

Environmental Sciences



BP205TT

Ecosystems: Basic Concepts

NRM Class 6

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What we will learn?

- What is meant by an ecosystem
- The biotic and abiotic community
- Food chains, trophic levels, ecological pyramid
- Water and carbon cycles (skip)
- Benefits from ecosystem services

Some definitions

- Ecosystem: Defined area in which a community lives with interactions taking place among the organisms between the community and its non-living physical environment.
- An ecosystem is formed by the interactions between all living and non-living things
- How do living and non-living things interact in an environment?

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 Services

- The human economy depends upon the services performed for free by ecosystems.
- The ecosystem services supplied annually are worth many trillions of dollars.
- Economic development that destroys habitats and impairs services can create costs to humanity over the long term that may greatly exceed the short-term economic benefits of the development.
- These costs are generally hidden from traditional economic accounting, but are nonetheless real and are usually borne by society at large.
 - <http://www.epa.gov/watertrain/pdf/issue2.pdf>

Ecosystems: Fundamental Characteristics

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

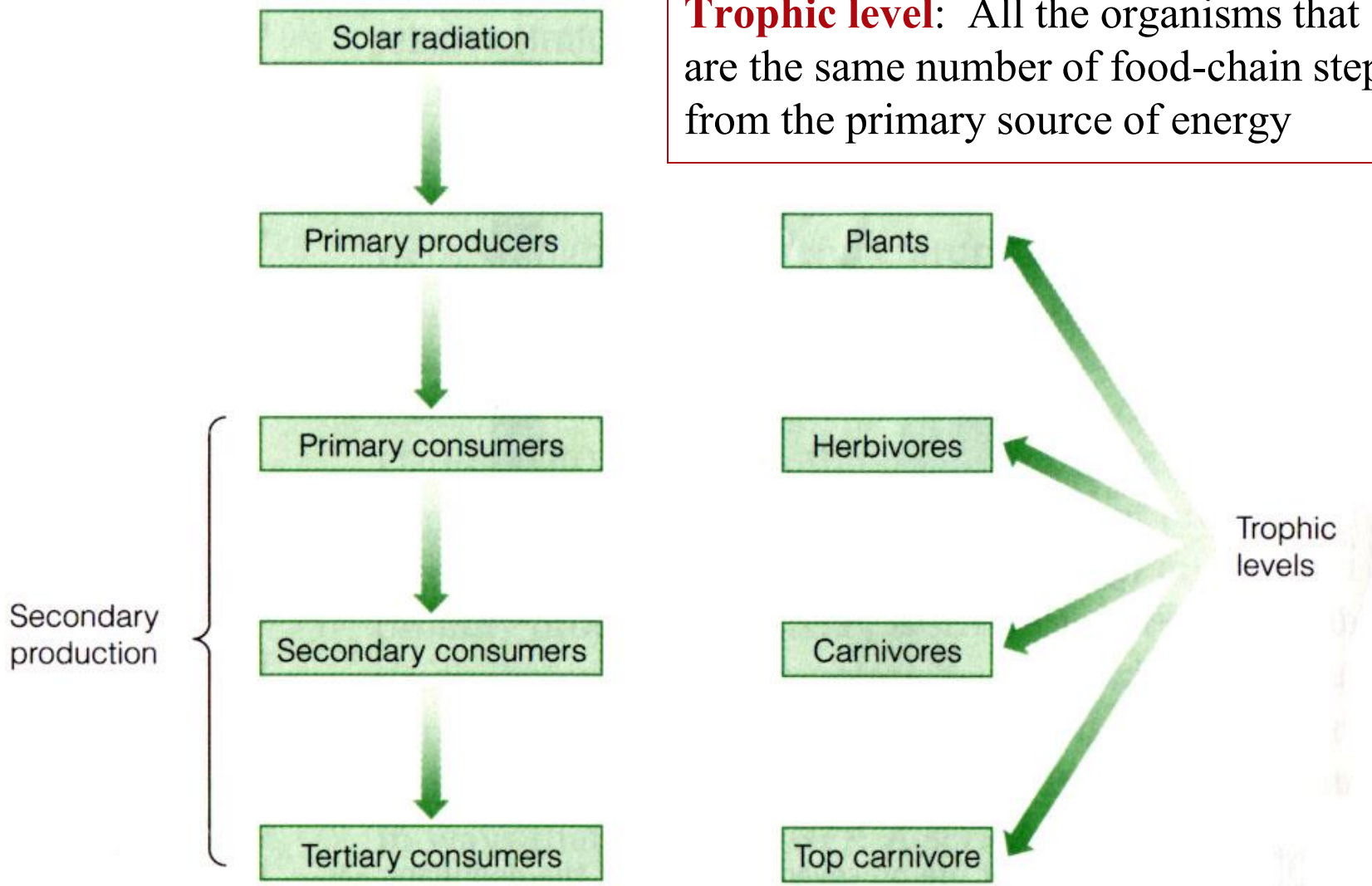
Abiotic components:

- **ABIOTIC components:**
 - provides practically all the energy for ecosystems.
- **Inorganic substances**, e.g., sulfur, boron, tend to cycle through ecosystems.
- **Organic compounds**, such as proteins, carbohydrates, lipids, and other complex molecules, form a link between biotic and abiotic components of the system.

BIOTIC components

- The biotic components of an ecosystem can be classified according to their **mode of energy acquisition**.
- **In this type of classification, there are:**
 - **Autotrophs** and **Heterotrophs**
 - Organisms that produce their own food from an energy source, such as the sun, and inorganic compounds.
 - Organisms that consume other organisms as a food source.

Trophic level: All the organisms that are the same number of food-chain steps from the primary source of energy



The schematic structure of a food chain. Each trophic level may contain many species.

Trophic Levels

- A trophic level is the position occupied by an organism in a food chain.
- 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**.

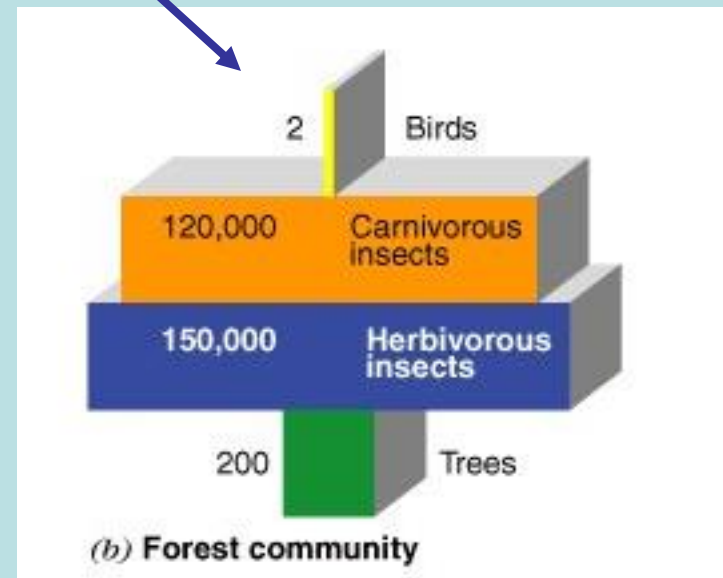
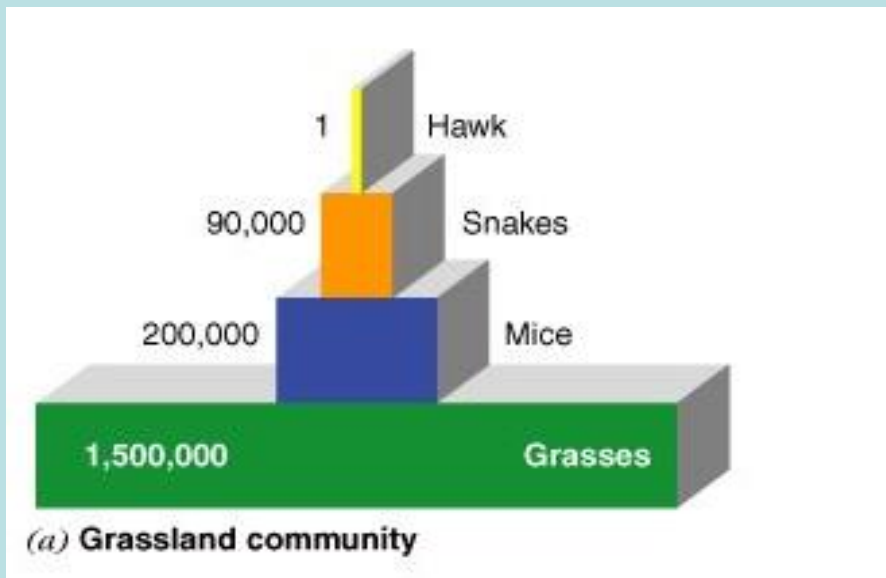
Trophic Levels Found on an Energy Pyramid

- The greatest amount of energy is found at the base of the pyramid.
- The least amount of energy is found at top of the pyramid.



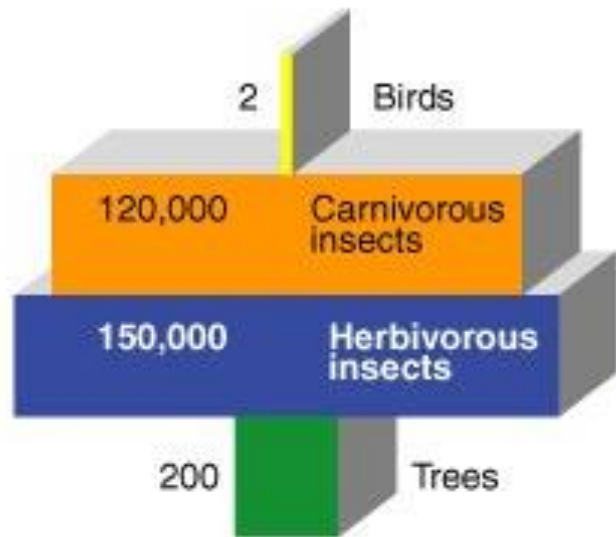
Trophic Structure Reminder

- Eltonian pyramids
- Number of individuals per species
- Is this pyramid stable?

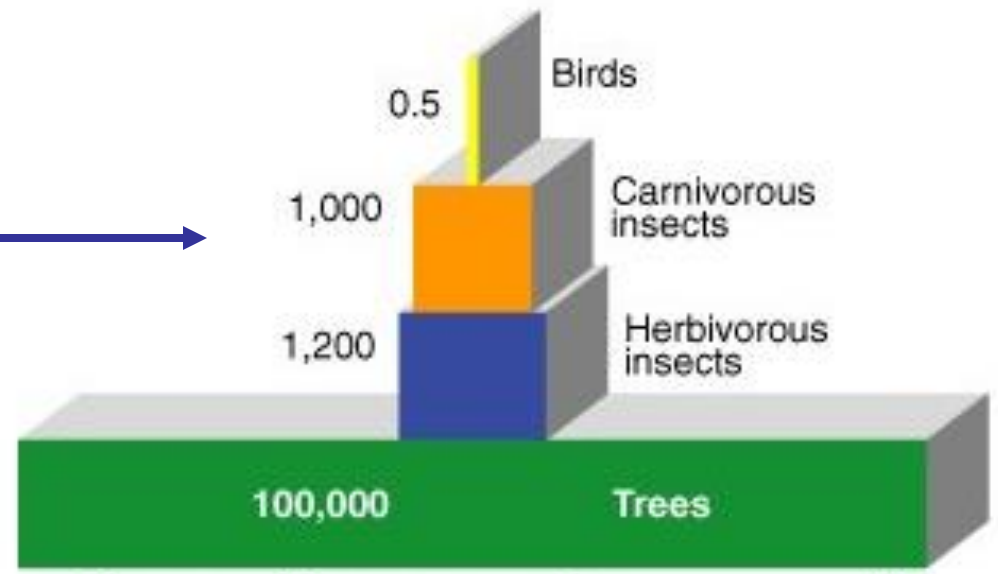


Trophic Structure Reminder

- What if we transformed each species into biomass instead of absolute numbers?



(b) Forest community



(c) Biomass of forest community

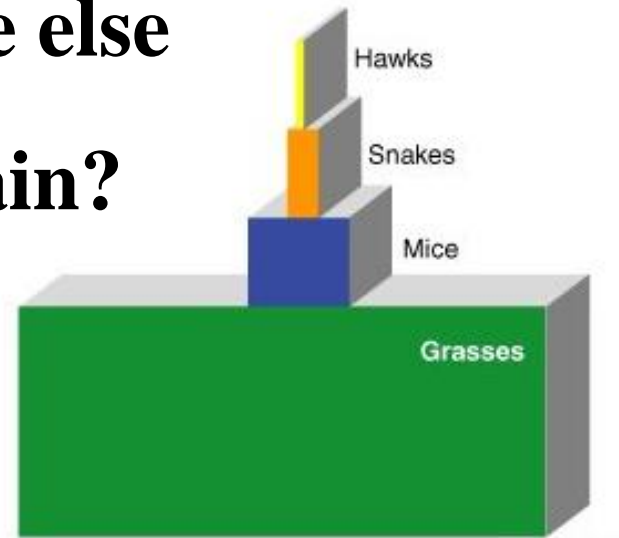
(kg)

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.**

Trophic Structure Reminder

- Express trophic structure as energy transfer
- Energy pyramids can never be inverted
- Is there room for anyone else at the top of this food chain?

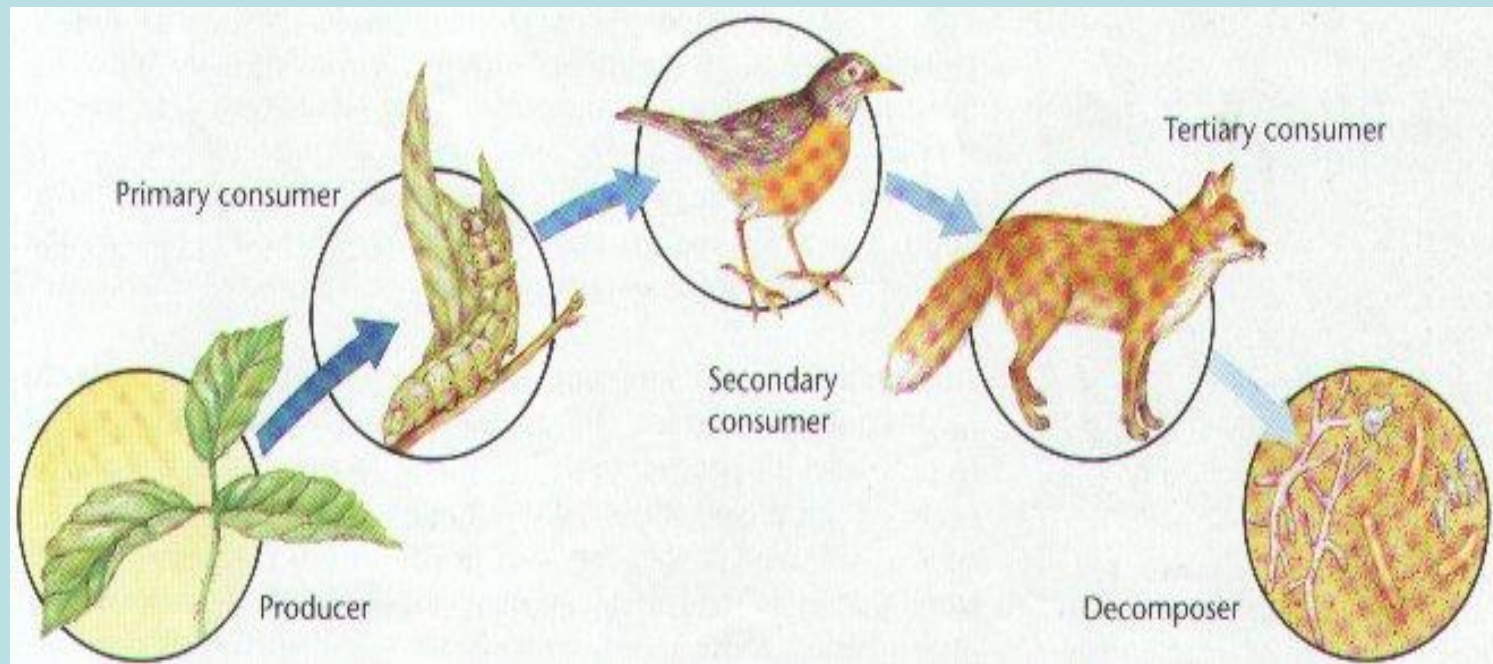


(e) Energy levels of a stable community (kcal/day)

Food Chains

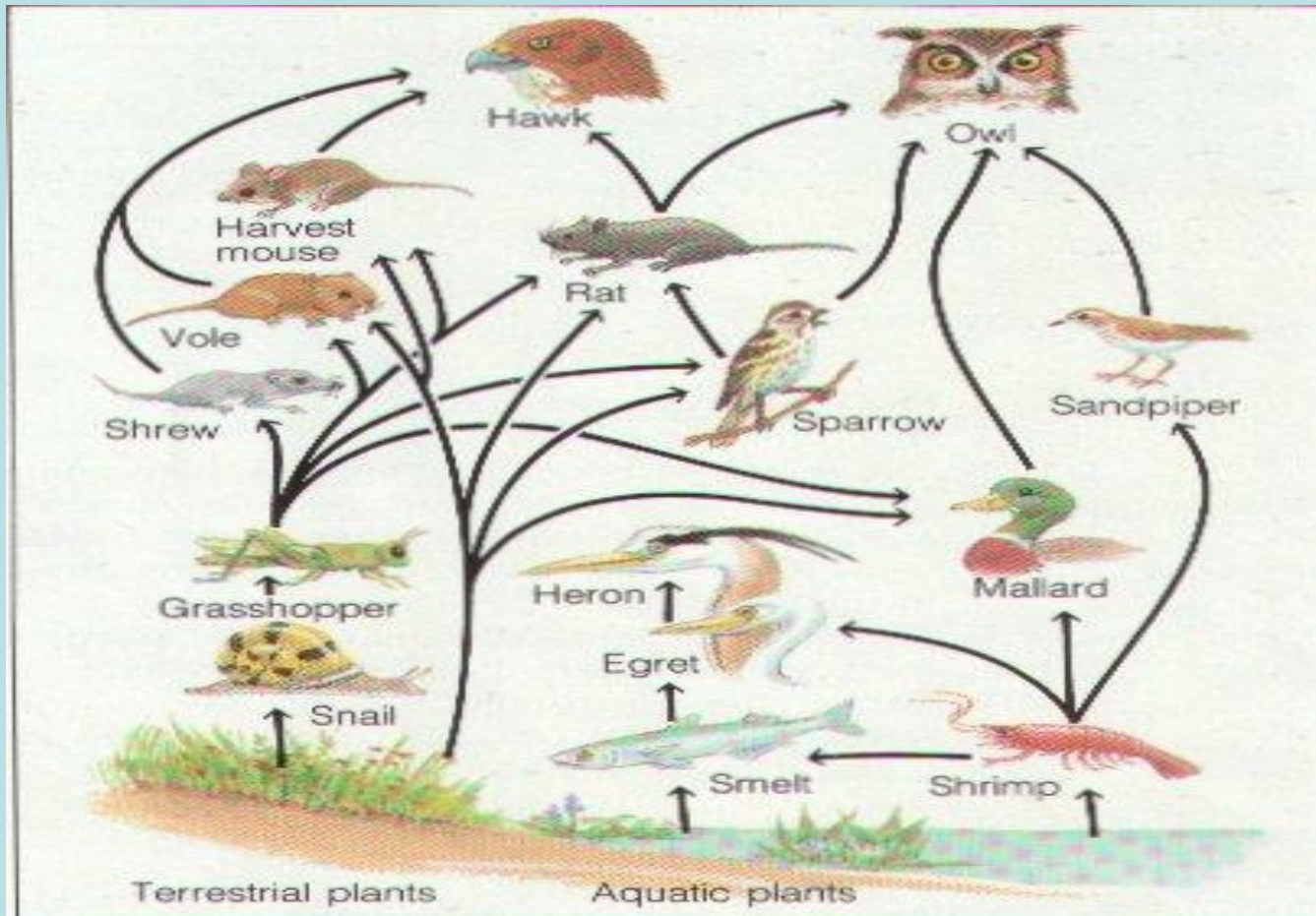
- The producers, consumers, and decomposers of each ecosystem make up a food chain.
- There are many food chains in an ecosystem.
- Food chains show where energy is transferred and not who eats who.

Example of a Food Chain



Food Webs

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



Food web of a hot spring

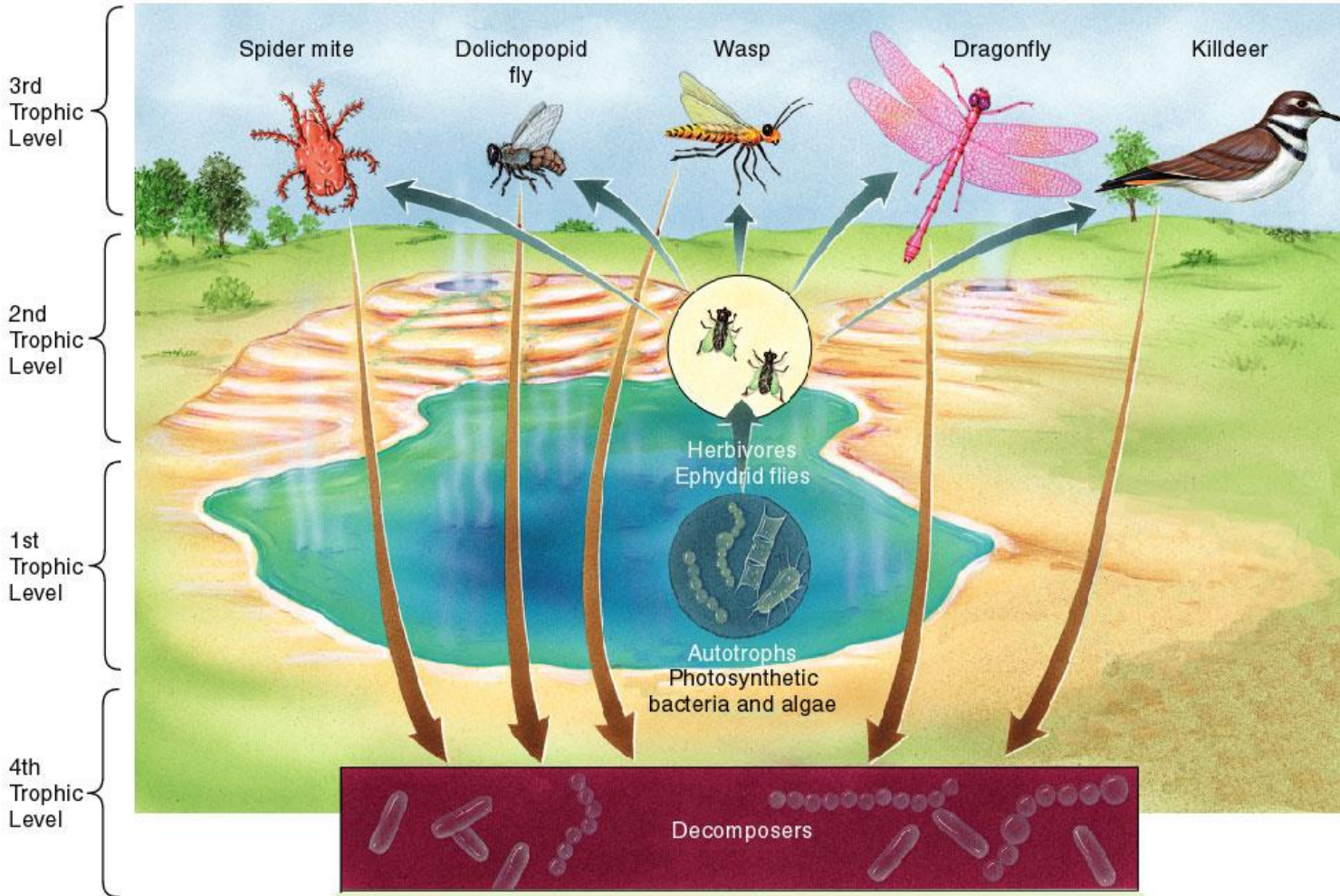
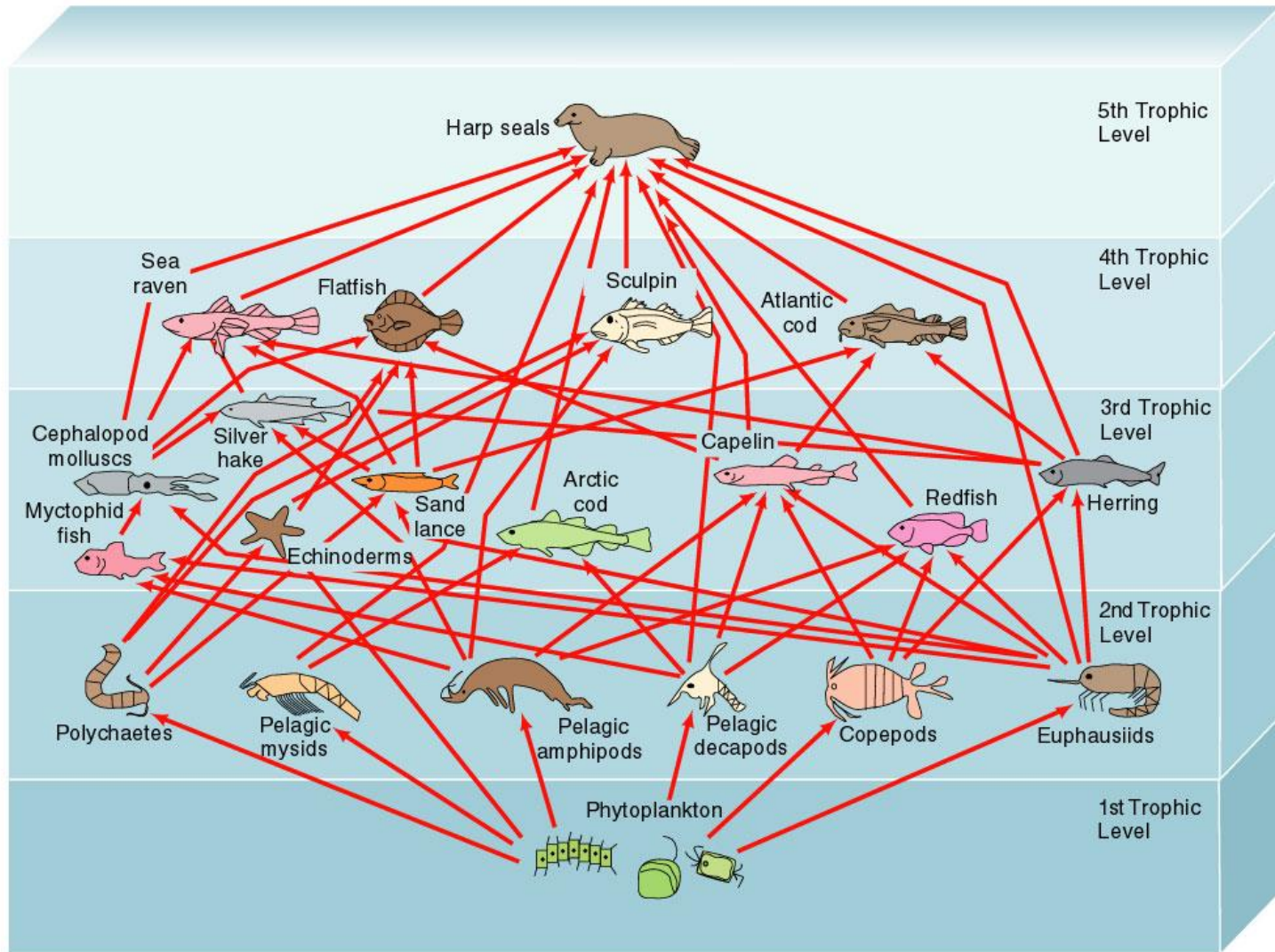


Fig 6.5 Food web of the harp seal.



Ecology

is

The study of the distribution and
abundance of organisms,

AND

the flows of energy and materials
between abiotic and biotic
components of ecosystems.