Ecology

What do you imagine when you hear word "Ecology"?

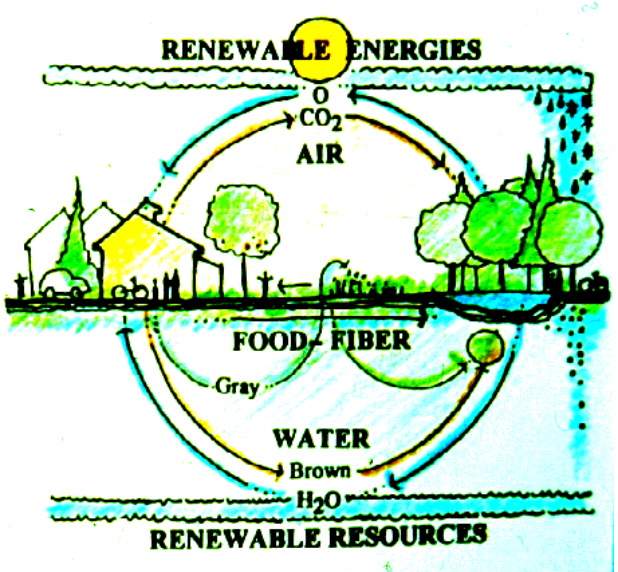
Top

Ecological basics of the environmentalism

- **Ecology –**

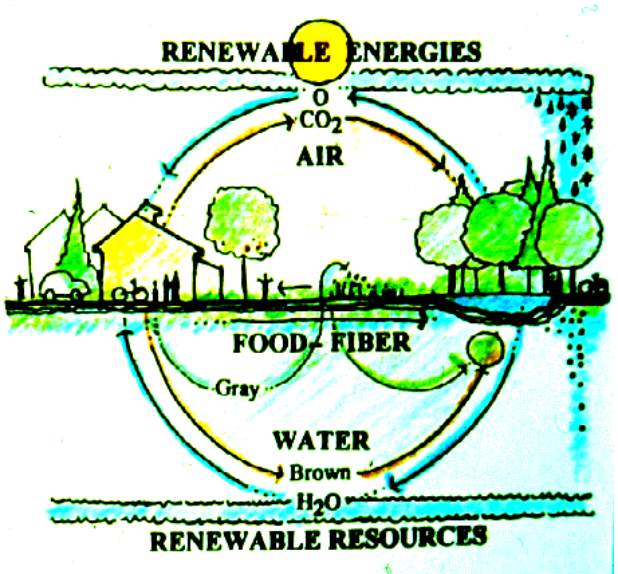
- **Environmental studies –**

- **Environmentalism – env. activism -**



Ecological basics of the environmentalism

- **Ecology** – the science of the relationships between organisms and their environment in which they live and organisms with each other
  - non-evaluative, exclusively descriptive
  - sometimes are environmental studies called ecology (in general)
- **Environmental studies** - addresses the humans' relationship to the environment
  - includes both descriptive and normative components
  - takes evaluation opinions (good X bad)
- **Environmentalism** – **env. activism** - social movement (ideology) which aims to promote the conclusions of environmental studies in society

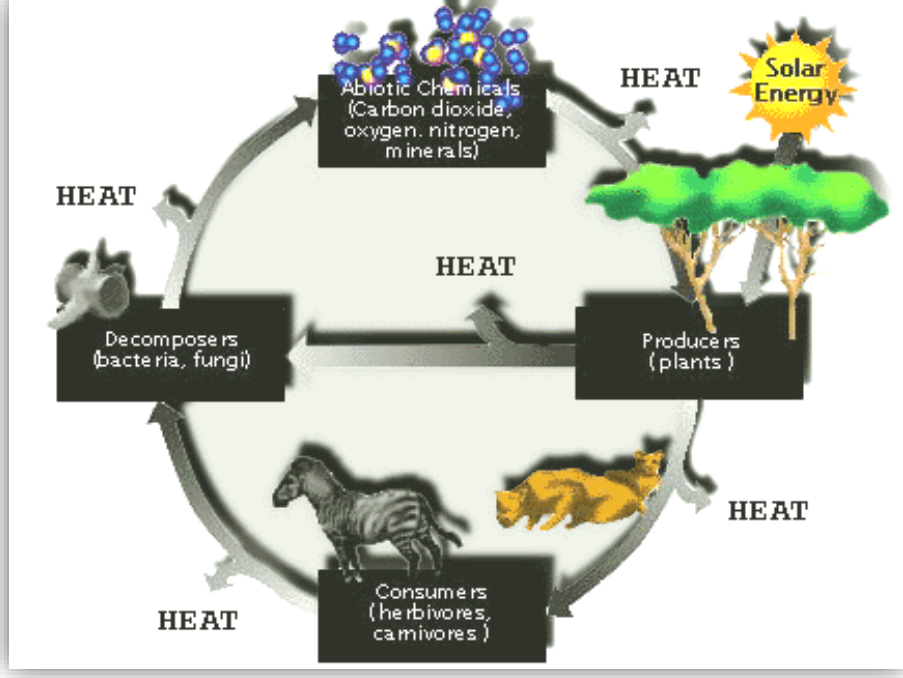


Ecosystem

• dynamic circulation system of living organisms and their environment, where an exchange of matter, energy and information takes place

• Ecosystems represent the quality from which human society arose and on which it is existentially dependent

• human - an integral part of many ecosystems



How humans influence ecosystems or its components?


D. Raver

Ecosystem

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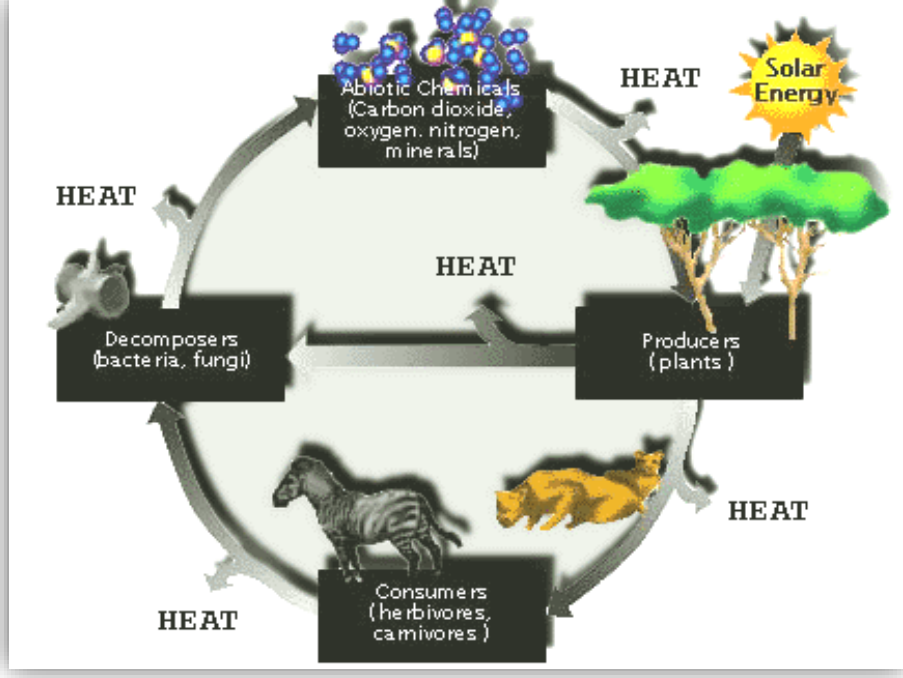
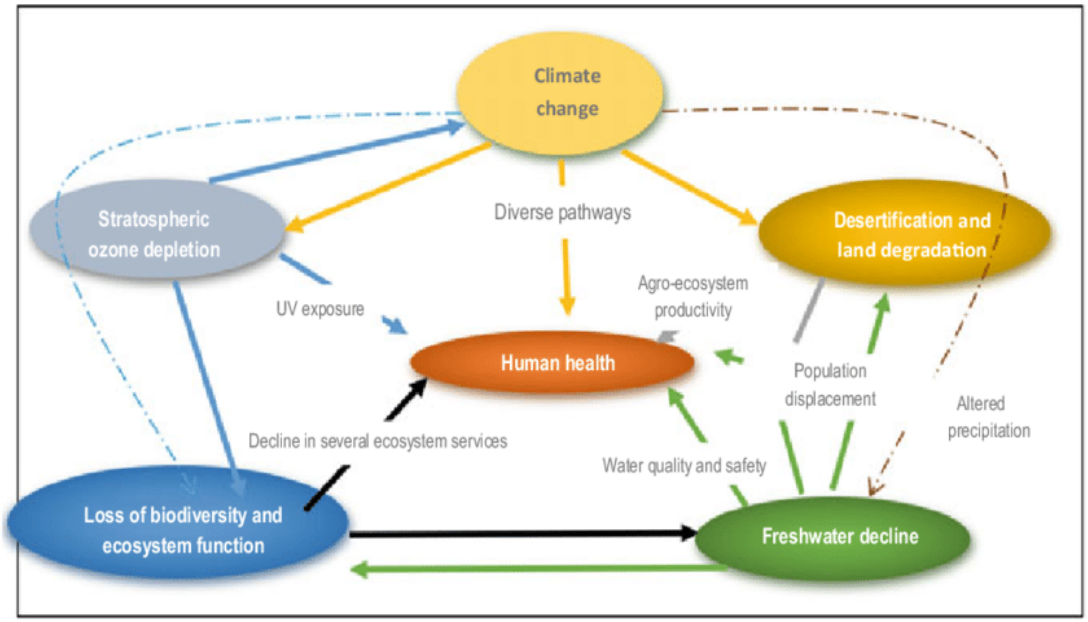
• human - an integral part of many ecosystems

• humans influence ecosystems and vice versa





Ecological stability

- the ability of an ecosystem to compensate the changes caused by external factors and to preserve its natural functions and properties
- the greater the diversity of the ecosystem = the greater the stability
  - e.g. monoculture **X** mixed culture (forest) – pests (e.g. bark beetle)
- resistence –
- resilience –

Ecological stability

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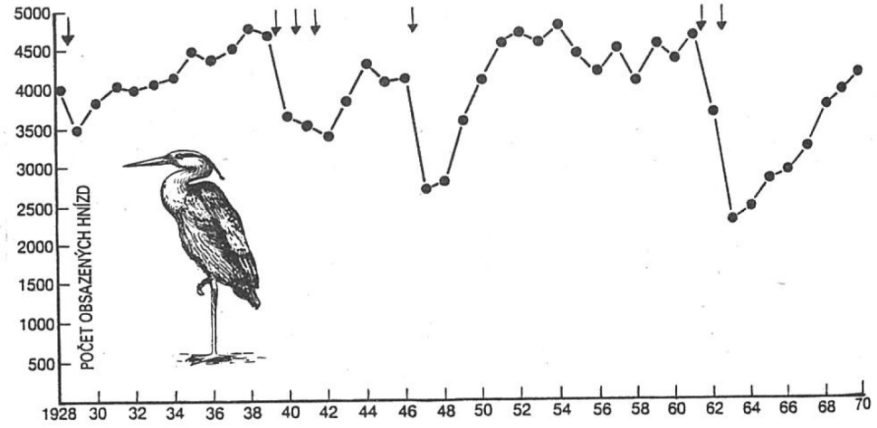
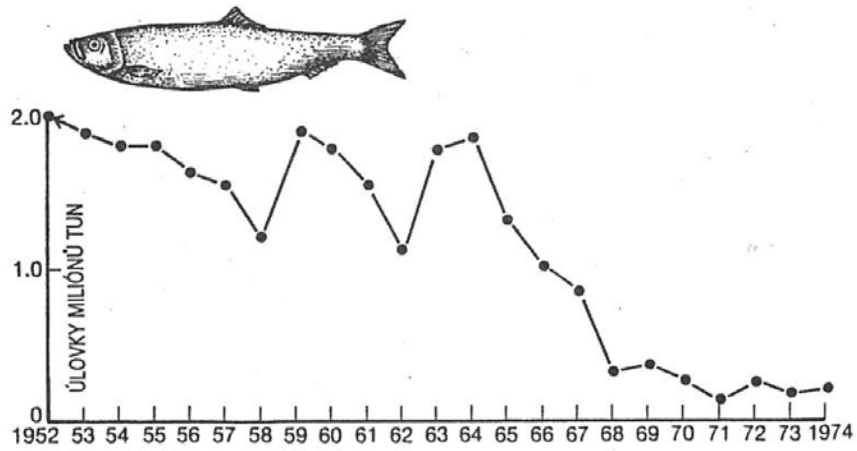
  - e.g. monoculture **X** mixed culture (forest) – pests (e.g. bark beetle)
- resistence – the ability of the ecosystem to resist to disruptions
- resilience – the ability of the ecosystem to return to its original state after a disruption
- both properties act more/less together, but their capacities are limited

1e) Volavka popelavá (Ardea cinerea) – počty obsazených hnízd v Anglii a Walesu za 42 let obvykle kolísají okolo 4 až 4,5 tisíc hnízdních párů. Početnost populace, odkázané na lov rybek v nezamrzajících vodách, výrazně klesá po krutých zimách a pak stoupá na původní úroveň.



1f) Sleď severní – třicetiletá časová řada úlovků. V polovině šedesátých let výrazný pokles stavů v důsledku nových technik neregulovaného průmyslového lovu.



Homeostasis

- state of a dynamic functional balance → from individuals to the biosphere
- the basic premise of the effort of all organisms → to perform life functions as long as possible

The principle of feedbacks

- positive x negative feedback

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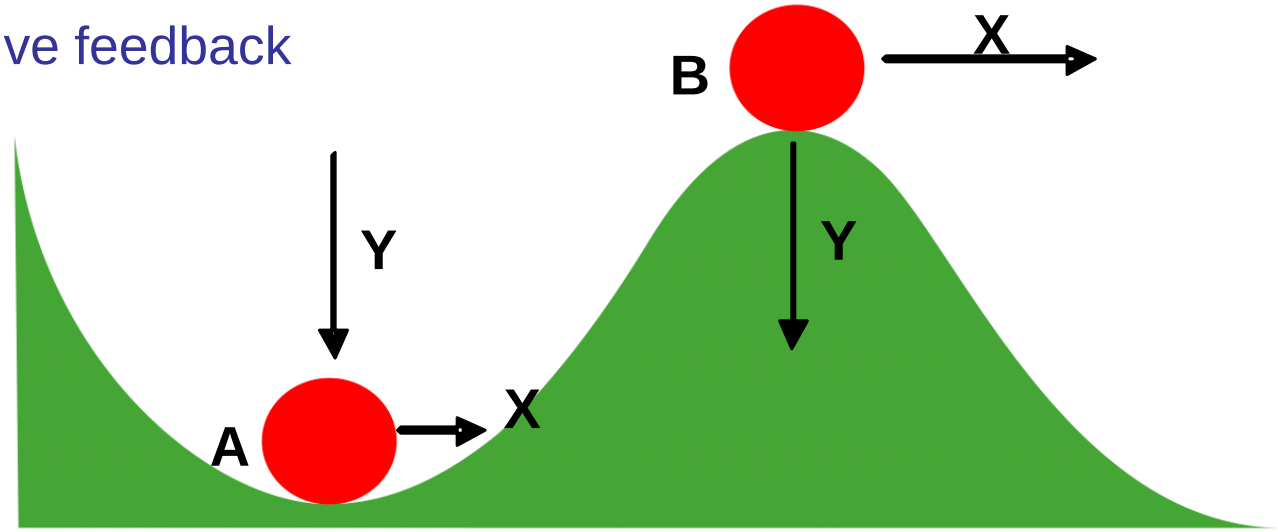


• a prerequisite for homeostasis are sets of functional negative feedbacks that keep the system in a steady state

Feedbacks in ecosystems or society

A negative feedback

- compensatory homeostatic mechanism - at all levels of the ecosystem (individuals, populations, food chains, ecosystems)

E.g: Stabilization of predator and prey populations

Do you know any example of negative feedback in human body or society?

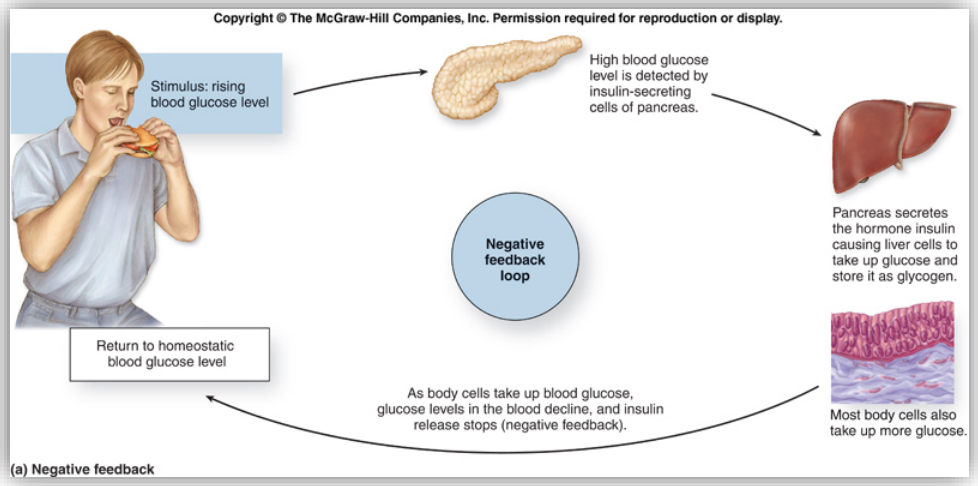
Feedbacks in ecosystems or society

A negative feedback

• compensatory homeostatic mechanism - at all levels of the ecosystem (individuals, populations, food chains, ecosystems)

E.g: Stabilization of predator and prey populations

- Maintaining a stable blood sugar level (enzyme activity, blood pressure, etc.)



- In society: Economical sanctions for pollution, punishments in general

Feedbacks in ecosystems

https://web.microsoftstream.com/video/320fc566-e6b9-4789-9277-51fd7849a7bf?search=river

Feedbacks in ecosystems or society

Positive feedback - mostly fatal in ecosystems

- but! creation of a new eco-system

E.g: Extinction of plant and animal species (reduction of biodiversity)

- causes instability in the number of more resistant species

- temperature fluctuations (extinction of plants) and environmental degradation, etc.

Do you know any example of a positive feedback from the human body or society?

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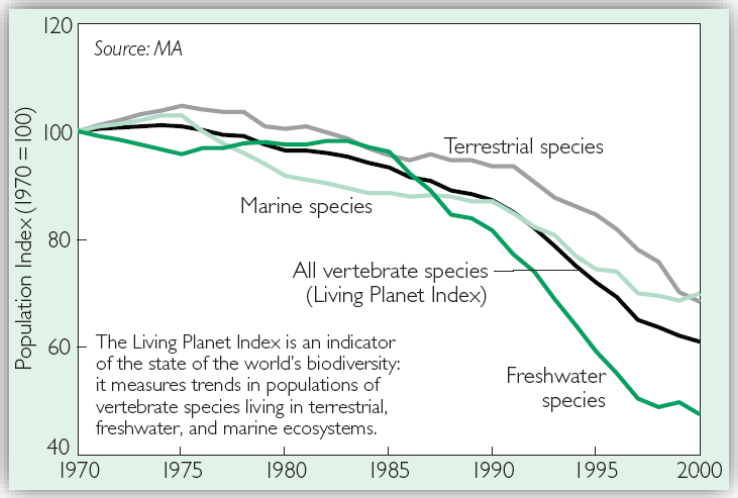

E.g: Rewards and compliments

E.g: The relationship of the human population, food production and

technologies:

E.g.: Green Revolution - technol. innovation → increas in agric. production → increase in population → increase in number of potential investors → more technol. innovation → increase in agri. production → increase in population ...

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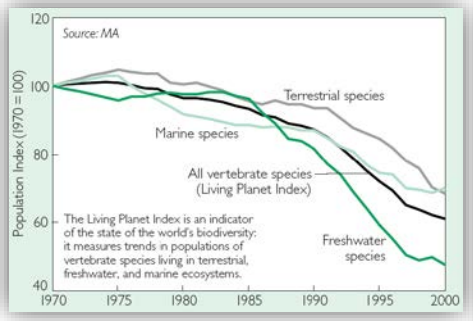
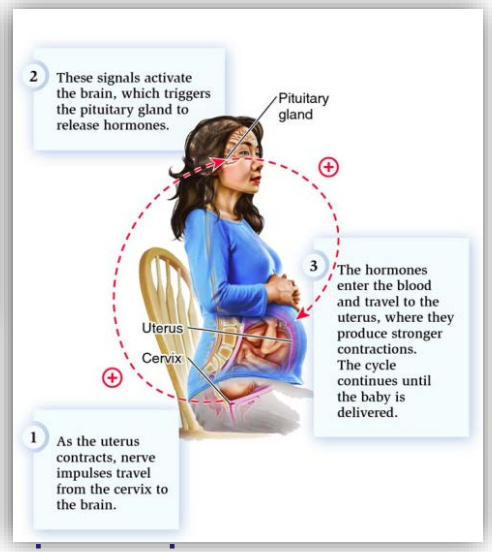


E.g: Rewards and compliments



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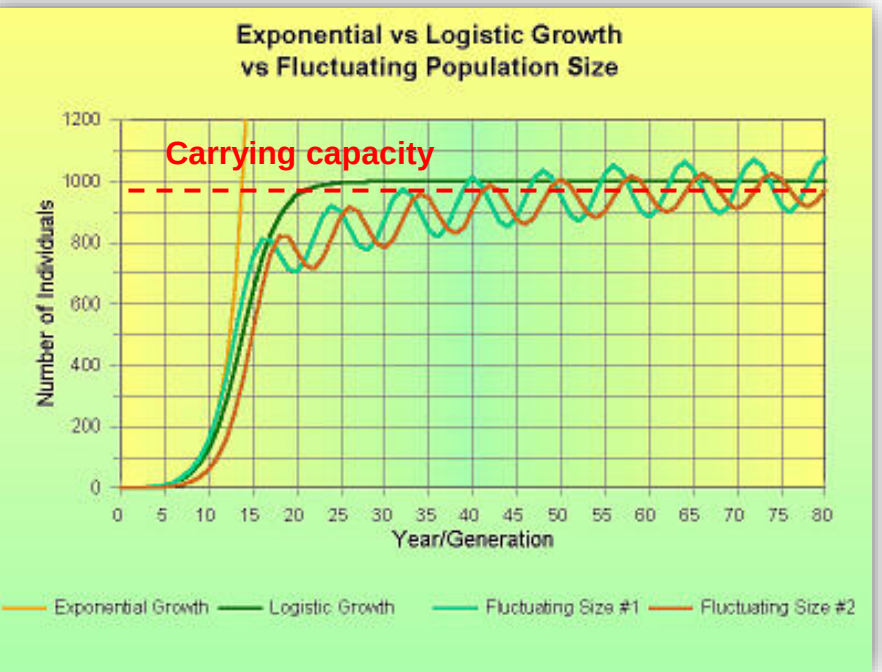
Carrying capacity, growth curves of populations

- CC – a property of the environment indicating how large a population can live in this environment in the long term without disturbing it



Carrying capacity, growth curves of populations

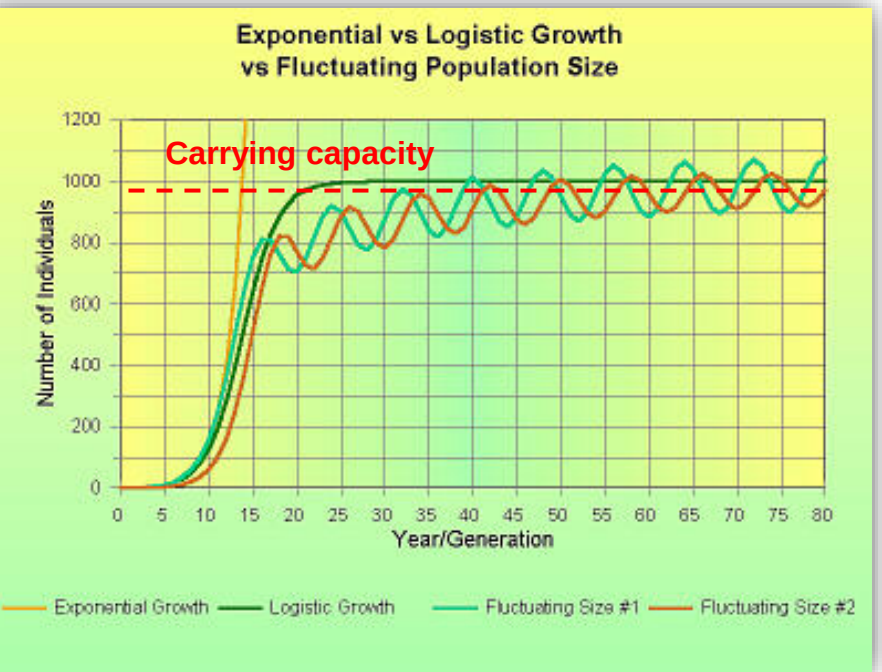
- CC – a property of the environment indicating how large a population can live in this environment in the long term without disturbing it

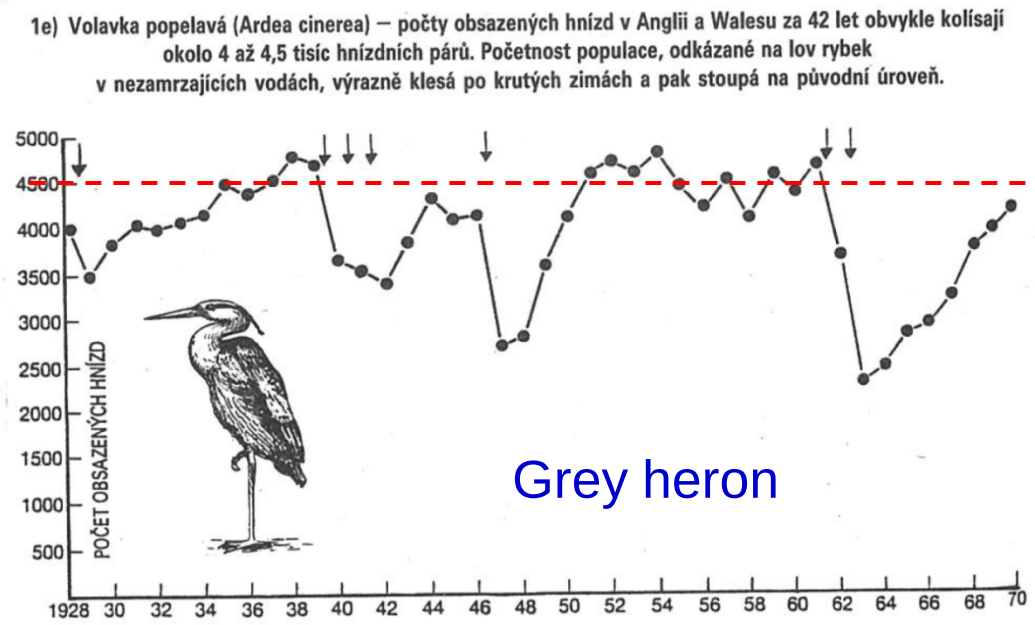
GC type S – logistic growth – population growth and stabilization at the CC

- negative feedback between population and environment characteristics

- limiting factors: eg. population density, availability of resources, predators
- establishing a dynamic balance

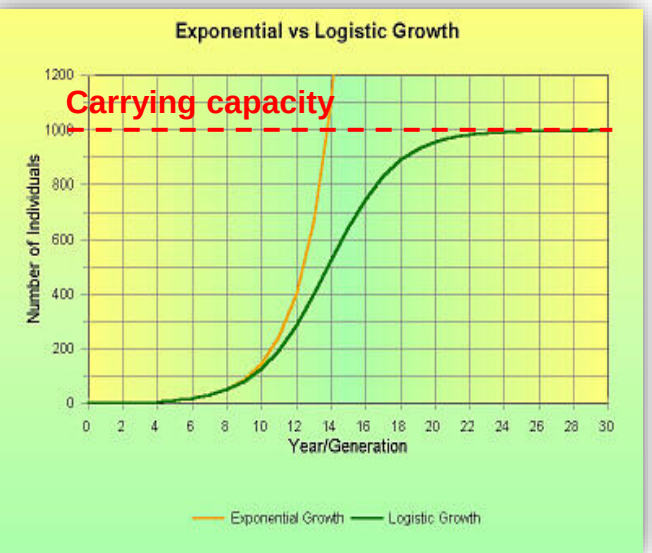
Ex. population of predators and prey, number of trees in a certain area, etc





Carrying capacity, growth curves of populations

GC type J - exponential growth - CC overshoot, followed by a collapse



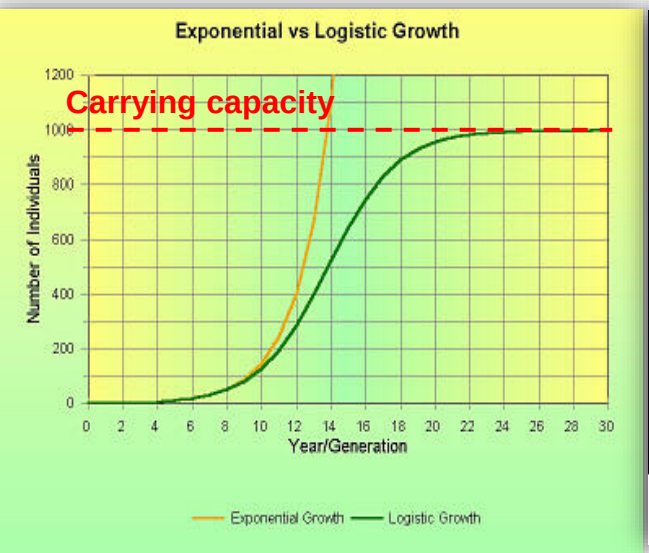
Carrying capacity, growth curves of populations

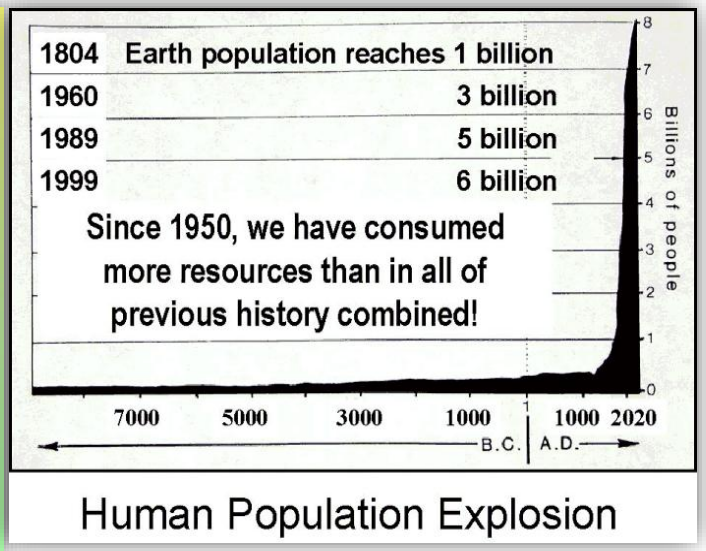
GC type J - exponential growth - CC overshoot, followed by a collapse

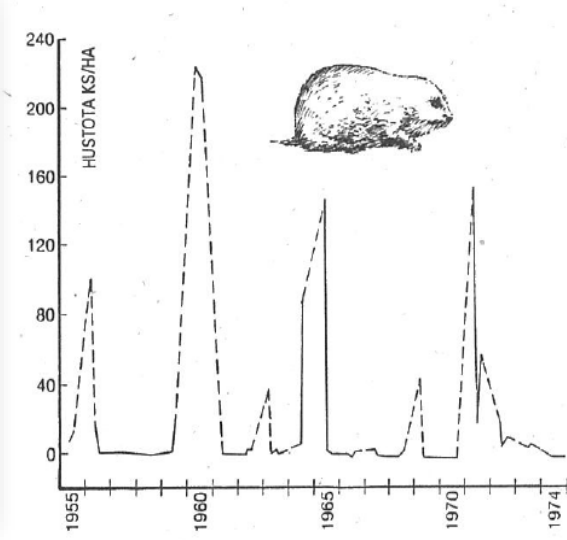
- in the case of the source of new E resources and materials, the collapse of the population may be followed by the growth again
- not common in ecosystems, usually present a limiting factor

Eg: increases in cyanobacterial bloom, lemmings‘ population…

- also applies to the human population, thanks to the increase in NCPs by increasingly advanced technologies dependent on the growing consumption of E, raw materials = offensive adaptation







Food chains in ecosystems

I. Grazing – prey chain

• plants - 1st order consumers (herbivores) - 2nd order consumers (carnivores and omnivores).

• body size increases and the number of individuals in the population decreases

II. Detritic chain

• dropping of dead biomass (eg leaves) - decomposition by decomposers (eg. earthworms) up to fungi and bacteria (soil, water)

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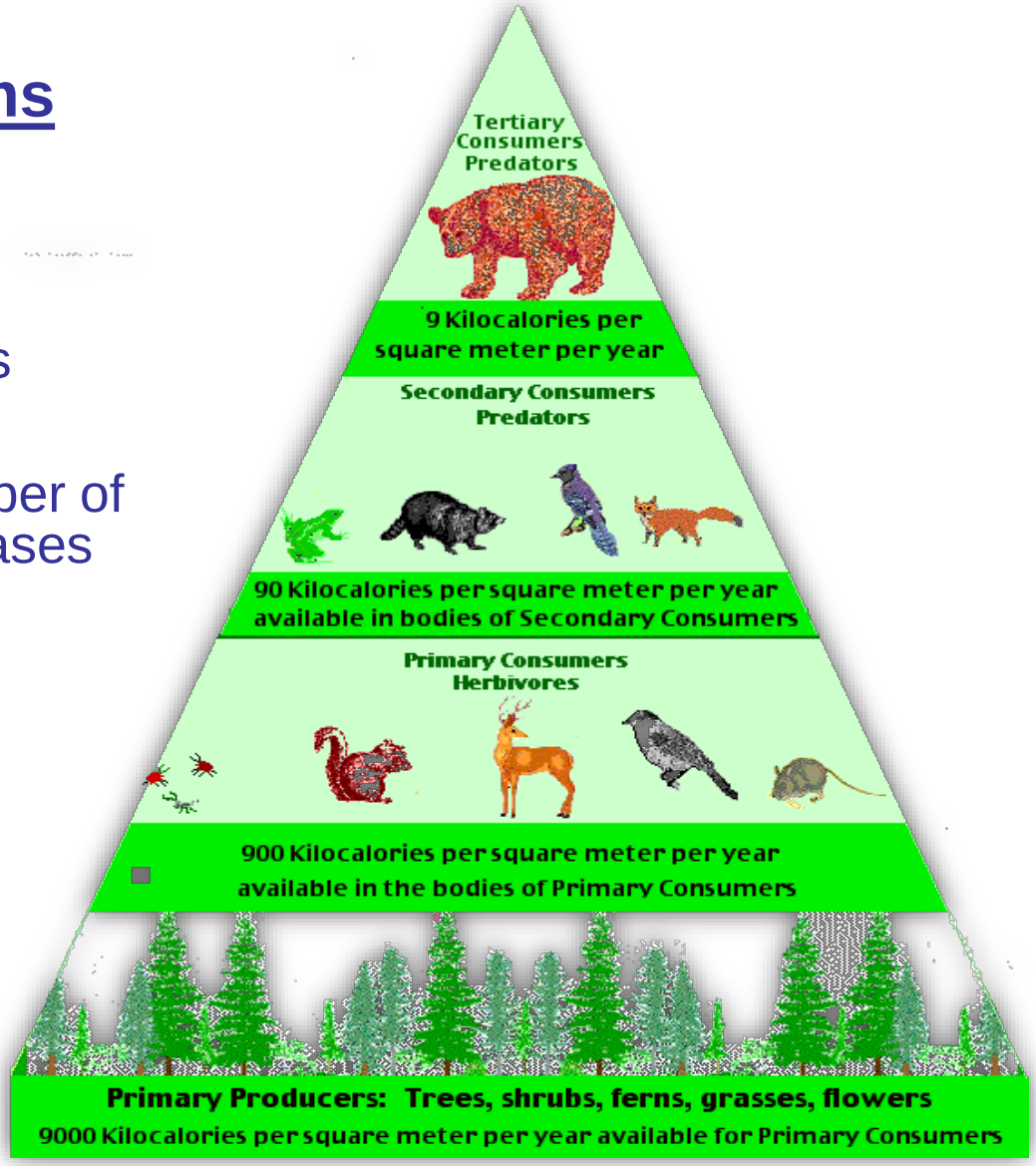

Food pyramide

- organism at a higher level of the pyramids feed on the organisms below

• is given in abundance to biomass, energy flow

• upwards - large energy losses in the order of 1000: 100: 10: 1

Evolution of ecosystems

succession - community development by systematic species replacement

• studied eg in lava fields (primary x secondary succession)

lichens, mosses → annual plants → perennials → shrubs → trees

Colonization strategy

• r-strategists - typical of the early stages of succession, fast life strategies

- emphasis on the number and mobility of offspring; competitiveness lagged behind

Do you know any r-strategists? Plants, animals?

Evolution of ecosystems

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Colonization strategy

• r-strategists - typical of the early stages of succession, fast life strategies

- emphasis on the number and mobility of offspring; competitiveness lagged behind

• K-strategists - typical of late stages of ecosystems

- emphasis on the quality and competitiveness of offspring, often long-lasting

Do you know any K strategists? Plants, animals?

What about people? K or r startegists?

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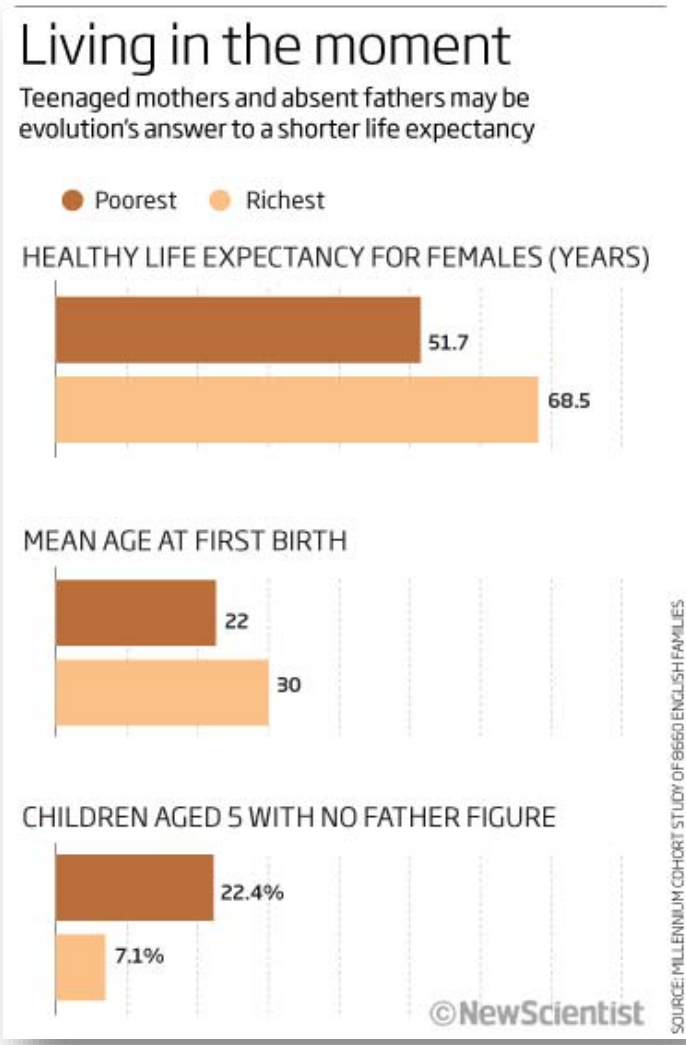
FEATURE 14 July 2010

Die young, live fast: The evolution of an underclass

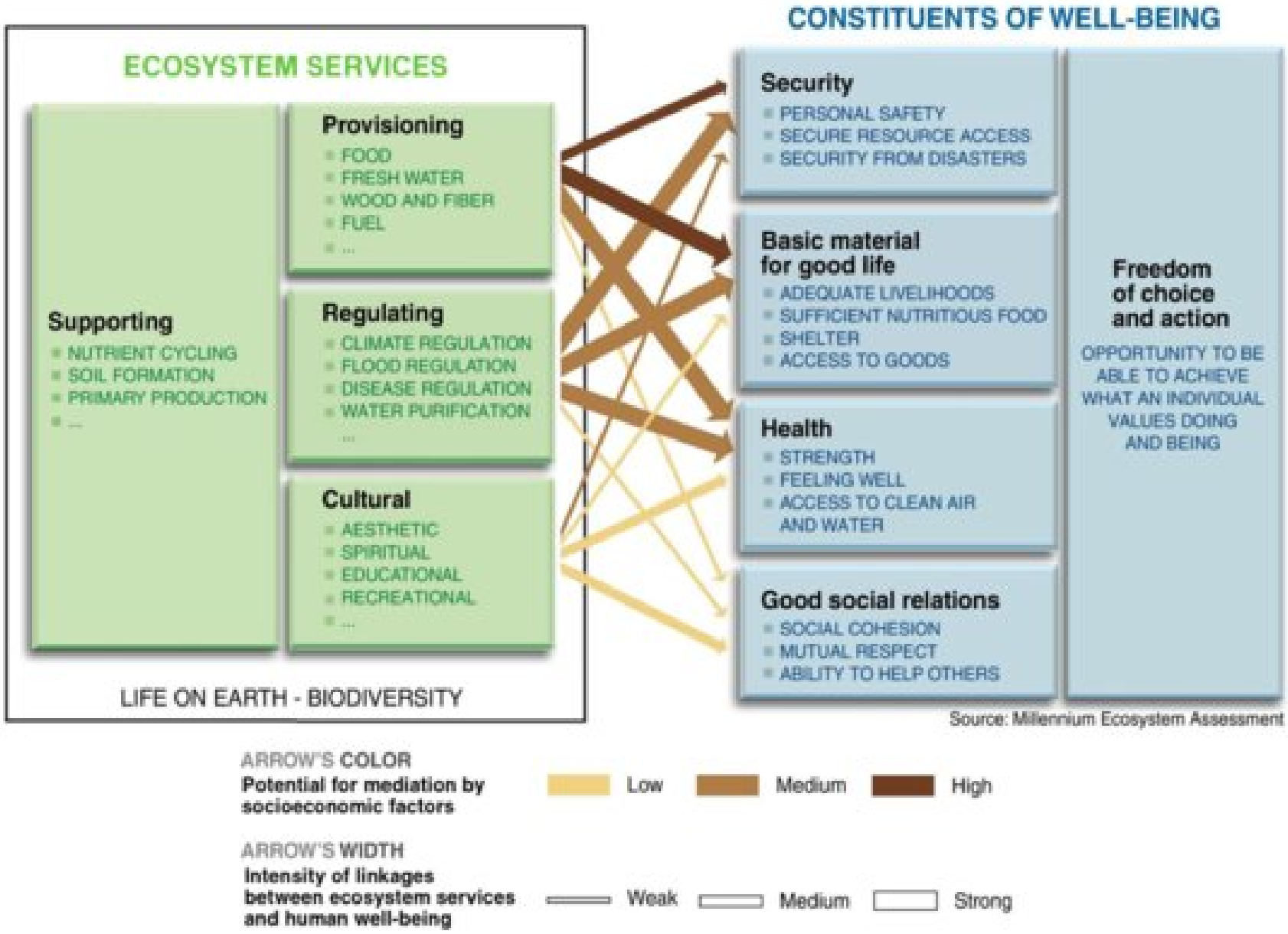
They're often branded as thoughtless and irresponsible, but teenage mothers and deadbeat dads may be making the best of their bad situations



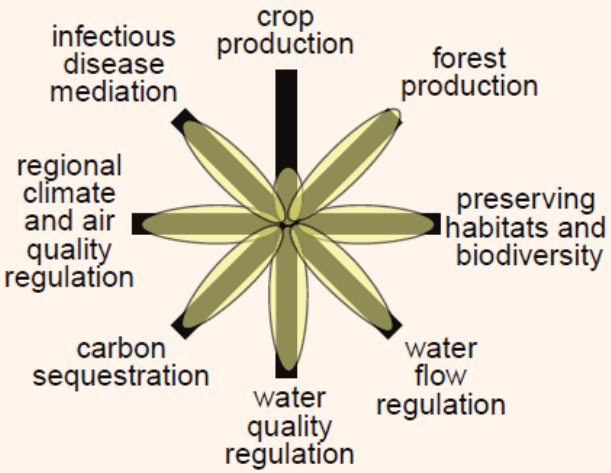
As the environment gets better, individuals start investing more in their family and romantic relationships, and become less impulsive and less aggressive.

Ecosystems and well-being

Ecosystems and well-being

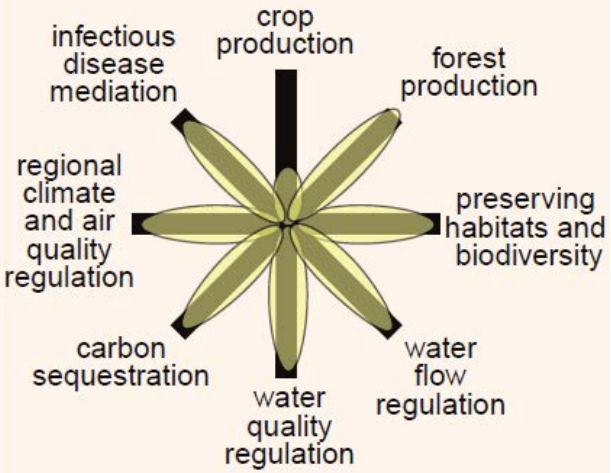


Ecosystems and well-being



natural ecosystem

Ecosystems and well-being



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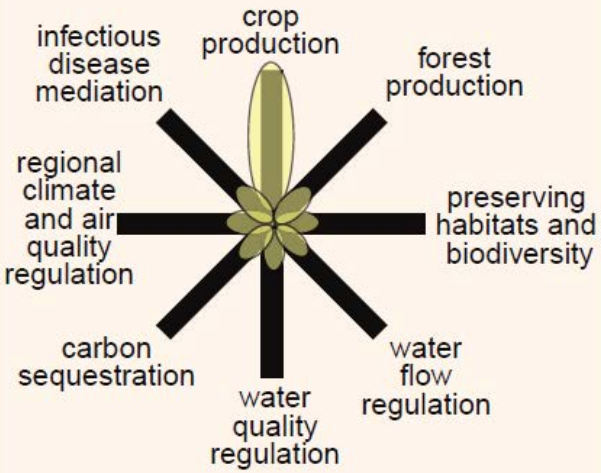
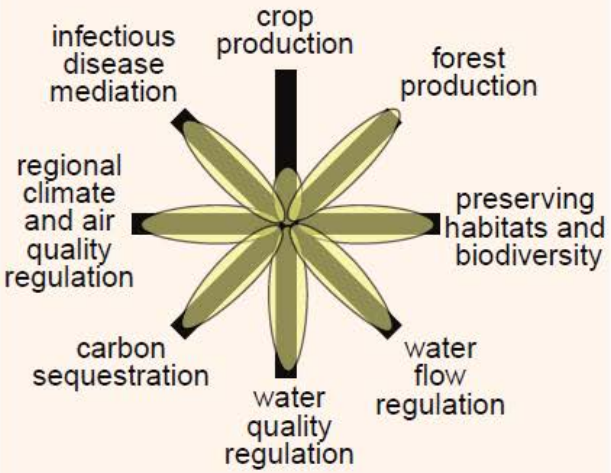


intensive cropland

Ecosystems and well-being



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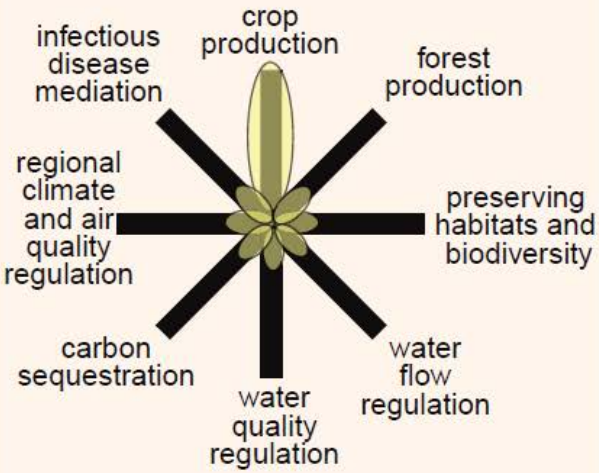

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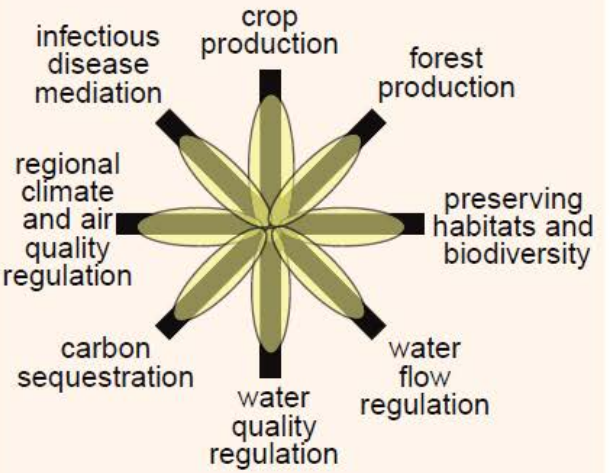
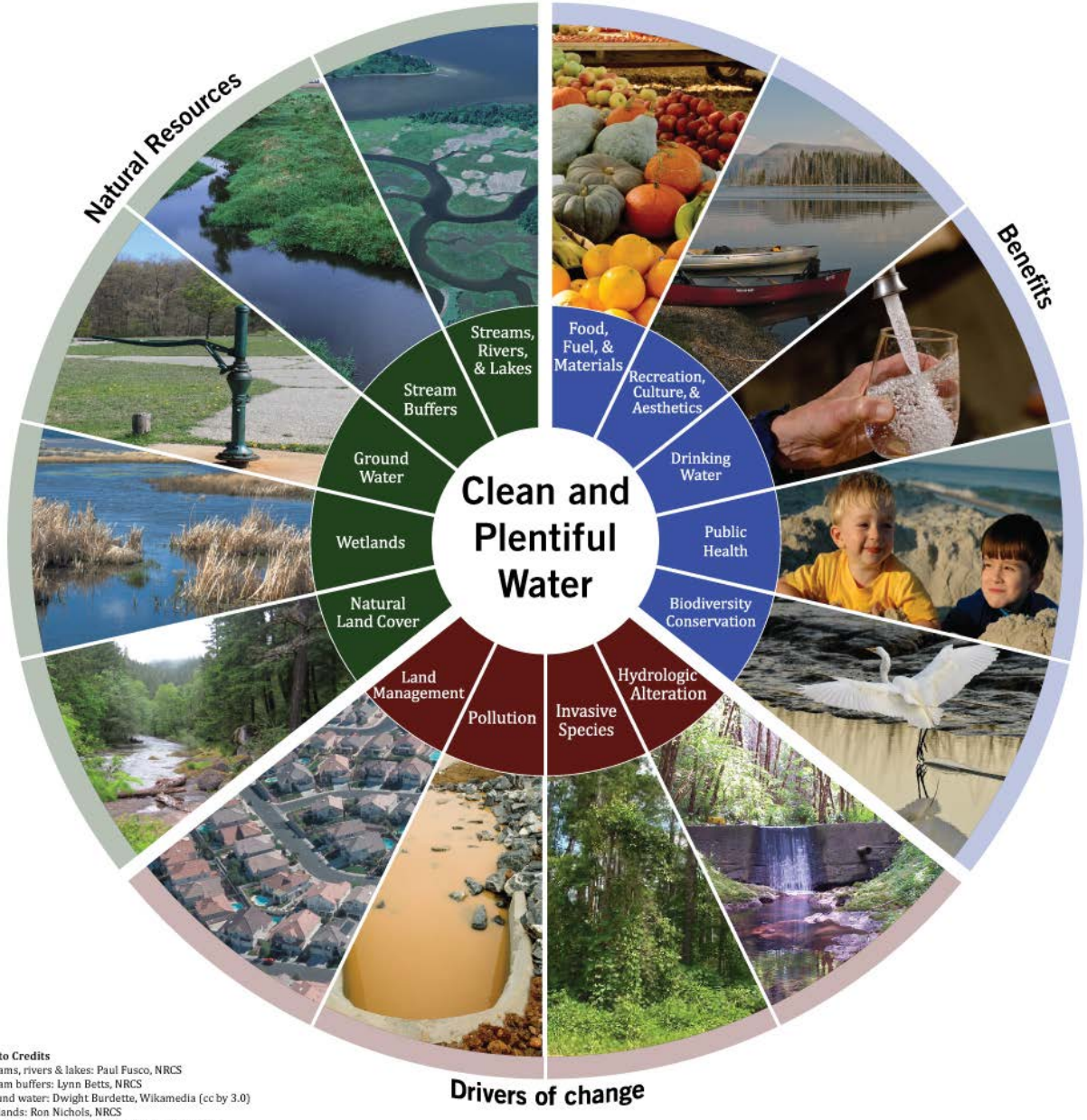


cropland with restored ecosystem services



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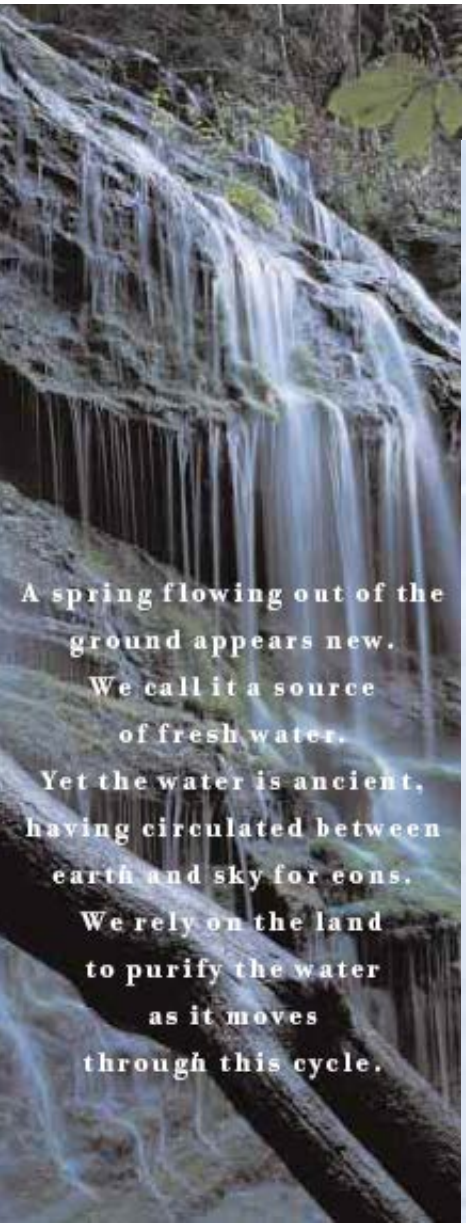
Recreation, culture, and aesthetics: Joe Peaco, NPS
Food, fuel, and materials: Eric Vance, EPA

This EnviroAtlas eco-wheel was created by Jessica Jahre, EPA contractor

Importance of ecosystems



- **ecosystems → productive engines of the Earth - life**

The Costs of Clean Water

Here are some global and local indicators of our dependence on the water filtration and purification services that ecosystems provide. The human and economic costs of trying to replace them can be high.

- **Percentage of the world's population that lacks access to clean drinking water:**
  28 percent, or as many as 1.7 billion people (UNICEF 2000)
- **Number of people who die each year because of polluted drinking water, poor sanitation, and domestic hygiene:**
  5 million. Additionally, waterborne diseases such as diarrhea, ascariasis, dracunculiasis, hookworm, schistosomiasis, and trachoma cause illness in perhaps half the population of the developing world each year (WHO 1996).
- **Percentage of urban sewage in the developing world that is discharged into rivers, lakes, and coastal waters without any treatment:**
  90 percent (WRI et al. 1996:21)
- **Amount spent on bottled water worldwide in 1997:**
  $42 billion (Beverage Industry 1999)
- **Amount U.S. consumers spent on home water filtration systems in 1996:**
  $1.4 billion (Trust for Public Land 1997:24)
- **Cost incurred by households in Jakarta that must buy kerosene to boil the city's public water before use:**
  Rp 96 billion or US$52 million a year (1987 prices) (Bhatia and Falkenmark 1993:9)
- **Replacement cost of the water that would be lost if thirteen of Venezuela's National Parks that provide critical protection for urban water supplies were deforested:**
  $103 million to $206 million (net present value) (Reid forthcoming:6)
- **Typical cost to desalinize seawater:**
  $1.00–$1.50 per cubic meter (UNEP 1999:166)
- **Amount of open space and critical recharge area paved over every day in the United States:**
  11.7 km² (TPL 1997:3)
- **Estimated annual value of water quality improvement provided by wetlands along a 5.5-km stretch of the Alchovy River in Georgia, USA**
  $3 million (Lerner and Poole 1999:41)
- **Cost to construct wetlands to help process and recycle sewage produced by the 15,000 residents of Arcata, California:**
  $514,600 for a 40-ha system (Marinelli 1990). The city's alternative was to build a larger wastewater treatment plant at a cost of $25 million (Neander n.d.).

Primary Goods and Services Provided by Ecosystems

Ecosystem	Goods	Services
Agroecosystems 	■ Food crops ■ Fiber crops ■ Crop genetic resources	■ Maintain limited watershed functions (infiltration, flow control, partial soil protection) ■ Provide habitat for birds, pollinators, soil organisms important to agriculture ■ Build soil organic matter ■ Sequester atmospheric carbon ■ Provide employment
Coastal Ecosystems 	■ Fish and shellfish ■ Fishmeal (animal feed) ■ Seaweeds (for food and industrial use) ■ Salt ■ Genetic resources	■ Moderate storm impacts (mangroves; barrier islands) ■ Provide wildlife (marine and terrestrial) habitat ■ Maintain biodiversity ■ Dilute and treat wastes ■ Provide harbors and transportation routes ■ Provide human habitat ■ Provide employment ■ Provide for aesthetic enjoyment and recreation
Forest Ecosystems 	■ Timber ■ Fuelwood ■ Drinking and irrigation water ■ Fodder ■ Nontimber products (vines, bamboos, leaves, etc.) ■ Food (honey, mushrooms, fruit, and other edible plants; game) ■ Genetic resources	■ Remove air pollutants, emit oxygen ■ Cycle nutrients ■ Maintain array of watershed functions (infiltration, purification, flow control, soil stabilization) ■ Maintain biodiversity ■ Sequester atmospheric carbon ■ Moderate weather extremes and impacts ■ Generate soil ■ Provide employment ■ Provide human and wildlife habitat ■ Provide for aesthetic enjoyment and recreation

Freshwater Systems 	■ Drinking and irrigation water ■ Fish ■ Hydroelectricity ■ Genetic resources	■ Buffer water flow (control timing and volume) ■ Dilute and carry away wastes ■ Cycle nutrients ■ Maintain biodiversity ■ Provide aquatic habitat ■ Provide transportation corridor ■ Provide employment ■ Provide for aesthetic enjoyment and recreation
Grassland Ecosystems 	■ Livestock (food, game, hides, fiber) ■ Drinking and irrigation water ■ Genetic resources	■ Maintain array of watershed functions (infiltration, purification, flow control, soil stabilization) ■ Cycle nutrients ■ Remove air pollutants, emit oxygen ■ Maintain biodiversity ■ Generate soil ■ Sequester atmospheric carbon ■ Provide human and wildlife habitat ■ Provide employment ■ Provide for aesthetic enjoyment and recreation

Primary Human-Induced Pressures on Ecosystems

Ecosystem	Pressures	Causes
Agroecosystems 	■ Conversion of farmland to urban and industrial uses ■ Water pollution from nutrient runoff and siltation ■ Water scarcity from irrigation ■ Degradation of soil from erosion, shifting cultivation, or nutrient depletion ■ Changing weather patterns	■ Population growth ■ Increasing demand for food and industrial goods ■ Urbanization ■ Government policies subsidizing agricultural inputs (water, research, transport) and irrigation ■ Poverty and insecure tenure ■ Climate change
Coastal Ecosystems 	■ Overexploitation of fisheries ■ Conversion of wetlands and coastal habitats ■ Water pollution from agricultural and industrial sources ■ Fragmentation or destruction of natural tidal barriers and reefs ■ Invasion of nonnative species ■ Potential sea level rise	■ Population growth ■ Increasing demand for food and coastal tourism ■ Urbanization and recreational development, which is highest in coastal areas ■ Government fishing subsidies ■ Inadequate information about ecosystem conditions, especially for fisheries ■ Poverty and insecure tenure ■ Uncoordinated coastal land-use policies ■ Climate change
Forest Ecosystems 	■ Conversion or fragmentation resulting from agricultural or urban uses ■ Deforestation resulting in loss of biodiversity, release of stored carbon, air and water pollution ■ Acid rain from industrial pollution ■ Invasion of nonnative species ■ Overextraction of water for agricultural, urban, and industrial uses	■ Population growth ■ Increasing demand for timber, pulp, and other fiber ■ Government subsidies for timber extraction and logging roads ■ Inadequate valuation of costs of industrial air pollution ■ Poverty and insecure tenure

Freshwater Systems 	■ Overextraction of water for agricultural, urban, and industrial uses ■ Overexploitation of inland fisheries ■ Building dams for irrigation, hydropower, and flood control ■ Water pollution from agricultural, urban, and industrial uses ■ Invasion of nonnative species	■ Population growth ■ Widespread water scarcity and naturally uneven distribution of water resources ■ Government subsidies of water use ■ Inadequate valuation of costs of water pollution ■ Poverty and insecure tenure ■ Growing demand for hydropower
Grassland Ecosystems 	■ Conversion or fragmentation owing to agricultural or urban uses ■ Induced grassland fires resulting in loss of biodiversity, release of stored carbon, and air pollution ■ Soil degradation and water pollution from livestock herds ■ Overexploitation of game animals	■ Population growth ■ Increasing demand for agricultural products, especially meat ■ Inadequate information about ecosystem conditions ■ Poverty and insecure tenure ■ Accessibility and ease of conversion of grass-