

1  **Ecosystems**

Mark Mayo  
Cypress College

2  **Ecology Basics**

- Producers (primary producers) – autotrophic organisms\* that are capable of photosynthesis or chemosynthesis
- They make food
- Most free oxygen in the atmosphere comes from photosynthesis \*

3  **Ecology Basics**

- Consumers – any organism that consumes producers or other consumers
  - carnivore – a meat eater; really one that eats another animal (worms and insects are meat too!)
  - herbivore \* – organisms that eats plants only (aka 1<sup>o</sup> consumer)
  - omnivore – organism that eats plants and animals

4  **Ecology Basics**

- Decomposers \* – fungi and bacteria who obtain energy by breaking down the remains of organisms

5  **Ecology Basics**

- Detritivores – obtains their energy from decomposing particles of organic material

6  **Ecosystem**

- Definition of an ecosystem \* – an array of organisms (biotic) and the physical environment (abiotic) in the process of energy transfer ultimately from the sun
  - It runs on energy input from the sun
  - It also needs nutrient inputs from soil
  - Energy is not recycled \* – passed through levels and lost to environment as heat
  - Nutrients are frequently recycled – some lost

7  **Trophic levels**

- Producer – a plant or organism capable of changing inorganic compounds into organic compounds that can be used for food.
- This is usually a plant \*
- Could also be cyanobacteria & some protists \*

8  **Trophic levels**

- Primary (1<sup>o</sup>) consumer – eats producers (herbivores and omnivores)
- Secondary (2<sup>o</sup>) consumer – eats primary consumers
- Tertiary (3<sup>o</sup>)

consumer – eats secondary consumers

9  **Food Chain**

- A linear series of relationships based on trophic level \*

10  **Food Web**

- A food web is much more complicated than a single chain \*
- Often one organism is prey for several other organisms
- A predator is someone else's prey

11  **Food Web**

12  **Food Web**

13  **Energy Flow Through the Ecosystem**

- Energy from a primary source (sun) flows in a one-way direction through food webs \*
- Grazing food web
  - Sun
  - Producers
  - Herbivores (1° consumer)
  - Carnivores (2° consumer)
  - Decomposers

14  **Energy Flow Through the Ecosystem**

- Energy from a primary source (sun) flows in a one-way direction through food webs
- Detrital food webs
  - Sun
  - Producers
  - Decomposers
  - Detritivores

15  **Ecological pyramid**

- Definition of ecological pyramid \* - graphic representation of the various trophic levels in a way to depict the relative amounts of biomass in each level
- 90% of the energy is lost at each new level

16  **Ecological pyramid**

- Producers - eelgrass, algae, other plants (809)
- Herbivores (1° consumers) – fish, turtles, invertebrates (37)
- 2° consumers - fish invertebrates (11)
- 3° consumers) – large-mouth bass, gar (1.5)
- Decomposers – bacteria, crayfish (5)
- As you climb the ecological pyramid energy is lost and biomass declines

17  **Ecological pyramid**

- 18  **Biomass**
- Definition of biomass \* - the dry weight of all organic matter in a given ecosystem
  - Plant materials and animal waste used as fuel.
- 19  **Biological Magnification**
- A pesticide becomes more concentrated as it moves from producers to the various trophic levels
- 20  **Biogeochemical Cycles**
- Hydrologic Cycle or Water Cycle \*
    - Precipitation – rainfall, snow, sleet, hail, dew etc.
    - Runoff – water that cannot be absorbed and passes by gravity to the lowest level (ocean, lake, stream)
    - Groundwater – water beneath the surface – pools, and rivers
    - Respiration – biological process that uses oxygen and sugar to make energy and releases water
    - Evaporation – physical change of aqueous water to water vapor which is dependent on heat
    - Transpiration – loss of water directly from plant leaves to atmosphere
- 21  **Biogeochemical Cycles**  
Hydrologic  
Cycle  
or  
Water Cycle
- 22  **Biogeochemical Cycles**
- Carbon Cycle
    - Sources of carbon:
    - Respiration products
    - Burning of fossil fuels
    - Volcanic eruptions
    - Oceans hold vast amounts of carbon in the form of carbonates
    - Plants, animals, soil and the atmosphere hold most carbon
    - Atmospheric carbon is in the form of carbon dioxide CO<sub>2</sub>
- 23  **Biogeochemical Cycles**  
Carbon  
Cycle
- 24  **Biogeochemical Cycles**
- Carbon Cycle
    - Excessive CO<sub>2</sub> has led to global warming mostly because of the overuse of fossil fuels
    - Carbon dioxide acts to retain heat like a blanket around the earth
    - Plants reduce atmospheric carbon dioxide and thus reduce global warming!
- 25  **Biogeochemical Cycles**  
Carbon  
Cycle
- 26  **Biogeochemical Cycles**
- Nitrogen Cycle

- Nitrogen ( $N_2$ ) forms 80% of the earth's atmosphere
- Very few organisms have the ability to break down  $N_2$  and convert it to a form useful to organisms
- Bacteria, volcanic action and lightning are the primary methods to break down  $N_2$
- Nitrogen is needed for producers to conduct photosynthesis

27  **Biogeochemical Cycles**

- Nitrogen Cycle

28  **Biogeochemical Cycles**

- Nitrogen Cycle
  - Legumes \* are plants that had special bacteria in the roots that are capable of converting atmospheric nitrogen ( $N_2$ ) to fertilizer

29  **Biogeochemical Cycles**

- Nitrogen Cycle
  - Nitrogen fixation: conversion atmospheric nitrogen ( $N_2$ ) to ammonia ( $NH_3$ ) which is quickly converted to  $NH_4^+$  or the ammonium ion
  - Bacteria such as Cyanobacteria, *Rhizobium* and Azotobacter all can perform nitrogen fixation
  - These organisms fix 200 million metric tons of nitrogen per year
  - Plants capable of considerable nitrogen fixation are called legumes – they have a symbiotic relationship with bacteria to achieve nitrogen fixation

30  **Biogeochemical Cycles**

- Nitrogen Cycle
  - Humans use fertilizers to add nitrogen to soil depleted of nitrogen
  - The problem with fertilizer use is the cost and runoff of nitrogen rich materials into the lakes and streams which acts as a pollutant

31  **Biogeochemical Cycles**

- Nitrogen Cycle
  - Ammonification – bacteria and fungi breakdown organisms to release nitrogen

32  **Biogeochemical Cycles**

- Phosphorus Cycle
  - Definition of the Phosphorus Cycle - the movement of the element phosphorus from mineralized forms to aqueous forms and then the incorporation into plants and animals
  - Rock formations on land contains phosphate
  - Erosion takes phosphates from the rocks and moves it to streams and rivers eventually to reach the ocean
  - Phosphates are RARE on earth! \*

33  **Biogeochemical Cycles**

- Phosphorus Cycle

34  **Biogeochemical Cycles**

- Phosphorus Cycle
  - Plants remove phosphates from soil and concentrate it in their tissues
  - Animals gain phosphates when they eat plants
  - Animals lose phosphates in urine and fecal waste

35  **Biogeochemical Cycles**

- Phosphorus Cycle
  - Bird and bat guano is concentrated uric acid and phosphates

36  **Biogeochemical Cycles**

- Phosphorus Cycle
  - Runoff of human applied fertilizers yield excessive phosphates and nutrients
  - This can lead to algal bloom in streams and lakes
  - Algal blooms can rob the lake of nutrients to support other life forms (fish die!)