

Energy Flow in Ecosystems

TEKS

B.12C Analyze the flow of matter and energy through trophic levels using various models, including food chains, food webs, and ecological pyramids.

Vocabulary

- Food chain
- Food web
- Biomass
- Ecological pyramid
 - Energy pyramid
 - Biomass pyramid
 - Numbers pyramid
- Energy
- Trophic level
- Producer
- Consumer
- Decomposer
- Detritivore
- Primary
- Secondary
- Tertiary
- Keystone Species
- Biological Magnification
- Heat loss
- 10% rule

Prerequisite questions

- What is energy?
- How do organisms interact in an ecological setting?

Essential Question #1

- How does energy flowing through an ecosystem affect the organisms in that ecosystem?

Energy Flow

- In ecological diagrams like food chains, food webs and pyramids, **arrows** represent energy being transferred from one location to another.



- Energy is moving from the grasshopper to the duckling.

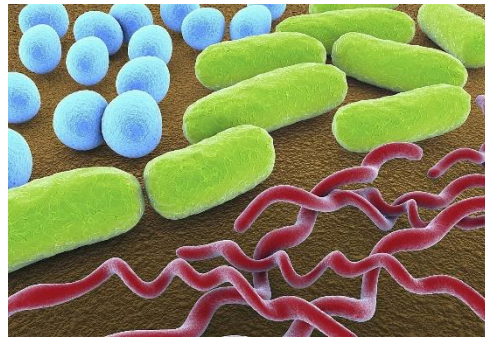
Trophic Levels

- **Primary producers** – use external energy sources (Sun or hydrothermal vents) to make sugars.
- **Primary consumers** – consume the primary producers to get the stored sugars.
(Also called *herbivores*)
- **Secondary consumers** – consume primary consumers to get at stored nutrients.
(Also called *carnivores*)
- **Tertiary consumers** – can consume any level but mostly eat secondary producers.

(If an organism eats both primary producers and consumers it is called an *omnivore*)

Decomposers and Detritivores

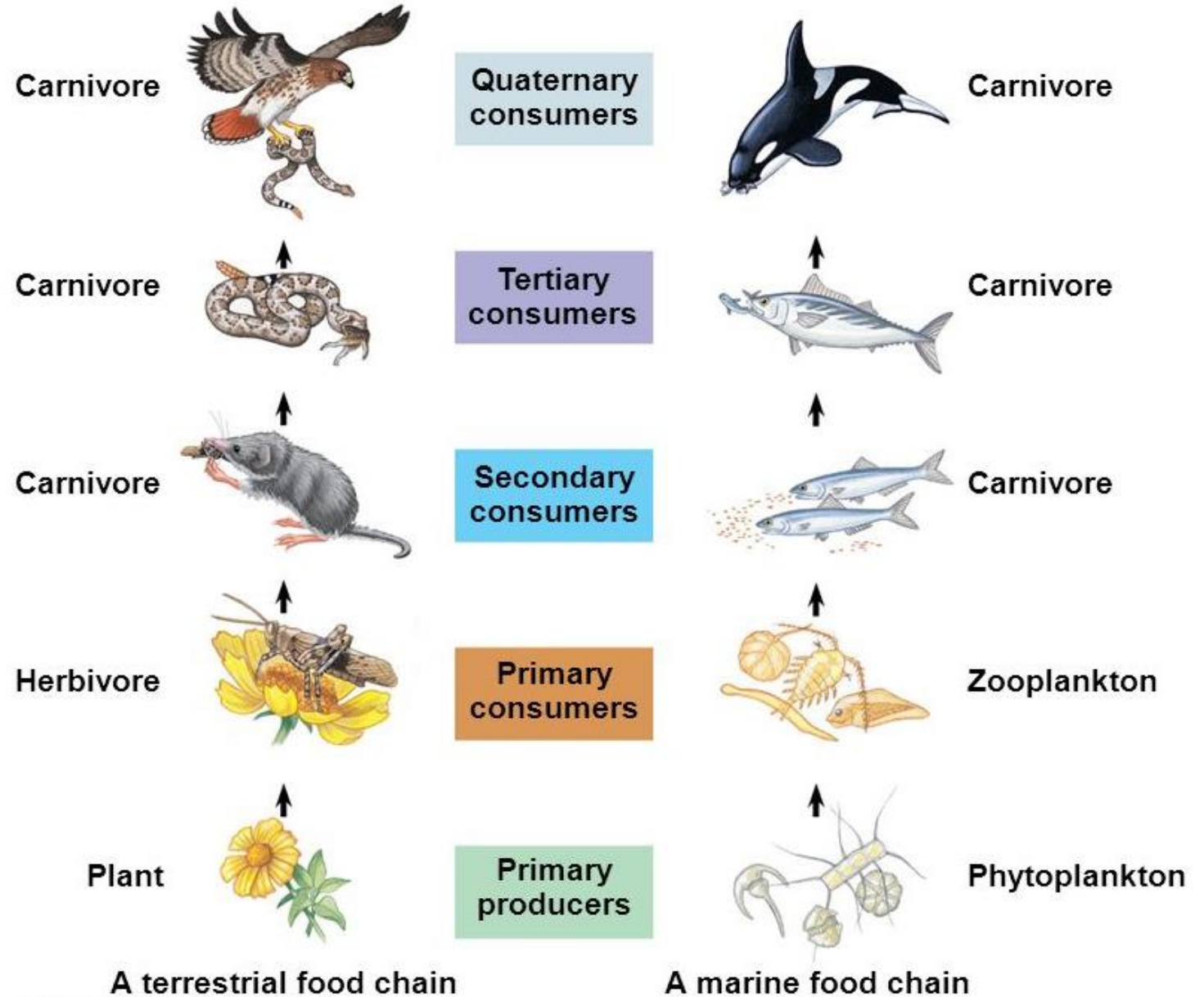
- **Decomposer** – an organism that feeds on decaying matter (detritus) and returns nutrients to the soil.



- Two VERY important decomposers are **bacteria** and **fungi**.
- **Detritivore** – an organism that feeds on detritus (decaying matter)

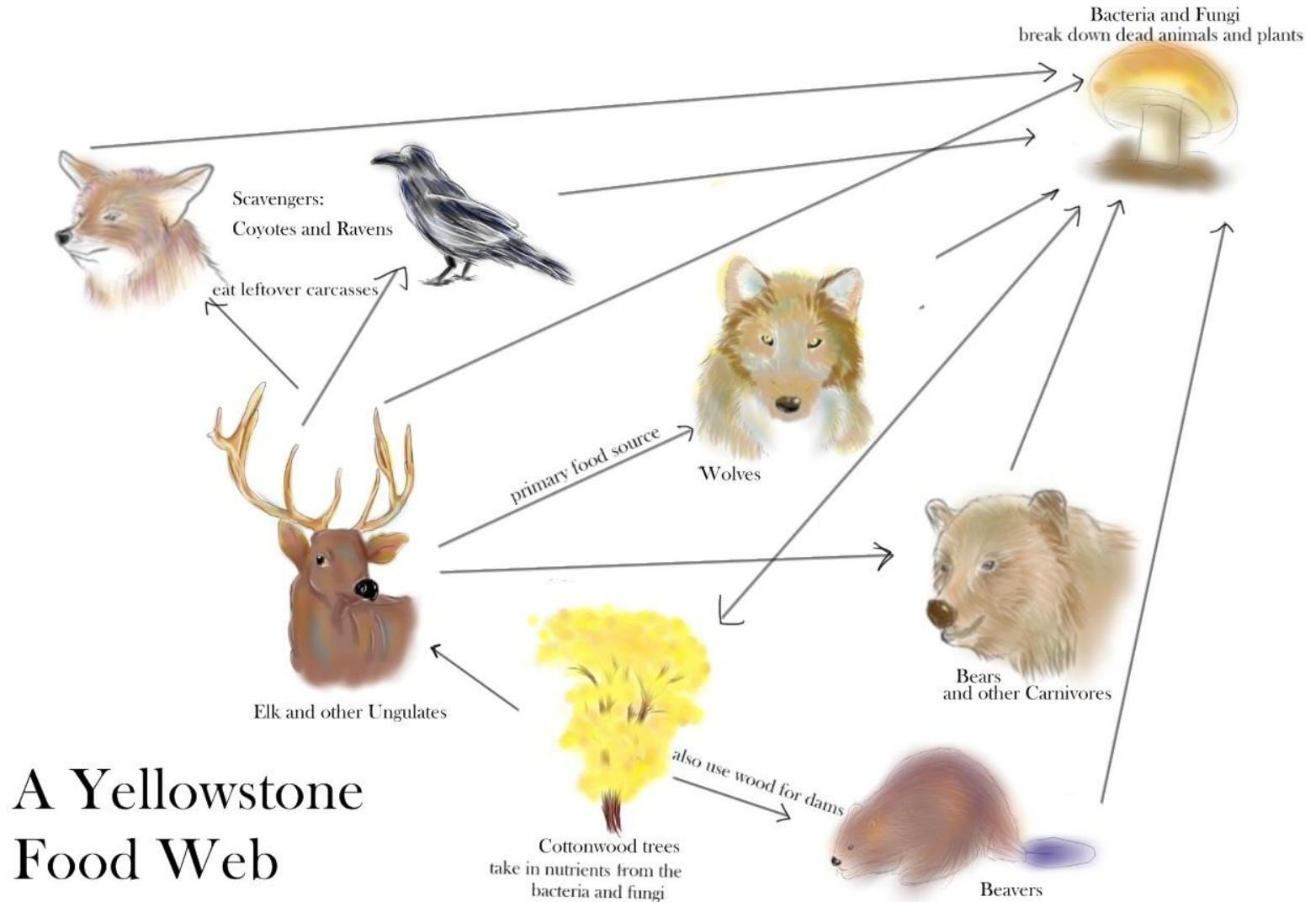
Food Chain

- **Food chains** show the movement of energy in a **single** pathway.



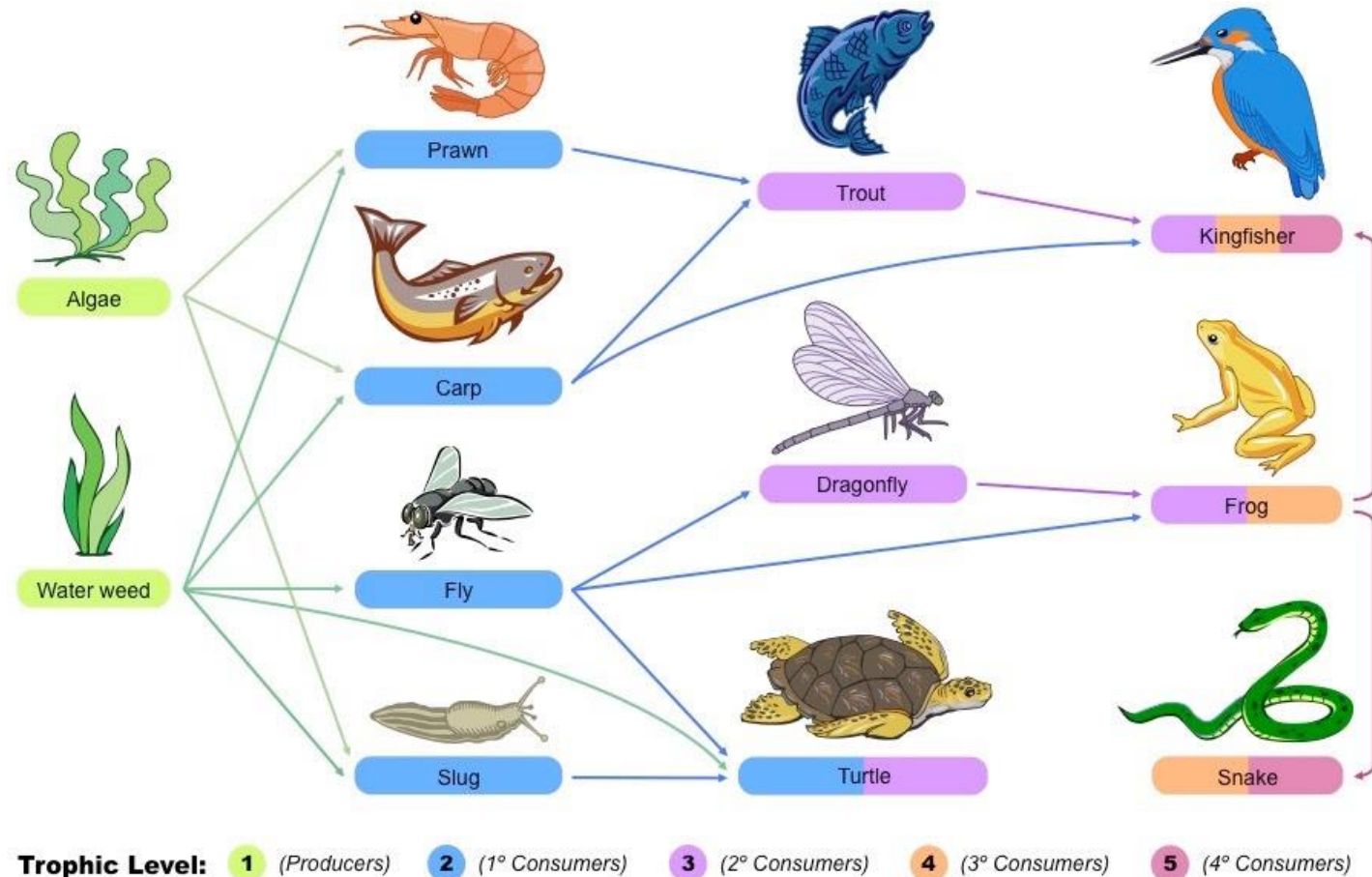
Food Web

- Food webs show the interactions of **MANY** food chains.
- A good food web (or chain) will include decomposers to show their importance.



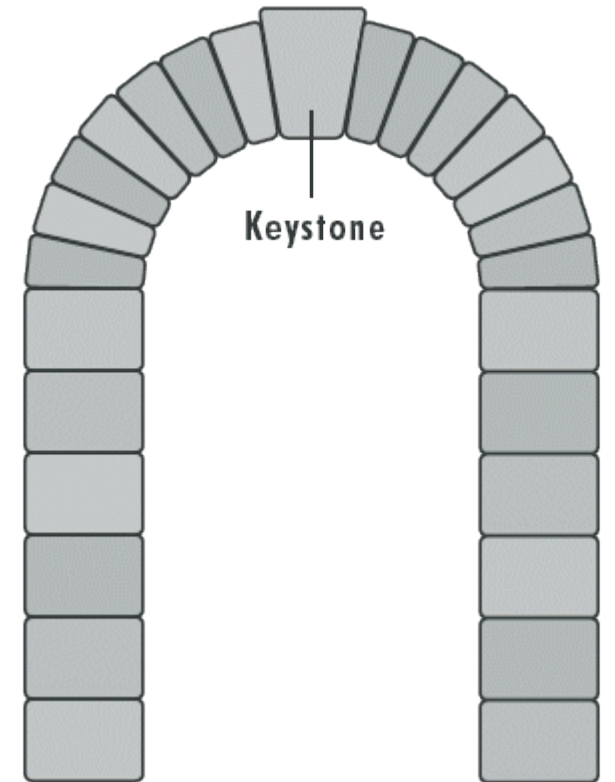
Tracking Trophic Levels

- Create a system that helps you to track what trophic level each organism is feeding at.
- This will help you greatly on tests.



Keystone Species

- Some organisms are so important, that if they are removed then significant changes to happen to the entire ecosystem.
- These organisms are called **Keystone Species**.
- Watch [How Wolves Change Rivers](#)

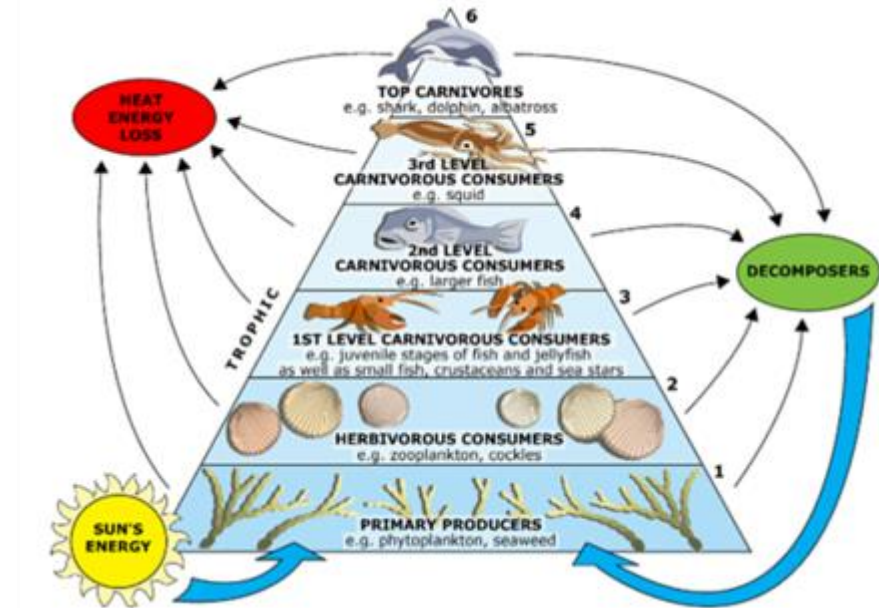


Ecological Pyramids

- Food webs can be converted into ecological pyramids, showing different data.

3 types of Ecological Pyramids:

1. Energy pyramids
2. Biomass pyramids
3. Numbers pyramids



- All pyramids follow the **10% rule**! (Also called **Rule of 10**)

10% Rule of Ecological Pyramids

- When moving from a lower trophic level up to a higher trophic level, only 10% of the stored energy moves up.
- The other 90% of the energy is used by the lower trophic level organism trying to surviving in its trophic level.

The grasshopper uses about 90% of all its energy to survive and not be eaten by cute little ducks (any other thing) in hopes of reproducing.

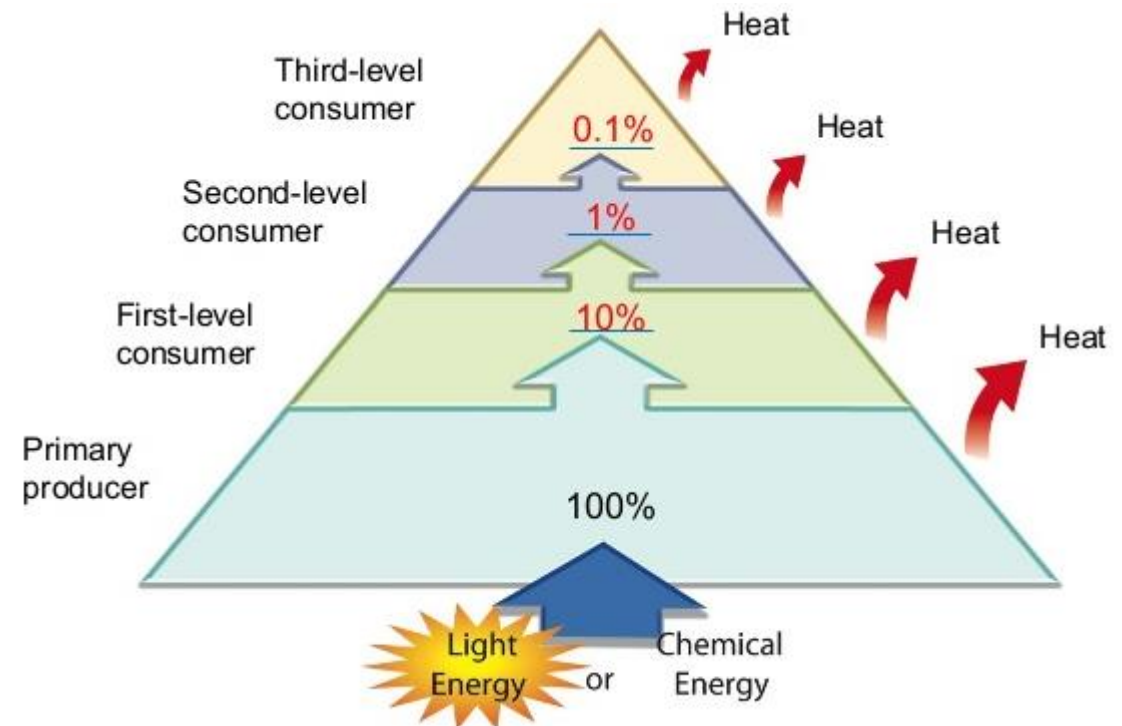


The duckling only receives about 10% of all the available energy in the grasshopper when it eats the grasshopper.

Ecological Pyramids

1. Energy pyramids show the energy (in Joules or kcals) that move from one trophic level to the next.

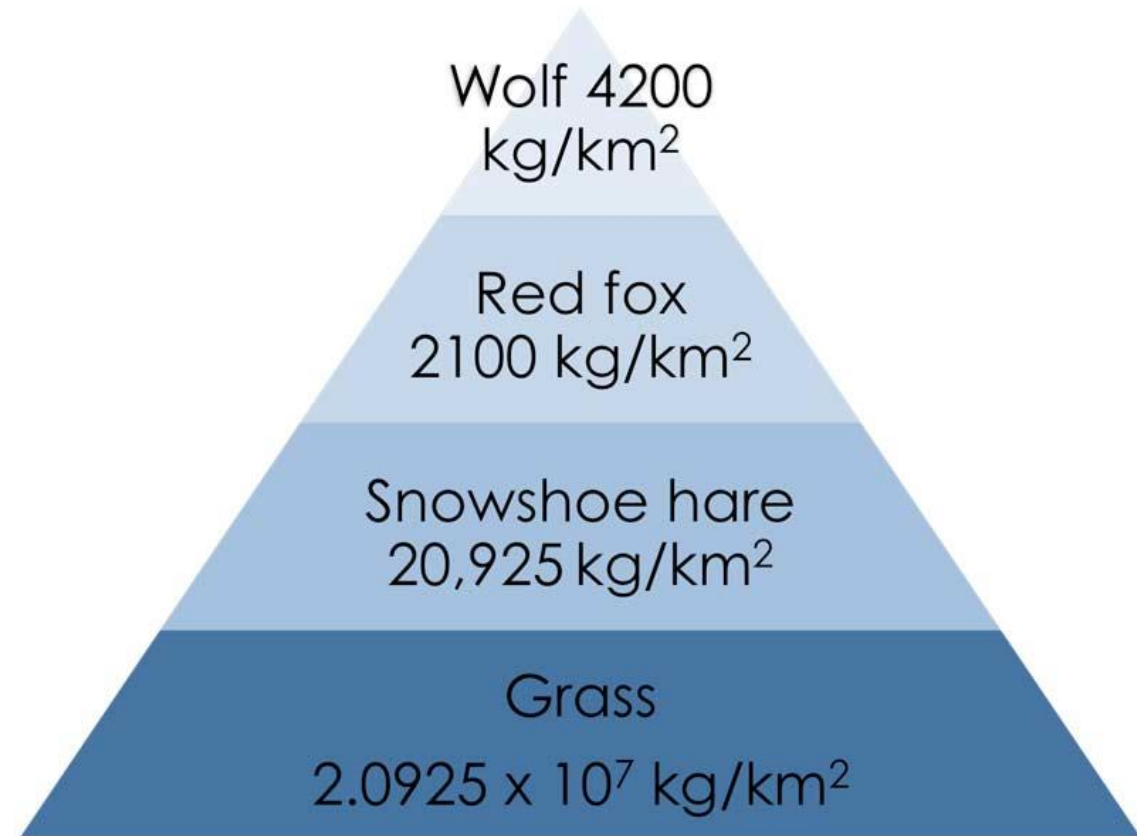
Since only 10% reaches the predator, 90% is lost. Some of that 90% is **lost in the form of heat** back to the environment.



Ecological Pyramids

2. Biomass pyramids show the amount of physical matter that move from one trophic level to the next.

Since only 10% reaches the predator, 90% is lost. Some of that 90% is **lost in the form of heat** back to the environment.

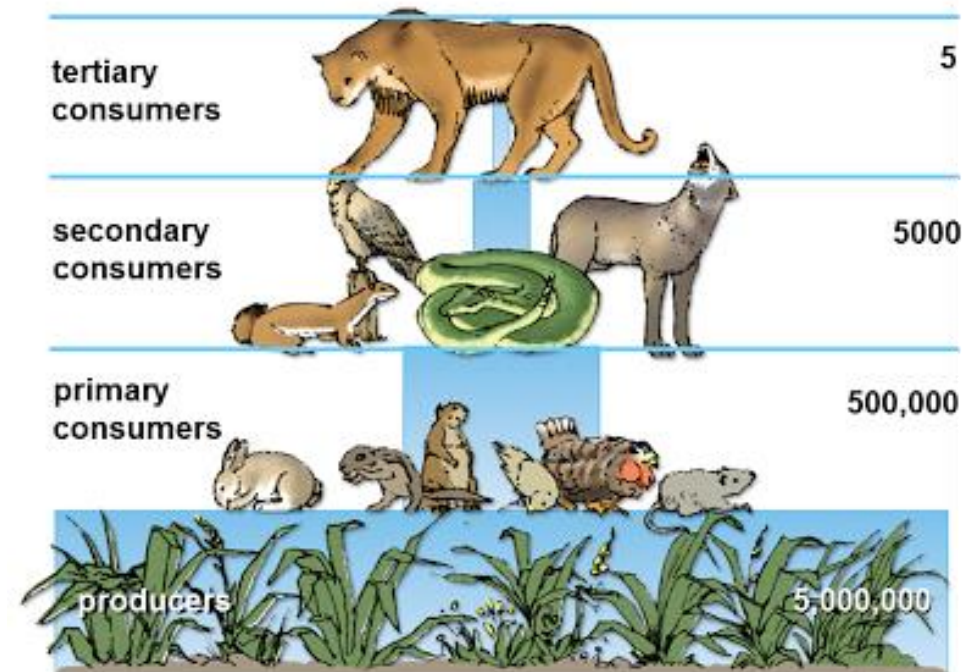


Ecological Pyramids

3. Numbers pyramids show the quantity of organisms that can be sustained (kept alive) at any give trophic level

- Notice, as you move up the food chain, less and less organisms can be sustained (kept alive)

Since only 10% reaches the predator, 90% is lost. Some of that 90% is **lost in the form of heat** back to the environment.



Biological Magnification

- Biological Magnification pyramids show how toxins accumulate (increase) as you move up a food chain.
- Examples:
DDT & mercury poisoning

Lower trophic levels have smaller organisms that only contain a few toxins in their body, but as larger organisms eat A LOT of the small ones, the toxins build up in their tissues.

