

Ecosystems : Fundamental concepts (UG Hons. 2nd year)

by

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What is an ecosystem?

- **System** = regularly interacting and interdependent components forming a unified whole
- **Ecosystem** = an ecological system;
= a community and its physical environment treated together as a functional system

- Ecosystem means ecological system.
- **Ecology** is the scientific study of the interrelationships between organisms, and between organisms and their environment. Haeckel 1863. "the study of all the complex interrelationships referred to by Darwin as the conditions of the struggle for existence, or the economy of nature."
- Ecosystem: Defined **area** in which a community lives with interactions taking place among the organisms between the community and its non-living physical environment.

Ecosystems:

Fundamental Characteristics

- Structure:
 - Living (biotic)
 - Nonliving (abiotic)
- Process:
 - Energy flow
 - Cycling of matter (chemicals)
- Change:
 - Dynamic (not static)
 - Succession, etc.

- **Abiotic Components**

These include the non-living, physico - chemical factors such as air, water, soil and the basic elements and compounds of the environment.

Abiotic factors are broadly classified under three categories.

Climatic factors which include the climatic regime and physical factors of the environment like light, humidity, atmospheric temperature, wind, etc.

Edaphic factors which are related to the structure and composition of soil including its physical and chemical properties, like soil and its types, soil profile, minerals, organic matter, soil water, soil organisms. Inorganic substances like water, carbon, sulphur, nitrogen, phosphorus and so on. Organic substances like proteins, lipids, carbohydrates, humic substances etc.

Biotic Components:

- **Primary Producers**
- Sunlight is the main energy source for life on Earth.
- Organisms that can capture energy from sunlight or chemicals and use that energy to produce food are called **autotrophs**, or **primary producers**.
- The process in which autotrophs capture light energy and use it to convert carbon dioxide and water into oxygen and sugars is called **photosynthesis**.
- The process in which autotrophs use chemical energy to produce carbohydrates is called **chemosynthesis**.

Photoautotrophs

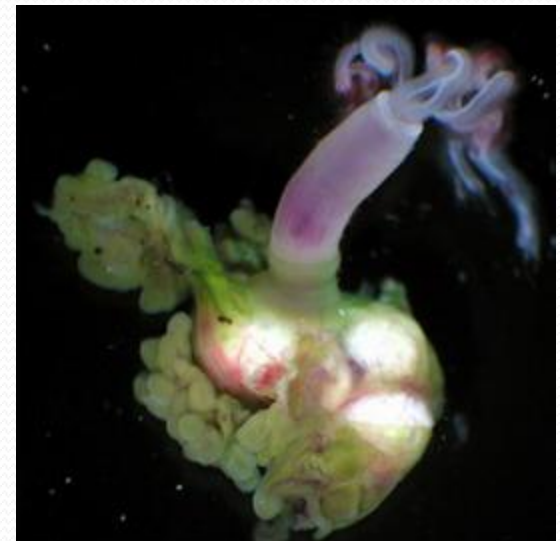
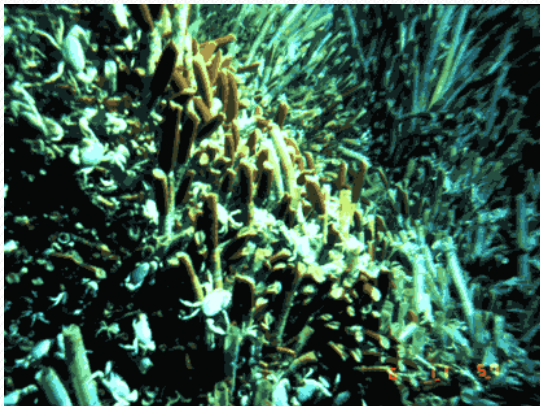
- Without autotrophs, there would be no life on this planet
- Ex. Plants and Algae



Autotrophs

- Chemotrophs

- Autotrophs that get their energy from inorganic substances, such as salt
- Live deep down in the ocean where there is no sunlight
- Ex. Bacteria and Deep Sea Worms



Consumers = Heterotrophs

- Organisms that do not make their own food
- Another term for Heterotroph is consumer because they consume other organisms in order to live
- Ex. Rabbits, Deer, Mushrooms

Heterotrophs



Rabbits



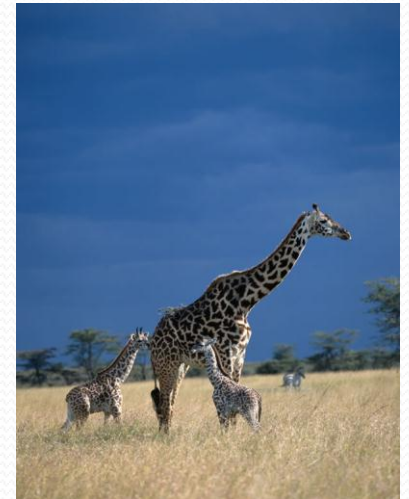
Deer



Mushrooms

Heterotrophs = Consumers

- Herbivores – eat ONLY plants
 - Ex. – Cows, Elephants, Giraffes



Heterotrophs = Consumers

- Carnivores – eat ONLY meat
 - Ex. – Lions, Tigers, Sharks



Heterotrophs = Consumers

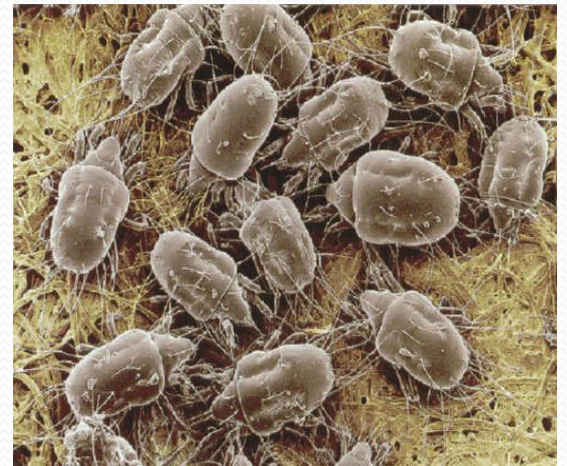
- Omnivores – eat BOTH plants and animals
 - Ex. – Bears and Humans



Kyle Smith

Heterotrophs = Consumers

- **Detritivores** - feed on the tissue (detritus) of dead organisms (plant or animal)
- Shrimp, earthworms, dust mites



Heterotrophs = Consumers

- **Scavengers**– Consumes the carcasses of dead animals but does not typically kill them itself.
 - Ex. – Vultures & Crows



Heterotrophs = Consumers

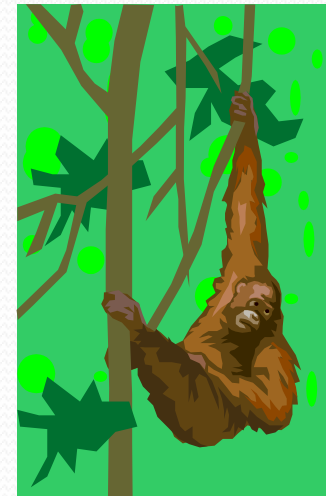
Decomposers – absorb any dead material and break it down into simple nutrients or fertilizers

- Ex. – Bacteria and Mushrooms



2 Essentials in an ecosystem: Energy and Nutrients...

1. Sunlight is source of ENERGY
2. $\frac{1}{2}$ energy stored in plants as starch
3. Energy CANNOT be recycled=FLOWS
4. NUTRIENTS are recycled naturally by DECOMPOSERS

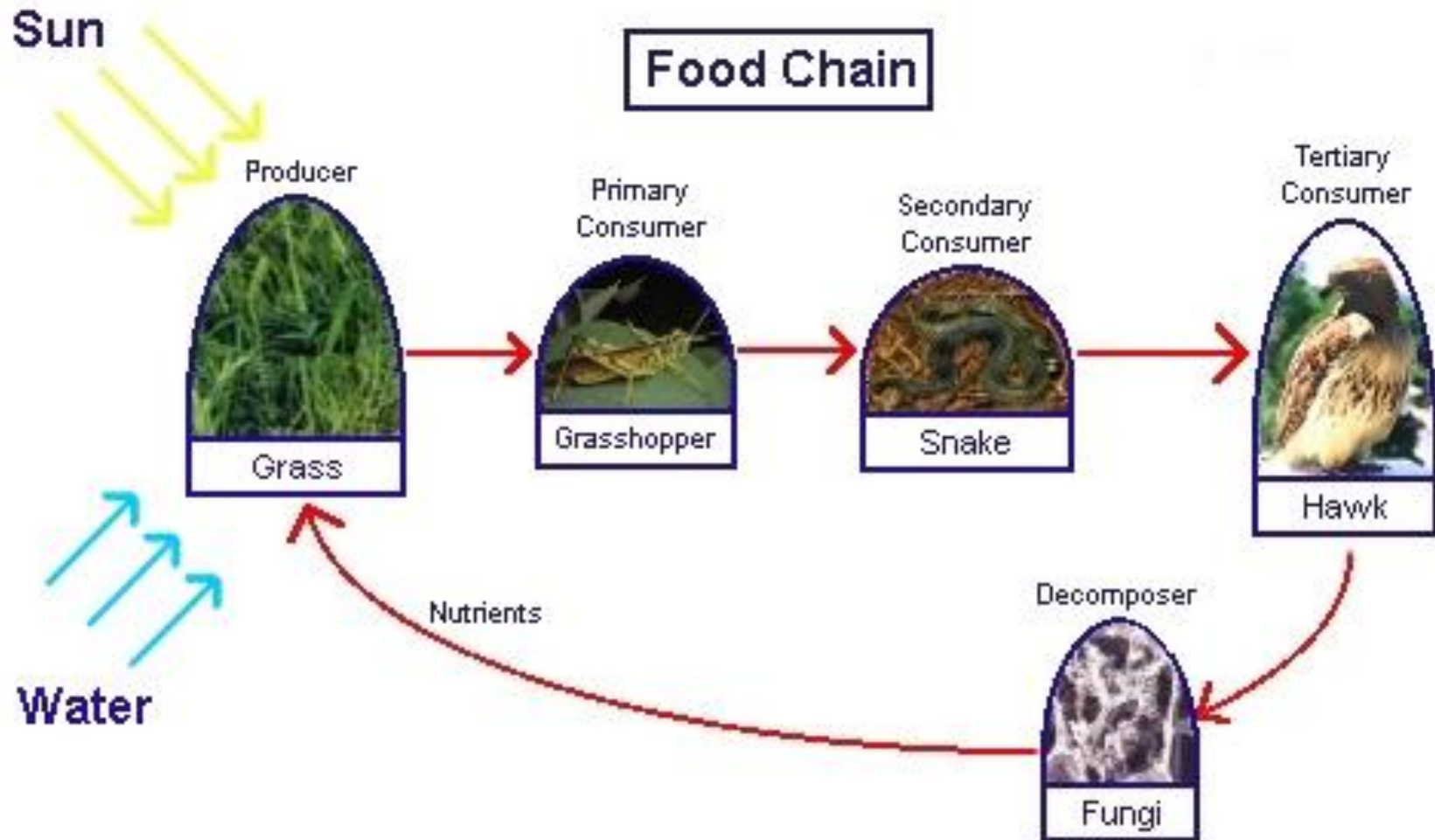


Food Chain



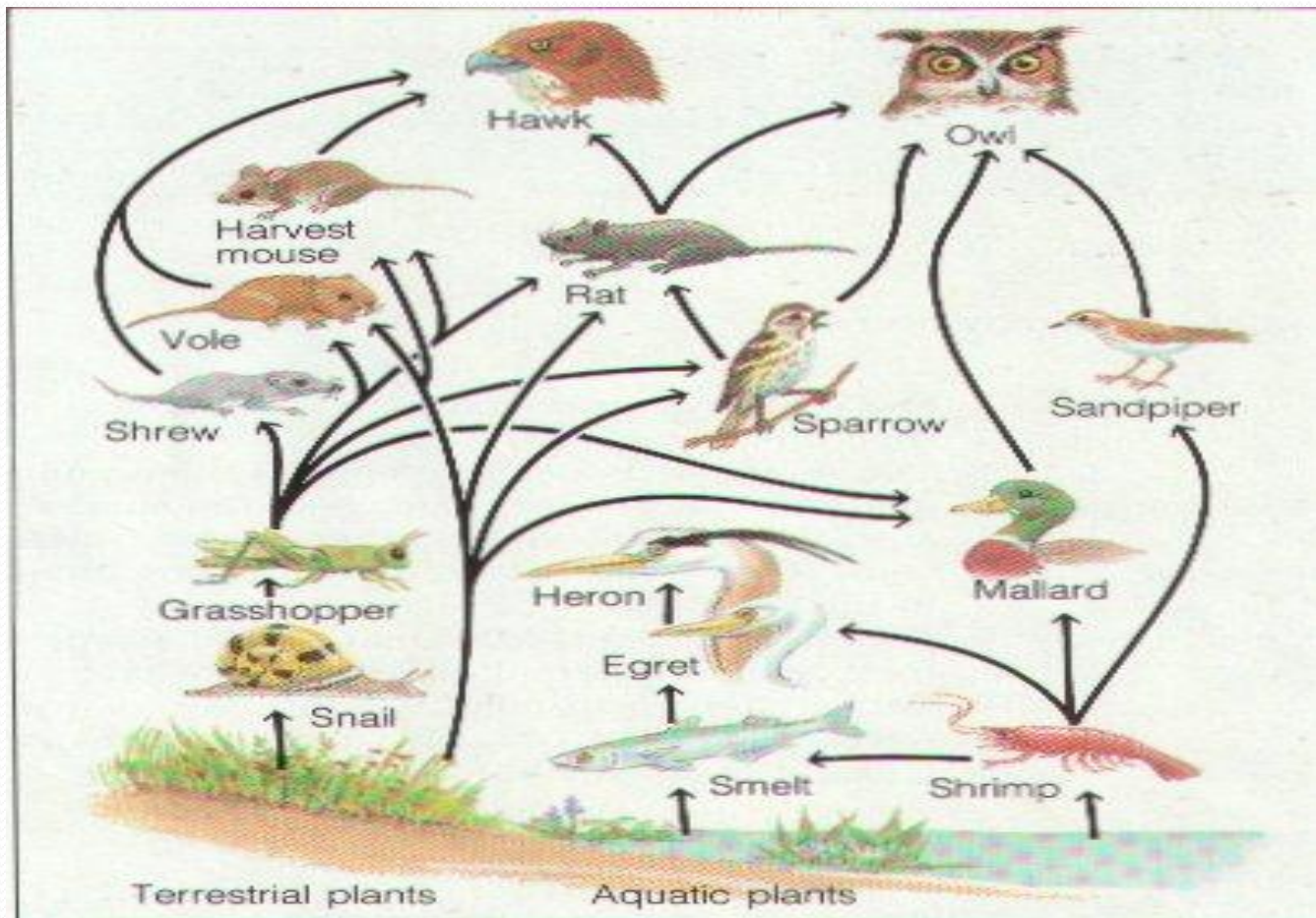
- A single chain or series of steps showing who eats who.
- Example: grass --→deer-→lion
- Shows only a ONE WAY flow of energy

energy flows in one direction: from sun to producers to consumers



Food Webs

- All the food chains in an area make up the **food web** of the area.



How to read a food web

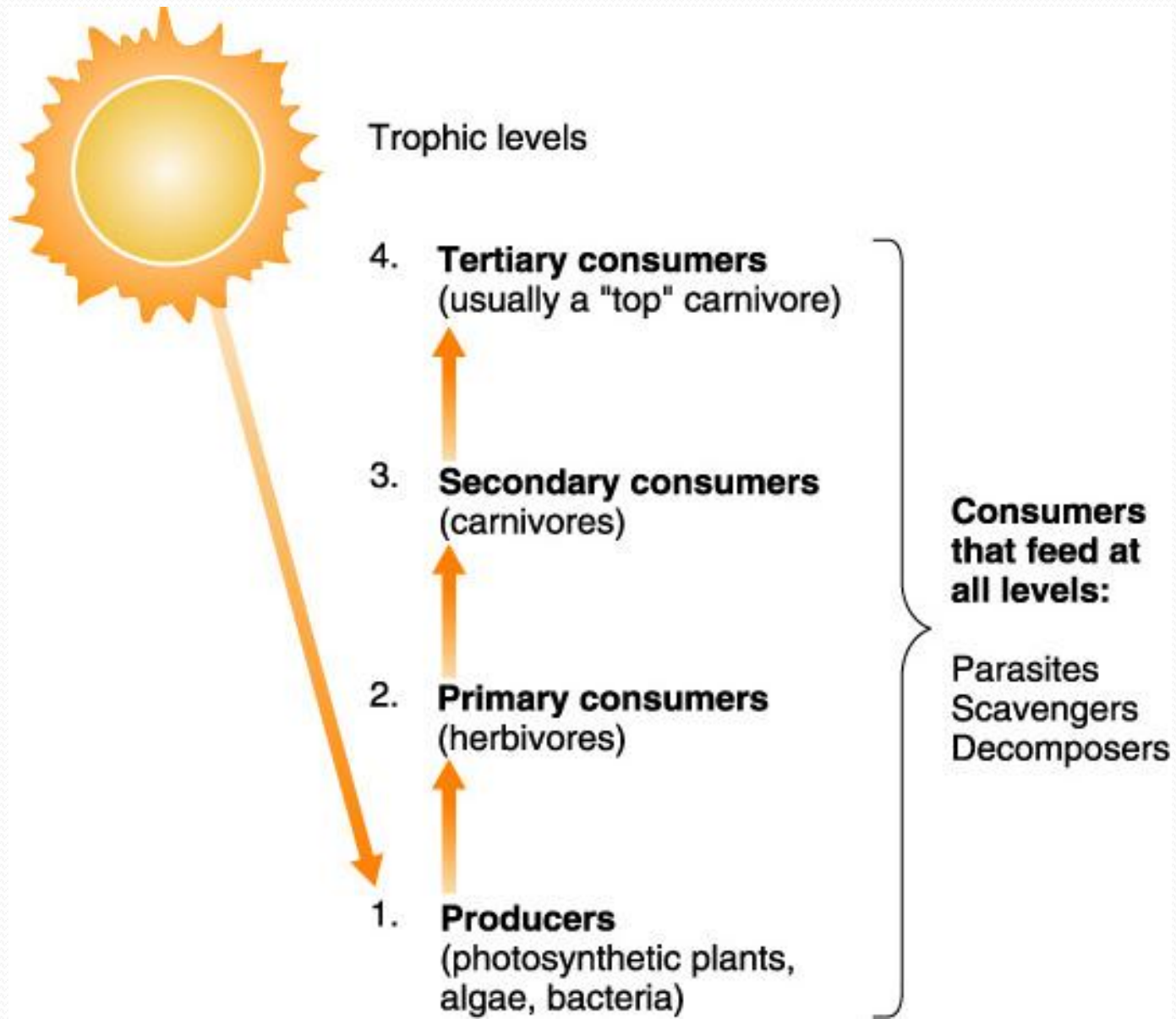


- The arrow points in the direction the energy and nutrients flow. Ex:
- grass energy — deer energy — tiger
- They show complex feeding relationships that result from interconnecting food chains.
- Food webs are different depending on where you are on the globe.
- Food webs are good indicators to the health of the Ecosystem.

Trophic Levels

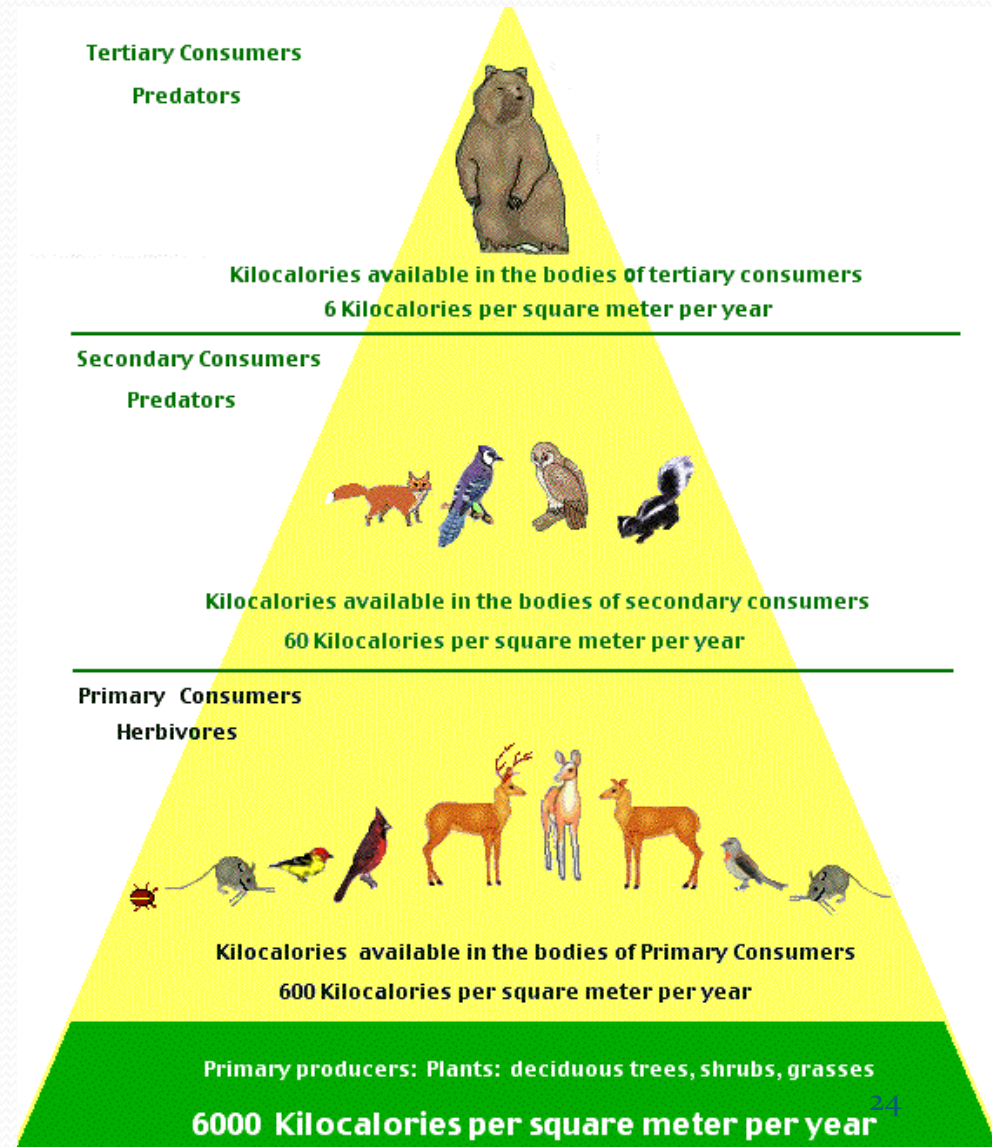
- An organism's feeding position in an ecosystem is called as **trophic level**.
- Organisms can also be identified by the kinds of food they consume:
 - Herbivores – cows eat plants.
 - Carnivores – lion eat animals.
 - Omnivores - man eat plants and animals.
 - Detrivores – ants & beetles eat detritus (litters)
 - Decomposers - bacteria and fungi breakdown complex organic matter into simpler compounds.

Trophic Levels



Trophic Levels

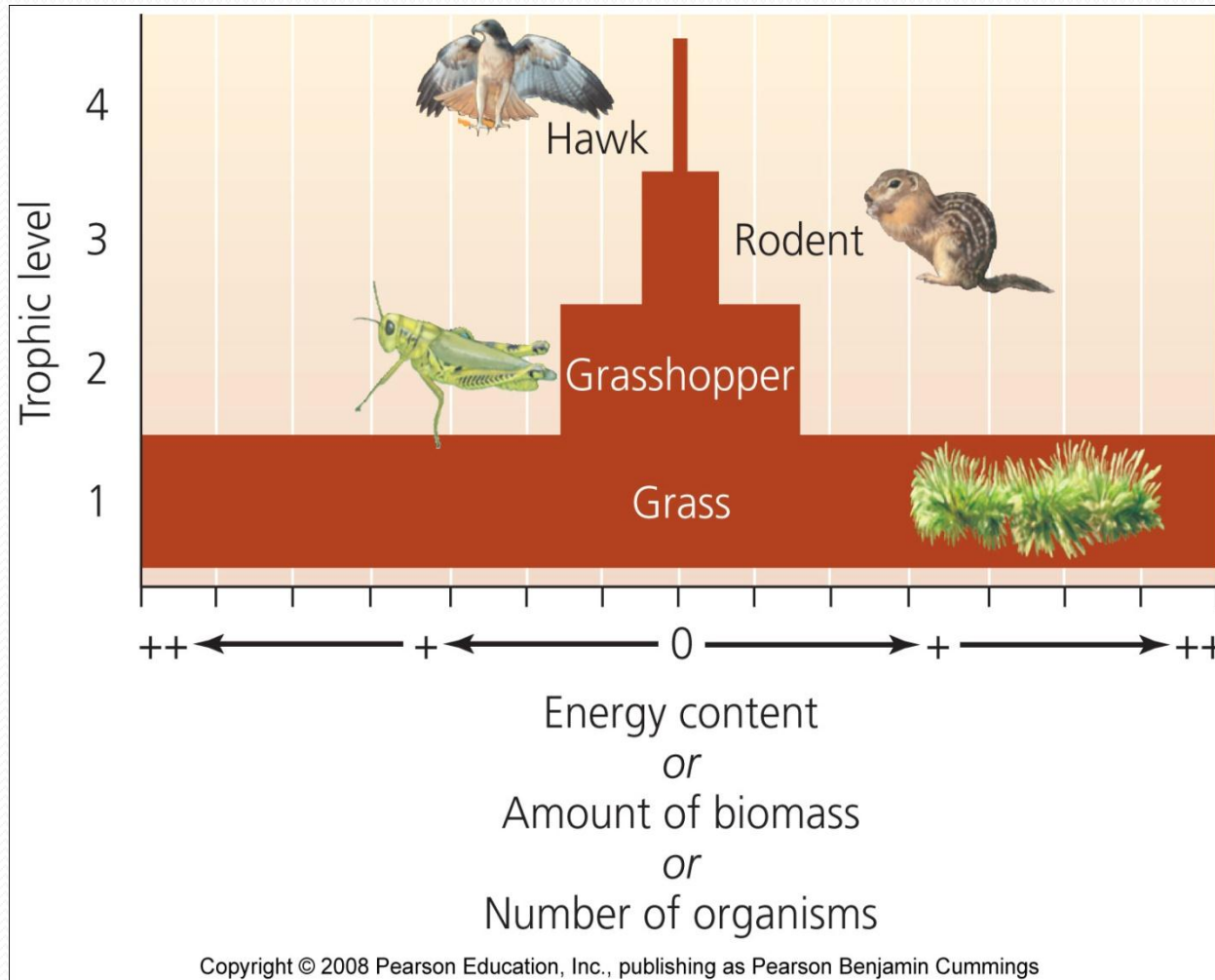
- Trophic levels can be analyzed on an energy pyramid.
- **Producers** are found at the base of the pyramid and comprise the **first trophic level**.
- **Primary consumers** make up the **second trophic level**.
- **Secondary consumers** make up the **third trophic level**.
- Finally **tertiary consumers** make up the **top trophic level**.



ECOLOGICAL PYRAMID

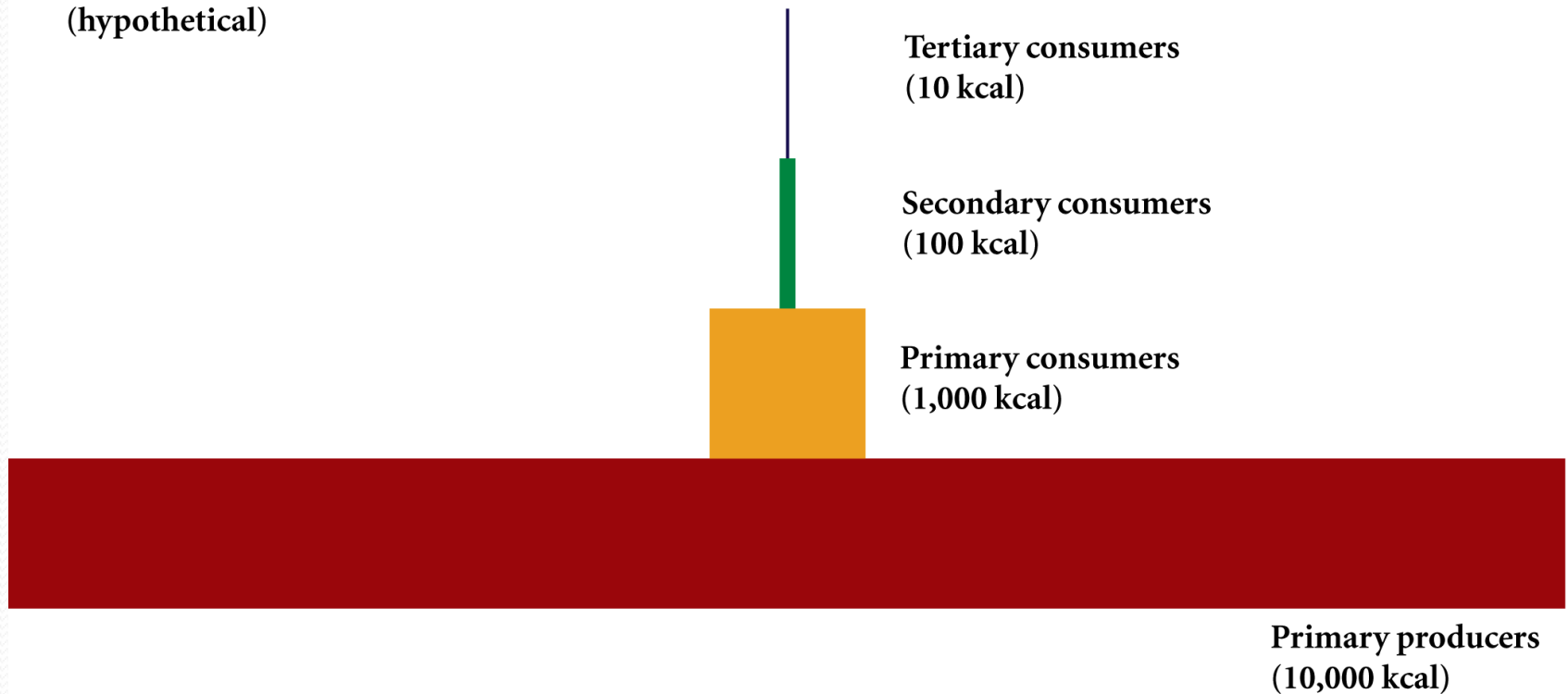
- ✚ Energy, biomass, and numbers decrease with each trophic level
- ✚ Most energy organisms use is lost as waste heat through respiration
 - ✚ Less and less energy is available in each successive trophic level
 - ✚ Each level contains only 10% of the energy of the trophic level below it
- ✚ There are far fewer organisms at the highest trophic levels, with less energy available

Pyramids of energy, biomass, and numbers



Ecological Pyramids of Energy

**Pyramid of Energy
(hypothetical)**

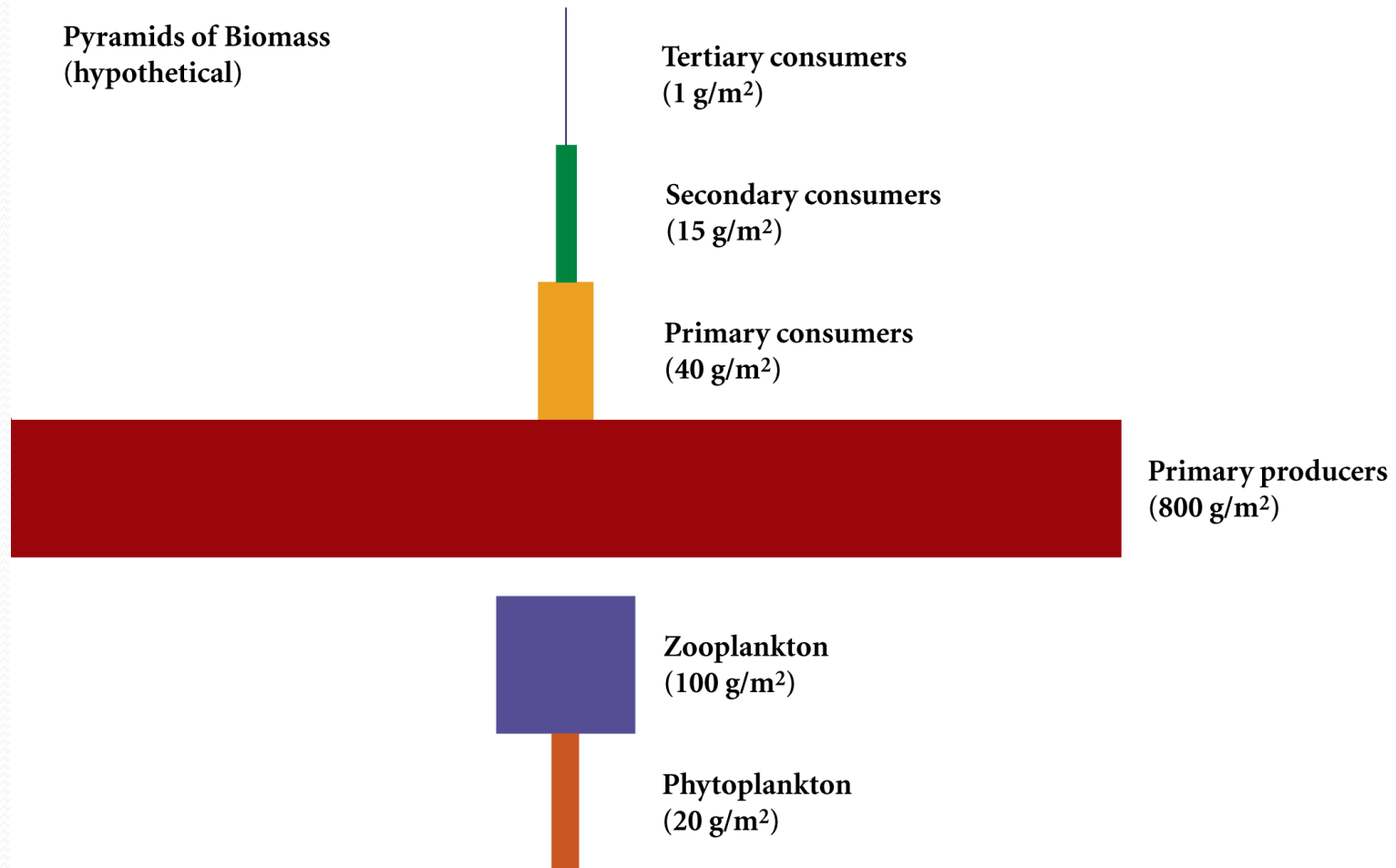


Biomass

- Energy is sometimes considered in terms of biomass, the mass of all the organisms and organic material in an area.
- There is **more** biomass at the trophic level of **producers** and **fewer** at the trophic level of tertiary **consumers**. (There are more plants on Earth than there are animals.)
- **Bio=life** **Mass=weight**
- **Bio + Mass = Weight of living things within an ecosystem.**

Ecological Pyramids of Biomass

Pyramids of Biomass
(hypothetical)





THANK YOU