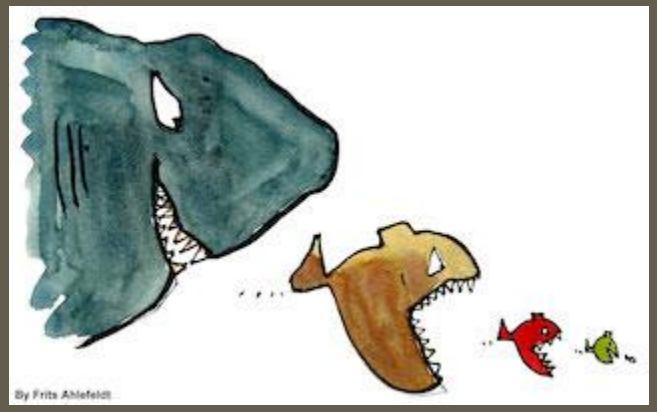
DO NOW

- Turn in your completed owl pellet lab to the bin
- Pick up the 4 different papers from the front table
- Take out your composition notebook on your desk



WARM UP:

1. Draw an energy pyramid and label the following trophic levels:
   - Primary producer
   - Primary consumer
   - Secondary consumer
   - Tertiary consumer
2. What is an example of an organism at each level of the pyramid in #1?
3. If 5000 J of energy is available in producers, how much of that energy would be available to tertiary consumers?

Define theseTerms:

- Autotroph
- Heterotroph
- Detritivore
- Gross primary production (GPP)
- Net primary production (NPP)

FOOD CHAINS, FOOD WEBS, ENERGY PYRAMIDS

UNIT 1: ECOLOGY

Notesheet 1

https://www.youtube.com/watch?v=LU8DDYz68kM

ECOSYSTEMS AND ENERGY

YOU MUST KNOW:

- How energy flows through the ecosystem (food chains and food webs)
- The difference between gross primary productivity and net primary productivity.
- The carbon and nitrogen biogeochemical cycles.

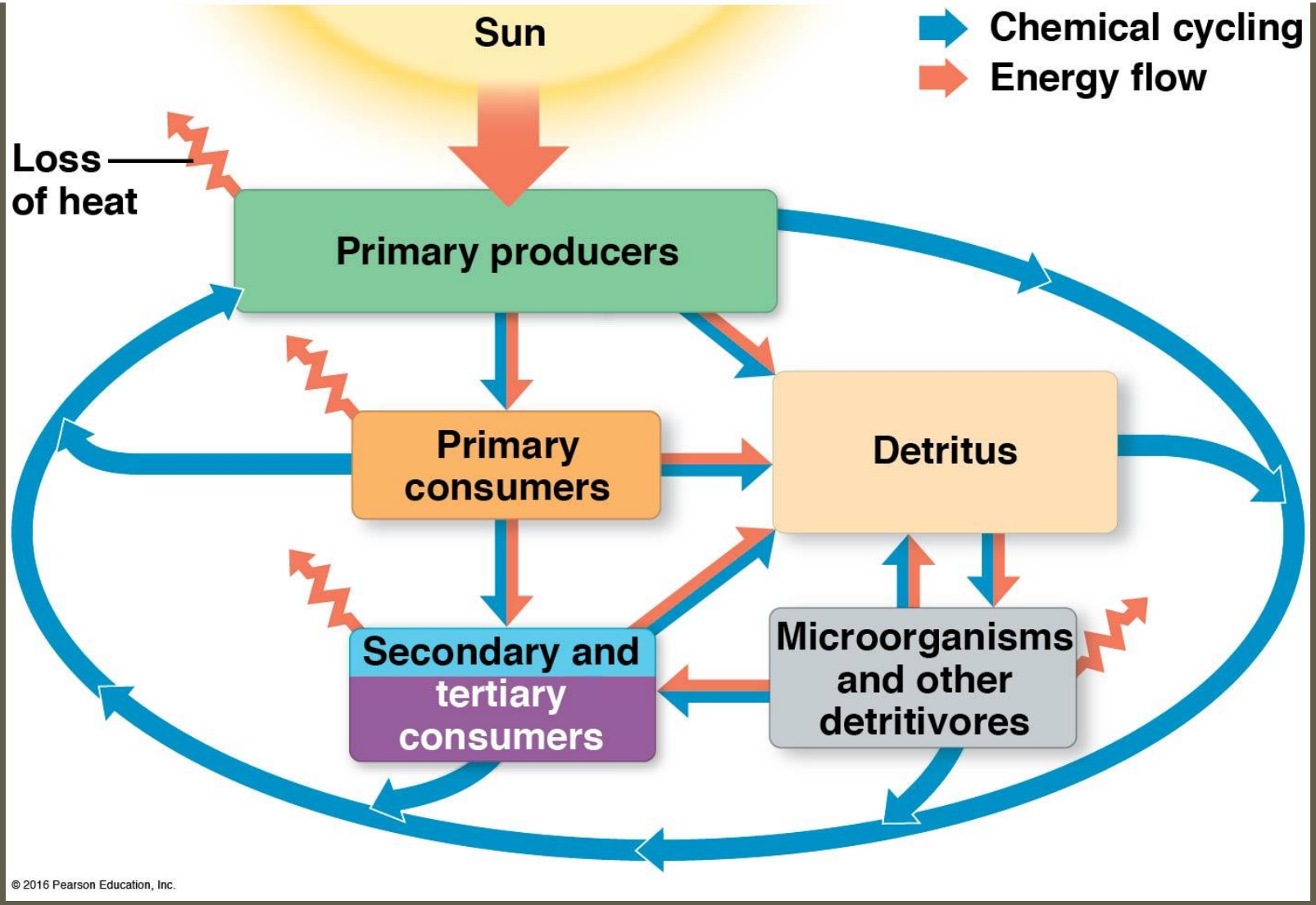
ECOSYSTEMS

Ecosystem = sum of all the organisms living within its boundaries (biotic community) + abiotic factors with which they interact

Involves two unique processes:

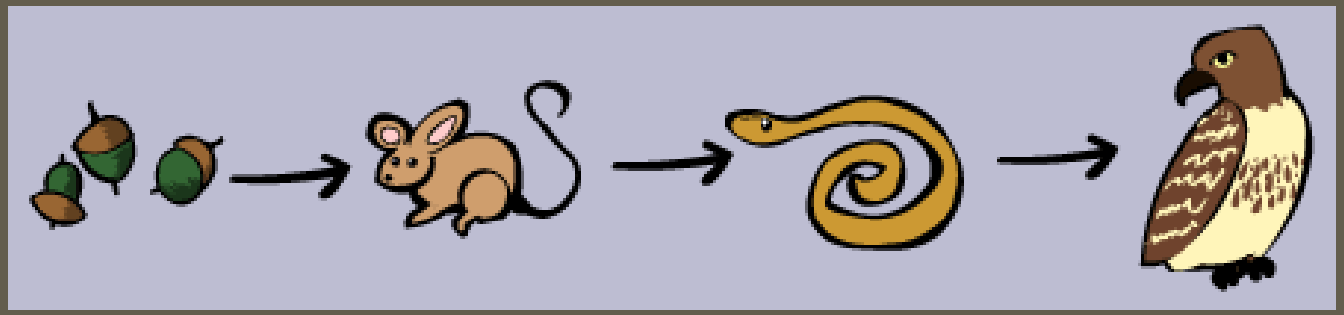
1. Energy flow
2. Chemical cycling

OVERVIEW OF ENERGY & NUTRIENT DYNAMICS



FOOD CHAIN

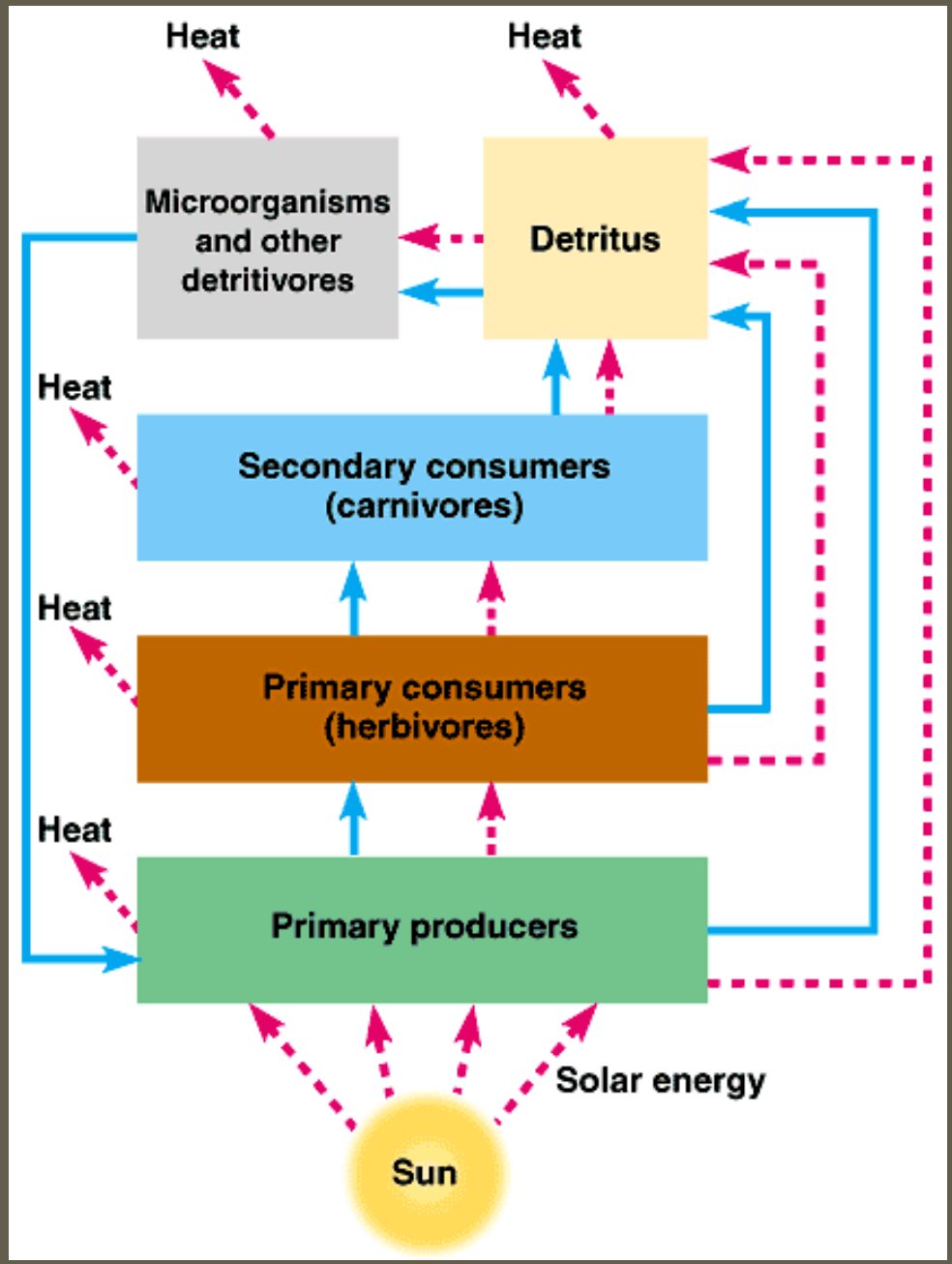
1. Sequence in which energy is transferred from one organism to the next.
2. Shows only one possible relationship
3. Arrows show transfer of energy



ENERGY FLOW IN AN ECOSYSTEM

- **Energy cannot be recycled** → must be constantly supplied to an ecosystem (mostly by SUN)
- The **autotrophs** ("self feeders") are the **primary producers**, and are usually photosynthetic (plants or algae).
  - They use light energy to synthesize sugars and other organic compounds.
- **Heterotrophs** ("other feeders") – can't make own food

- **Heterotrophs** are at trophic levels above the primary producers and depend on their photosynthetic output.



TO REVIEW IMPORTANT VOCAB:

AUTOTROPH

- Auto= self
- Self feeders/ make their own food
- Ex. Plants, algae

HETEROTROPH

- Hetero= different
- Depend on others (DIFFERENT organisms) for food

- Herbivores that eat primary producers are called **primary consumers**.
- Carnivores that eat herbivores are called **secondary consumers**.
- Carnivores that eat secondary consumers are called **tertiary consumers**.
- Another important group of heterotrophs is the **detritivores**, or **decomposers**.
    - They get energy from detritus, nonliving organic material, and play an important role in material cycling.

Main decomposers:

fungi & prokaryotes

Sun is beginning energy for food chains.

What are the feeding relationships in a food chain?

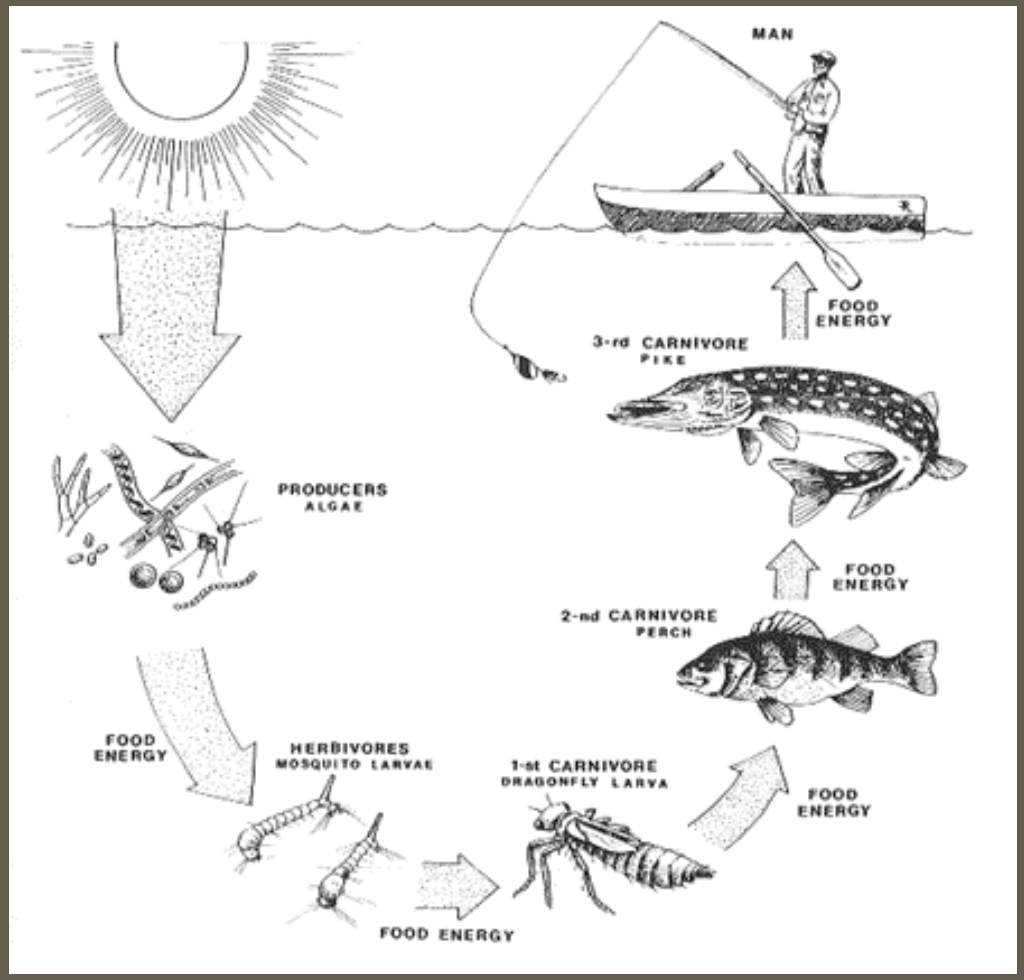
Producers receive energy from the sun. Use energy to make food.

Primary consumers (Herbivores) receive energy from producers. They are the first to get the energy from the plant, hence the term “primary”.

Secondary consumers (carnivores) receive energy from primary consumers. They are the second to get the energy from the plant.

FOOD CHAINS CONT…

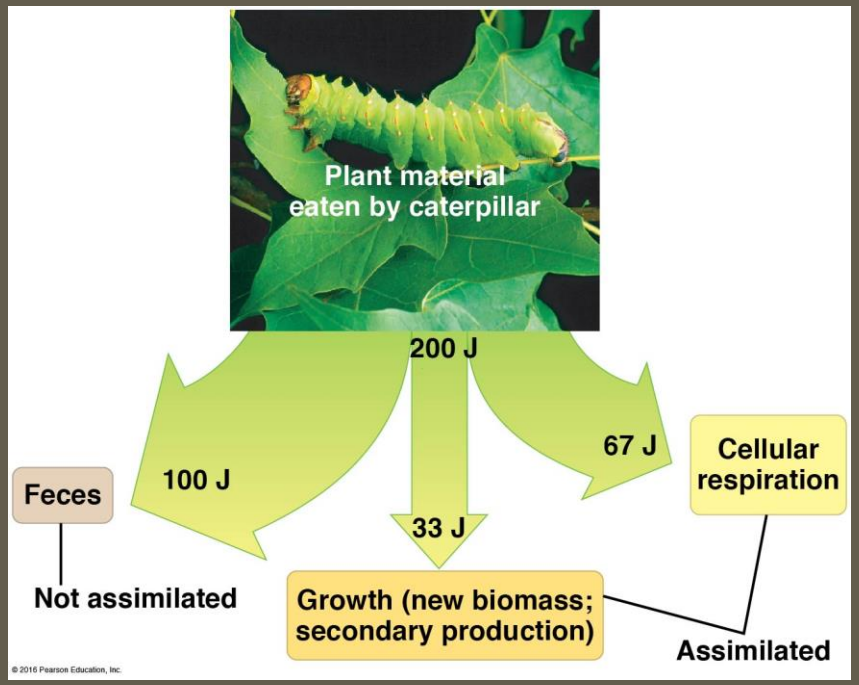
4. As energy moves thru food chain, 90% is used to perform life functions and is lost as heat. Only 10% available to next trophic (feeding) level.



Notice how arrows get smaller, showing decrease in energy availability.

ENERGY TRANSFER BETWEEN TROPHIC LEVELS IS TYPICALLY ONLY 10% EFFICIENT

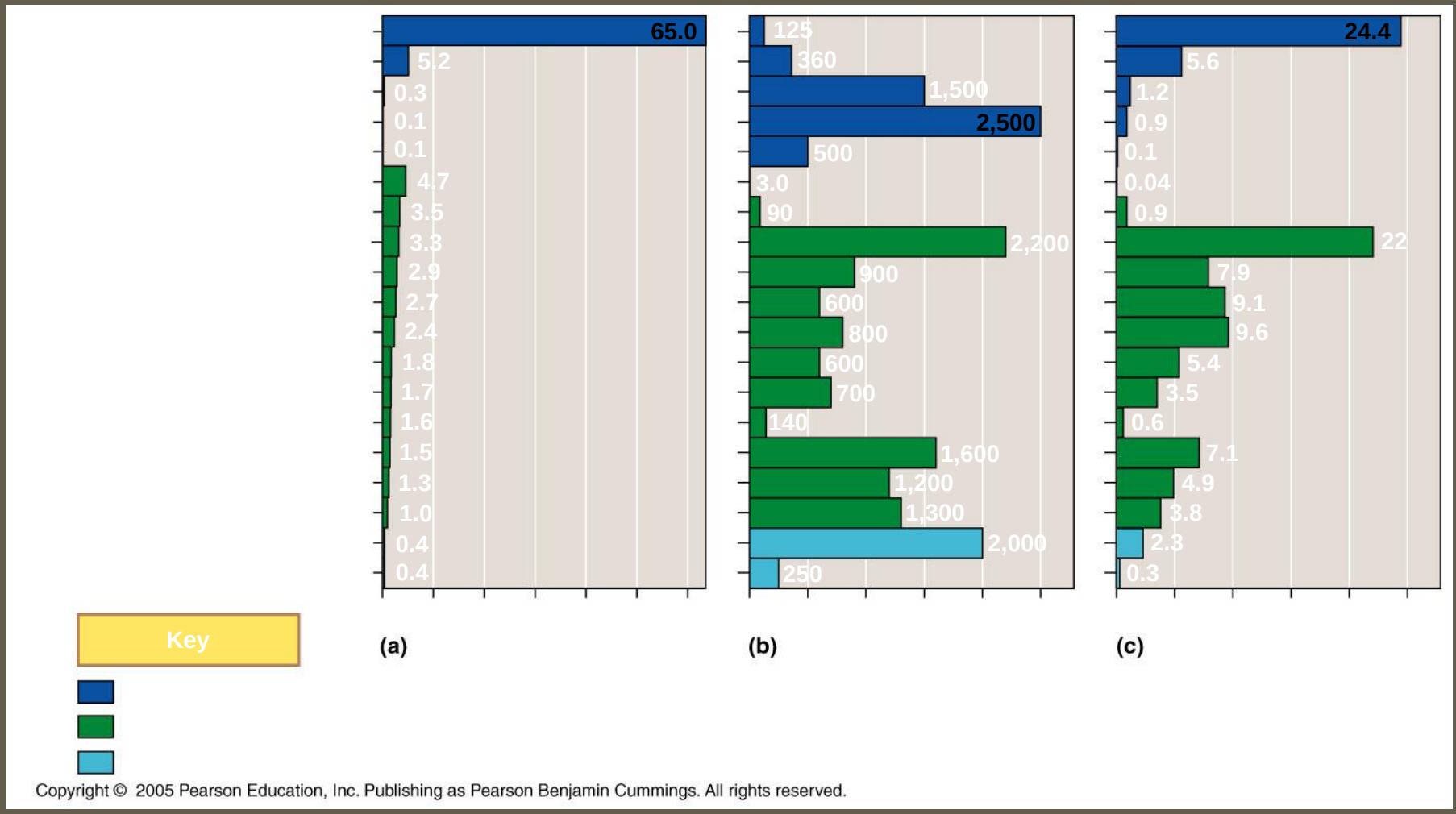
- Production efficiency: only fraction of E stored in food
- Energy used in respiration is lost as **heat**
- Energy flows (not cycle!) within ecosystems



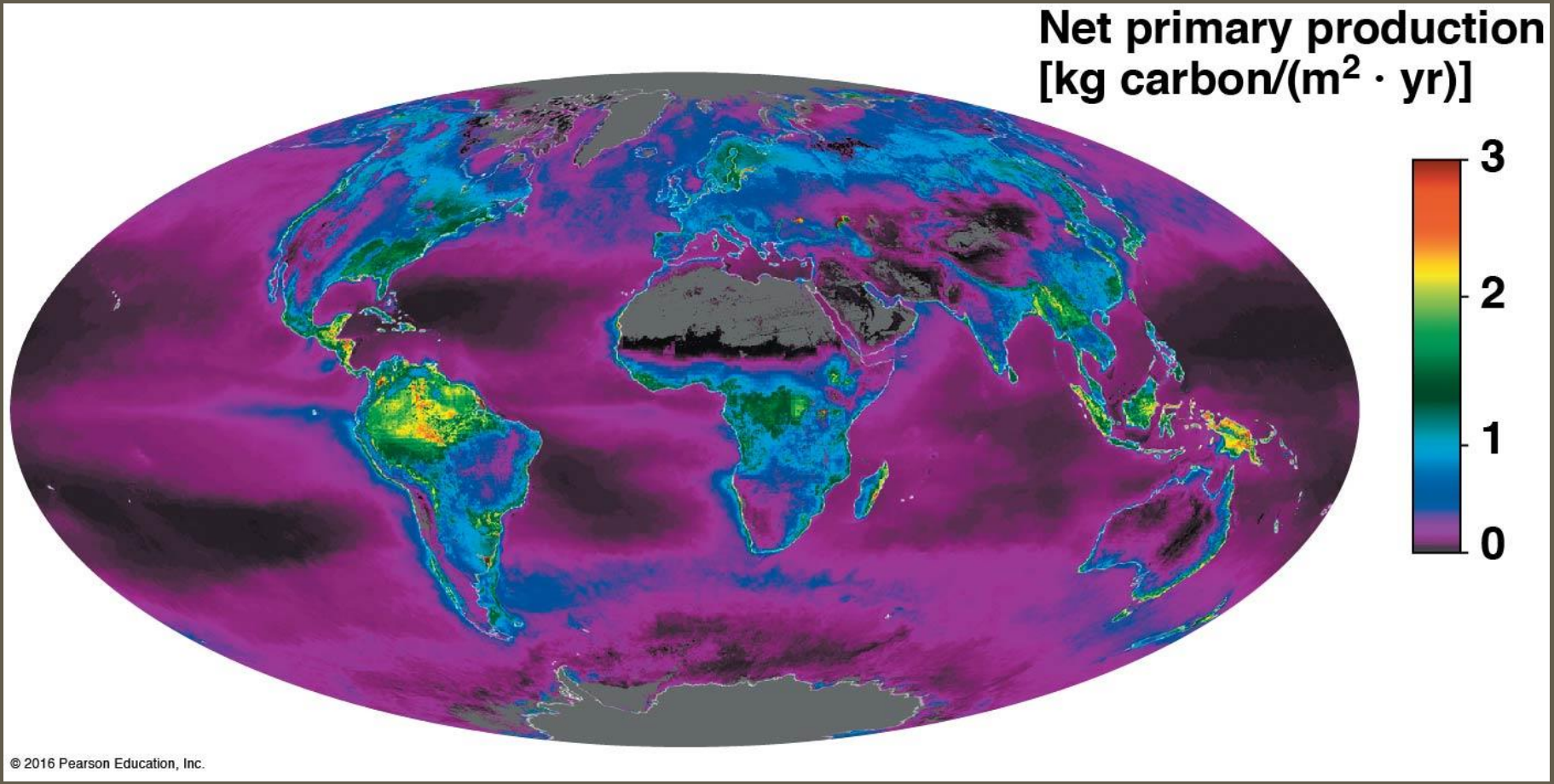
PRIMARY PRODUCTION

- **Primary production** = amt. of light energy that is converted to chemical energy
- **Gross primary production (GPP)**: total primary production in an ecosystem
- **Net primary production (NPP)** = gross primary production minus the energy used by the primary producers for **respiration (R)**:
  - NPP = GPP – R
- NPP = storage of chemical energy available to consumers in an ecosystem

NET PRIMARY PRODUCTION OF DIFFERENT ECOSYSTEMS



NET PRIMARY PRODUCTION



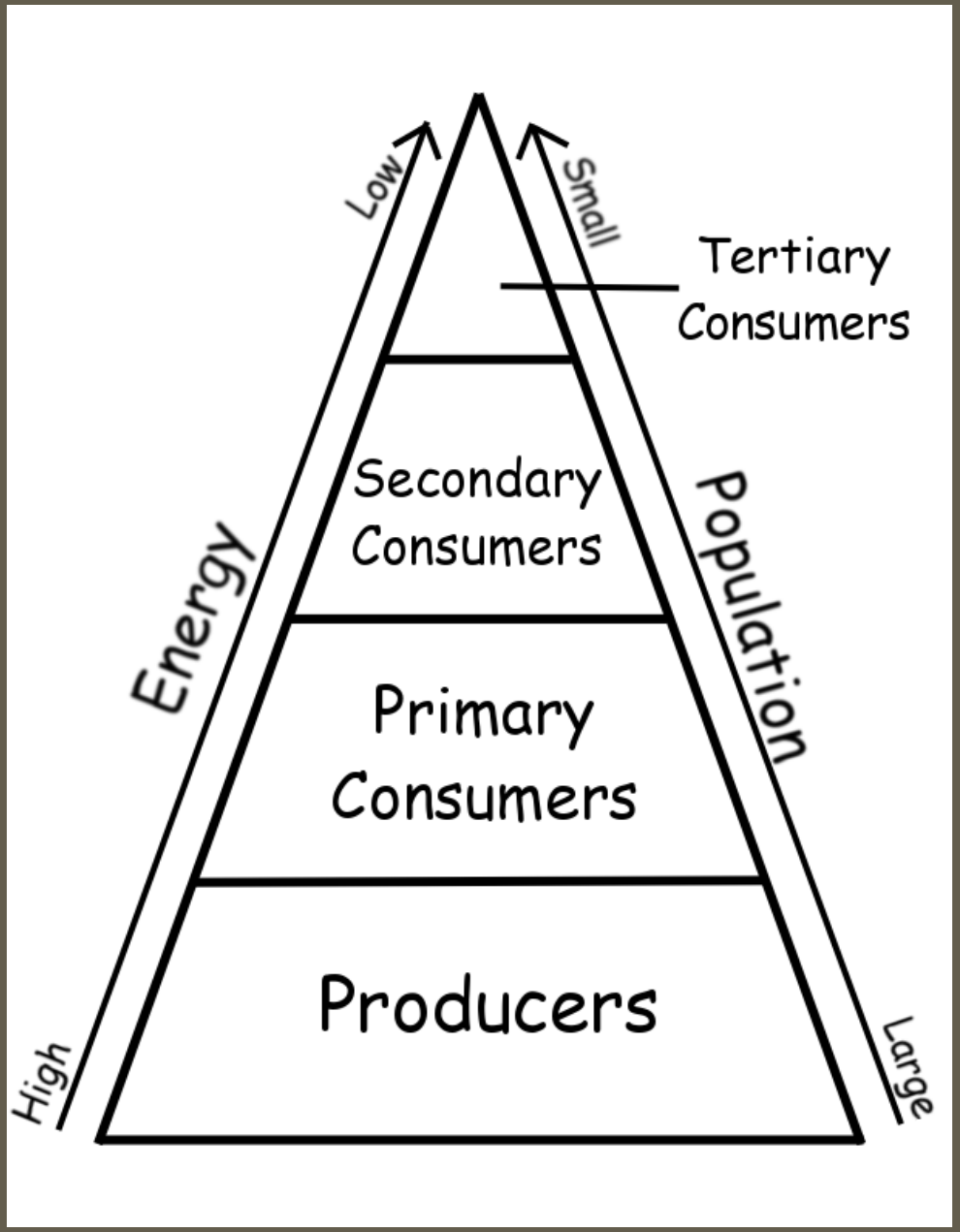
Primary production factors in:

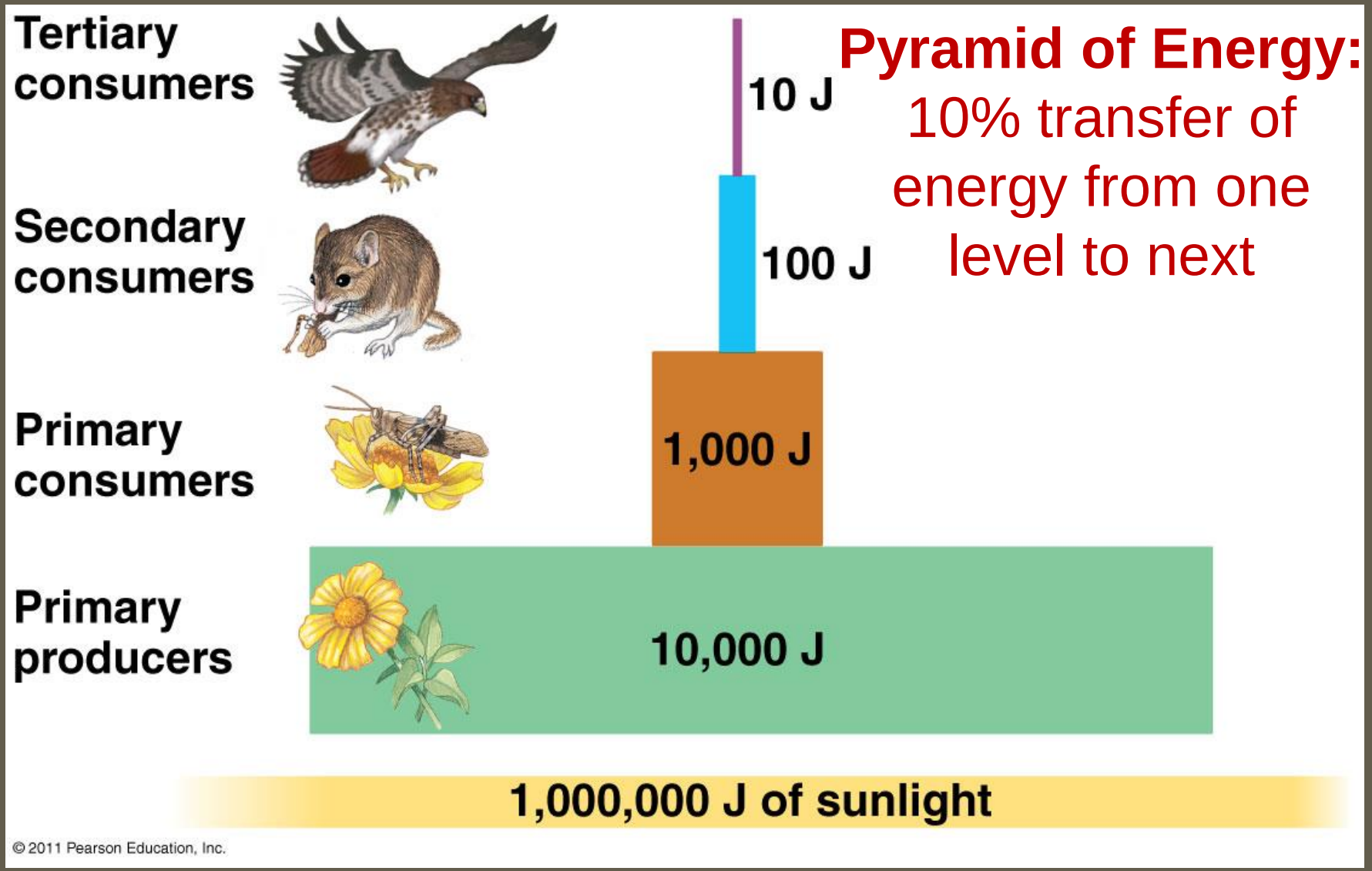
- **Aquatic ecosystems:**
  - Light availability (↑ depth, ↓ photosynthesis)
  - Nutrient availability (N, P in marine env.)
- **Terrestrial ecosystems:**
  - Temperature & moisture

- A nutrient-rich lake that supports algae growth is **eutrophic**.

ENERGY PYRAMID

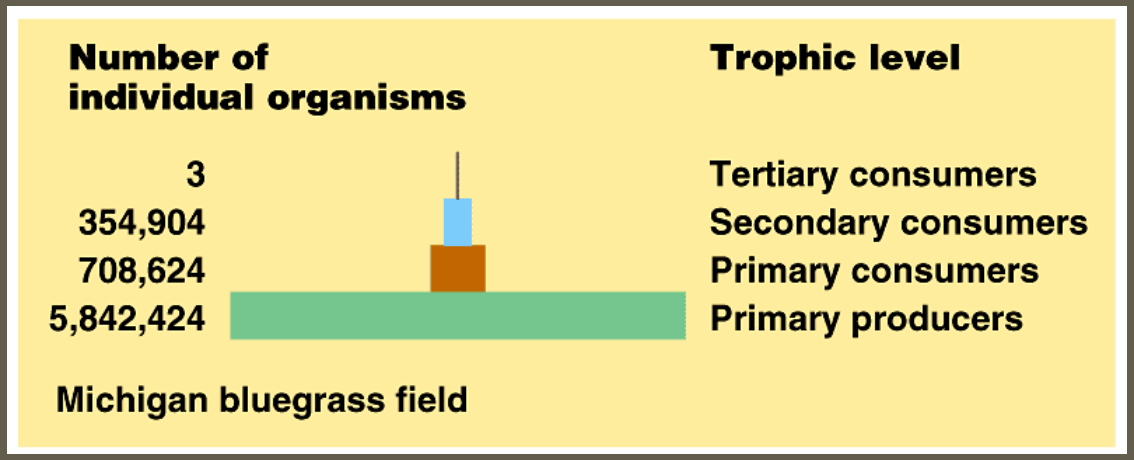
1. Pictoral model that shows how energy <u>decreases</u> as you move up a food chain.
2. Represents a <u>stable</u> community



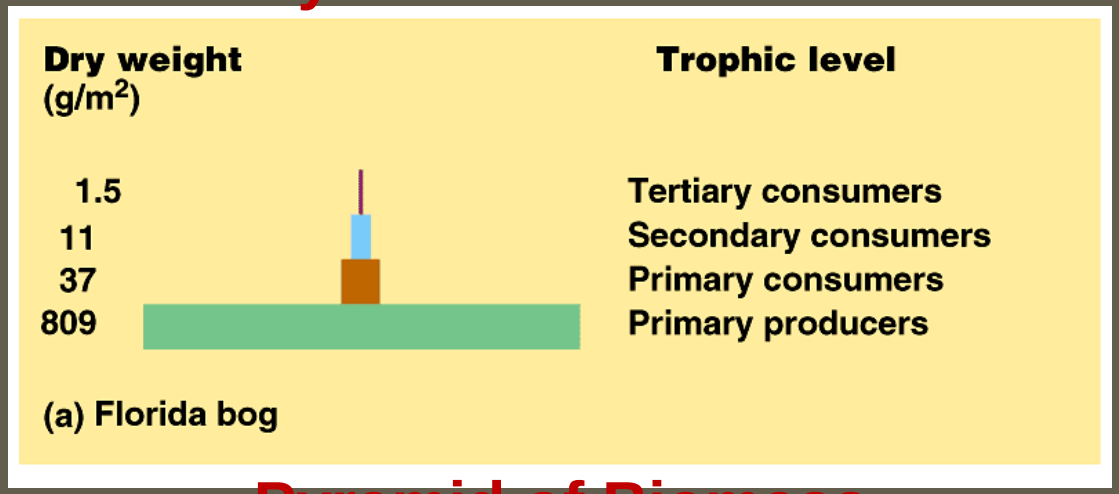

Tertiary consumers
Secondary consumers
Primary consumers
Primary producers
10 J
100 J
1,000 J
10,000 J
1,000,000 J of sunlight
Pyramid of Energy:
10% transfer of energy from one level to next
© 2011 Pearson Education, Inc.

ECOLOGICAL PYRAMIDS GIVE INSIGHT TO FOOD CHAINS

- Loss of energy limits # of top-level carnivores
- Most food webs only have 4 or 5 trophic levels

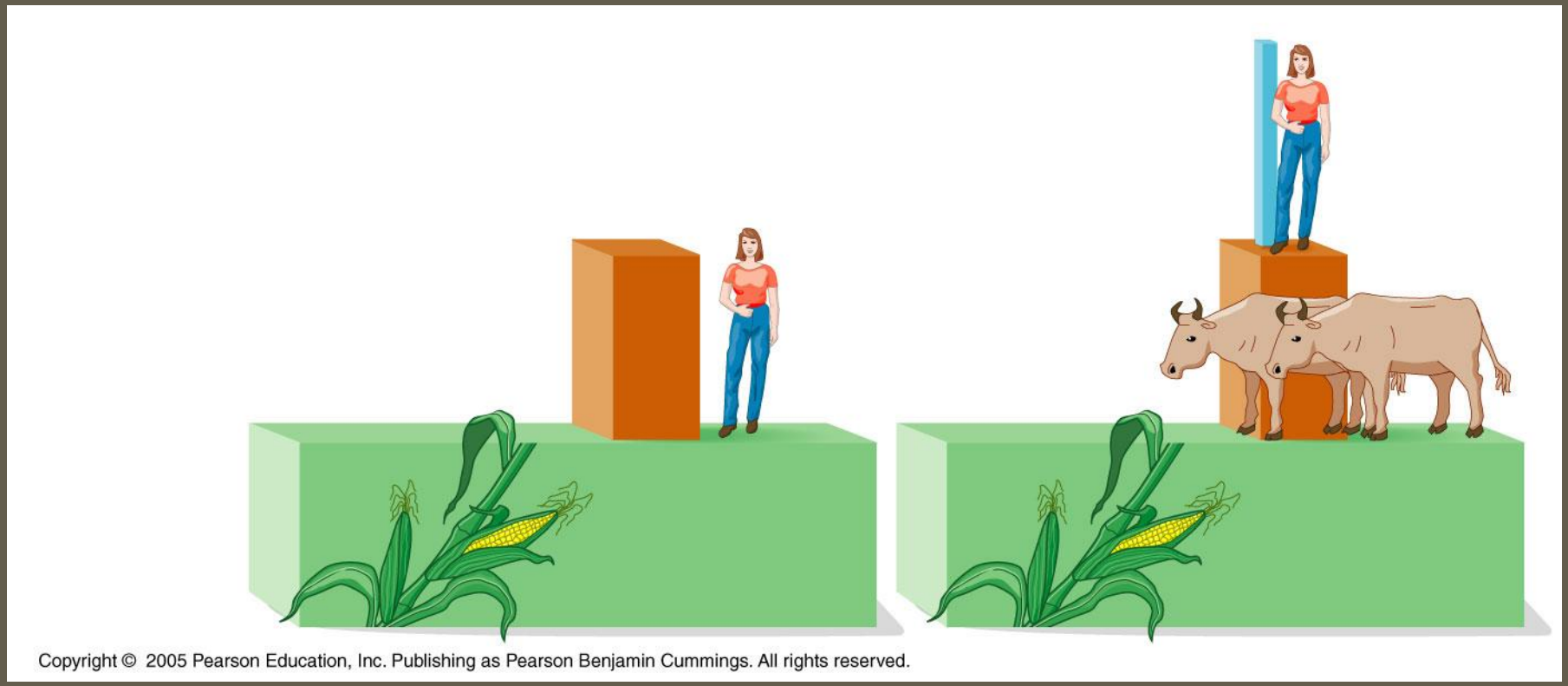


Pyramid of Numbers



Pyramid of Biomass

The dynamics of energy through ecosystems have important implications for the human population



TROPHIC STRUCTURES

- The **trophic structure** of a community is determined by the **feeding relationships** between organisms.
- **Trophic levels** = links in the trophic structure

- The transfer of food energy from plants → herbivores → carnivores → decomposers is called the **food chain**.

What limits the length of a food chain?

- Inefficiency of energy transfer along chain
- Long food chains less stable than short chains

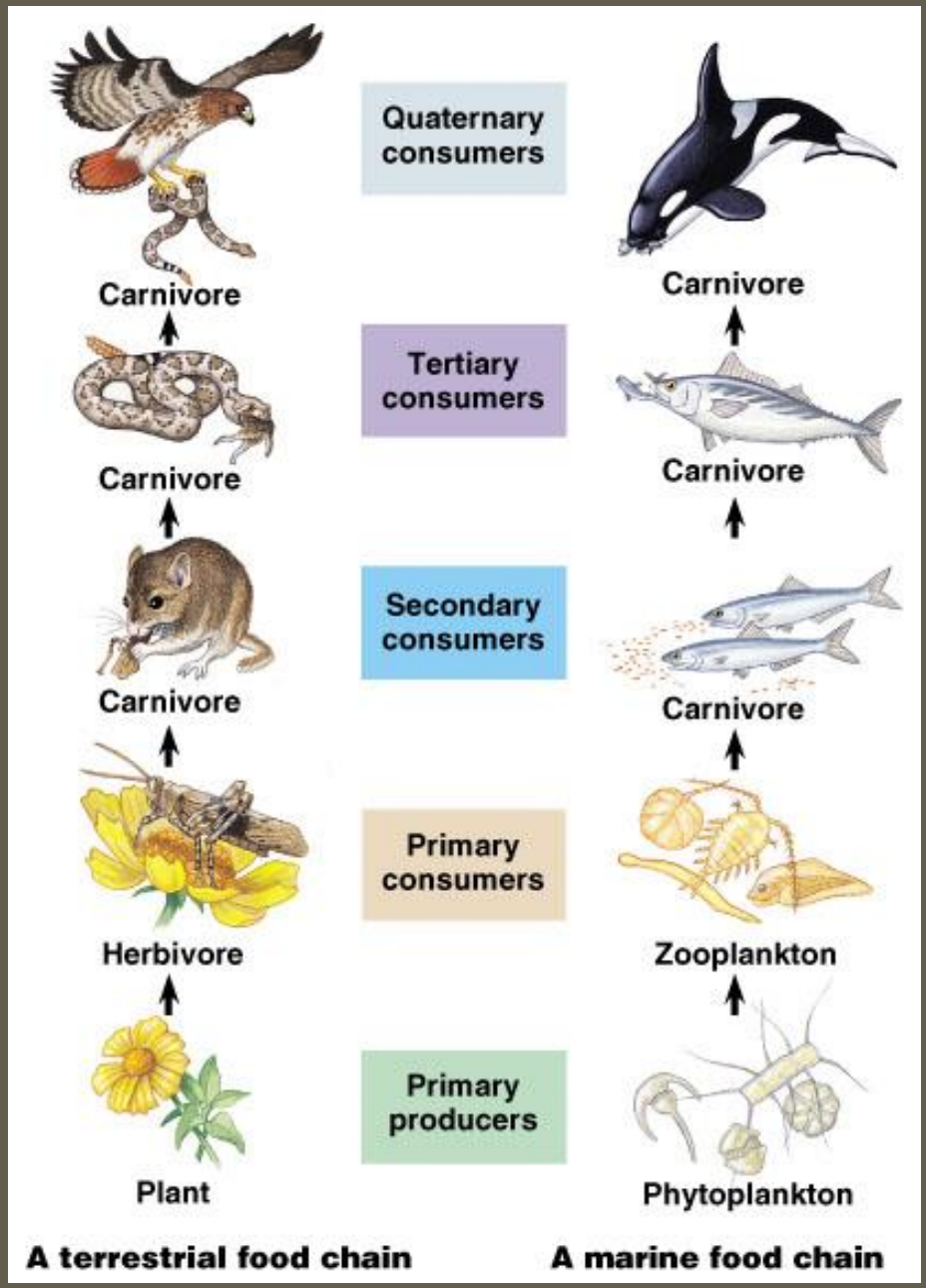
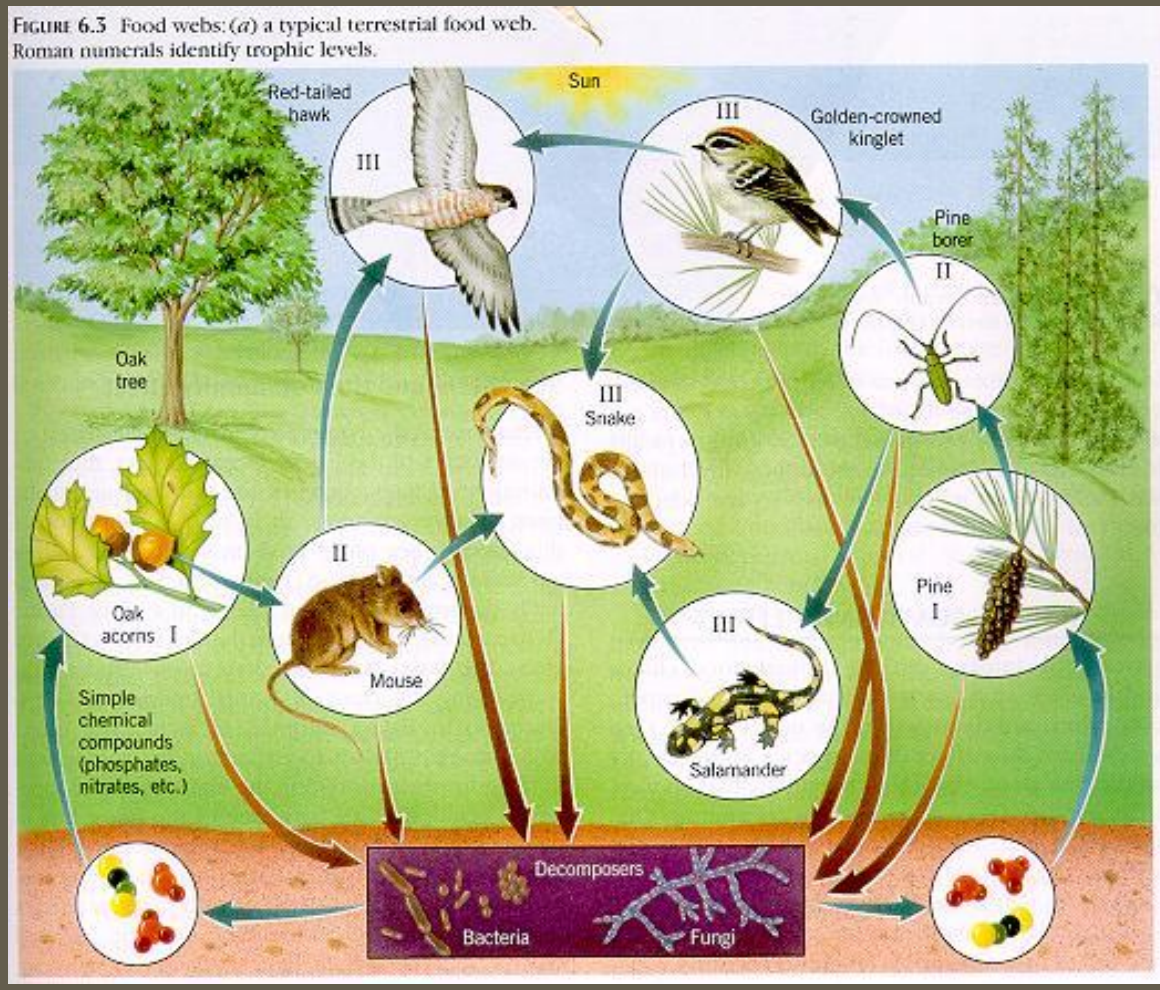


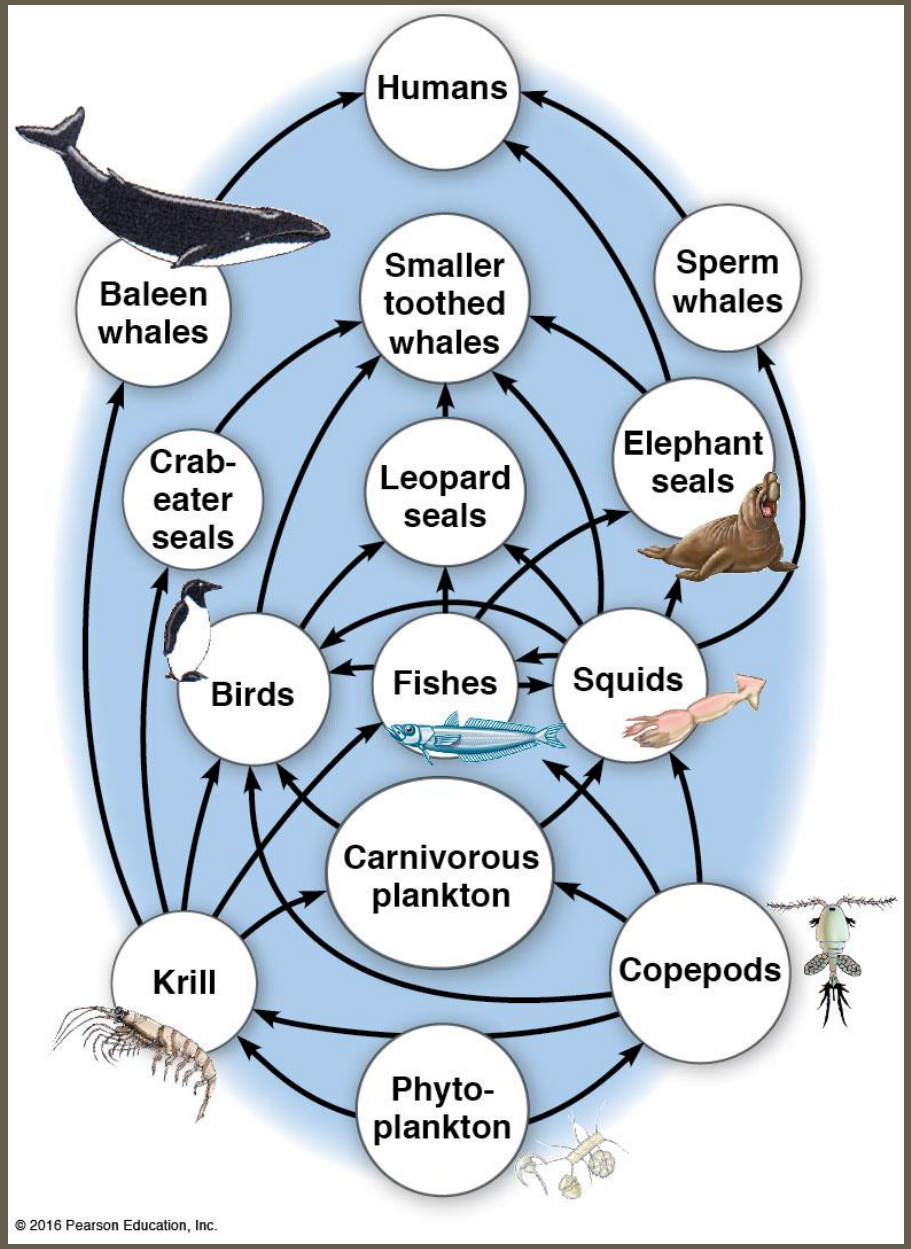
Fig. 53.10

FOOD WEBS

1. Show <u>all</u> possible feeding relationships in ecosystem.
2. Very <u>complex</u>
3. More <u>realistic</u>

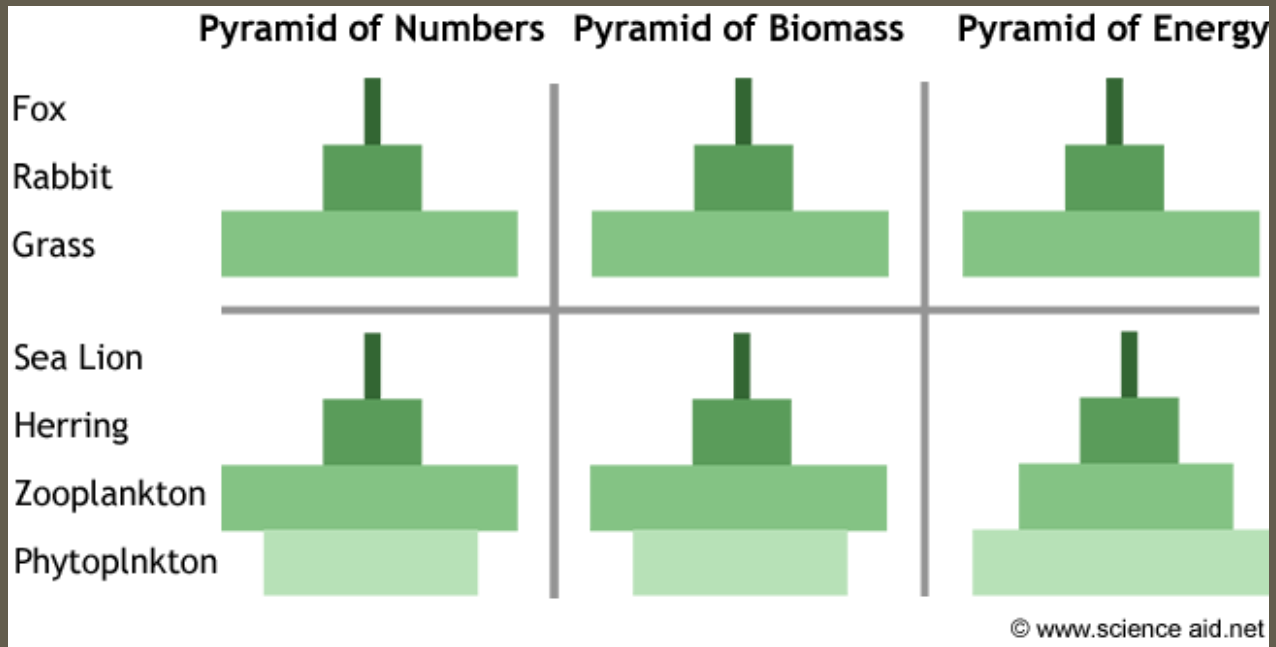


- Two or more food chains linked together are called **food webs**.
- A given species may weave into the web at <u>more than one</u> trophic level.



PYRAMID OF NUMBERS OR BIOMASS

- Pyramid of numbers shows the actual number of individuals
- Pyramid of biomass shows the amount of living material at each level



Tertiary Consumers

Predators

Kilocalories available in the bodies of tertiary consumers

6 Kilocalories per square meter per year

Secondary Consumers

Predators

Kilocalories available in the bodies of secondary consumers

60 Kilocalories per square meter per year

Primary Consumers

Herbivores

Kilocalories available in the bodies of Primary Consumers

600 Kilocalories per square meter per year

Primary producers: Plants: deciduous trees, shrubs, grasses

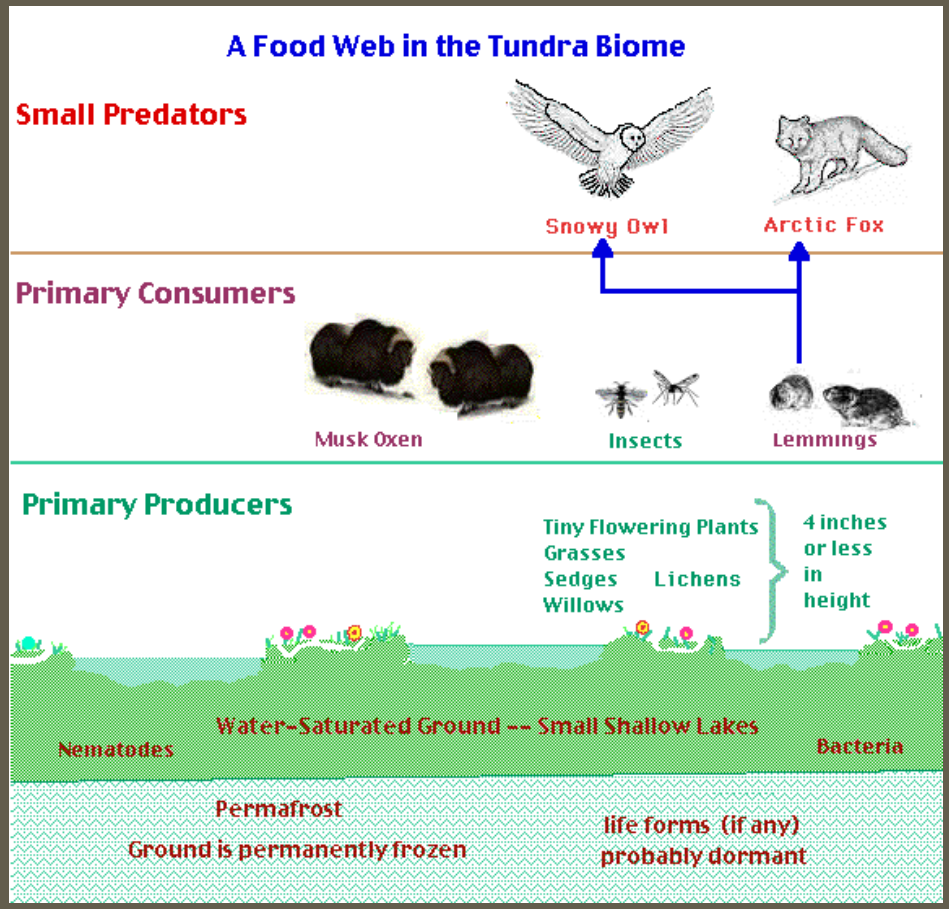
6000 Kilocalories per square meter per year

- Dominant species: has the highest biomass or is the most abundant in the community
- Keystone species: exert control on community structure by their important ecological niches

- Loss of sea otter → increase sea urchins, destruction of kelp forests
- Grizzly bear (transfer nutrients from sea → land by salmon diet)
- Prairie dogs (burrows, soil aeration, trim vegetation)

DIVERSITY & STABILITY IN THE ECOSYSTEM

1. The more <u>diverse</u> an ecosystem is the more <u>stable</u> it is. There are more organisms so more to potentially eat.
2. Simple food webs have <u>fewer</u> food sources to rely on therefore they are more unstable (Tundra). Small disturbances can greatly affect all organisms.



QUIZ OVER ALL OF THIS FIRST THING THURSDAY MORN!!!