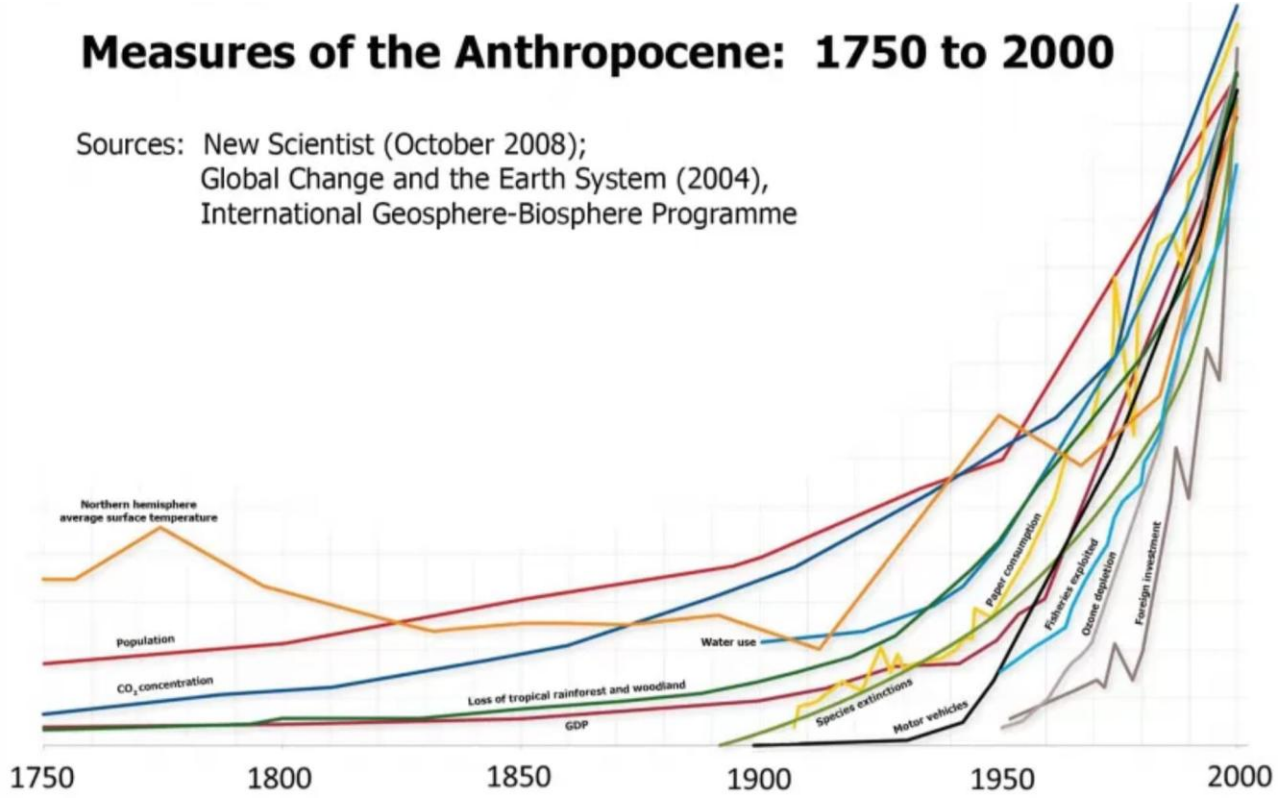
Example of tragedy of the commons: overfishing leading to a substantial decline in fish landings starting in 1992.



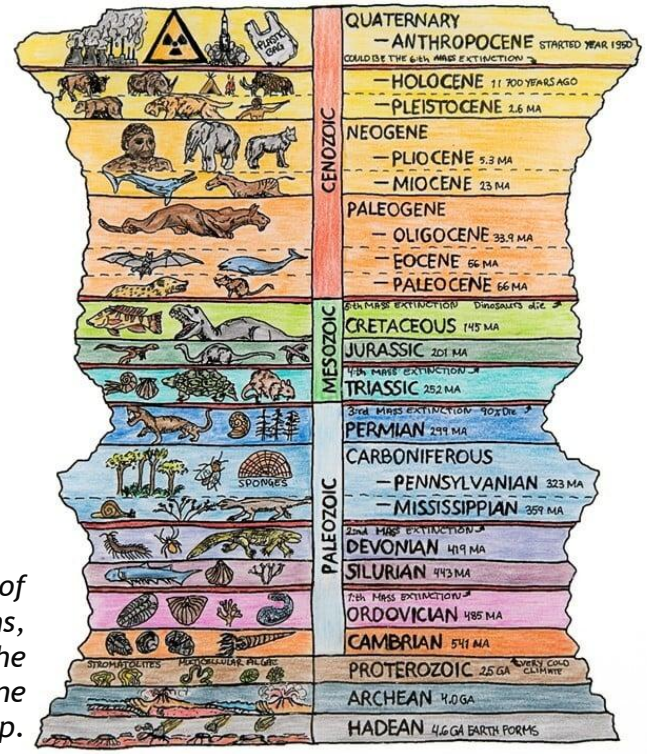
More information about tragedy of the commons: https://www.youtube.com/watch?v=jSuETYEgY68 .

Anthropocene

- The **Anthropocene** is an *unofficial* geological epoch, where human activity became the dominant influence on Earth's atmosphere, oceans, and ecosystems
- Represent a shift from human-environment interaction to human *domination* of global geophysical processes
  - Evident in global environmental consequences (e.g., deforestation)
- The **"Great Acceleration"** (c. 1950): The sudden, steep rise in human impact indicators, such as population growth, industrialization, and urbanization



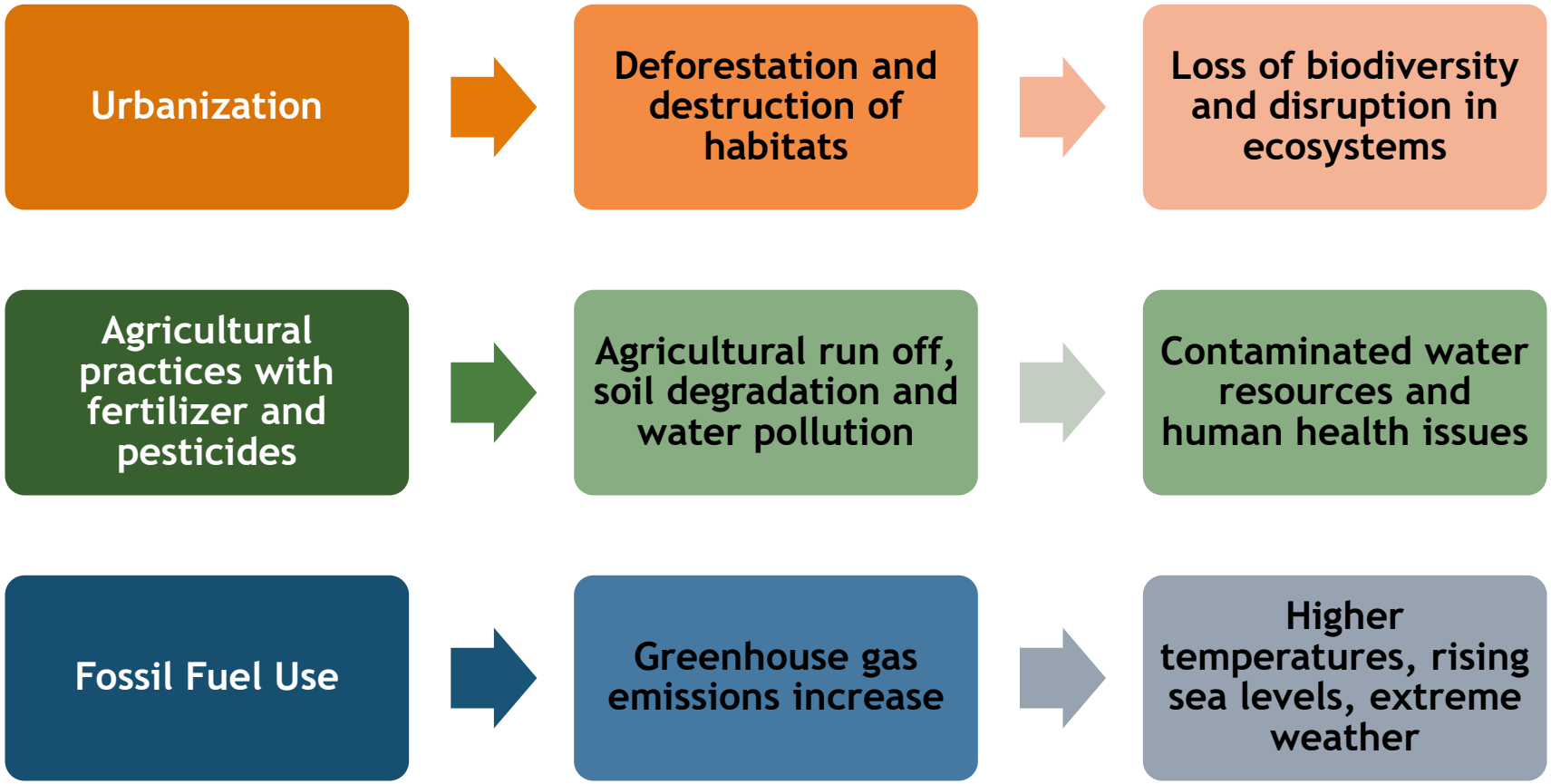
Graph illustrating the "Great Acceleration" and example measures starting to increase around 1950.



Representation of geological epochs, with the Anthropocene listed at top.

Human's Influence and Environmental Consequences

- Human actions create **chain reactions** that impact both the environment and society
  - Often multifaceted, complex feedback loops
  - Key consequences include: *resource depletion, pollution, ecosystem disruption and climate change*



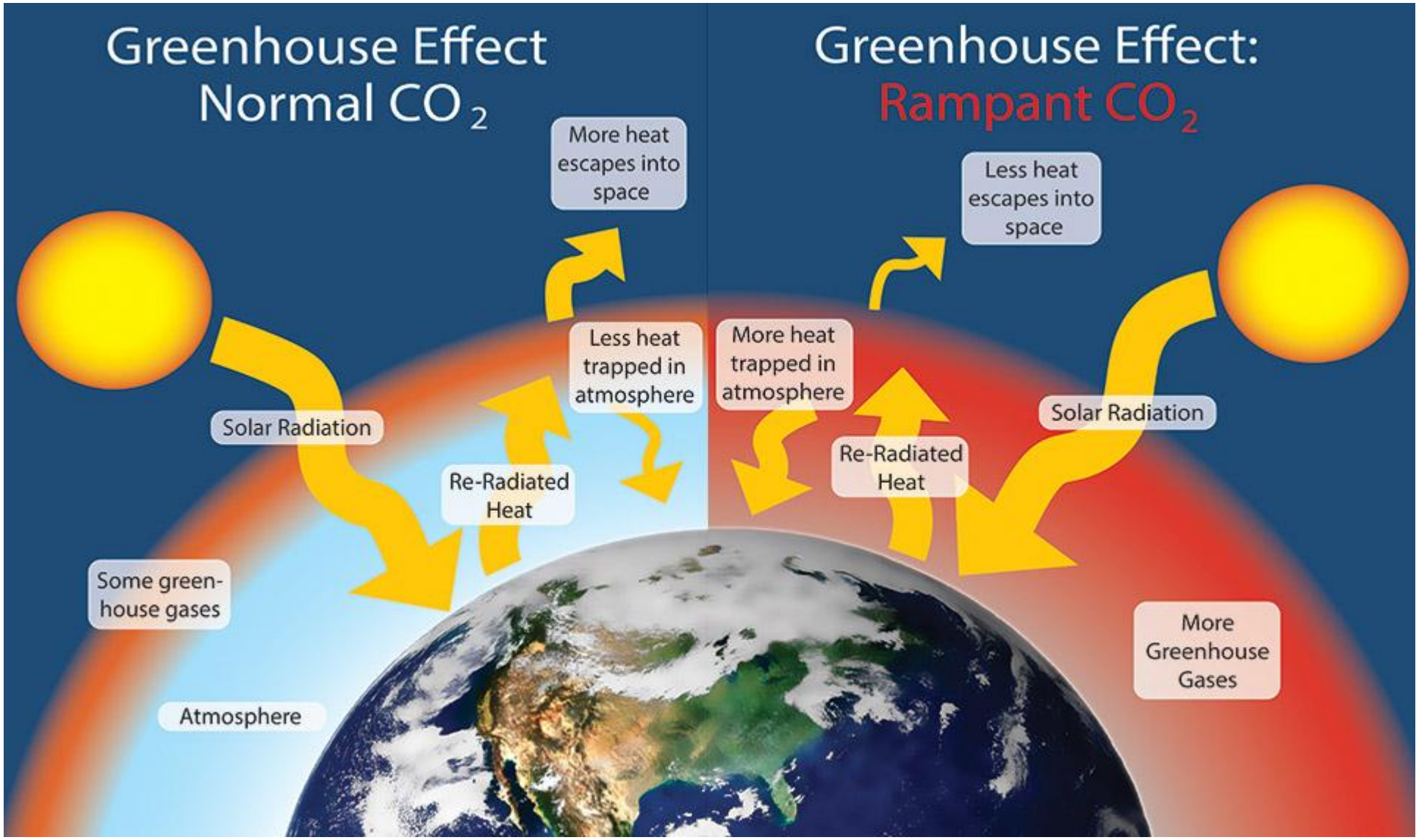
Human's Influence and Environmental Consequences

- Many global environmental challenges exist, but we will only focus on a few…



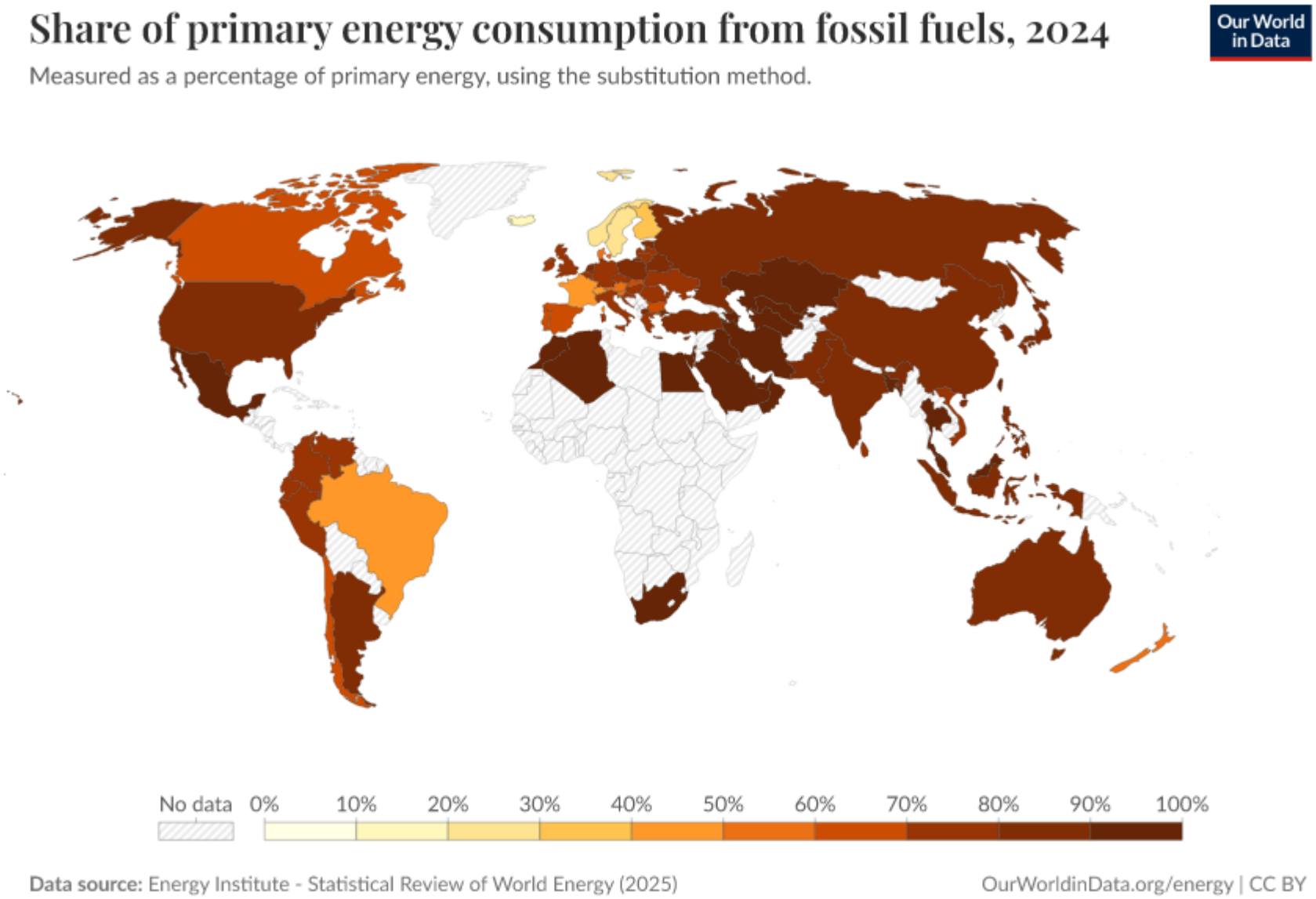
https://www.youtube.com/watch?v=jPwAXSZ6uww

Environmental Challenges: *Climate Change*



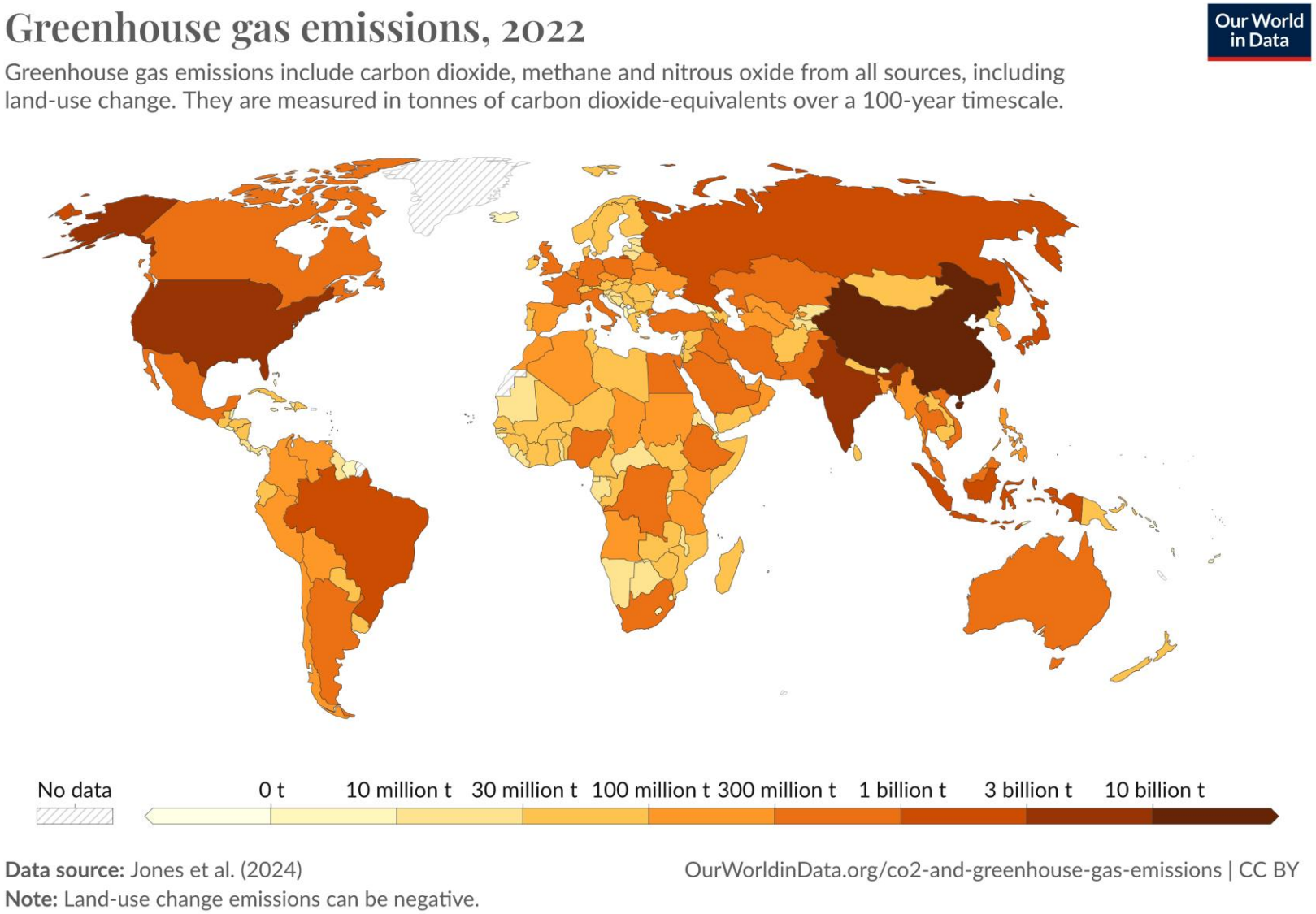
Infographic describing how climate change is accelerated by human-induced activities.

Environmental Challenges: *Fossil Fuels*



Fossil fuel usage across the world.

Environmental Challenges: *Greenhouse Gases*



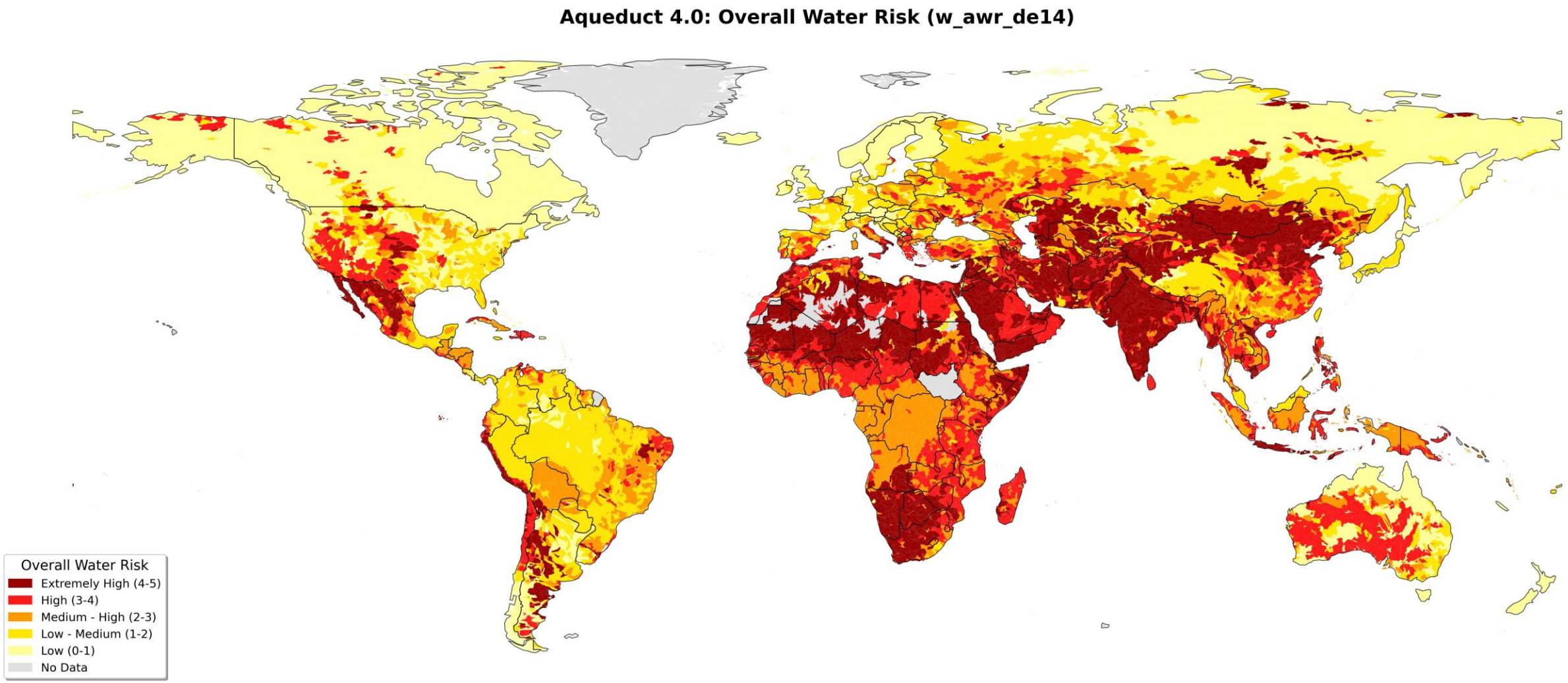
Greenhouse gas emissions across the world.

Environmental Challenges: *Sea Level Rise*



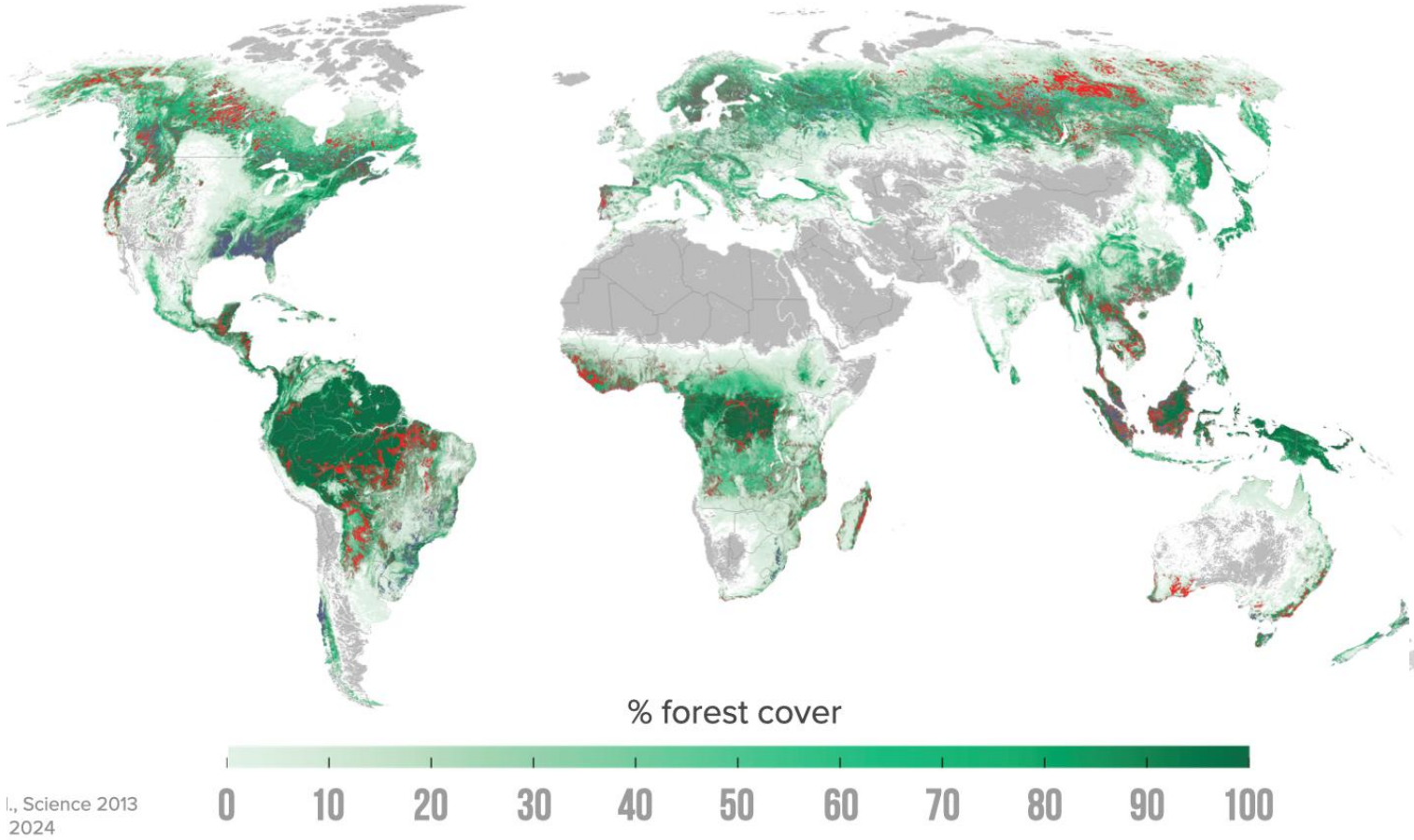
https://www.youtube.com/watch?v=6tesHVSZJOg

Environmental Challenges: *Water Scarcity and Quality*

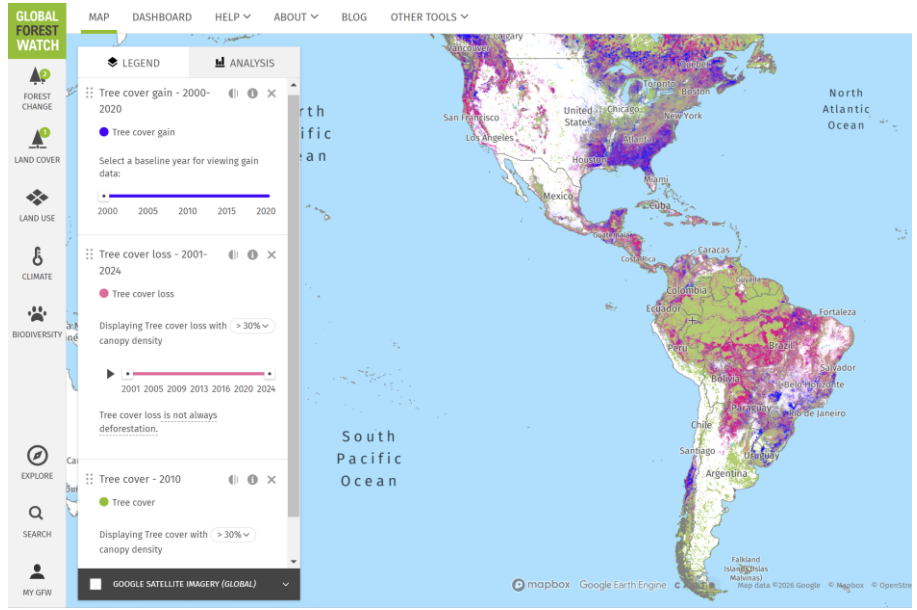


Overall water risk, reflecting the value of physical water quantity, water quality, and regulatory and reputational risks. From:
https://eos.org/research-and-developments/we-are-living-beyond-our-hydrological-means-un-report-warns

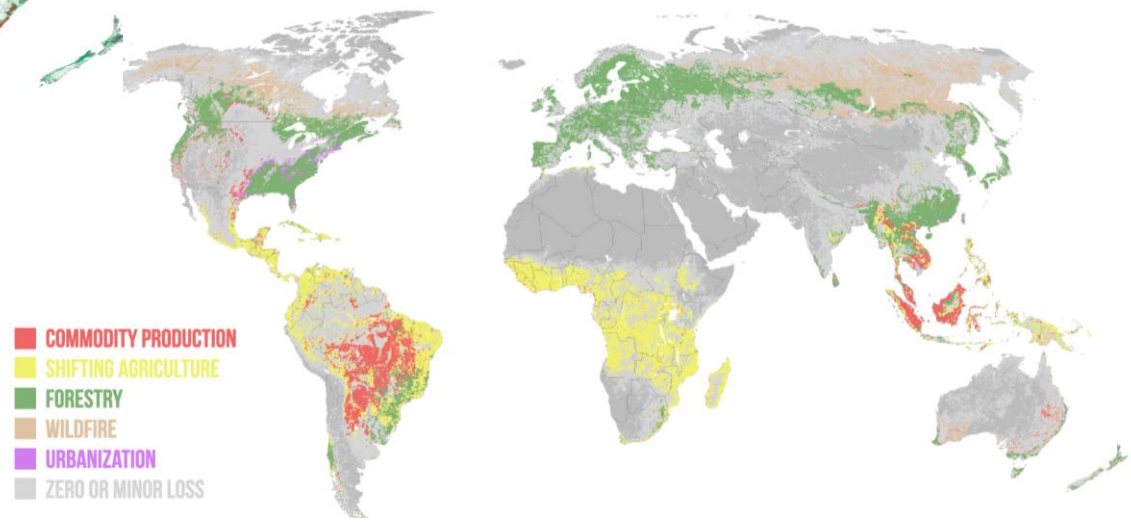
Environmental Challenges: *Deforestation*



Global map of forest cover, and areas in red showing where deforestation is occurring.
From: https://drawdown.org/insights/how-stopping-deforestation-is-a-powerful-emergency-brake-climate-solution

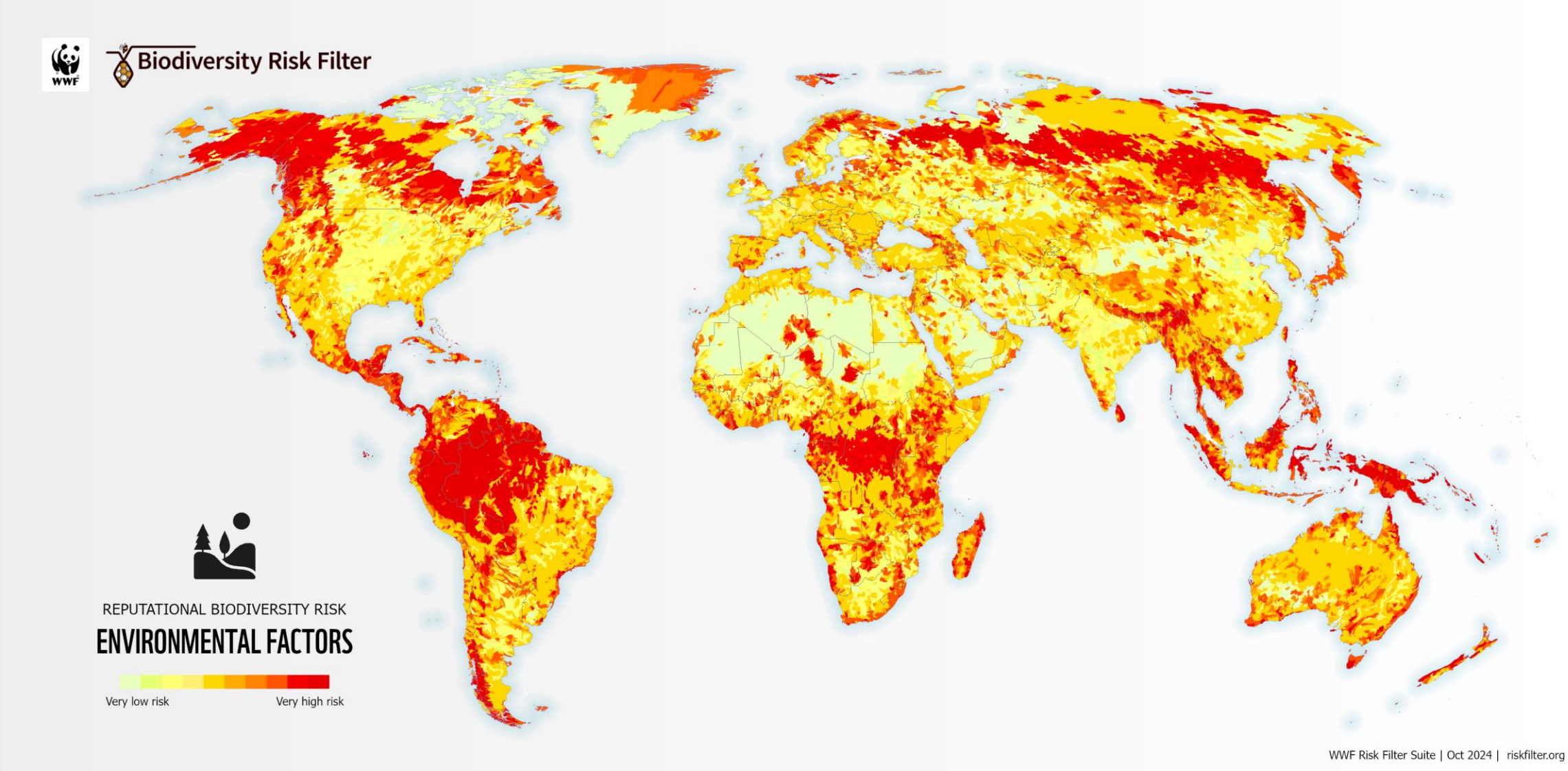


Interactive global map with deforestation layers:
https://www.globalforestwatch.org/map/



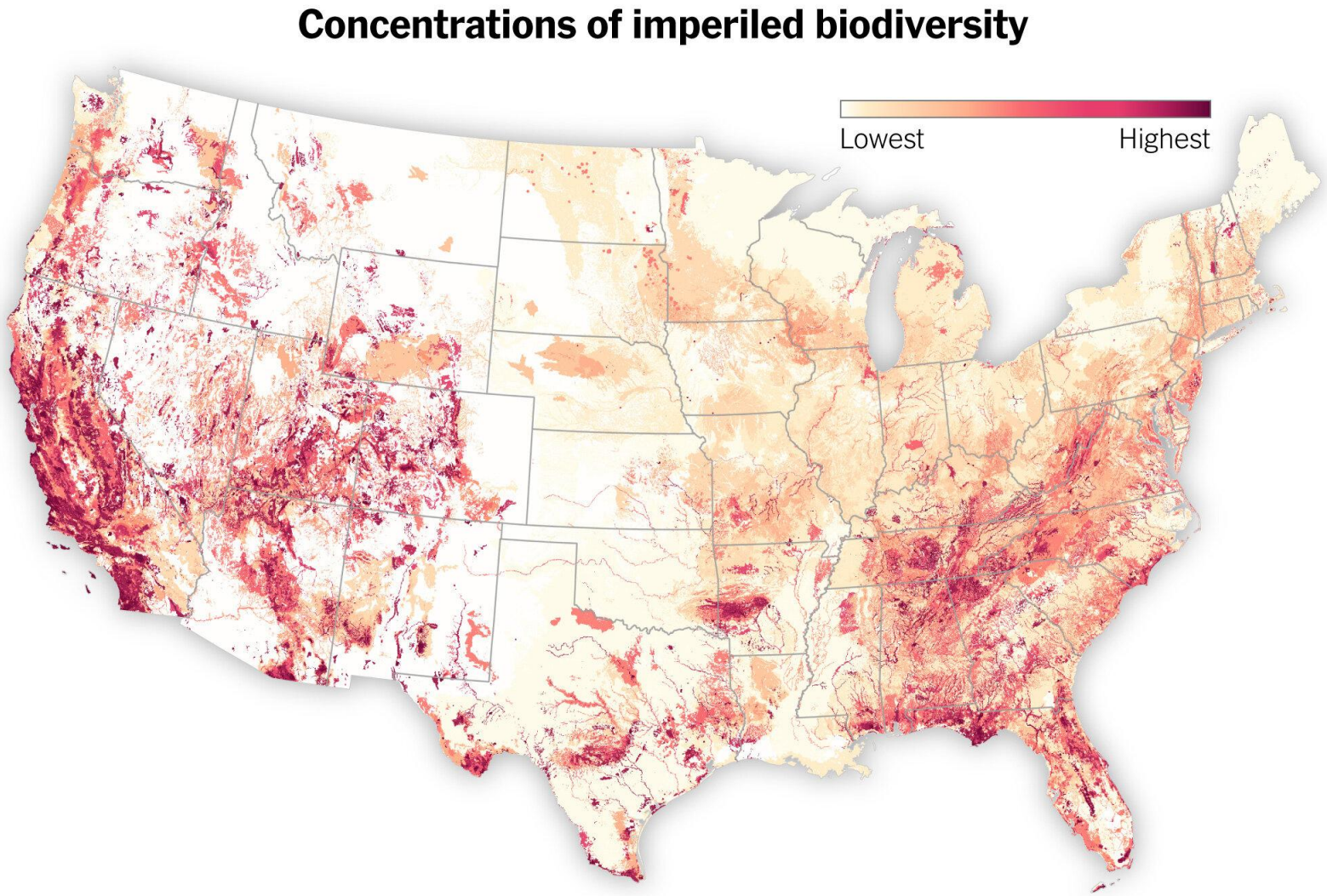
Primary drivers of deforestation across the globe.
From: https://drawdown.org/insights/how-stopping-deforestation-is-a-powerful-emergency-brake-climate-solution

Environmental Challenges: *Biodiversity*



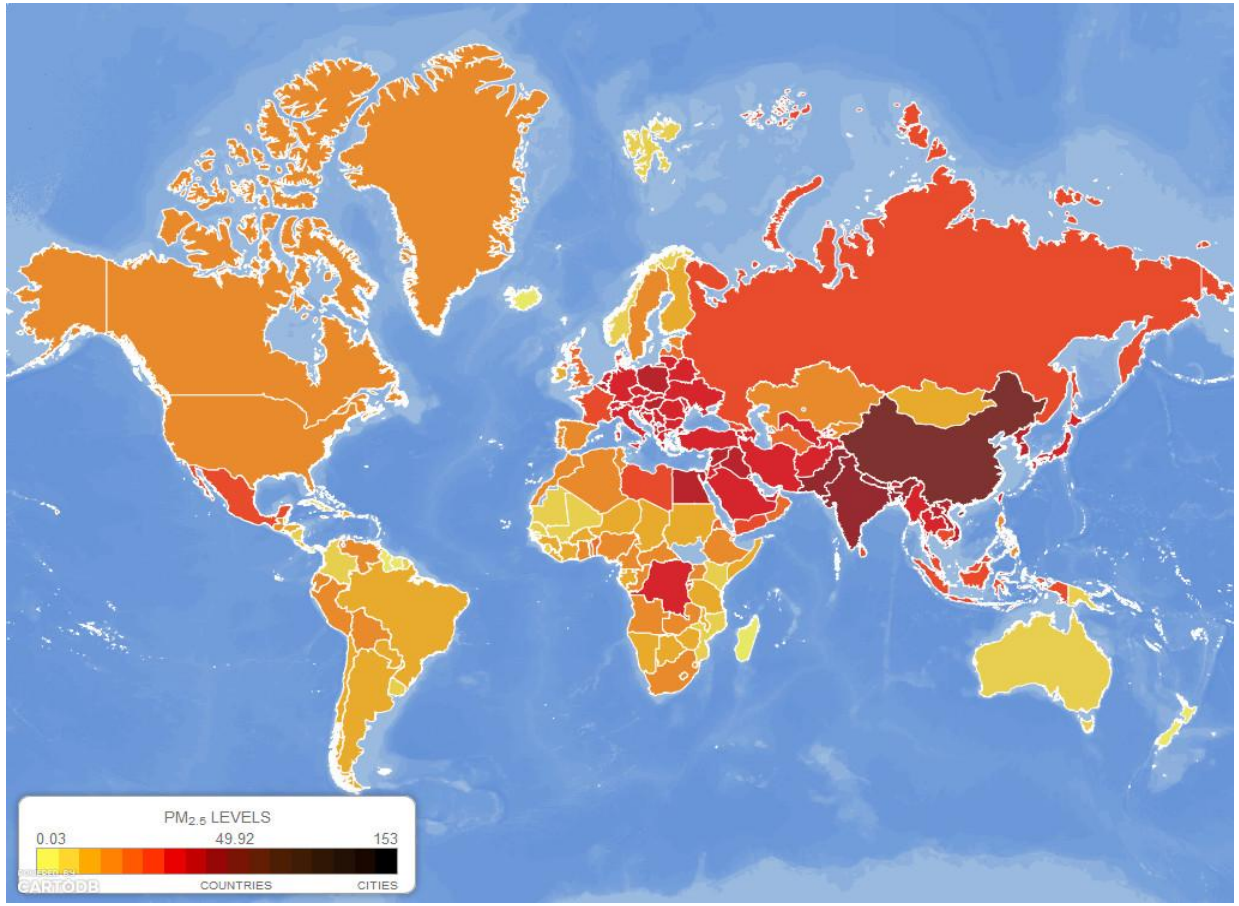
Global map of biodiversity risk based on environmental factors. Also an interactive map, from: https://riskfilter.org/biodiversity/explore/map

Environmental Challenges: *Biodiversity*

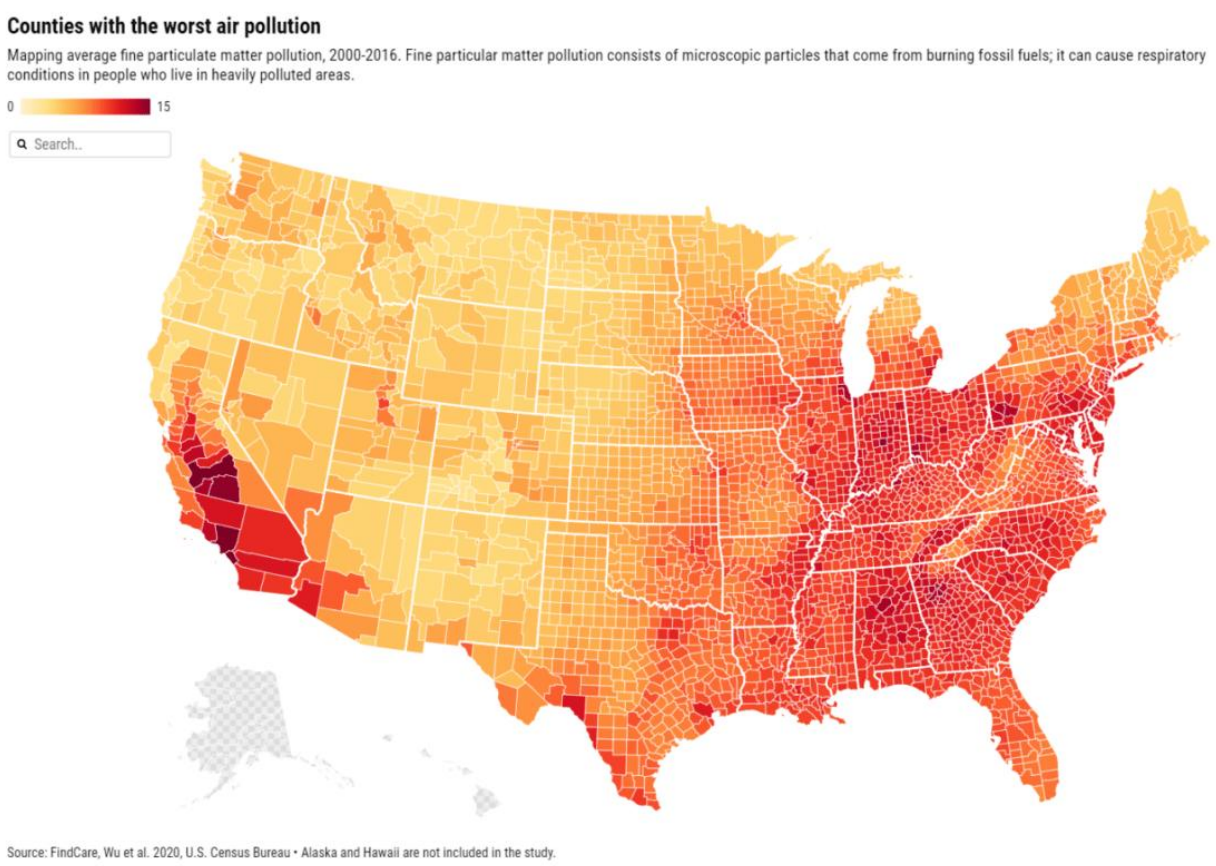


Map of where biodiversity is at the highest risk in the US. From:
https://www.nytimes.com/interactive/2022/03/03/climate/biodiversity-map.html

Environmental Challenges: *Air Pollution*



Air pollution across countries.
From: https://www.ecoclimax.com/2015/08/mapping-global-air-pollution-down-to.html



Air pollution across US counties.
From: https://www.healthline.com/health/allergic-asthma/air-pollution#air-pollution-map

Dynamic, Interactive Map: *www.iqair.com/us/air-quality-map*

The Natural Environment and Culture

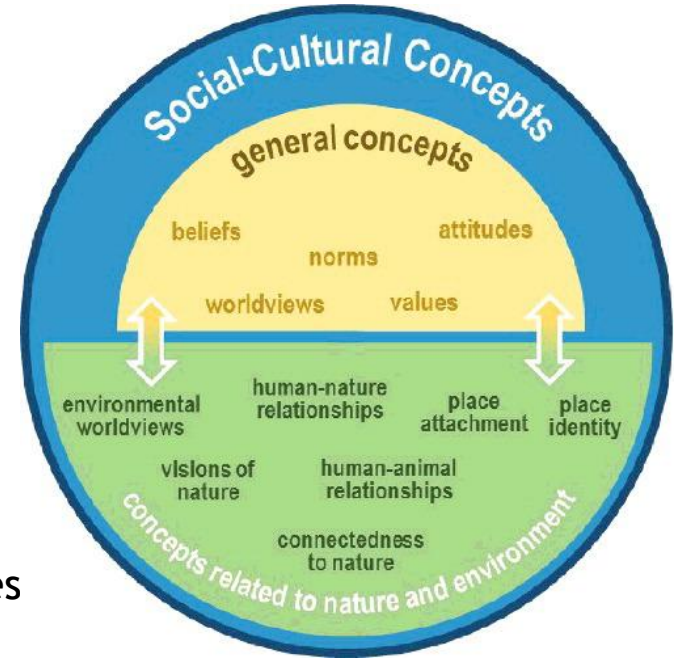
- Human impact on the environment is shaped by cultural perspectives → *How societies view nature influences whether their actions are sustainable or not*
  - **Integrated** view: Nature is part of human life → encourages careful, sustainable use
  - **Dominance** view: Nature exists for human use → can lead to unsustainable misuse



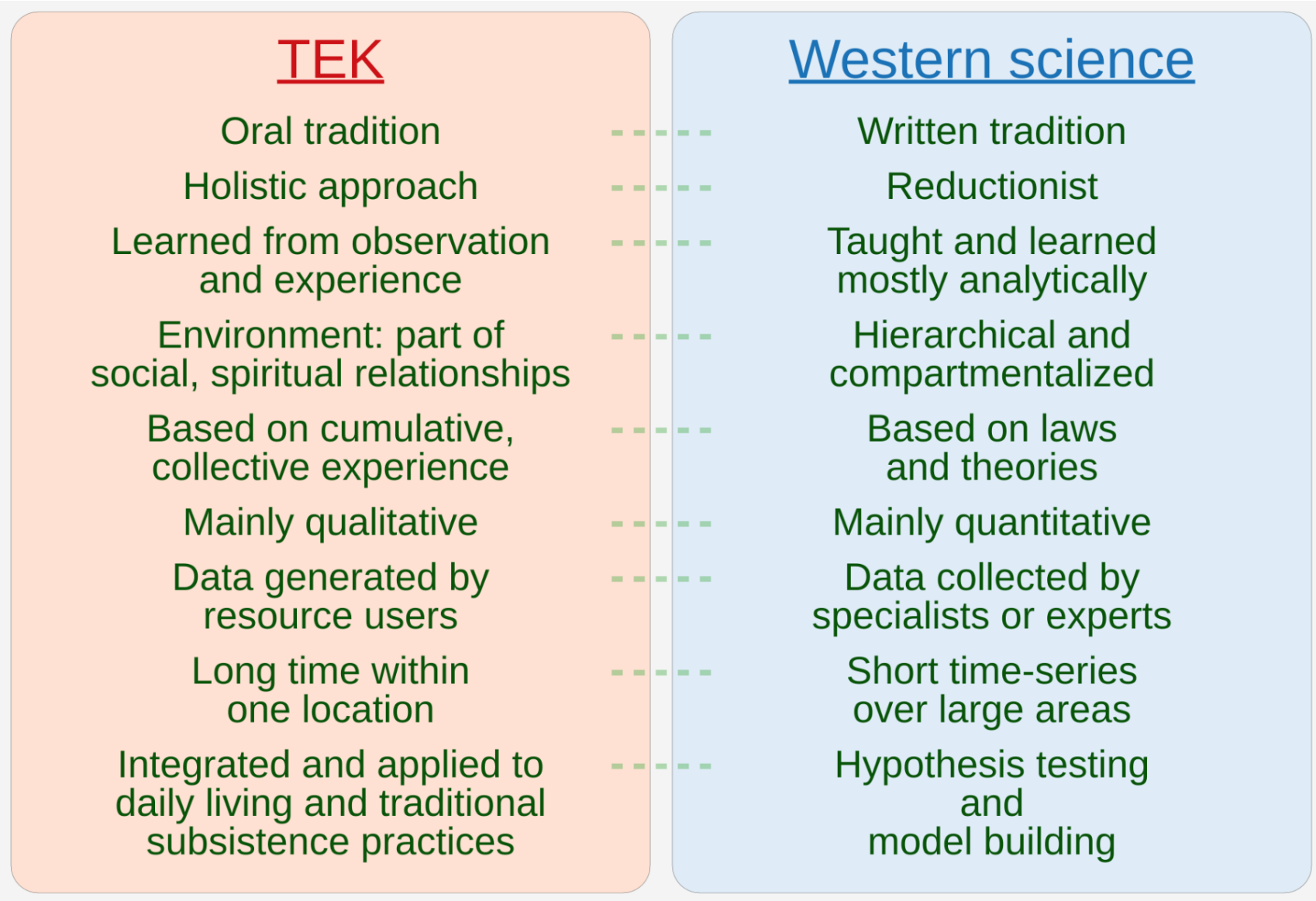
Interviews of individuals from the Great Bear Rainforest of Canada, showcasing the concepts, importance and value of TEK.

https://youtu.be/1QRpnHoGivk

- **Traditional Ecological Knowledge (TEK):**
  - Knowledge of the environment from direct long-term interaction
  - Passed orally through generations
  - Guides long-term adaptation, sustainability and resource management
  - Often tied to cultural identity, spirituality, and community practices
  - Combines empirical observations (e.g., animal migration) with cultural values
  - Place-Based: tied to a locality and local landscape
  - Differs from western science, but often integrated to improve environmental practices



The Natural Environment and Culture



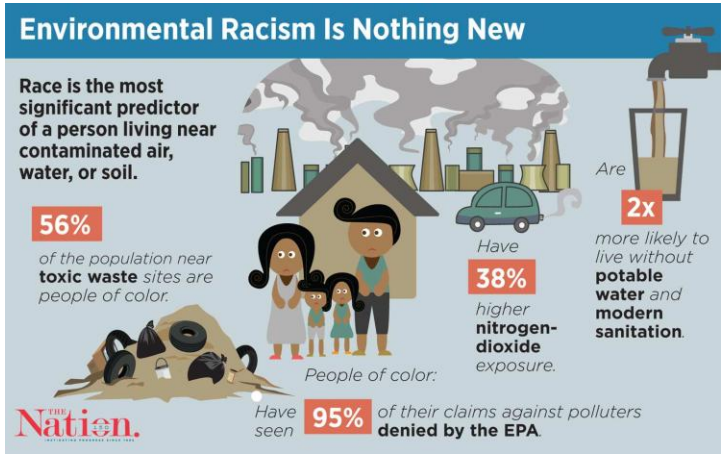
Difference between TEK and western science.

Environmental (in)Justice

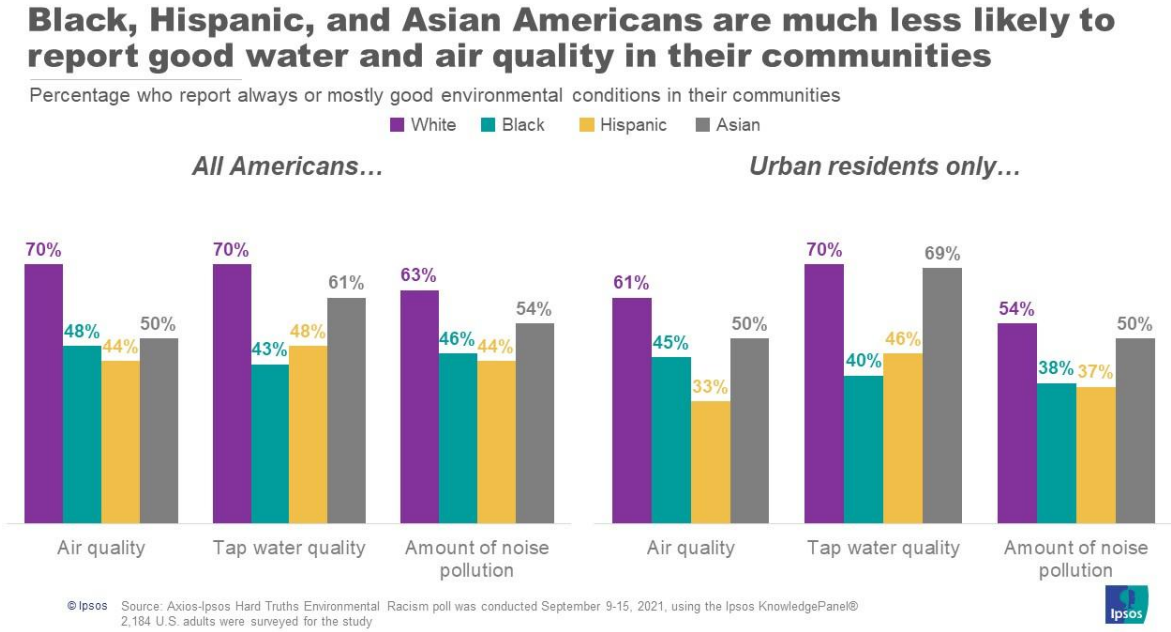
- Environmental risks are often unevenly distributed → Some communities face greater exposure to hazards

- **Environmental justice**: examining fairness in how environmental benefits and harms are distributed
  - Who gets access to clean air, water, and land?
  - Who is exposed to pollution and hazards?

- **Environmental Racism:** Environmental injustice linked to race and discrimination
  - Unequal targeting of communicates of color for environmental harm
    - Placement of hazardous facilities
    - Exposure to toxic waste and pollution
    - Exclusion from environmental decision-making



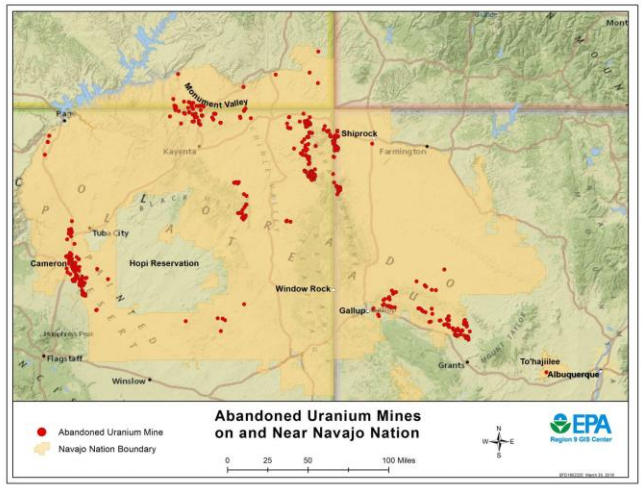
Infographic with statistics resembling environmental justice and racism.



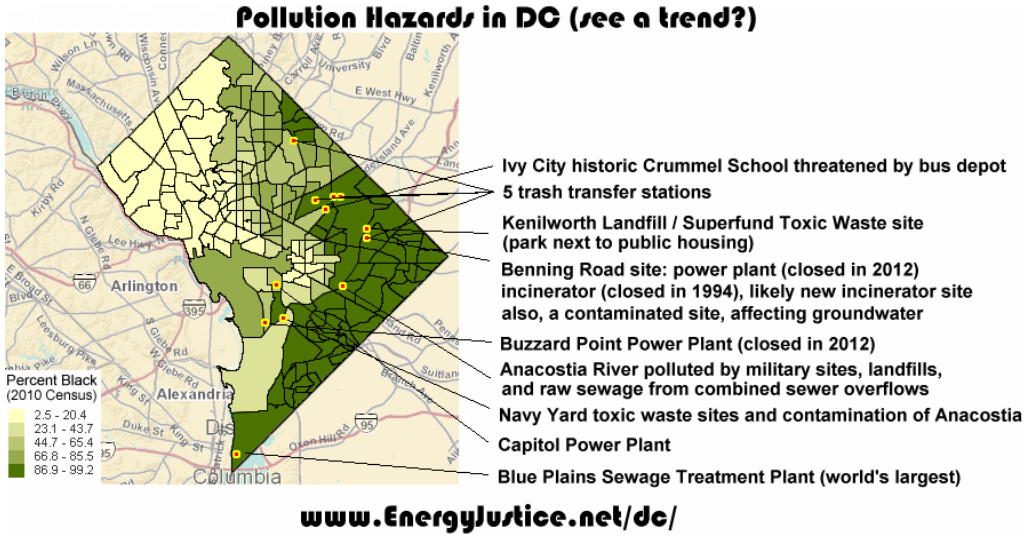
Graph of survey responses on various types of good environmental conditions by race.

Environmental (in)Justice - Other Case Studies

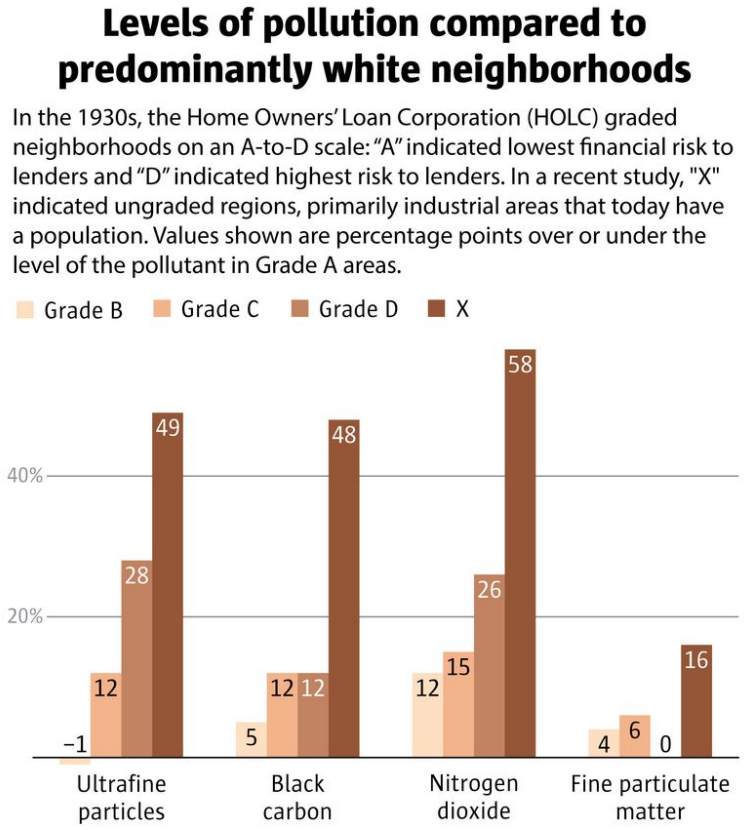
- ArcGIS Storymap on different environmental justice tools: https://storymaps.arcgis.com/stories/fe5b1a919ca54a33a351b87a6ecfcd08
- ArcGIS Interactive Map Experience: Environmental health disparities across Washington State: https://experience.arcgis.com/experience/d133fa97a3854f8eac905ec152f16b05/page/Measures



Uranium mining on Navajo land: Over 500 abandoned uranium mines (AUMs) exist across the Navajo Nation.



Pollution hazards in DC: Note the spatial distribution of trash transfer stations among Percent Black census tracts.



A UW study revealed that formerly redlined neighborhoods across the U.S. still have worse air quality: https://www.seattletimes.com/seattle-news/environment/uw-study-links-higher-levels-of-toxic-pollutants-to-seattles-redlining/