- What is this ?
- How long does it happen ?

Mount St. Helens

(a) 1979

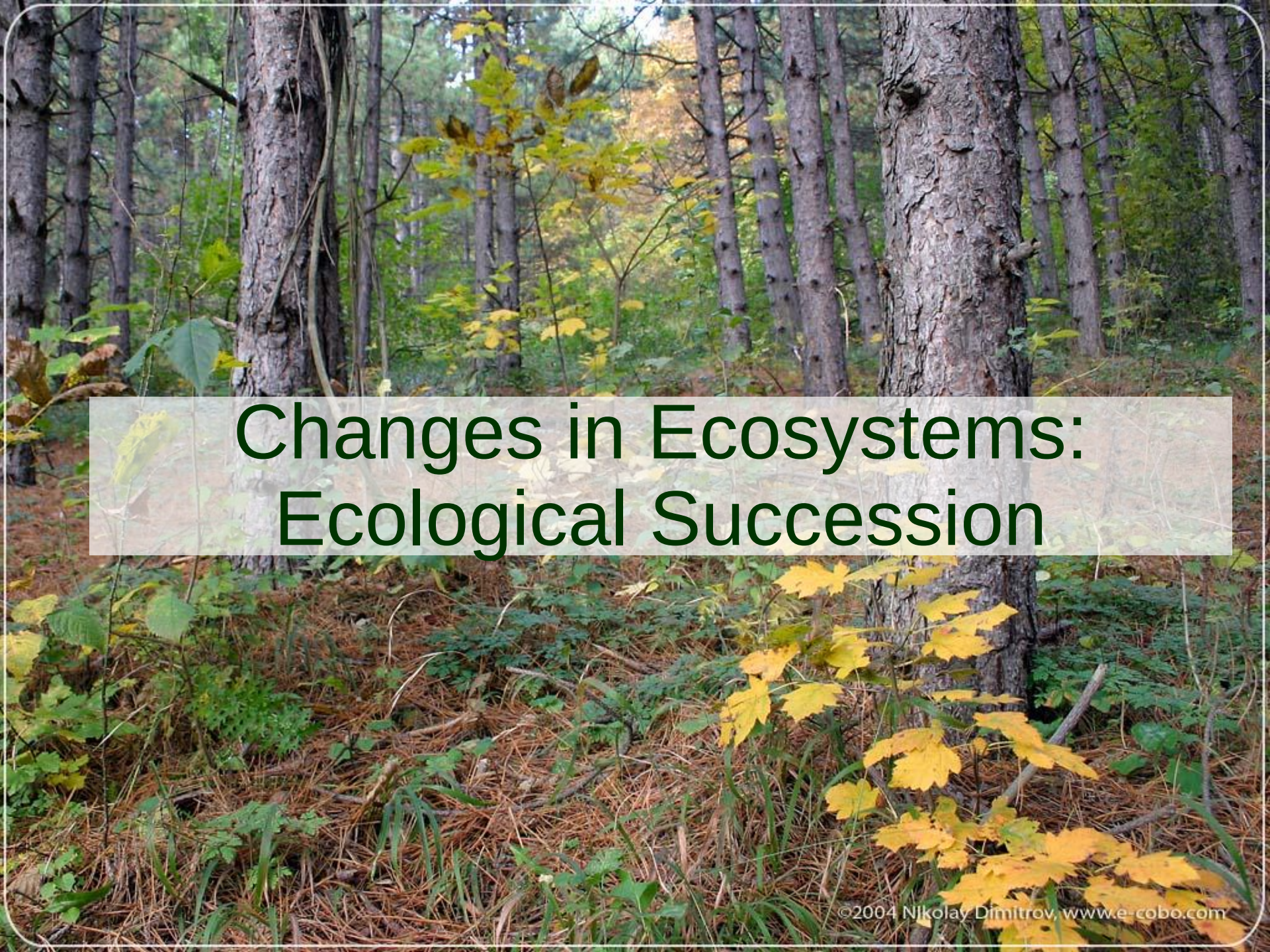
(b) 1980

(d) 1983

1999

GOAL

- ECOSYSTEM DEVELOPMENT
- DESCRIBING SUCCESSION
- DESCRIBING FLOW ENERGY


Changes in Ecosystems:
Ecological Succession
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Definition:

- Natural, gradual changes in the types of species that live in an area; can be primary or secondary
- The gradual replacement of one plant community by another through natural processes over time

Primary Succession

- Begins in a place without any soil
  - Sides of volcanoes
  - Landslides
  - Flooding
- Starts with the arrival of living things such as lichens that do not need soil to survive
- Called **PIONEER SPECIES**

Primary Succession

- Soil starts to form as lichens and the forces of weather and erosion help break down rocks into smaller pieces
- When lichens die, they decompose, adding small amounts of organic matter to the rock to make soil

Primary Succession

- Simple plants like mosses and ferns can grow in the new soil

Primary Succession

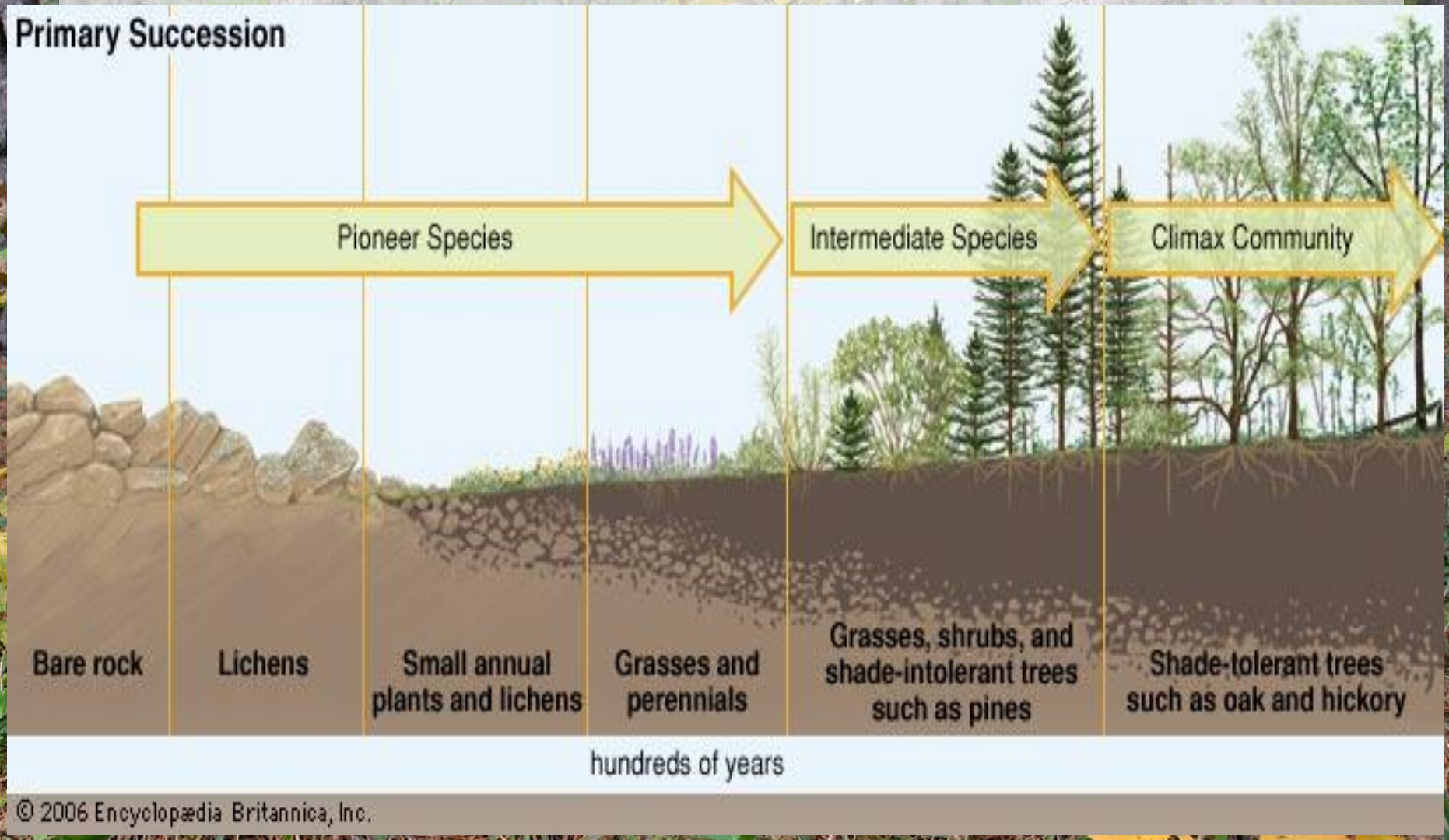
- The simple plants die, adding more organic material
- The soil layer thickens, and grasses, wildflowers, and other plants begin to take over

Primary Succession

- These plants die, and they add more nutrients to the soil
- Shrubs and tress can survive now

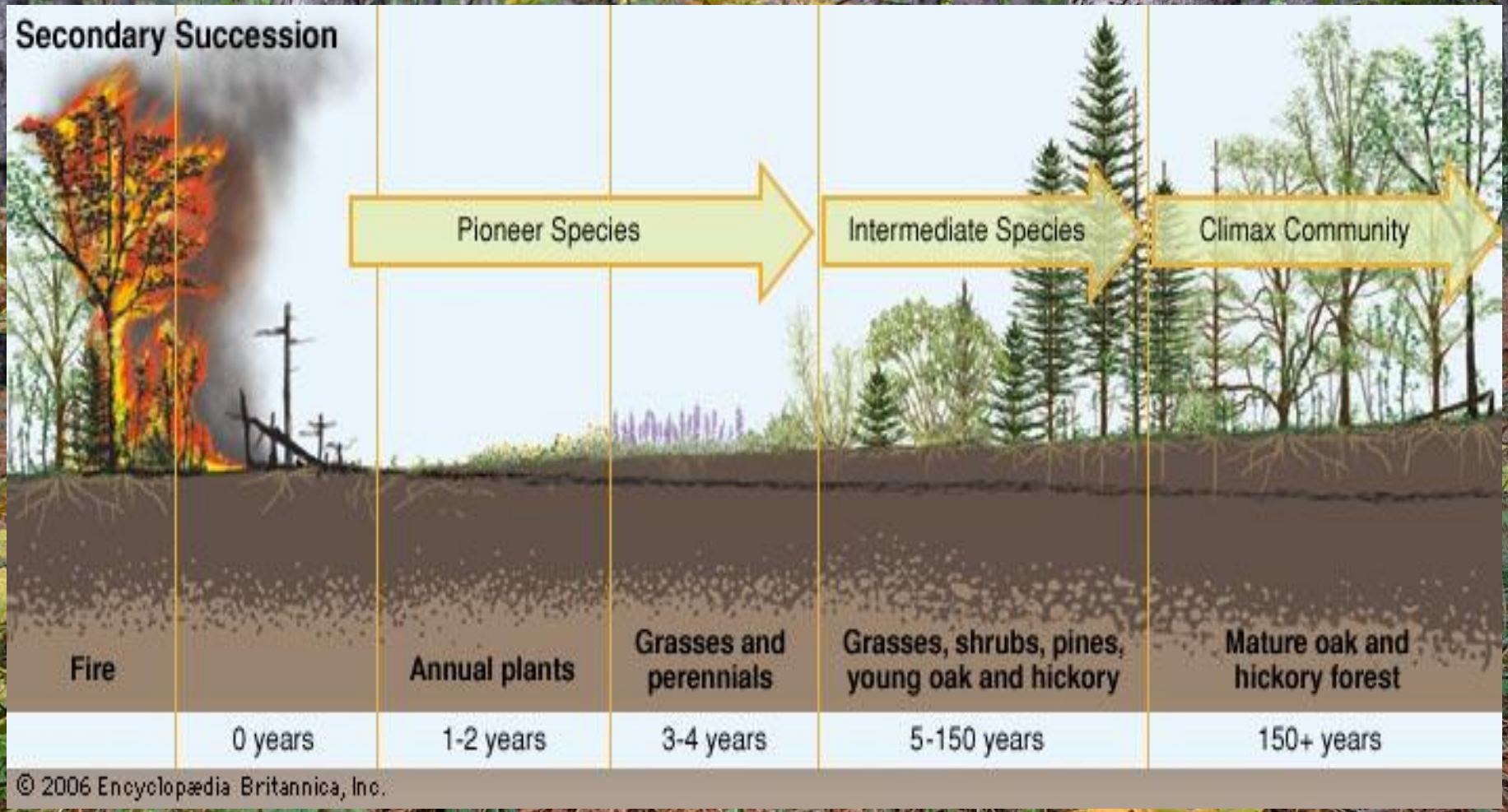
Primary Succession

- Insects, small birds, and mammals have begun to move in
- What was once bare rock now supports a variety of life

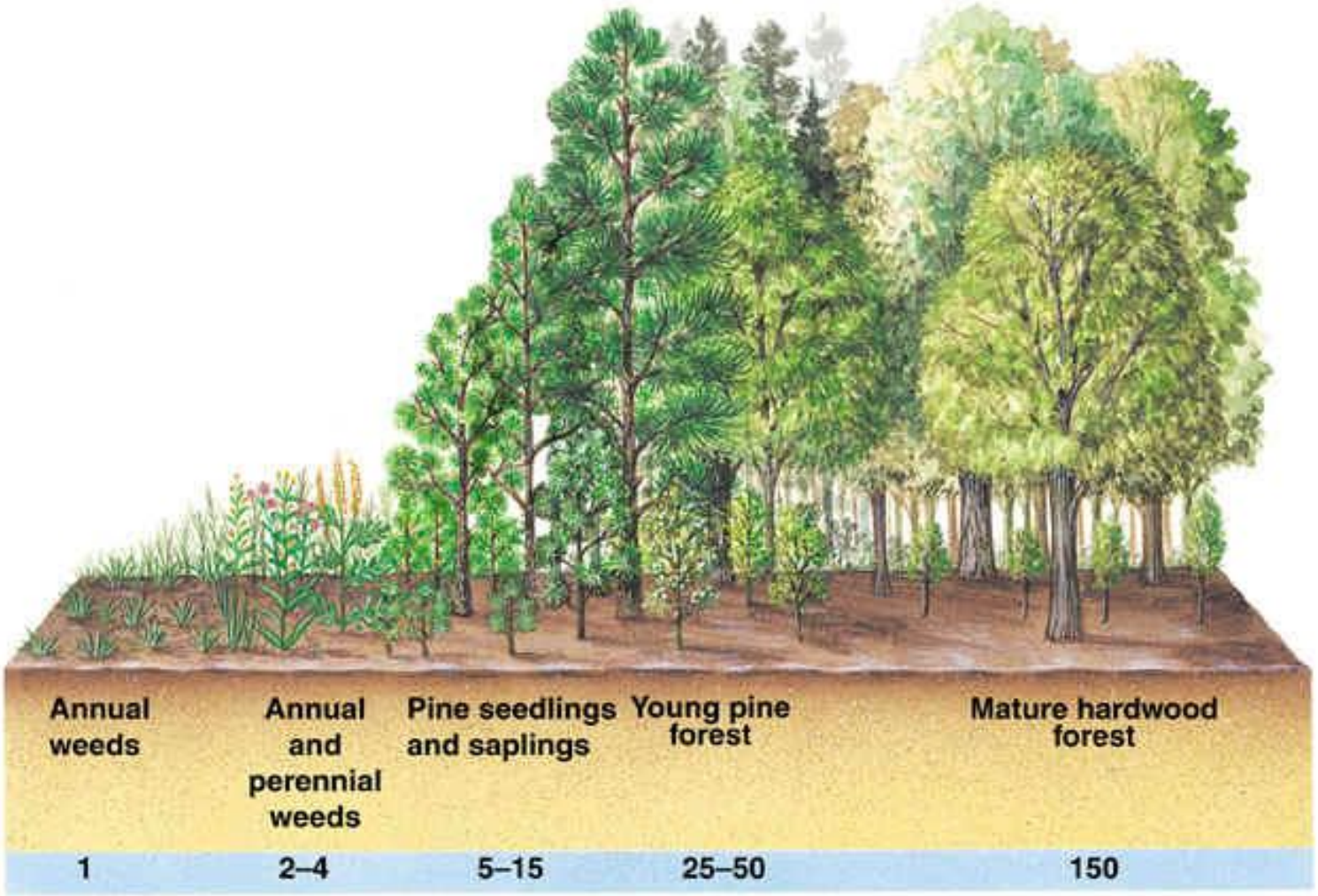


Secondary Succession

- Begins in a place that already has soil and was once the home of living organisms
- Occurs faster and has different pioneer species than primary succession
- Example: after forest fires



Raven/Berg, Environment, 3/e
Figure 5.17



Climax Community

- A stable group of plants and animals that is the end result of the succession process
- Does not always mean big trees
  - Grasses in prairies
  - Cacti in deserts

Ecosystem Ecology

Definitions

Ecosystem—

- Consists of all the abiotic factors in addition to the entire community of species that exist in a certain area. May contain many different communities.

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- Consists of all the abiotic factors in addition to the entire community of species that exist in a certain area. May contain many different communities.

Ecosystem Ecology—

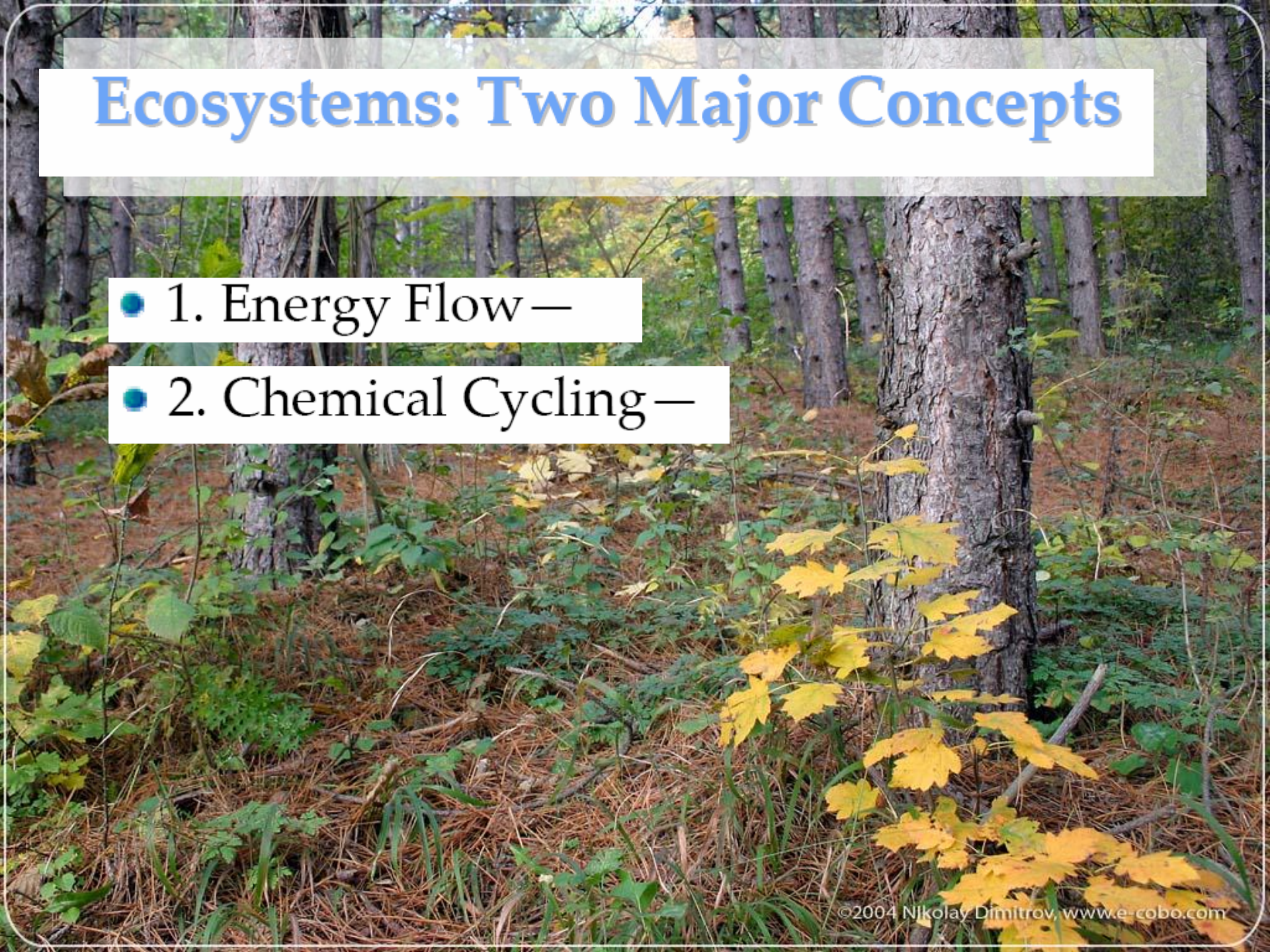
- The emphasis is on energy flow and chemical cycling among the various biotic and abiotic components

Vocabulary

- Biomass
  - the dry weight of organic matter comprising a group of organisms in a particular habitat
- Organic Elements
  - organic compounds are those which contain carbon and are biological in origin
- Inorganic Elements
  - inorganic elements do not usually contain carbon and are considered to be of a mineral, not biological, origin

Ecosystems: Two Major Concepts

- 1. Energy Flow—
- 2. Chemical Cycling—



Energy Flow in Ecosystems is Described by Two Laws

- *First Law of Thermodynamics*—
  - energy cannot be created or destroyed, only transformed
  - as in transformation/conversion of solar energy into chemical energy through photosynthesis
- *Second Law of Thermodynamics*—
  - energy transformation/conversions are never 100% efficient (excess energy often lost as heat)
  - which is why ~90% of energy is lost between trophic levels

Primary Production

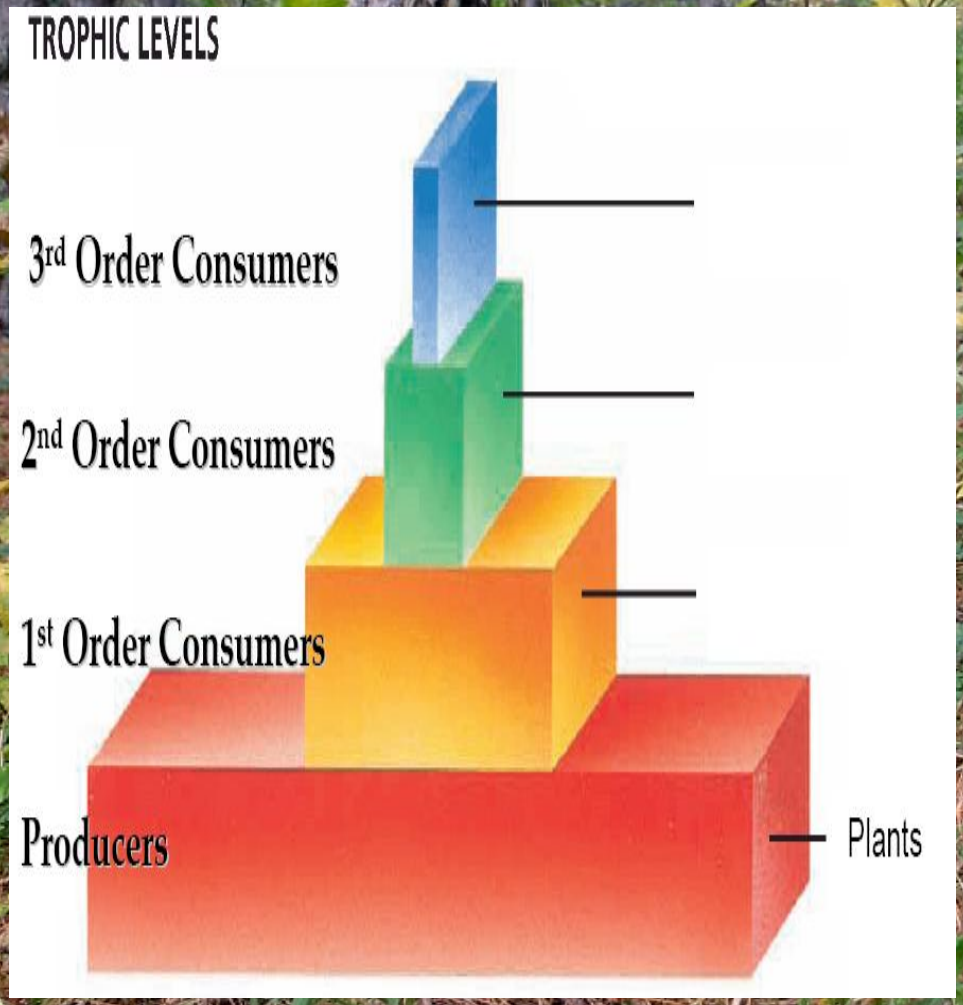
Gross Primary Production—

- all the solar energy plants convert to chemical energy through photosynthesis per unit time
- measured in Joules/m^2/yr

Net Primary Production =

Gross Primary Production – Respiration of Producers

Review of Trophic Structure

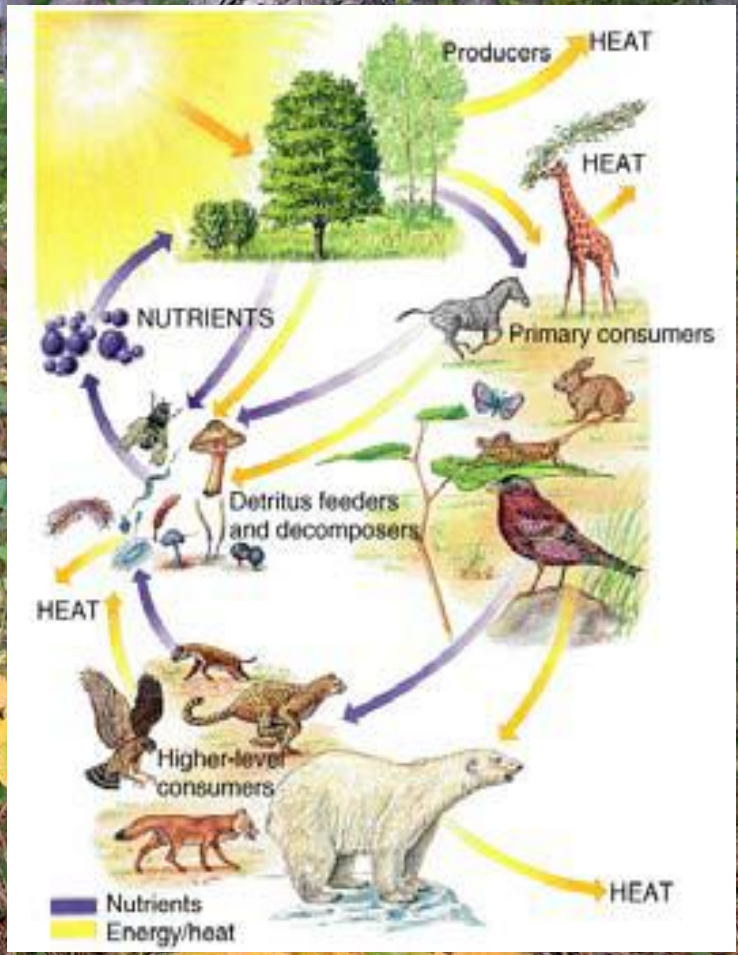


Review: Why does the energy pyramid look like it does?

- Energy transfer between trophic levels is never 100% efficient. Only 10-20% of energy is transferred

How is the other ~90% of energy lost?

- Heat loss through cellular respiration
- Not all organisms in lower trophic levels are consumed
- The whole mass of the prey is not assimilated into the predator's body
- Energy lost through the metabolic processes of the prey before they are consumed



Biomass Structure

Is the Biomass structure similar to the Trophic structure or not?

- Yes.
- Since only 10% of energy can be transferred to higher levels, there is not as much energy to support many large individuals

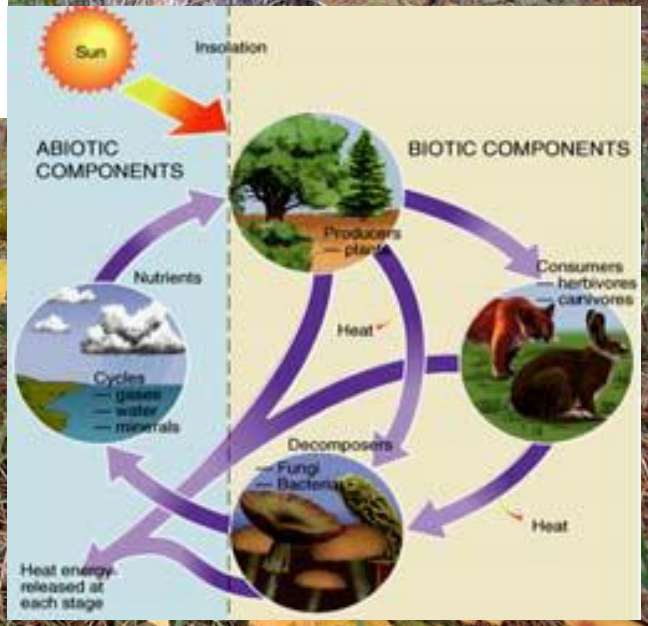
- Since energy is hard to measure, the biomass pyramid is often used in place of the energy pyramid

Chemical Cycling Described by One Law

- *Law of Conservation of Matter* —
  - Matter cannot be created or destroyed
  - This means all the atoms available to organisms must be recycled in the ecosystem

How are chemicals and atoms recycled?

- Decomposers (bacteria and fungi) break down waste and matter
- They return nutrients and atoms to the ecosystem
- Without them, producers would run out of minerals and chemicals; the ecosystem would collapse!



Biomagnification

Biomagnification—

- the process in which toxic chemical substances become more concentrated (accumulated) at each higher trophic level

How does biomagnification occur?

- Since toxins are stored in fatty tissue, the more an organism eats contaminated food, the more toxin it absorbs