

Lecture 2. 2012-01-19

- Ch 3 Ecosystems: What are they and how do they work.
Section “How do scientists study ecosystems” not part of the exam
- Ch 4 Biodiversity and evolution
Section “How do geological processes and climate change affect evolution” not part of the exam. Cases studies in section “What roles do species play in ecosystems” within brackets.
- Ch 5 Biodiversity, Species interactions, and Population control.
This chapter will be discussed Wednesday Jan 25.

Example of ecosystem:

Meadow land



Example of ecosystem

Coral reef



B. Christensen/Azote

Example of ecosystem

Grassland

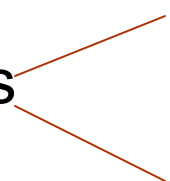


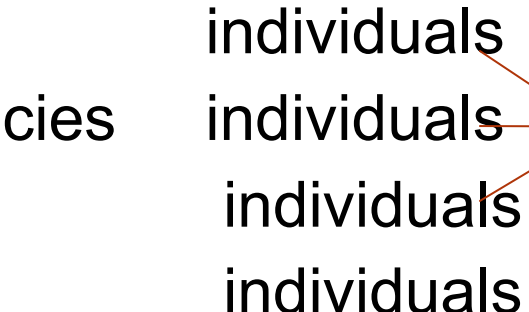
Copyright © 1997 Jason Anderson

The ecosystem

- Structure of living organisms

cells -----> organisms ---> species

cells  prokaryotic (membrane, no distinct nucleus)
eukaryotic (membrane, distinct nucleus)

Species  individuals
individuals — population
individuals — population community
individuals — population
ecosystem

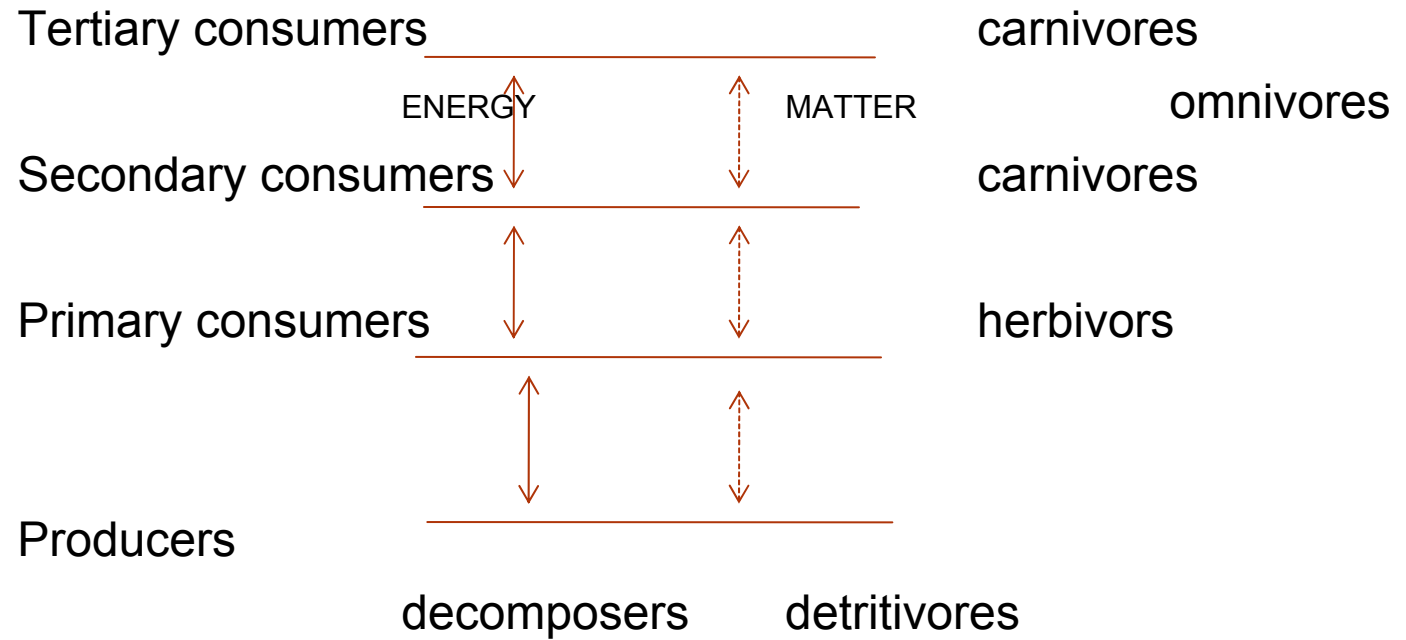
Some definitions

- Biosphere: it consists of the parts of the earth's air, water, and soil where life is found.
- Habitat : the place where a population or an individual normally lives

Major components of an ecosystem.

- Abiotic components: water, air, nutrients, rocks, heat, solar rad
- Biotic components: living and once living biological components, plants, animals, microbes.

Trophic levels in ecosystems



Food chain and food web

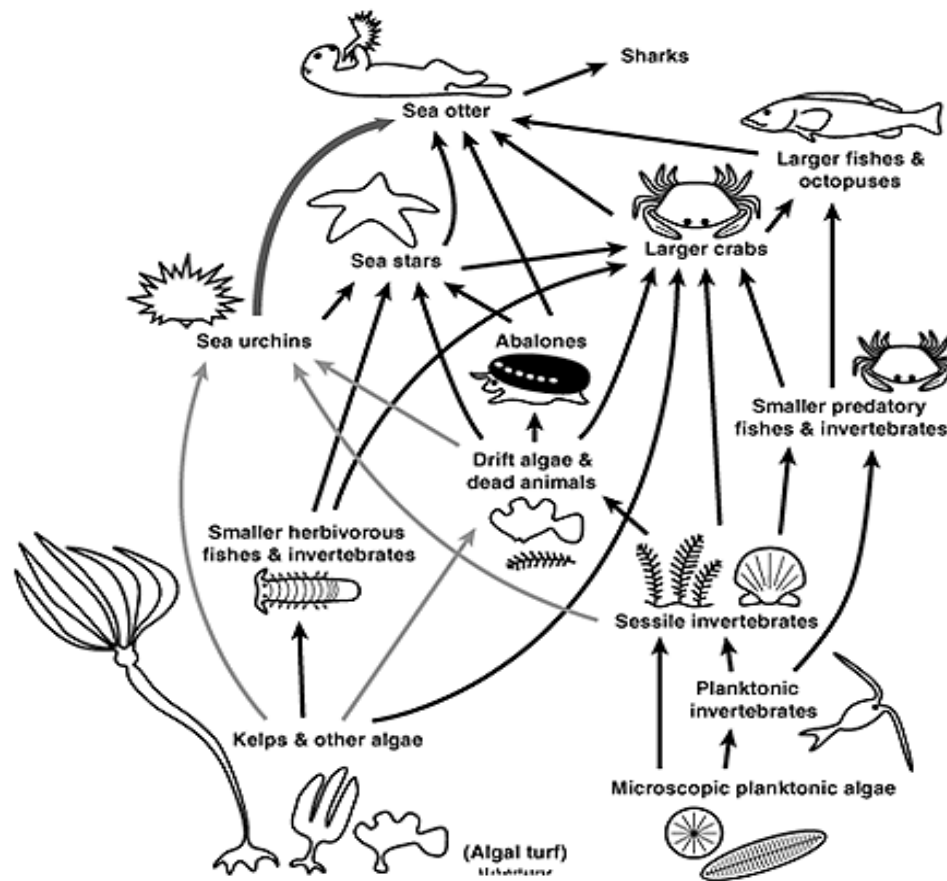
- Every organism in an ecosystem is assigned to a trophic level.
- A sequence of organisms, each of which serves as a source of food or energy for the next, is called a **food chain**.

Every transfer of energy by organisms involves a loss of energy to the environment as heat.

- Organisms in most ecosystems form a complex network of interconnected food chains called a **food web**.

Food web

A. With sea otters, kelp forest food web



Biomass and ecological efficiency

- Each trophic level in a food chain or web contains a certain amount of biomass, the dry weight of all organic matter contained in its organisms. In a food chain or web, chemical energy stored in biomass is transferred from one trophic level to another.
- The percentage of usable chemical energy transferred as biomass from one trophic level to the next is called ecological efficiency. Typically the efficiency is 10%.
(Range 2-40%)

Gross and net primary productivity

- Gross primary productivity is the **rate** at which an ecosystem's producers convert solar energy into chemical energy as biomass found in their tissues. Usually measured in $\text{kcal}/(\text{m}^2 \text{ year})$ or $(\text{J}/ \text{m}^2 \text{ year})$.

To stay alive, grow and reproduce, producers must use some of the chemical energy stored in the biomass they make for their own respiration

- Net primary productivity (NPP) is the rate at which producers use photosynthesis to produce and store chemical energy minus the rate at which they use of this stored chemical energy through aerobic respiration.

Energy processes

- Most producers capture sunlight to produce energy rich hydrocarbons (like glucose $C_6H_{12}O_6$) by photosynthesis.
- Organisms use the chemical energy stored in glucose (and other compounds) to fuel their life processes. In most cells the energy is released by **aerobic respiration**. (The opposite to photosynthesis.)

Cellular respiration without oxygen is called anaerobic respiration or fermentation.

Factors affecting population growth and population size

- Range of tolerance.
Variation in physical and chemical environment.
- Limiting factor principle:
Too much or too little of any abiotic factor can limit or prevent growth of a population, even if all other factors are at or near the optimal range of tolerance.

Chap 4. Biodiversity and evolution

- Biodiversity; the variety of properties

Somewhere between 4 and 100 millions species on the earth.

- Biological evolution by natural selection
- **Natural selection:** some individuals of a population have genetically based traits that enhance their ability to survive and produce offspring with the same traits.

Genetic variety through mutations, random changes in the structure of DNA.

Then on the whiteboard