Review Items
Ecosystem Structure

The Law of Conservation of Matter

- **Matter cannot be created nor destroyed**
- **Matter only changes form**
- **There is no “away”**

Laws Governing Energy Changes

First Law of Thermodynamics (Energy)

- Energy is neither created nor destroyed
- Energy only changes form
- You can't get something for nothing

ENERGY IN = ENERGY OUT

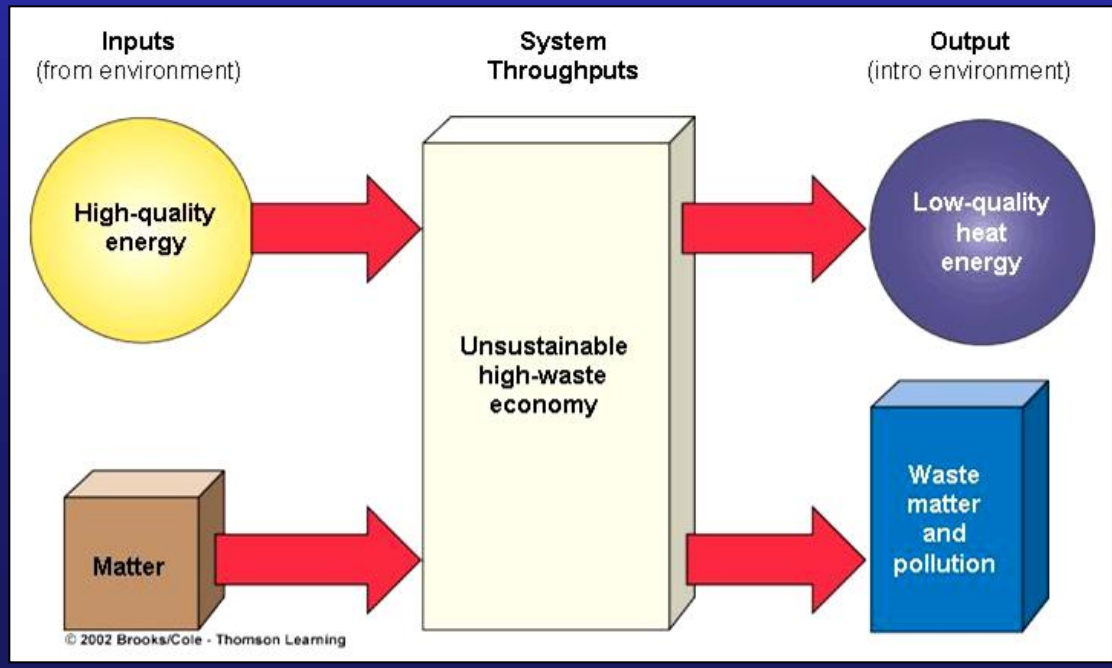
Laws Governing Energy Changes

Second Law of Thermodynamics

- In every transformation, some energy is converted to heat (lower quality)
- You cannot break even in terms of energy **quality**

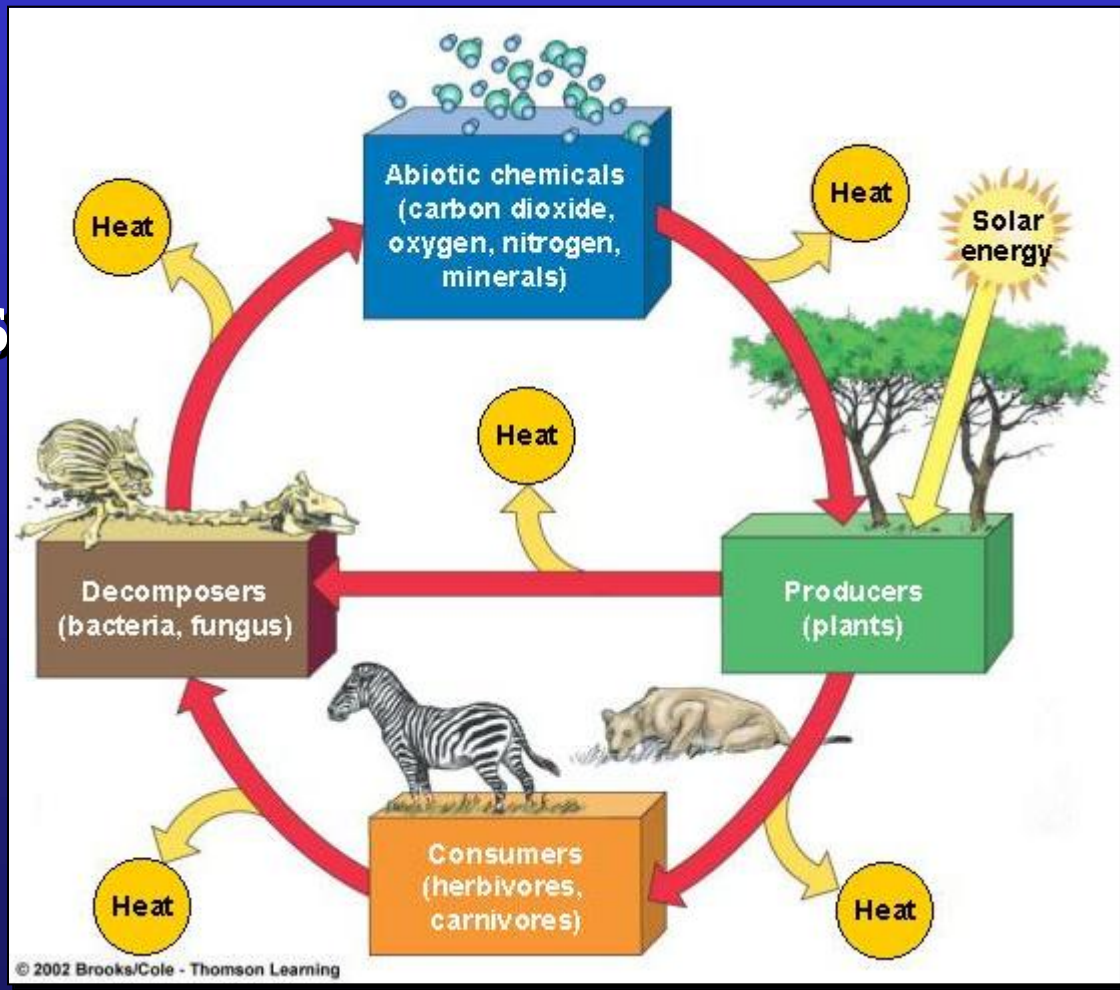
Connections: Matter and Energy Laws and Environmental Problems

- High-throughput (waste) economy
- Matter-recycling economy
- Low-throughput economy



The Biotic Components of Ecosystems

- Producers (autotrophs)
  - Photosynthesis
- Consumers (heterotrophs)
  - Aerobic respiration
- Decomposers



Consumers

- Primary, secondary, tertiary, etc.
- Herbivore - plant eater
- Carnivore - meat eater
- Omnivore - mixed plant/animal diet

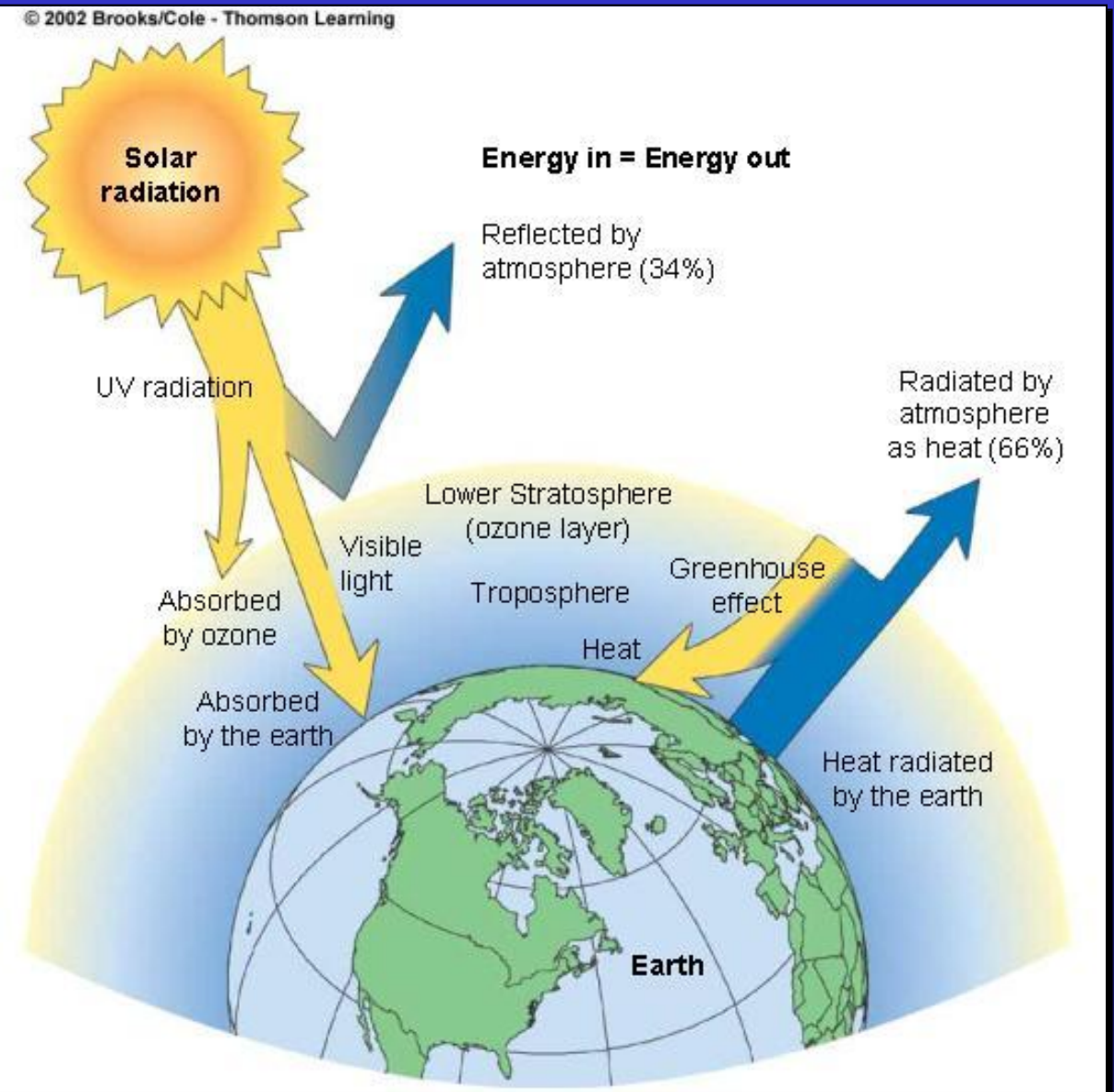
The Abiotic Components of Ecosystems

1) Outside energy source

2) Physical factors that determine weather, climate

3) Chemicals essential for life

Outside Energy Source



Powers photosynthesis

Warms earth

Powers water cycle

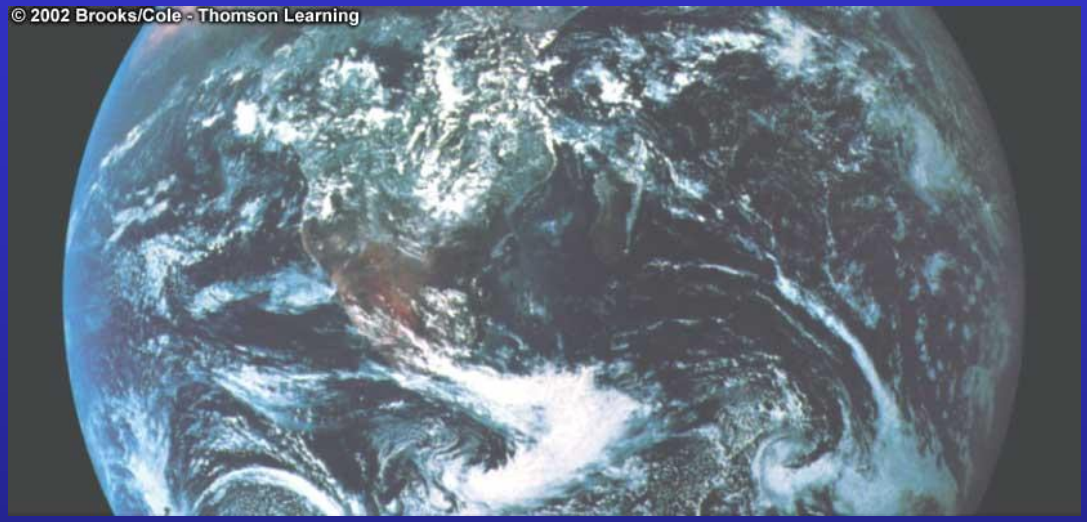
Physical factors that determine weather, climate

Heat

Wind

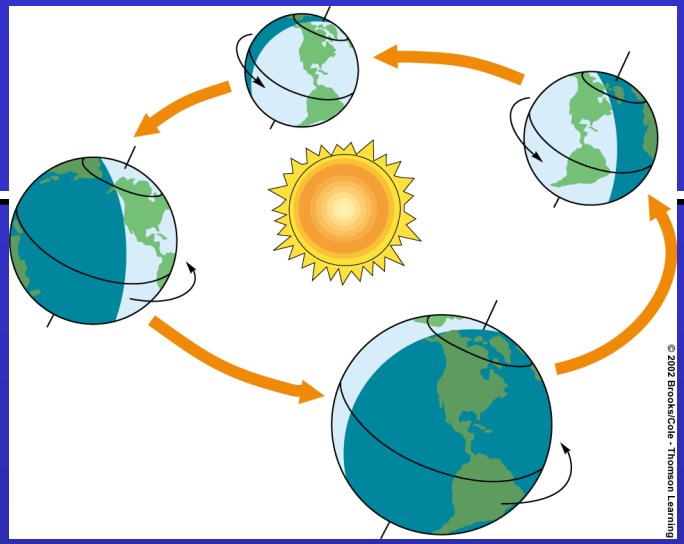
Precipitation

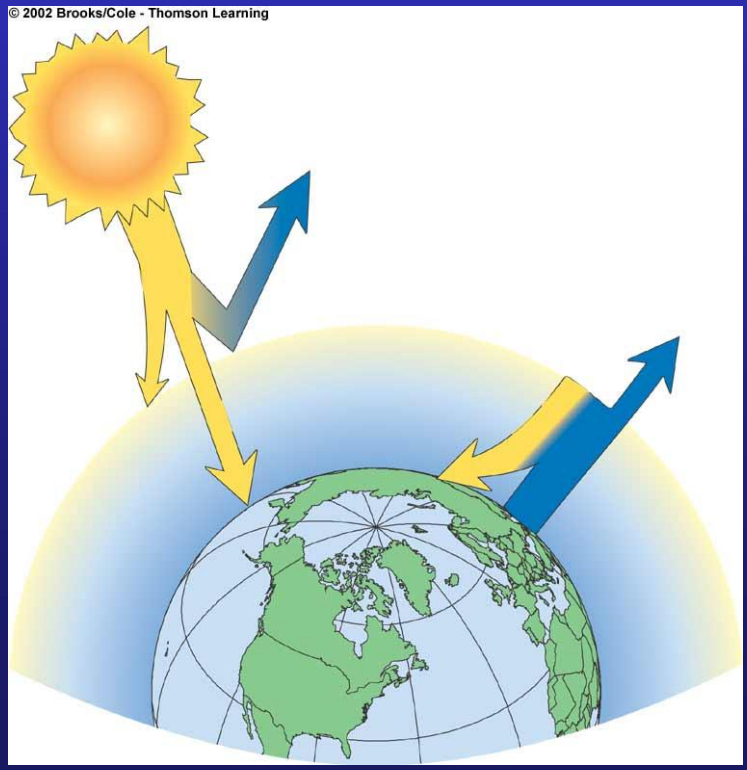
Topography



Heat

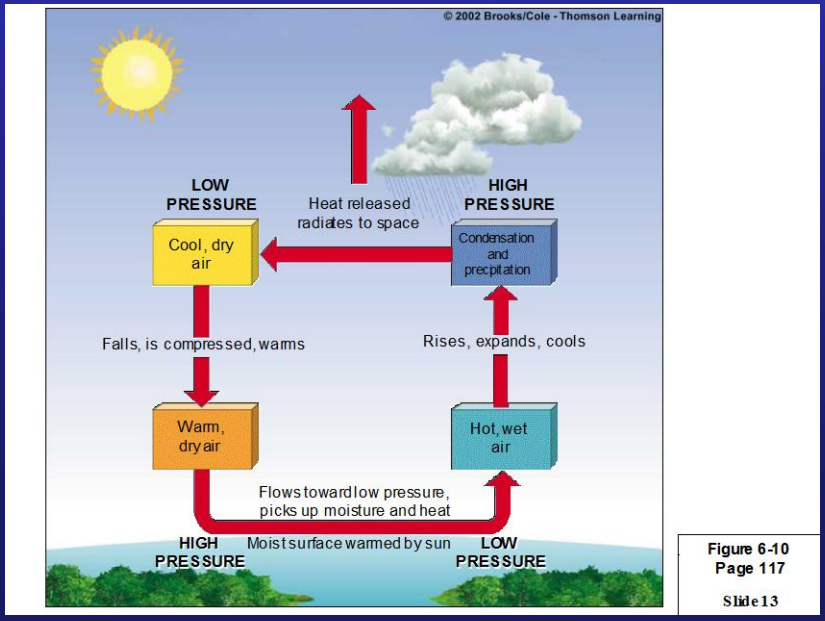
- Location
- Reflection
- Retention





Wind and Precipitation

- Uneven heating
- Ascending, descending air masses



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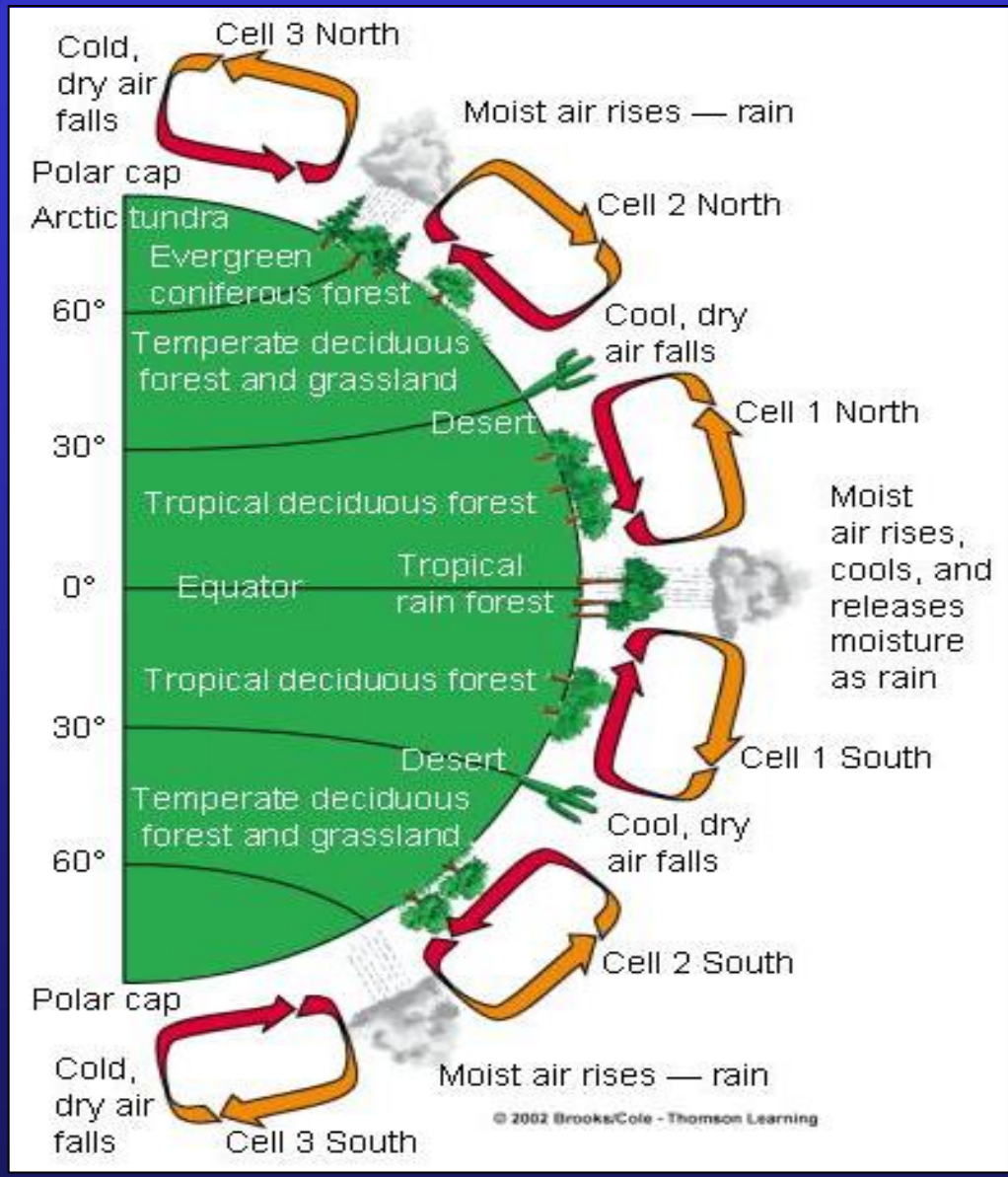
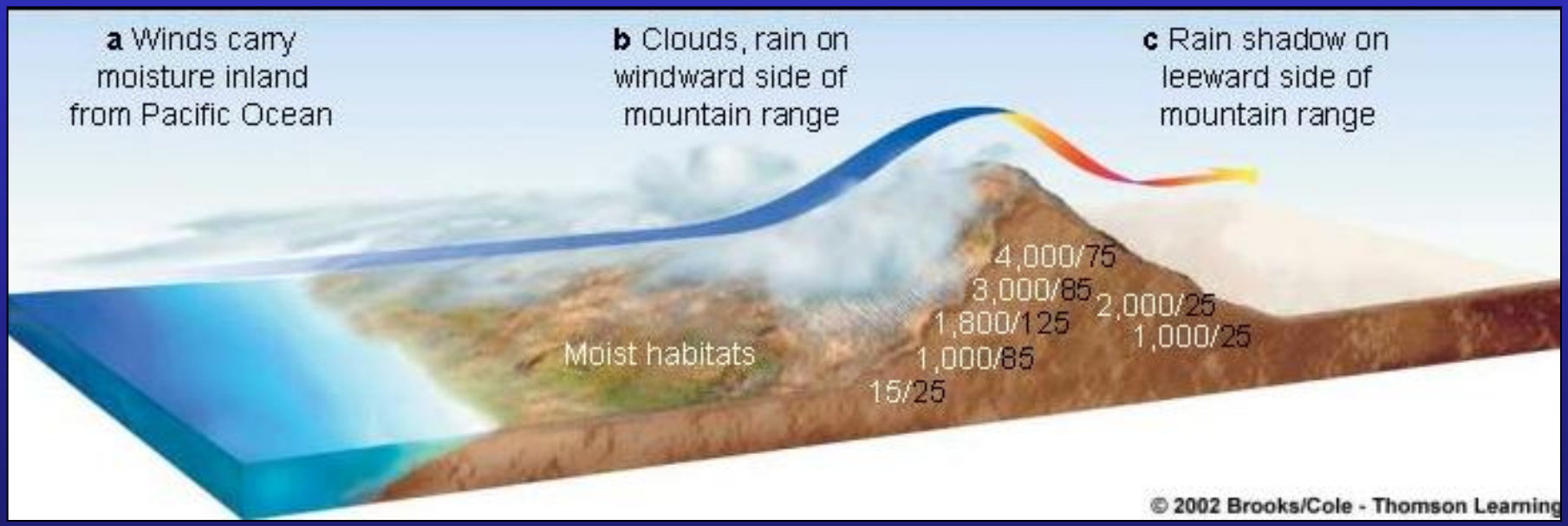


Modifiers

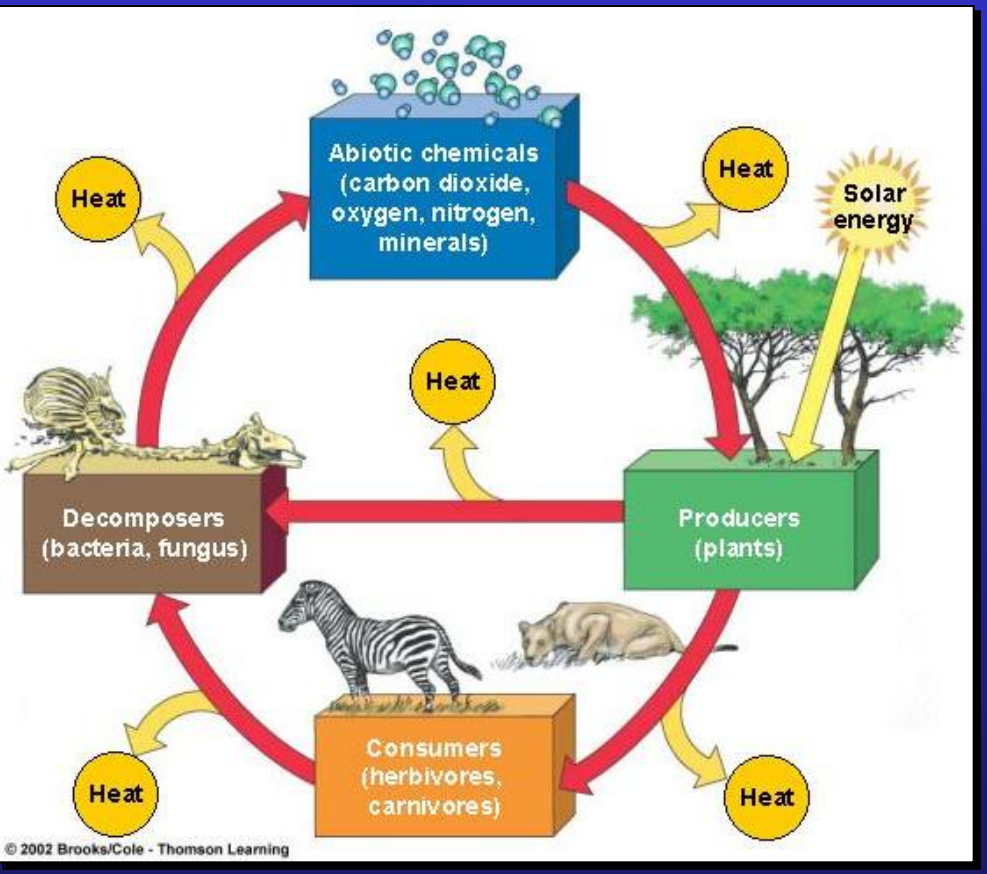
- *Rotation of the globe*
- *Geologic features*

Rain Shadows



Lake-effect Precipitation

Chemicals Essential for Life



- *Elements and compounds*
- *Recycled between biotic and abiotic parts*

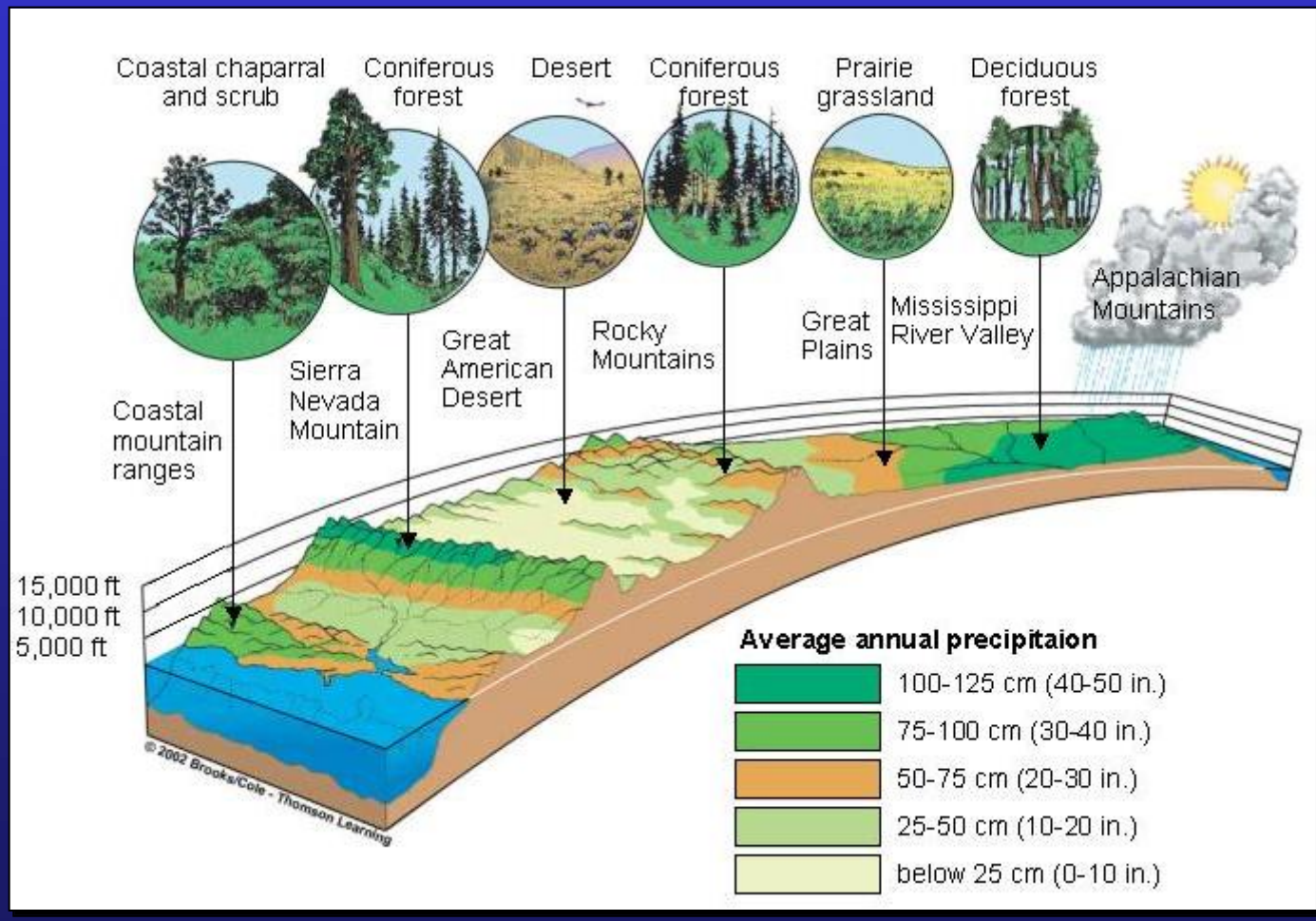
Limiting Factor Principle

- ***Too much or too little of any biotic factor can limit or prevent growth of a population, even if all other factors are optimal for that population.***

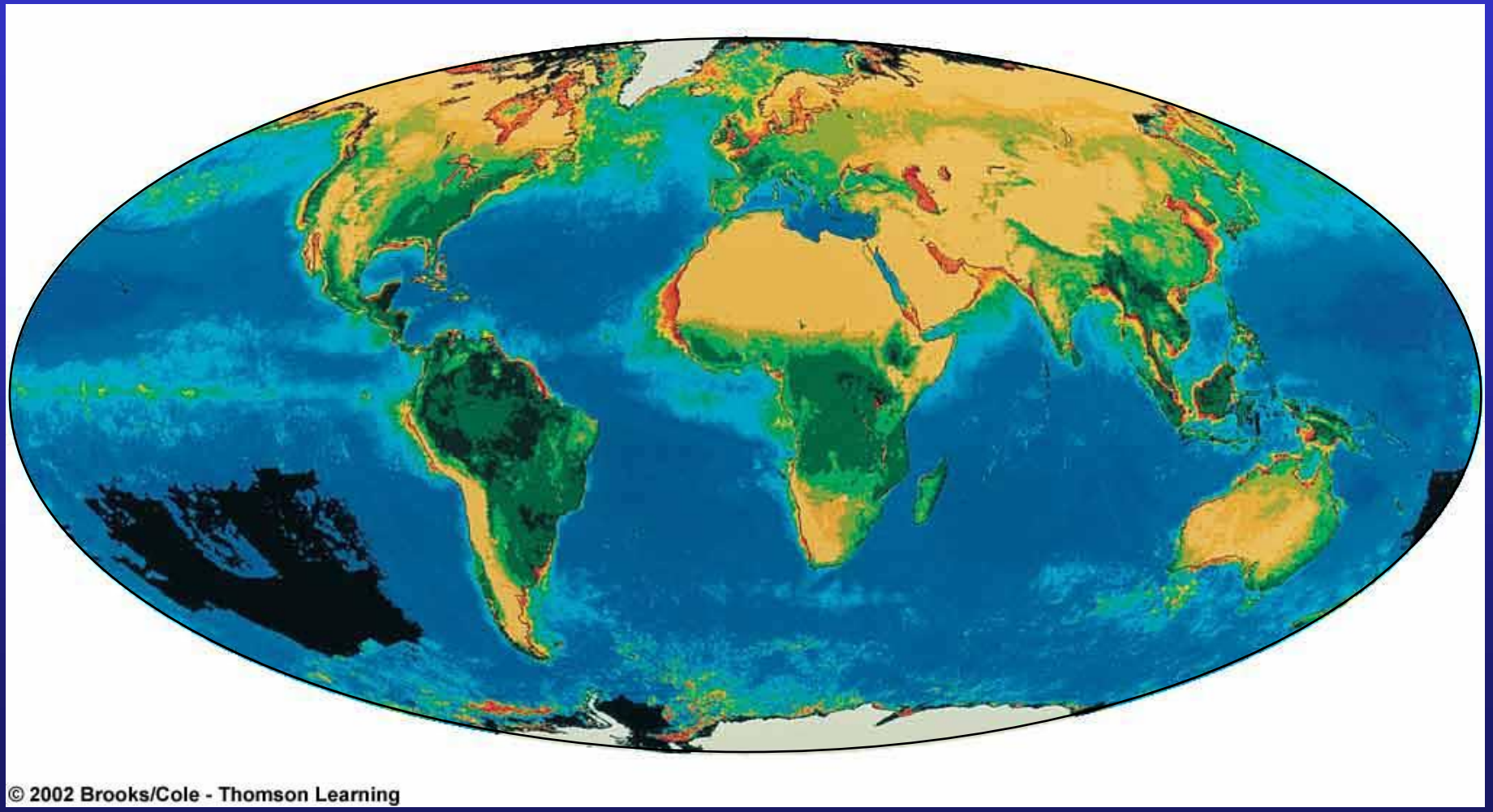
- ***Single factor most over-abundant or deficient in an ecosystem determines presence/absence of specific plants/animals.***

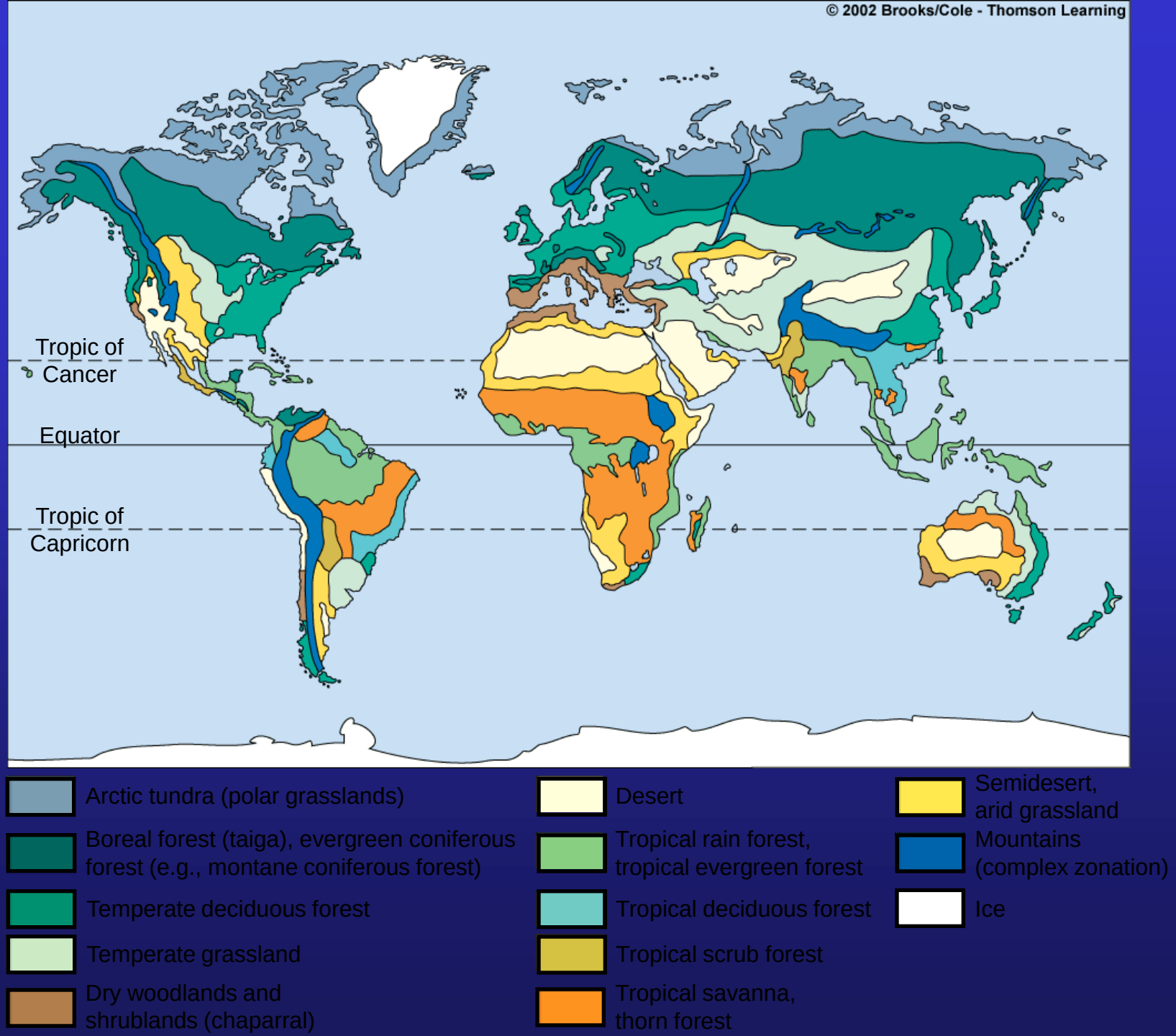
Ecosystem Concepts and Components

- Biomes
- Role of climate
- Aquatic life zones



Biomes - terrestrial ecosystems

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Tropic of Cancer
Equator
Tropic of Capricorn
Arctic tundra (polar grasslands)
Boreal forest (taiga), evergreen coniferous forest (e.g., montane coniferous forest)
Temperate deciduous forest
Temperate grassland
Dry woodlands and shrublands (chaparral)
Desert
Tropical rain forest, tropical evergreen forest
Tropical deciduous forest
Tropical scrub forest
Tropical savanna, thorn forest
Semidesert, arid grassland
Mountains (complex zonation)
Ice

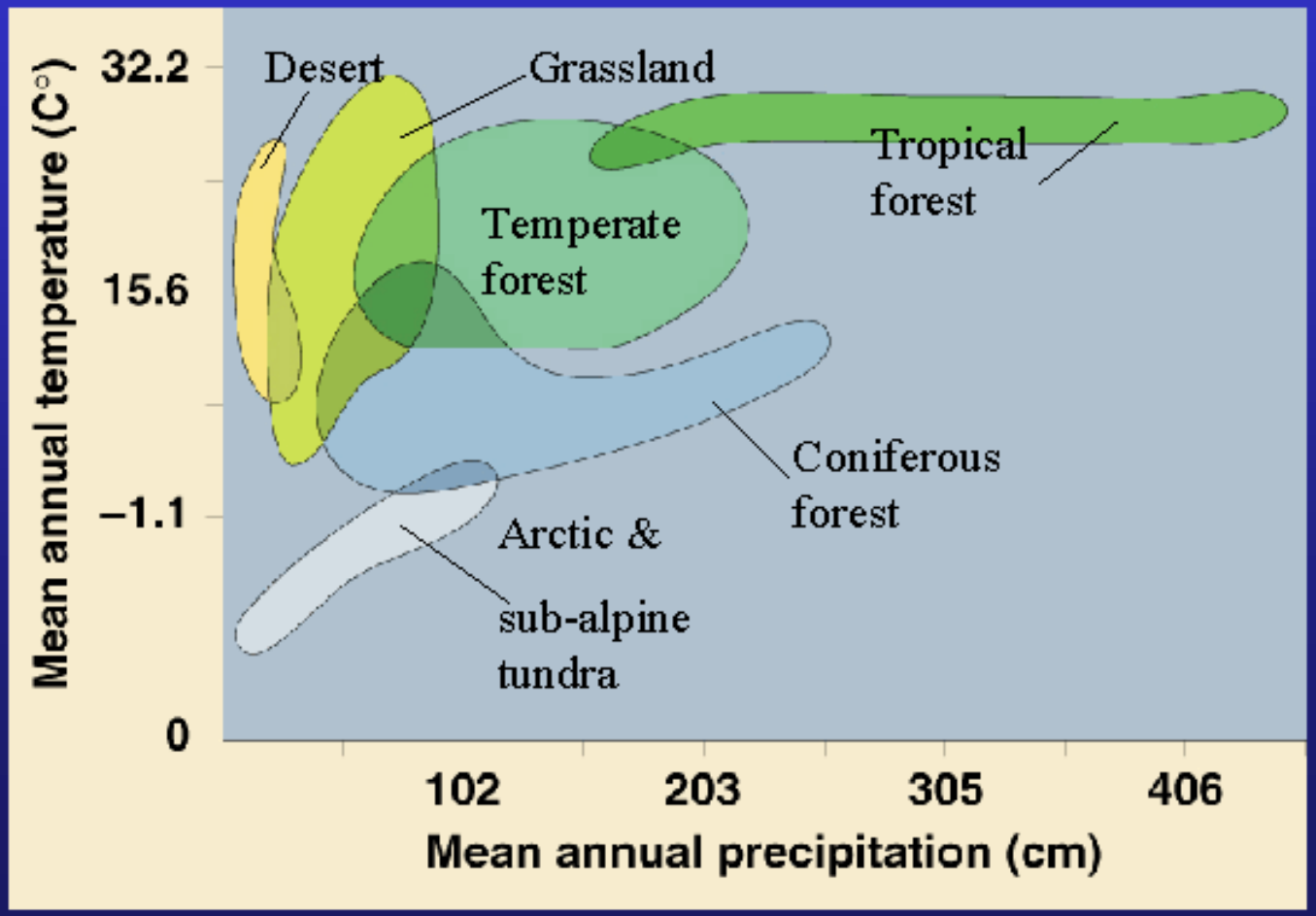
Biomes

- *Determined primarily by precipitation*
  - *Forests (> 75 cm rain per year)*
  - *Grasslands (30-75 cm rain per year)*
  - *Deserts (< 30 cm rain per year)*

Biomes

- *Determined secondarily by temperature*
  - *Type of forest, grassland, or desert determined by average annual temperature*

Climograph for USA



Prevailing weather defines distinct habitat types and assemblages of organisms

(annual means disguise important variation)

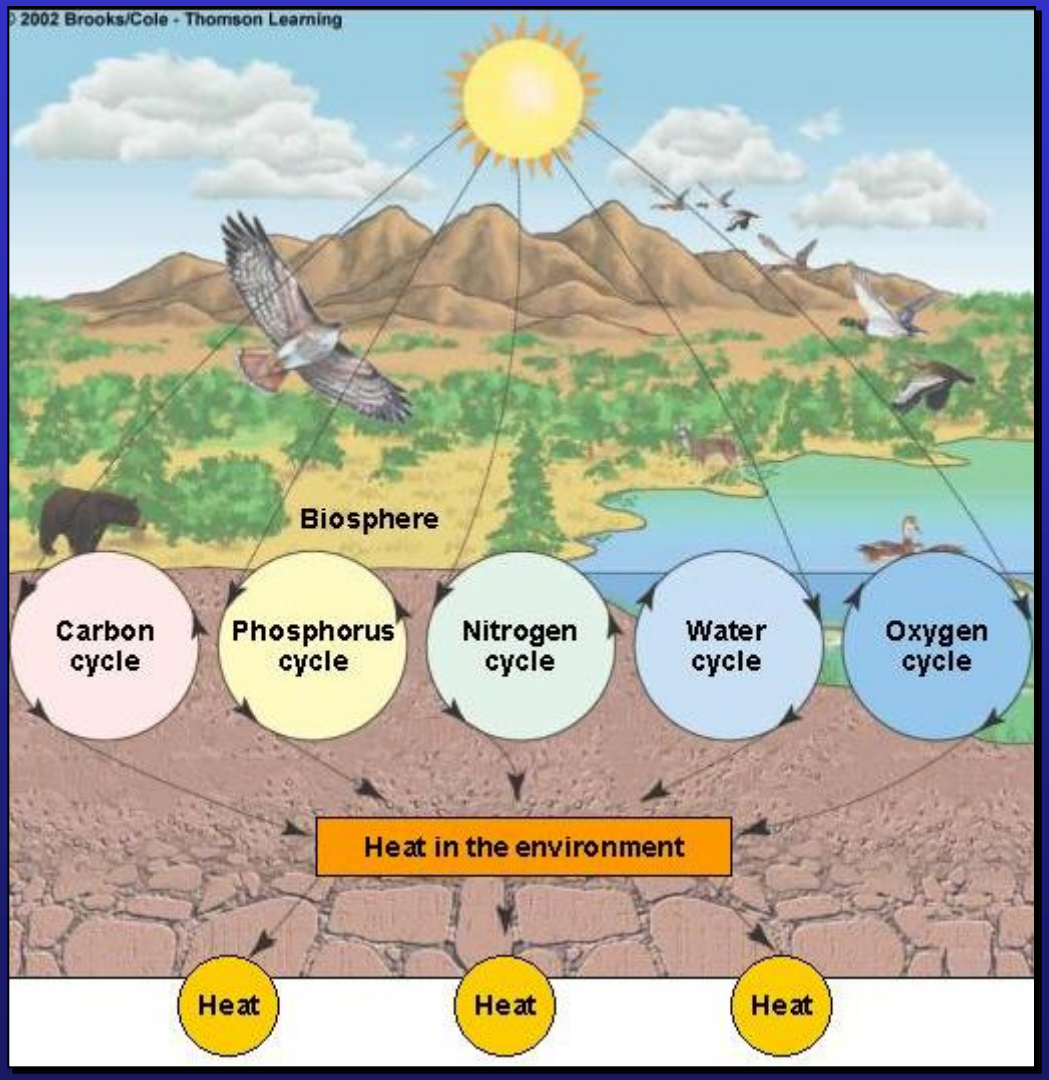
Aquatic ecosystems

- *Determined by salinity*
  - *Marine*
  - *Estuary*
  - *Freshwater*

Type determined by: depth, nearness to shore, size, water movement

Ecosystem Function

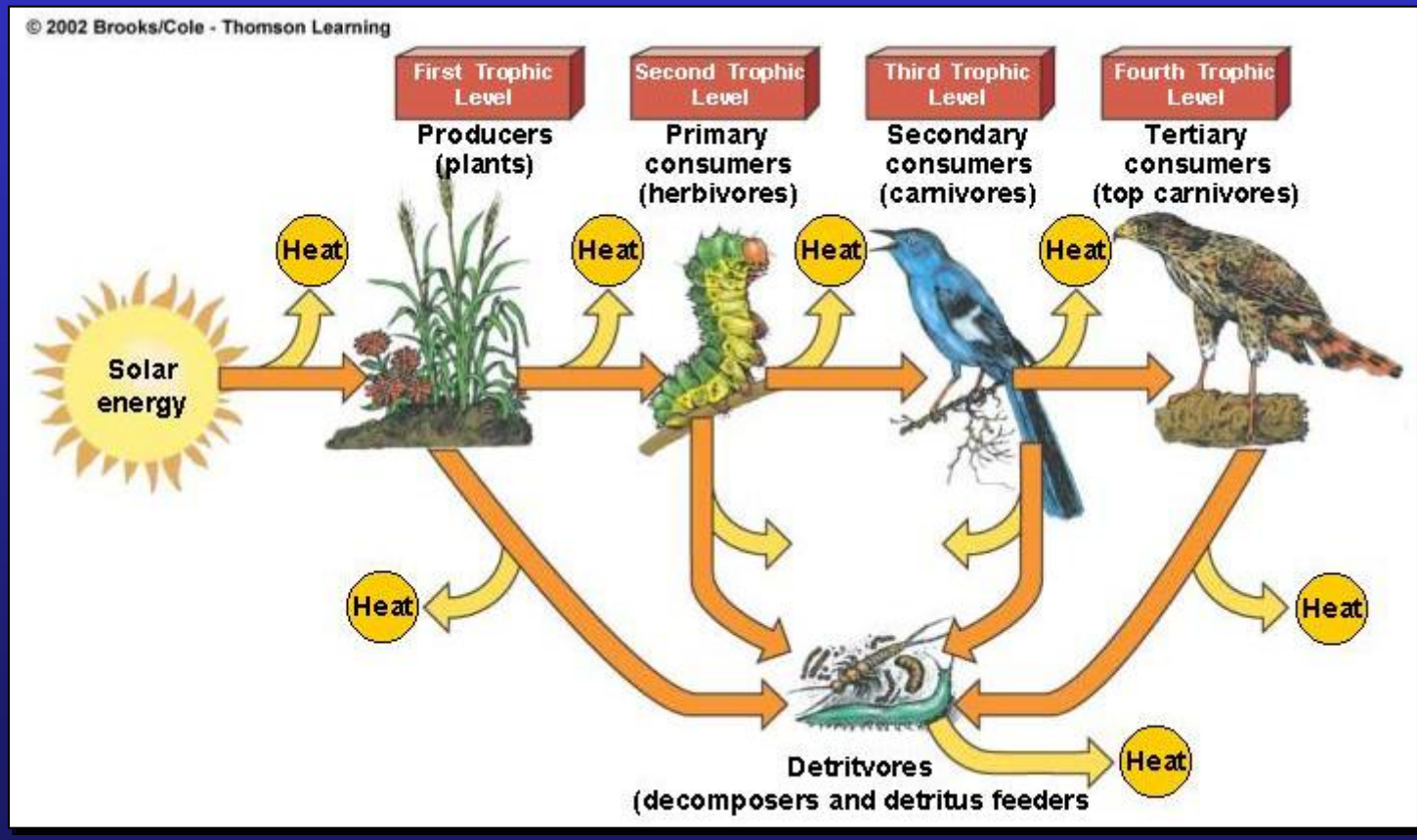
- One-way flow of energy
- Cycling of matter

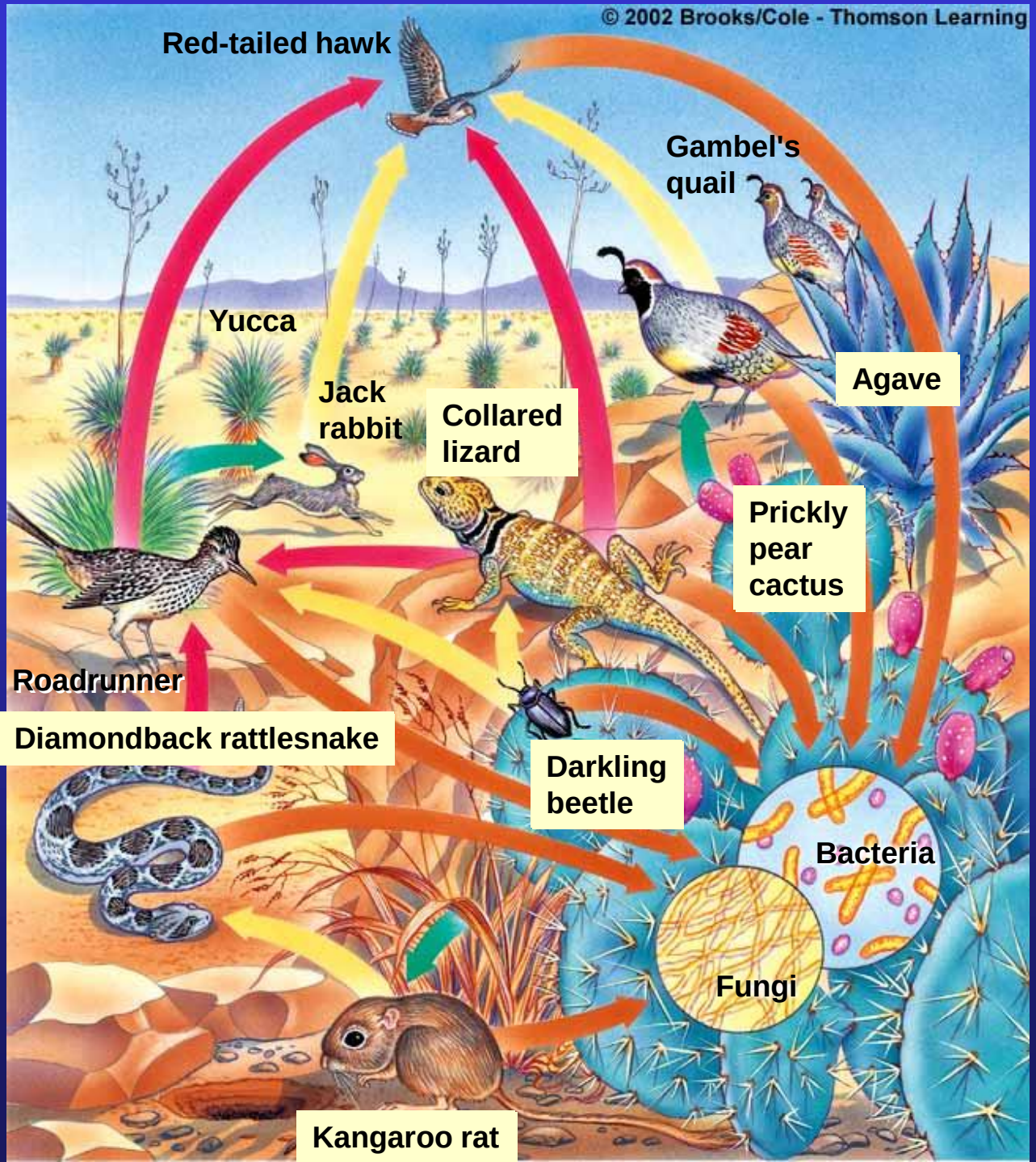


Matter and Energy Flow in Ecosystems

- Food chains
- Food webs

Trophic levels





Producer to primary consumer

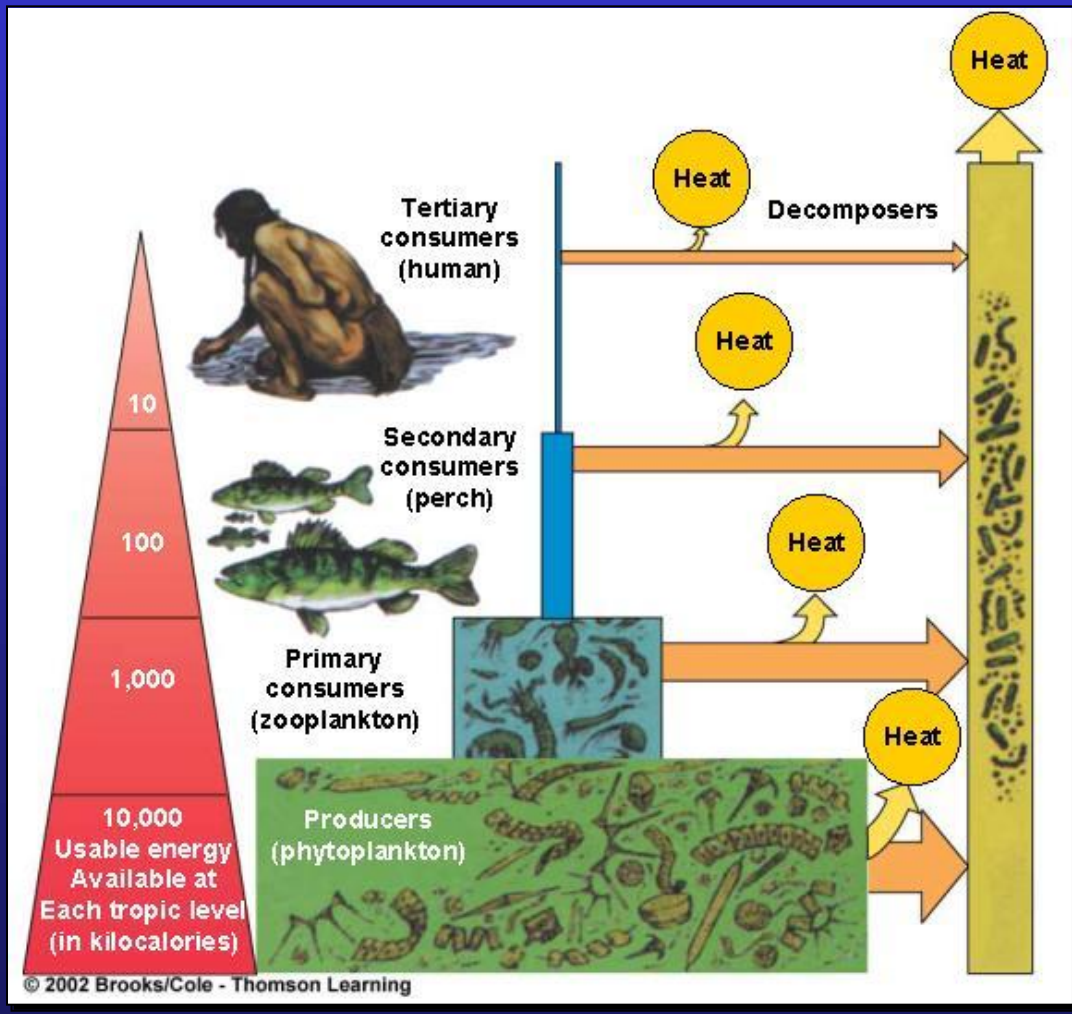
Primary to secondary consumer

Secondary to higher-level consumer

All producers and consumers to decomposers

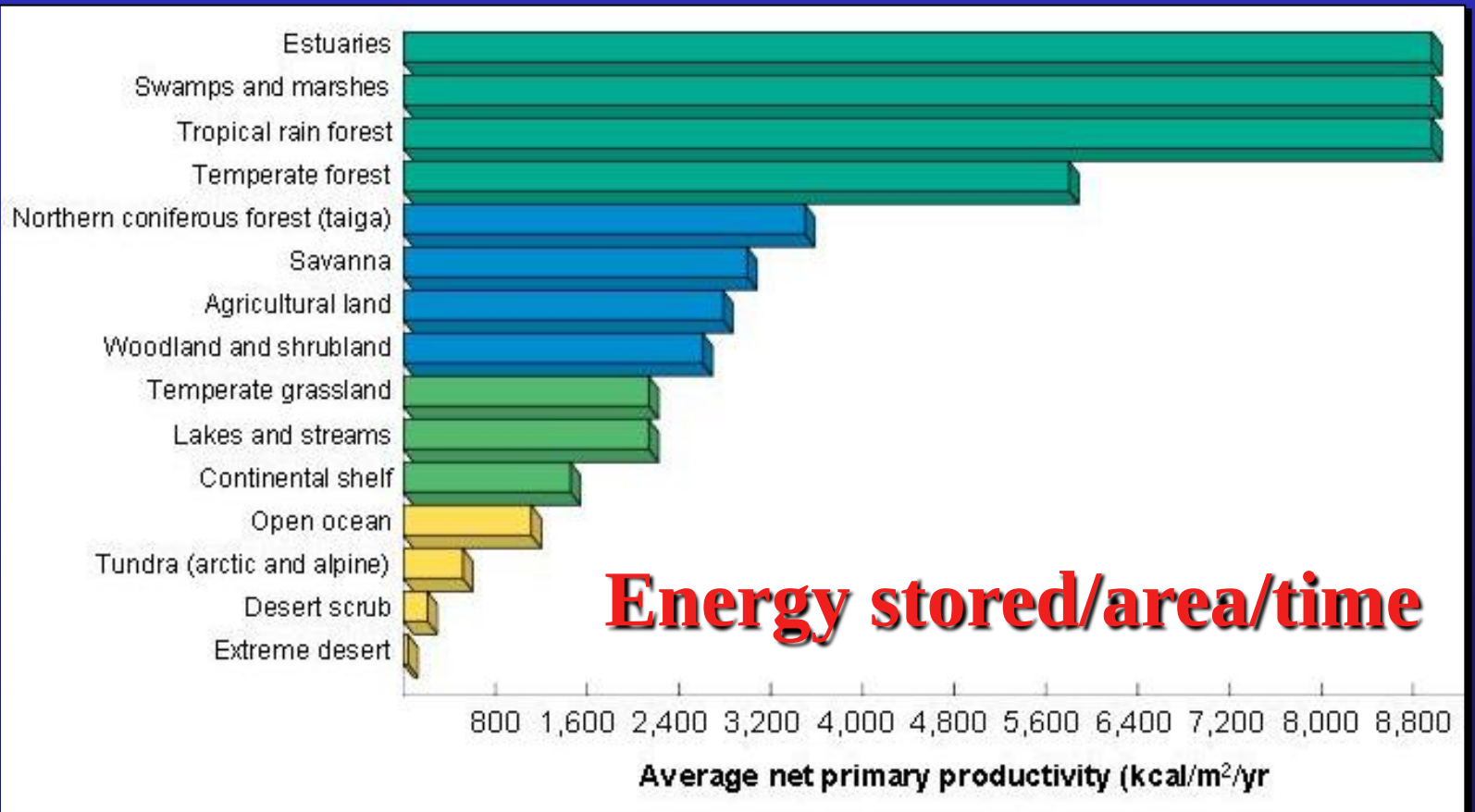
Ecological Pyramids

- Pyramid of energy flow
- Ecological efficiency (10%)
- Pyramid of biomass
- Pyramid of numbers



Energy Productivity of Ecosystems

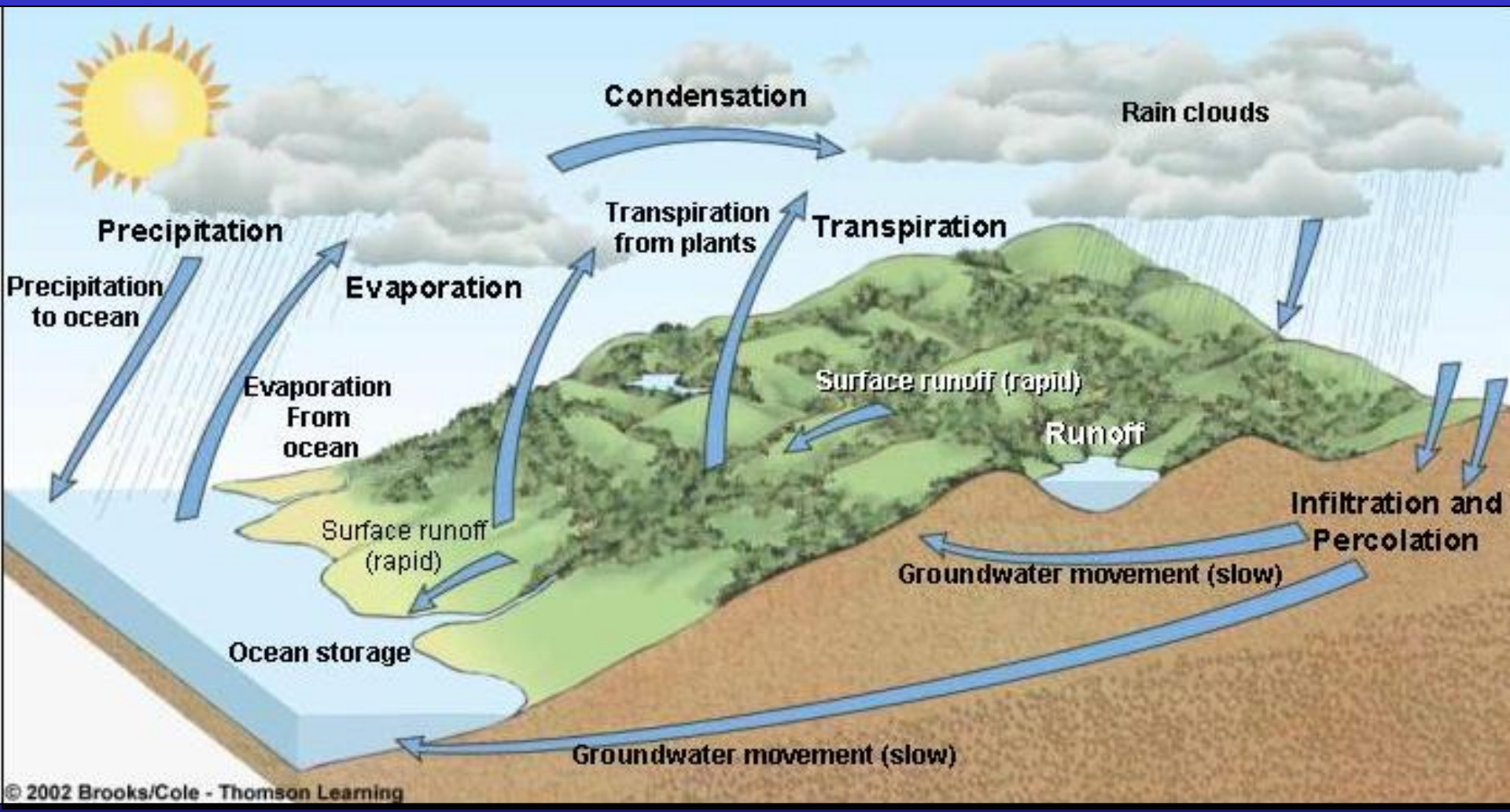
- Primary productivity
- Secondary productivity



Matter Cycling in Ecosystems

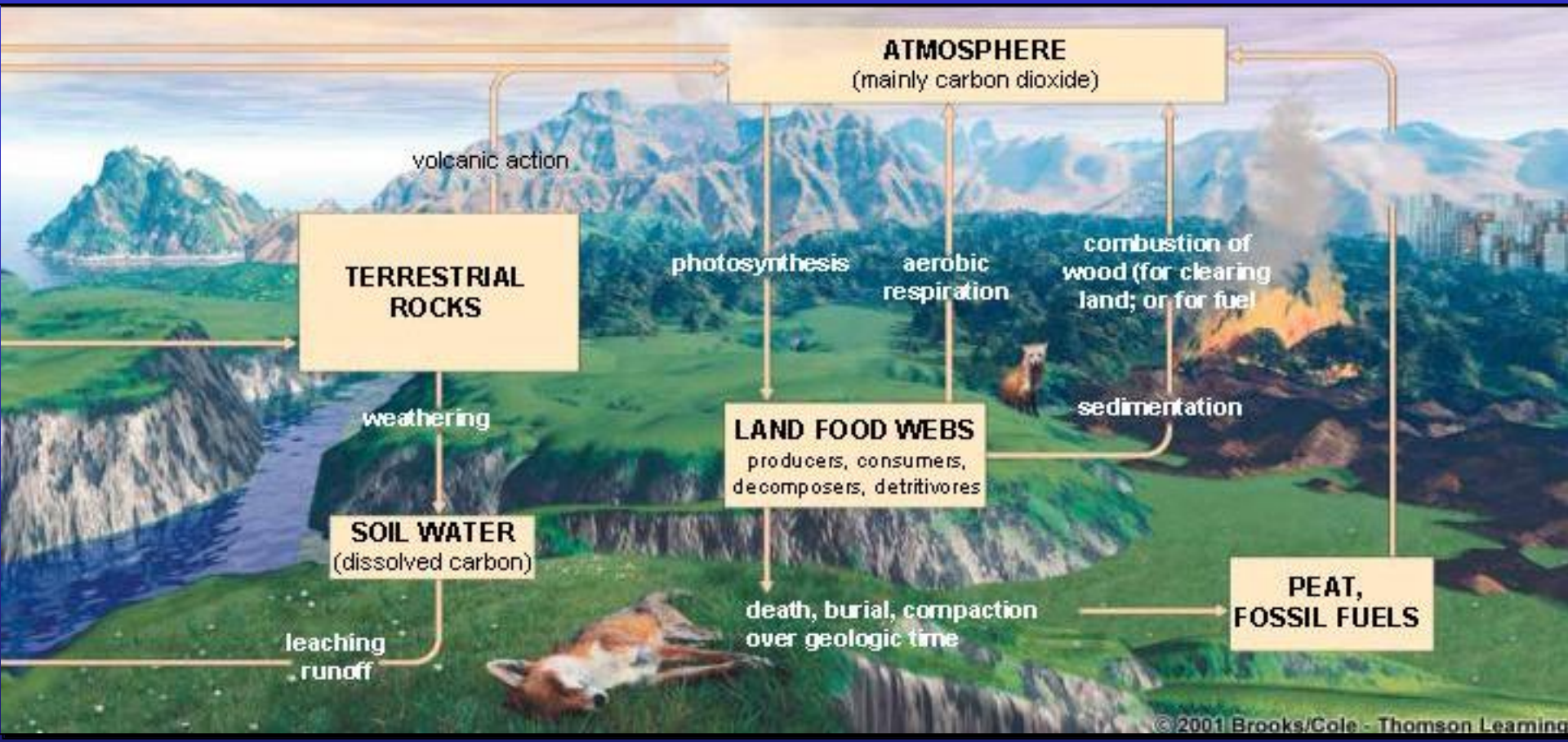
- **Biogeochemical or nutrient cycles**
- **Hydrologic cycle (H_2O)**
- **Atmospheric or gaseous cycles (C, N)**
- **Sedimentary cycles (P, S)**

Hydrologic (Water) Cycle



Driven by physical forces

The Carbon Cycle

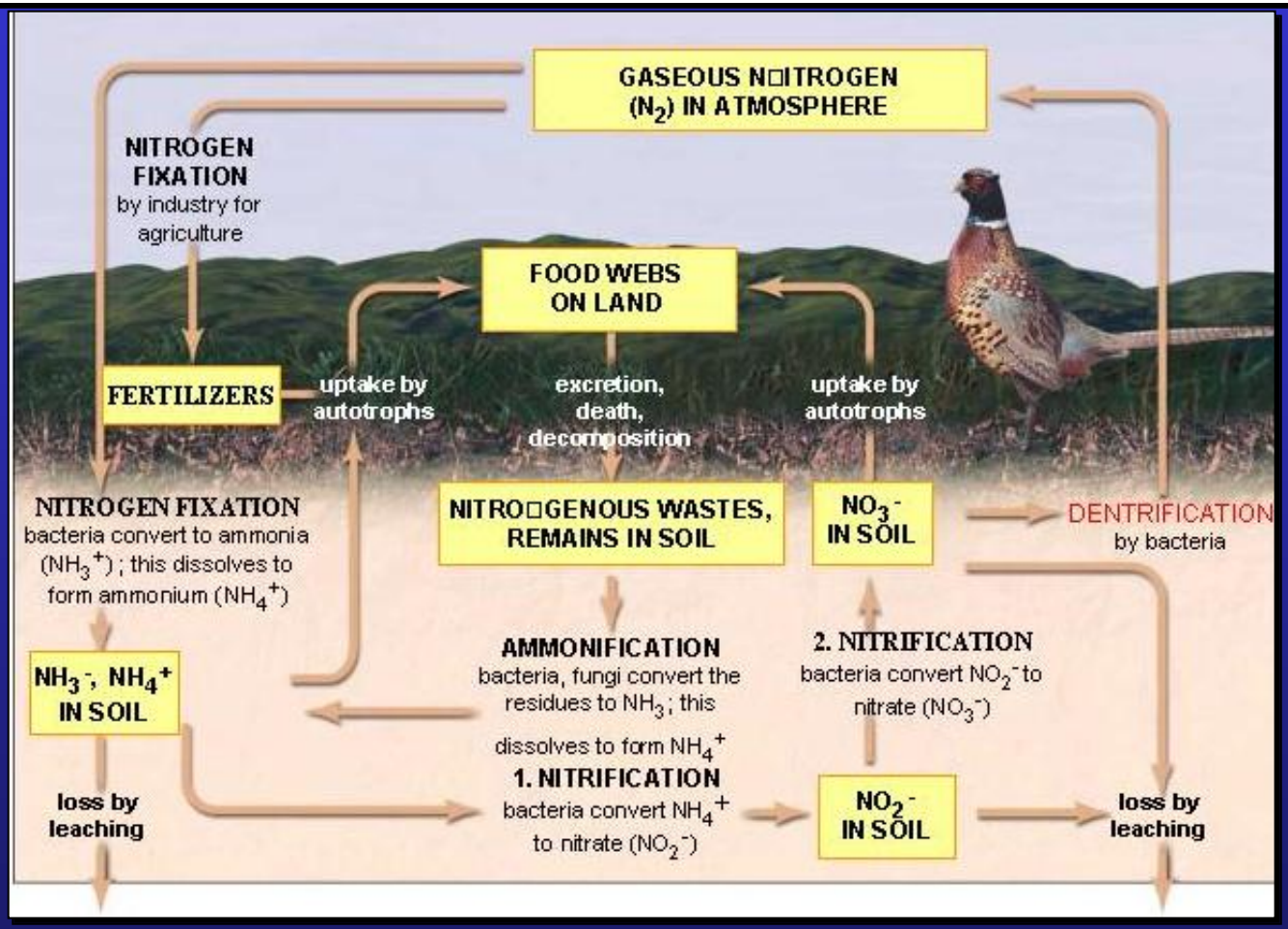


Driven by biological forces: photosynthesis and respiration

The Nitrogen Cycle

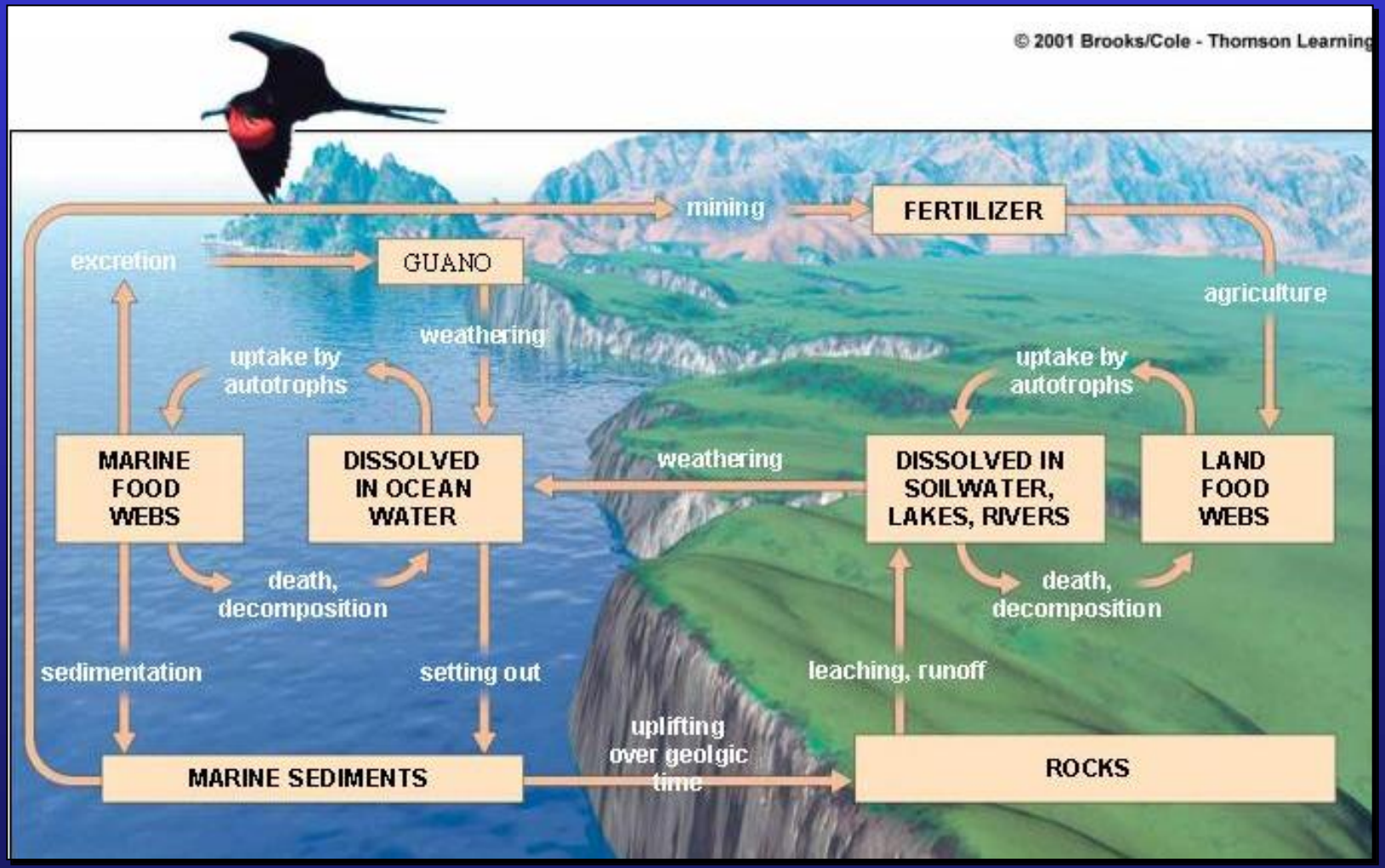
Root nodules on legumes

Cyanobacteria



Driven by biological forces: bacteria

The Phosphorus Cycle



Driven by physical forces

Community Change

- **Ecological succession - gradual replacement of one kind of community of organisms by another over time**

- **Initiated by disturbance**

Ecological Succession: Communities in Transition - Type #1

- **Primary succession**

  - begins with barren area, no soil

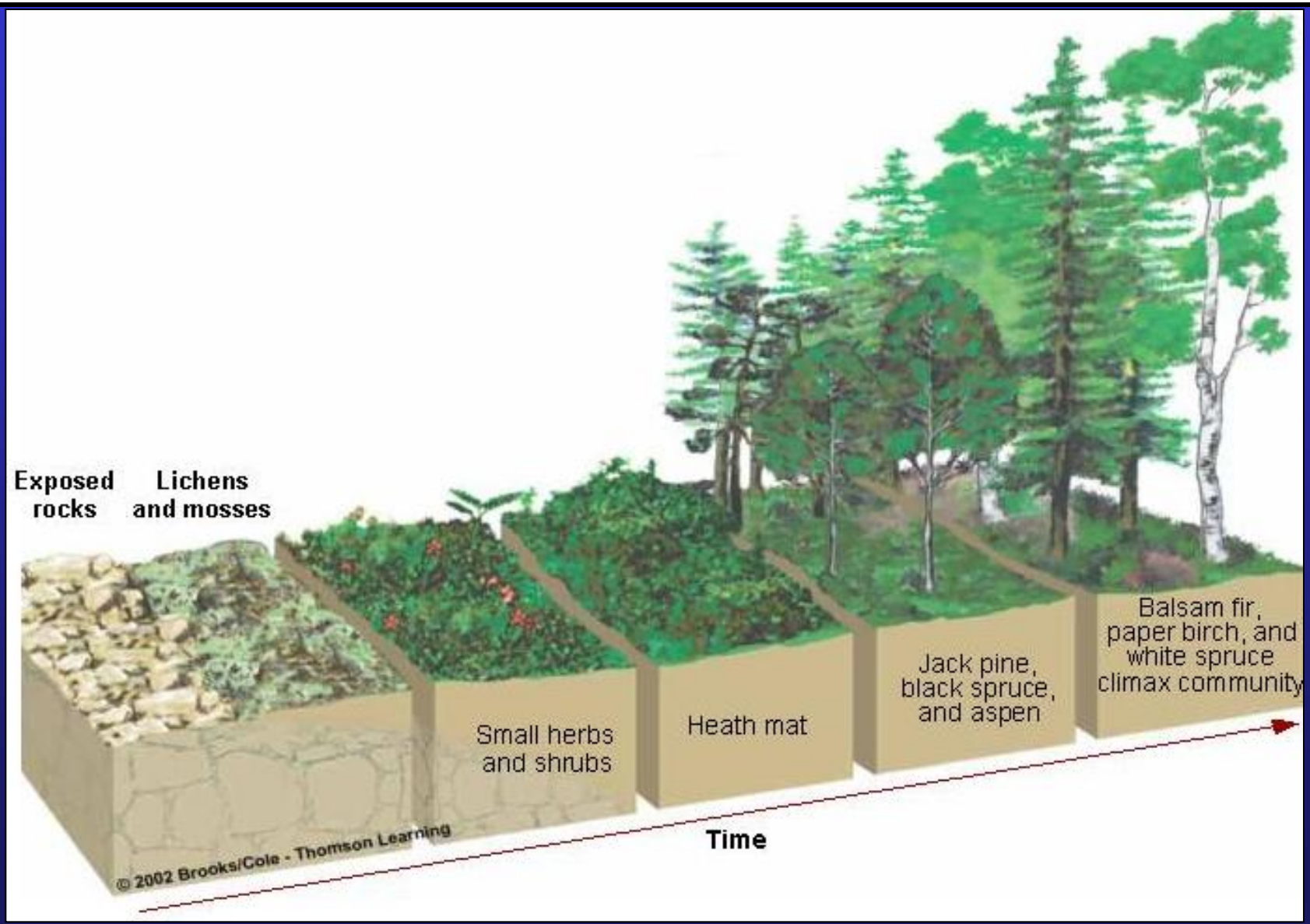
Ecological Succession: Communities in Transition - Type #1

- **Slow soil development by weathering, activities of tolerant species**
  - **pioneer species**

Ecological Succession: Communities in Transition - Type #1

- **Gradual changeover to less tolerant species over long periods of time**
  - equilibrium or successional species

Primary Succession



Ecological Succession: Communities in Transition - Type #2

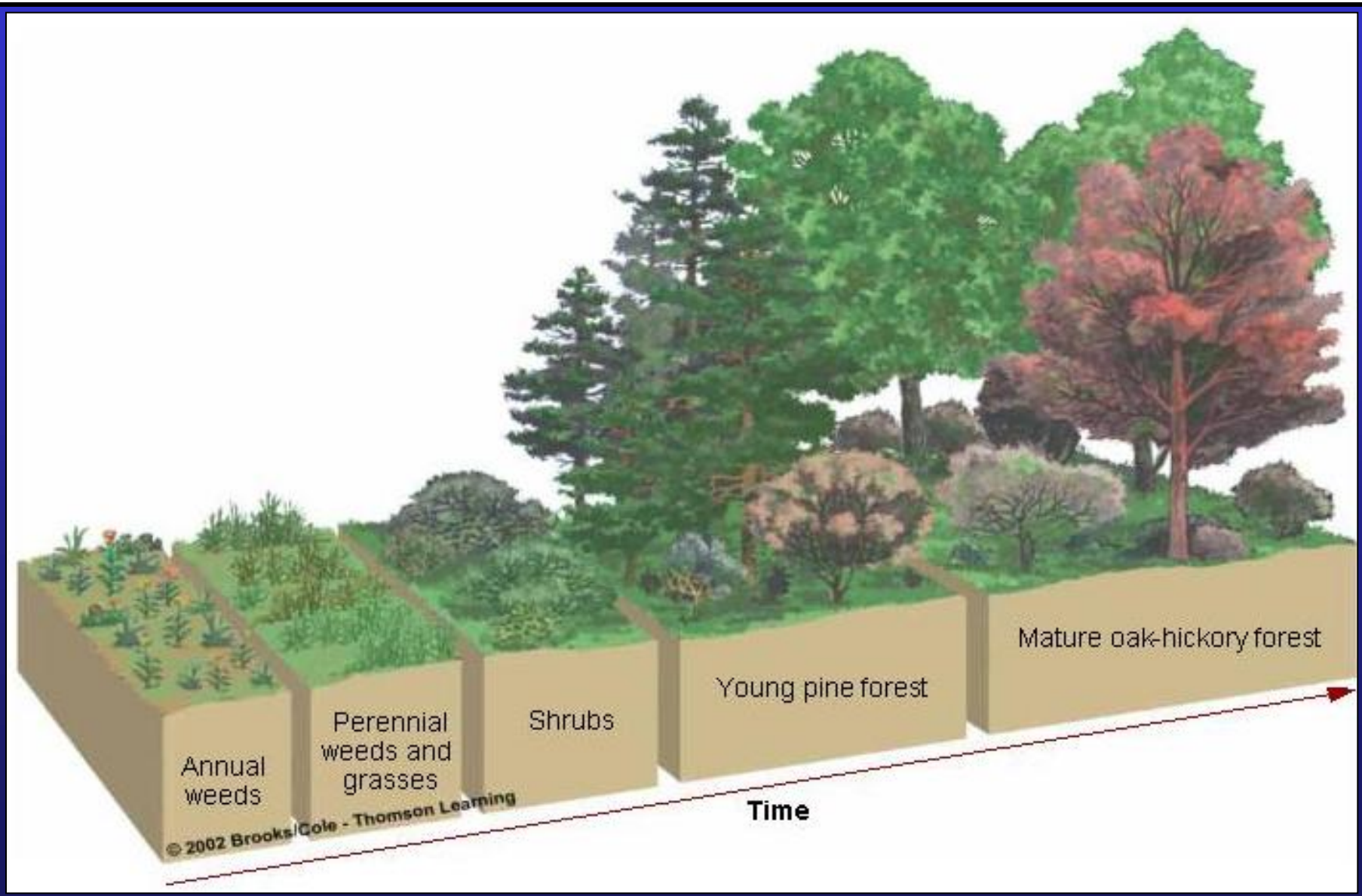
- **Secondary succession**

  - begins with soil already in place

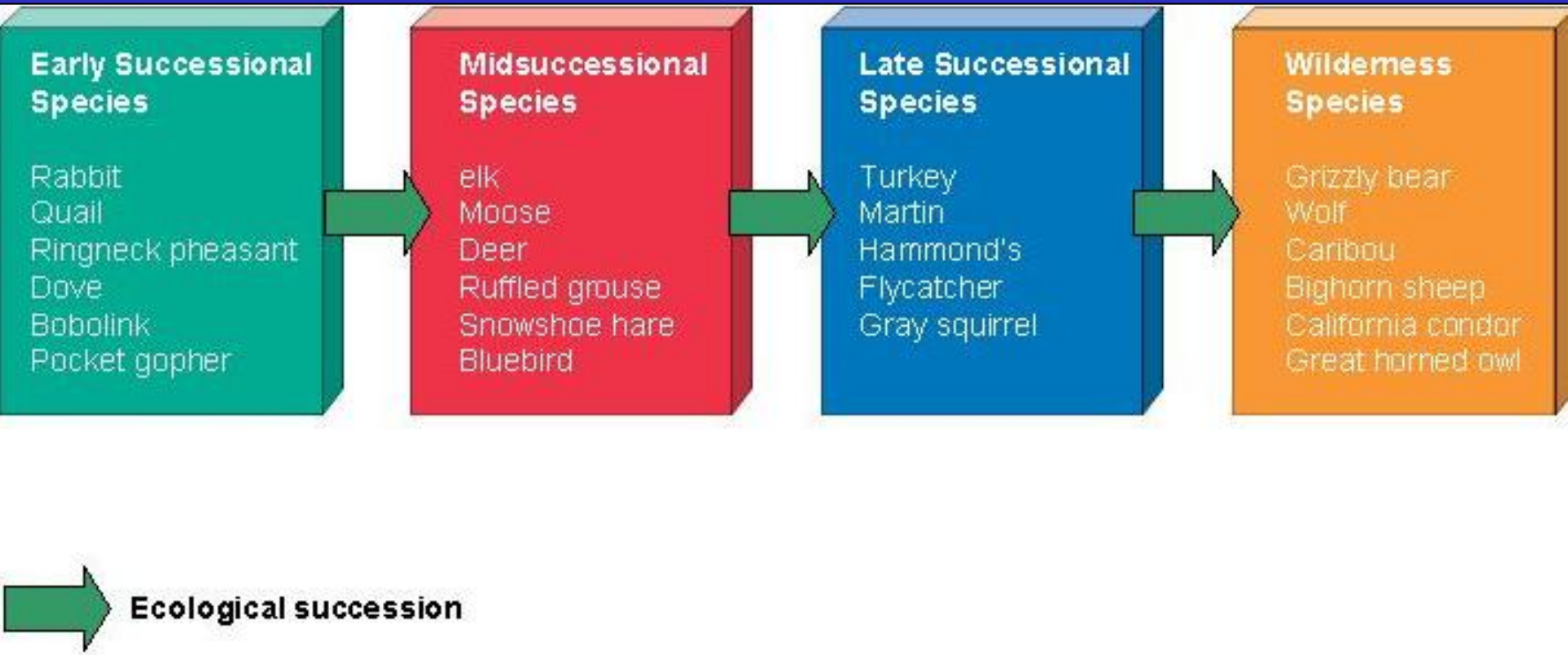
Ecological Succession: Communities in Transition - Type #2

- **Rapid changeover to less tolerant species over shorter periods of time**
  - **rapid because soil already present**

Secondary Succession



Succession and Wildlife



The End Product

- **If undisturbed, communities change toward a relatively stable stage**

  - climax community

  - long-term presence if not disturbed
  - dominated by less-tolerant species
  - general equilibrium