Introduction to Environmental Sciences

EES 102

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Core concepts in sustainable development

How do we describe resource use?

- Ecological footprint
- Throughput – A term widely used for describing resource use. Throughput is the amount of material or resources that flow through a system.

Example of a household.

- A household that consumes abundant consumer goods, foods, and energy brings in a great deal of natural resource-based materials; that household also disposes of a great deal of materials. Conversely, a household that consumes very little also tends to produce little waste.

Core concepts in sustainable development

Ecosystem services – It refers to services or resources provided by environmental systems. Often these are invisible. Nature doesn't put a price tag on them.

Provisioning – fuel we burn

Supporting services – less obvious to notice, water purification, production of food and oxygen by plants, etc.

Regulating services – maintenance of temperature by the earth's atmosphere, carbon capture by green plants, etc.

Cultural services – recreational, aesthetic, etc.

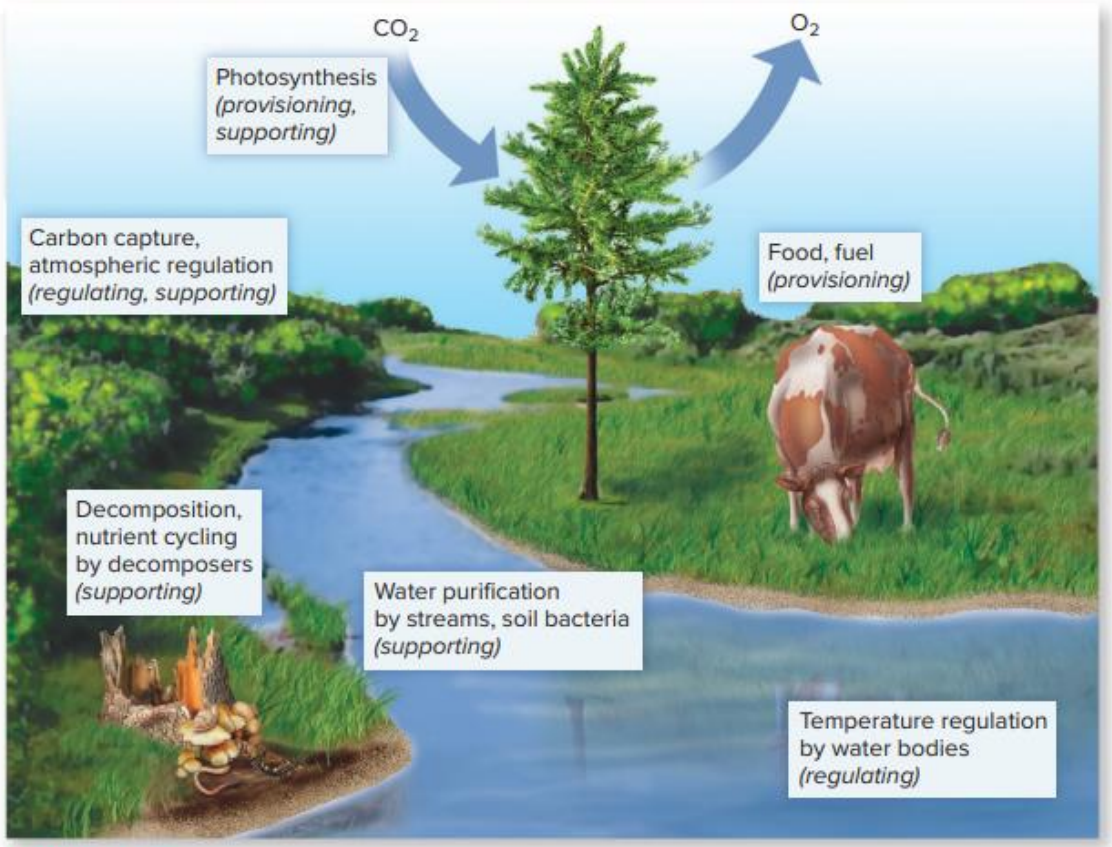


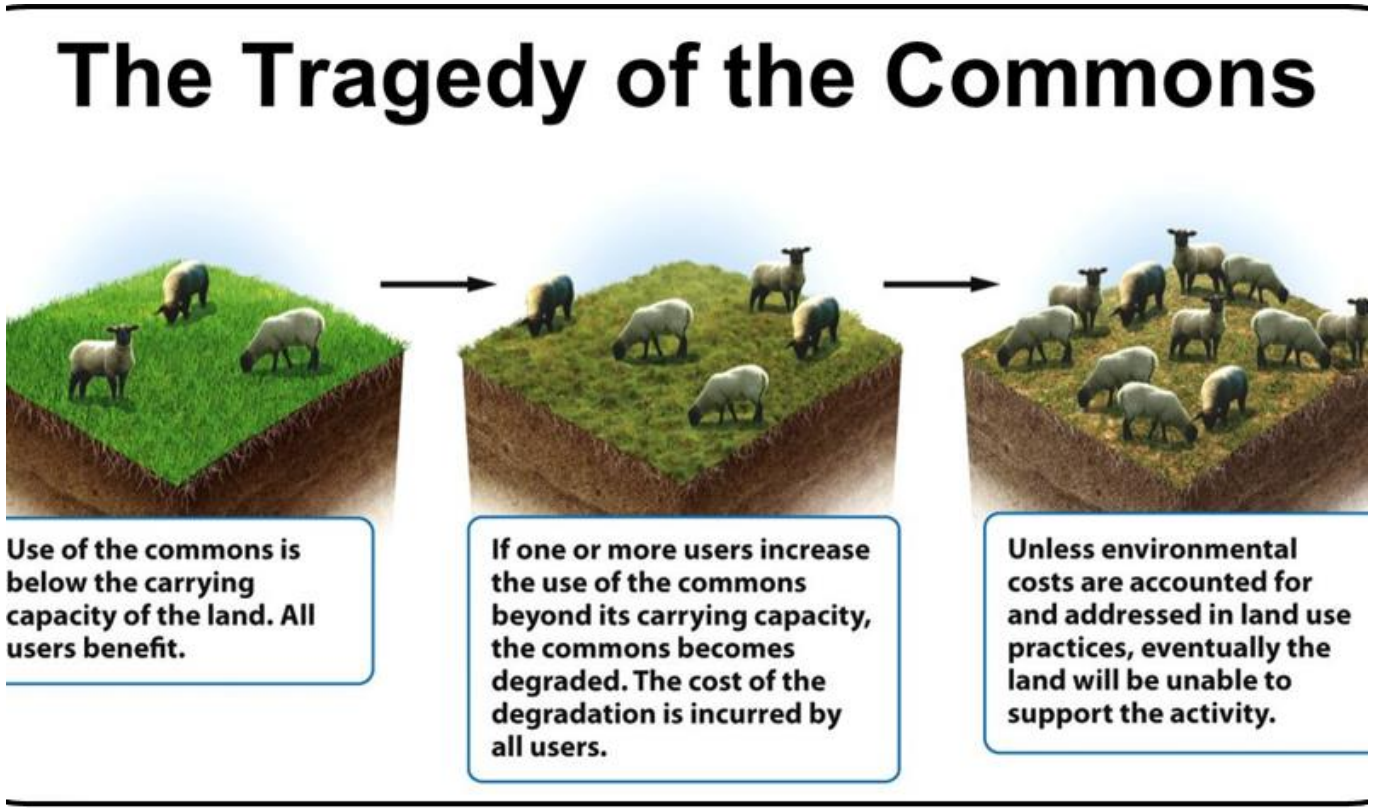
FIGURE 1.22 Ecosystem services we depend on are countless and often invisible.

Core concepts in sustainable development

How can we protect these services over the long term?

"Tragedy of the Commons," published in 1968 in the journal Science by ecologist Garret Hardin.

Hardin argued that population growth leads inevitably to overuse and then destruction of common resources—such as shared pastures, unregulated fisheries, fresh water, land, and clean air.

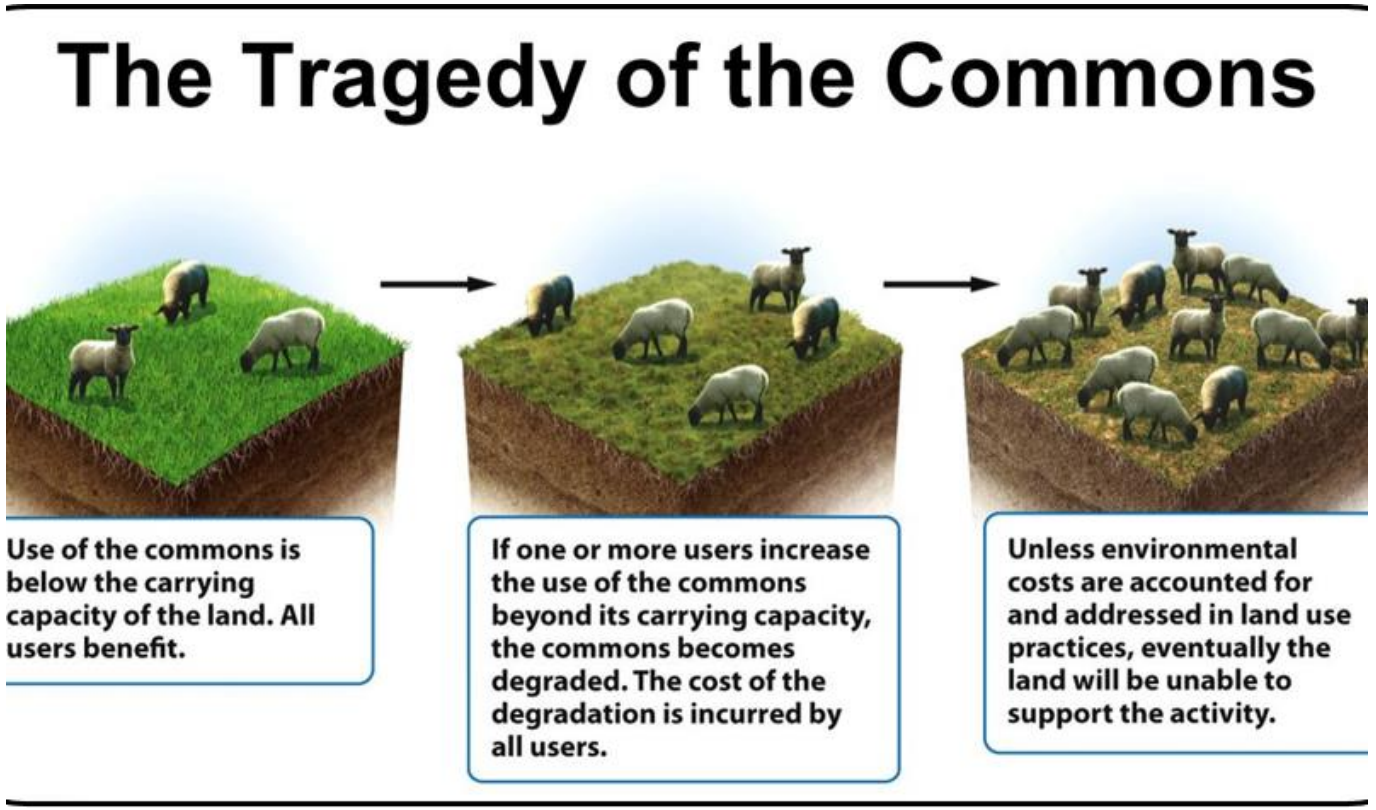


https://sustainable-environment.org.uk/Earth/Commons.php

Core concepts in sustainable development

Hardin proposed that there are only two ways to avoid this destruction:
(a)a system of private property, in which owners protect resources because of self-interest, or
(b) coercive regulation by the state.

An alternative perspective to Hardin's framework is strategies for managing the commons; that is, for collectively safeguarding commonly used resources – common forests, common grazing lands etc.
The importance of common property management was publicized by Elinor Ostrom, who won the 2009 Nobel Prize in Economic Sciences.



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Core concepts in sustainable development

What conditions can help communities manage their commons over the long term?

(1) effective and inexpensive monitoring of resource use;
(2) an ability to exclude outsiders, who don't understand rules of use; and
(3) frequent face-to-face communications and strong social networks among users, which reduce distrust and promote communication about the state of the resource.

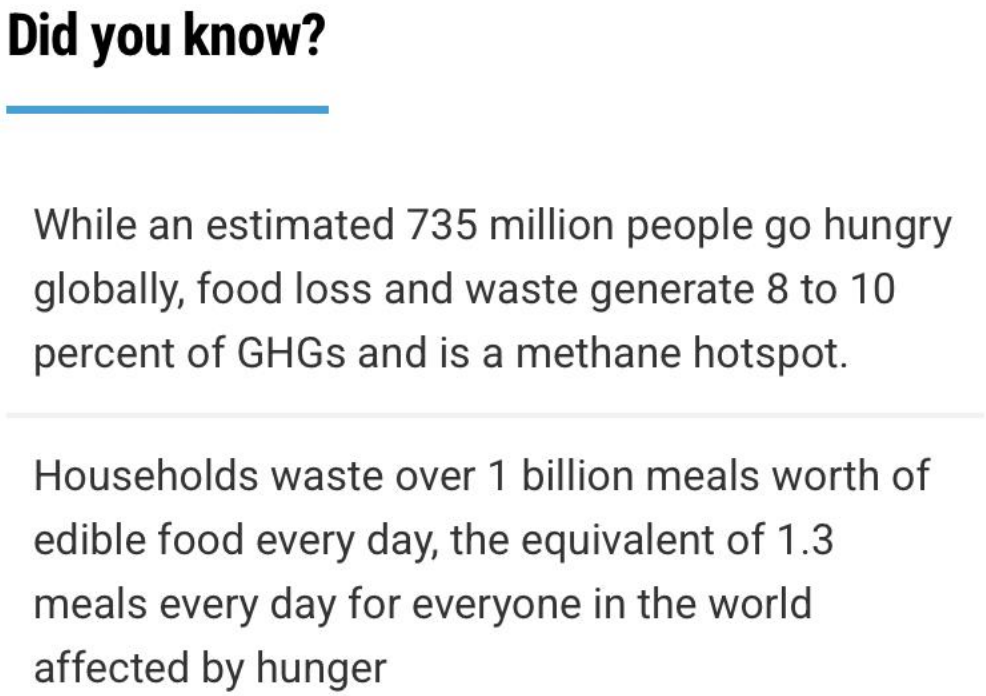
What type of institution is best for managing a global commons, such as climate or biodiversity?

Garret Hardin argued that local solutions to climate change are irrelevant as long as countries and international institutions fail to make policy changes. So preferably policy changes should happen at the country and international level.

Ostrom suggests investing in smaller, local, even individual policy changes.

What can you do?

https://www.globalgoals.org/take-action/?id=1



Planetary boundaries define broad limits

- Another way to think about environmental services is planetary boundaries or thresholds of abrupt or irreversible environmental change
- Johan Rockström and colleagues at the Stockholm Resilience Centre have identified nine major systems with these critical thresholds:
  - Climate change,
  - biodiversity,
  - land system change,
  - freshwater use,
  - biogeochemical flows (nitrogen and phosphorus),
  - ocean acidification,
  - atmospheric aerosols,
  - stratospheric ozone loss, and
  - "novel entities," including chemical pollution and Other factors

Planetary boundaries define broad limits

- Studies show that we have already passed the planetary boundaries for some of these systems, and that we are approaching limits for others.
- These overshoots are expected to cause rapid declines in ecosystem function and ecosystem services in many areas.
- Ecosystem services are tightly coupled.
- For example- destruction of tropical forests in Southeast Asia can influence heat and drought in North America. Drought and fires in North America enhance climate warming and sea ice loss in the Arctic.
- A planetary perspective helps us see interconnections in global systems and their effects on human well-being.

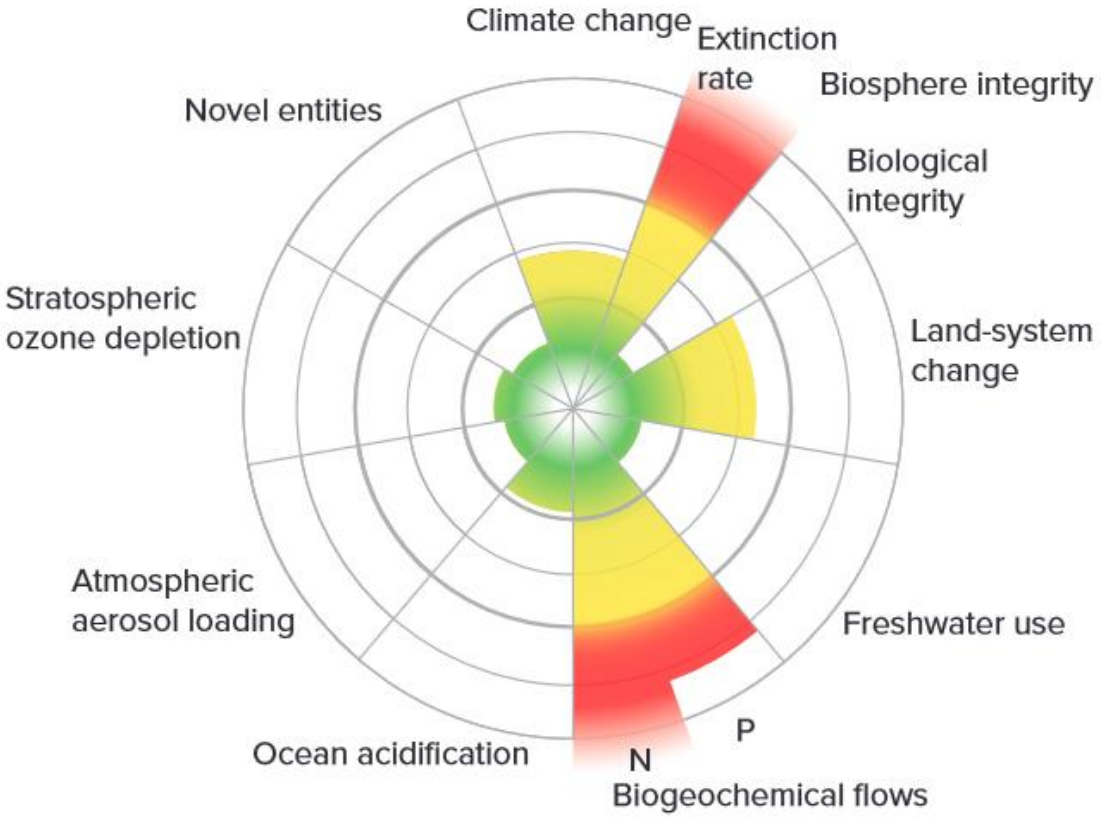
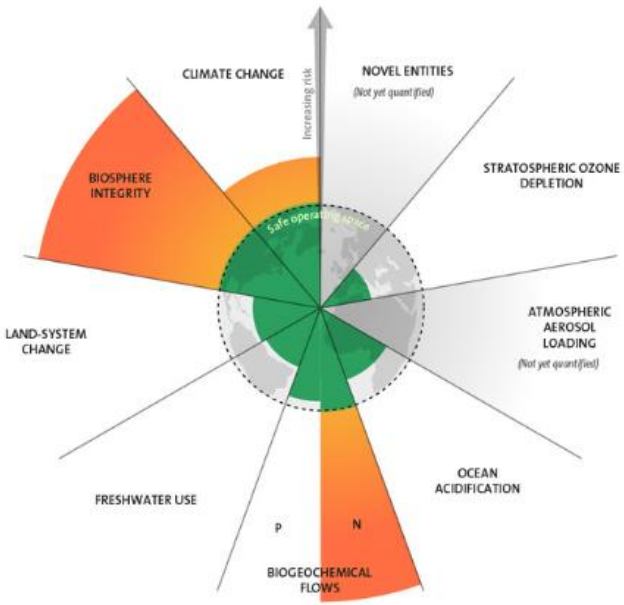


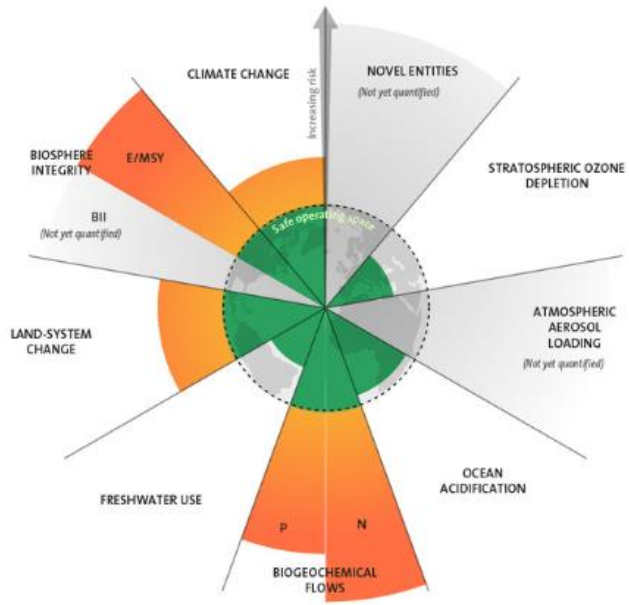
FIGURE 1.23 Calculated planetary boundaries, or thresholds beyond which irreversible change is likely. Green shading represents safe ranges; yellow represents a zone of increasing risk; red wedges represent factors exceeding boundaries.

2009



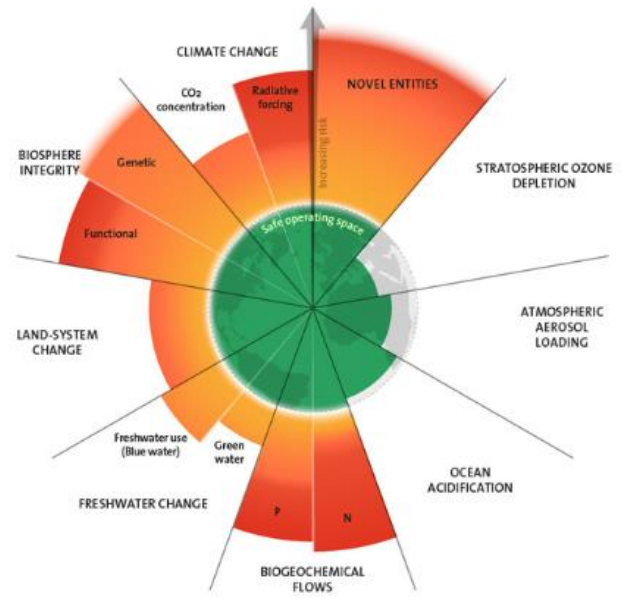
7 boundaries assessed,
3 crossed

2015



7 boundaries assessed,
4 crossed

2023



9 boundaries assessed,
6 crossed

https://www.stockholmresilience.org/research/planetary-boundaries.html

Planetary boundaries define broad limits

- https://www.science.org/doi/epdf/10.1126/science.1259855
- https://planetaryboundaries.kcvs.ca/#:~:text=Planetary%20Boundaries%20is%20a%20framework,harmful%20to%20humans%20and%20society.
- https://www.youtube.com/watch?v=ZIXxfLQuhsE

Indigenous peoples often protect biodiversity

500 million indigenous people who remain in traditional homelands still possess valuable ecological wisdom and are the guardians of little-disturbed habitats that are refuges for rare and endangered species and undamaged ecosystems.

As we seek strategies for sustainable development and biodiversity conservation, this knowledge may be an essential resource.

A few countries, such as Fiji, Ecuador, Canada, and Australia, acknowledge indigenous title to extensive land areas.

As the Kuna Indians of Panama say, "Where there are forests, there are native people, and where there are native people, there are forests."

FIGURE 1.24 Do indigenous people have unique knowledge about nature and inalienable rights to traditional territories?
Barry Barker/McGraw-Hill Education

Environmental justice

- **Environmental justice** combines civil rights with environmental protection to demand a safe, healthy, life-giving environment for everyone.
- Among the evidence of environmental injustice is the fact that three out of five African Americans and Latino/as, and nearly half of all Native Americans, Asians, and Pacific Islanders, live in communities with one or more uncontrolled toxic waste sites, incinerators, or major landfills, while fewer than 10 percent of all whites live in these areas.
- **Environmental racism** is inequitable distribution of environmental hazards based on race. Evidence of environmental racism can be seen in lead poisoning in children. Some 4 million children—many of whom are African American, Latino, Native American, or Asian, and most of whom live in inner-city areas—have dangerously high lead levels in their bodies.
- **Toxic colonialism** is the practice of targeting poor communities of color in the developing nations for waste disposal or experimentation with risky technologies.
- Although a treaty regulating international shipping of toxics was signed by 105 nations in 1989, millions of tons of toxic and hazardous materials continue to move—legally or illegally—from the richer countries to the poorer ones every year.