



# Chapter 3

## Ecosystem Ecology



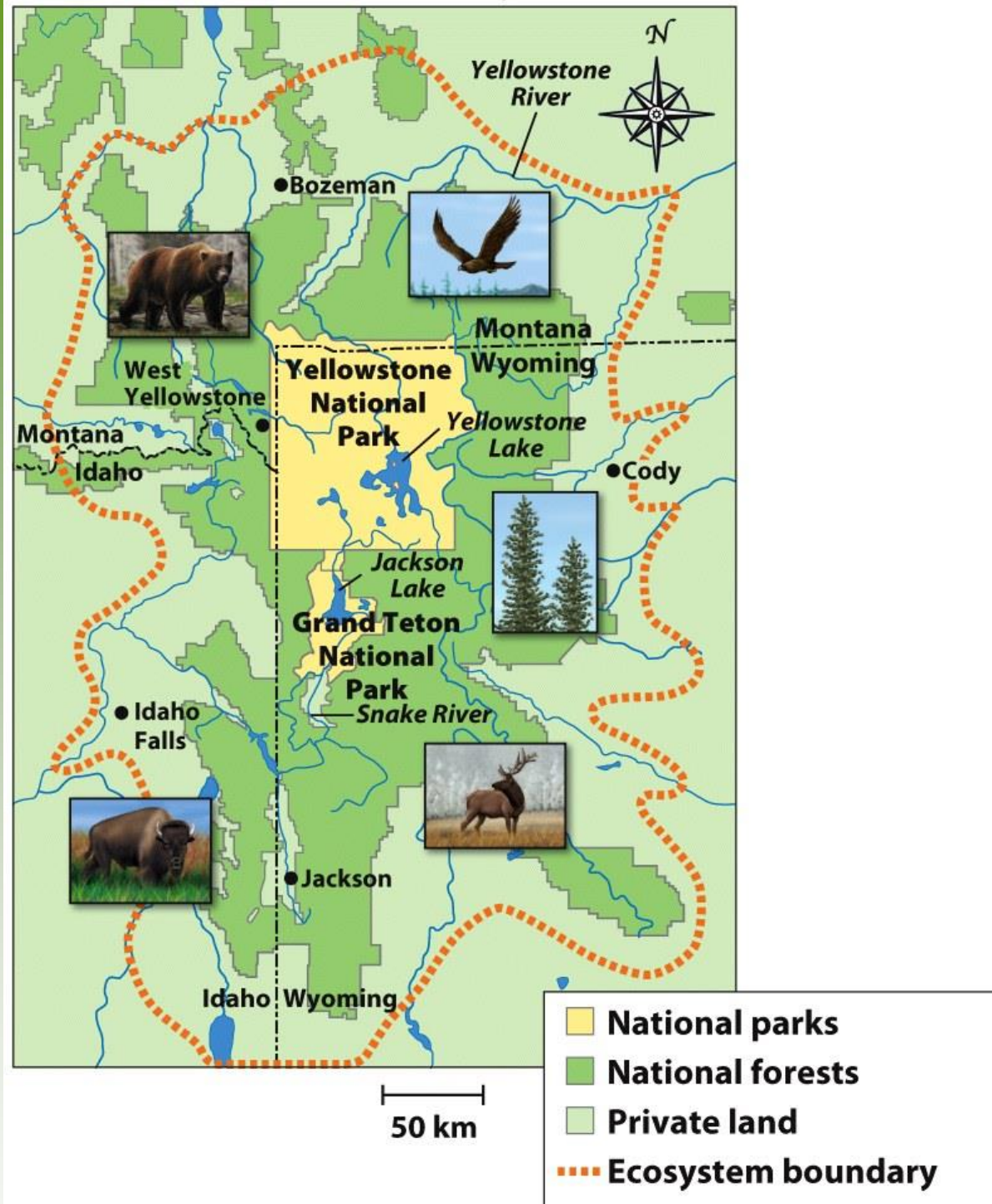
# Ecosystem Ecology Examines Interactions Between the Living and Non-Living World

- Ecosystem- A particular location on Earth distinguished by its particular mix of interacting biotic and abiotic components.

# Ecosystem Boundaries

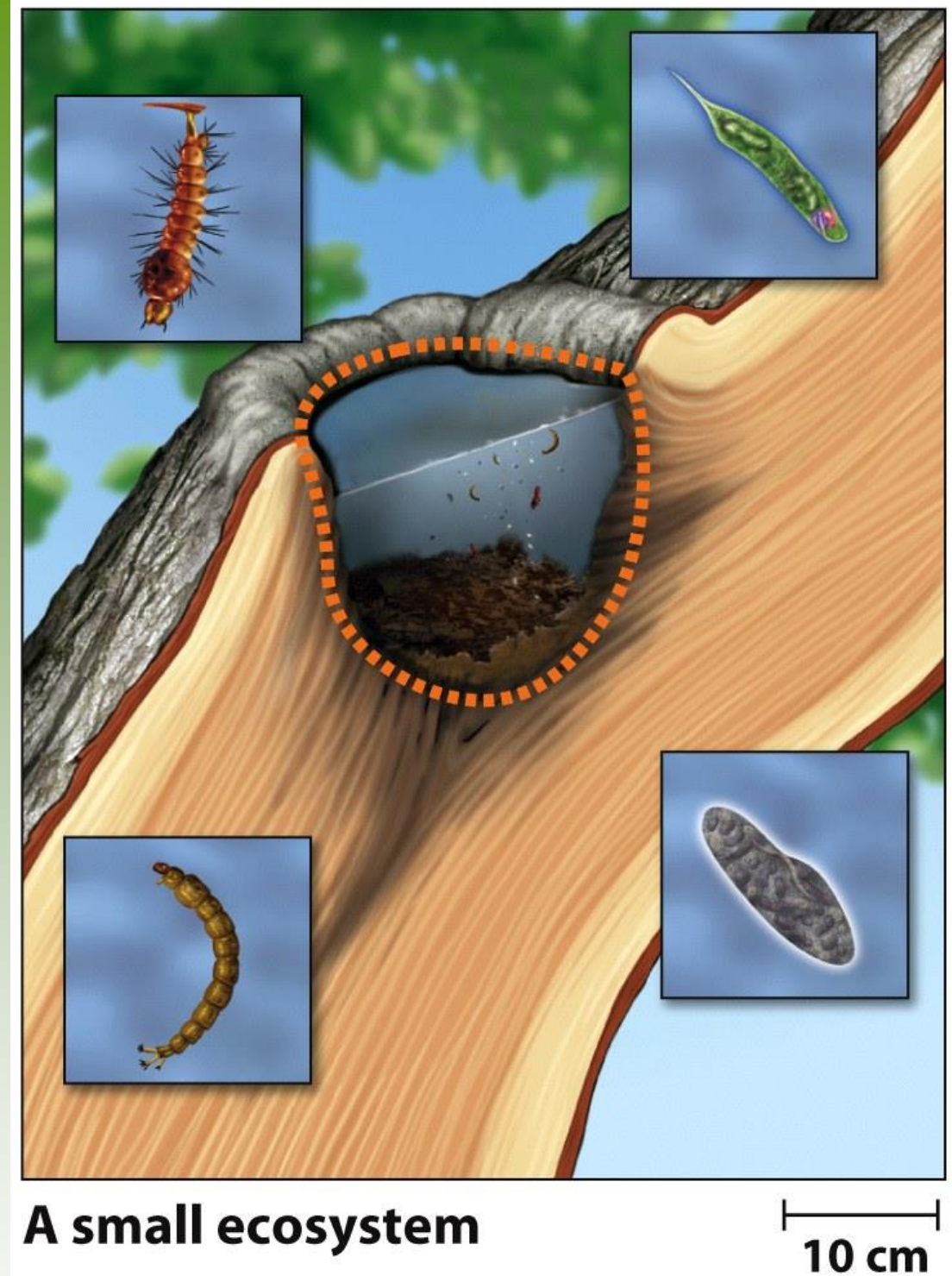
- Some ecosystems, such as a caves and lakes have very distinctive boundaries. However, in most ecosystems it is difficult to determine where one ecosystems stops and the next begins.

## The Greater Yellowstone Ecosystem



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## A small ecosystem

**Figure 3.2b**  
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# Ecosystem Processes

- Even though it is helpful to distinguish between two different ecosystems, ecosystems interact with other ecosystems.

# Energy Flows through Ecosystems

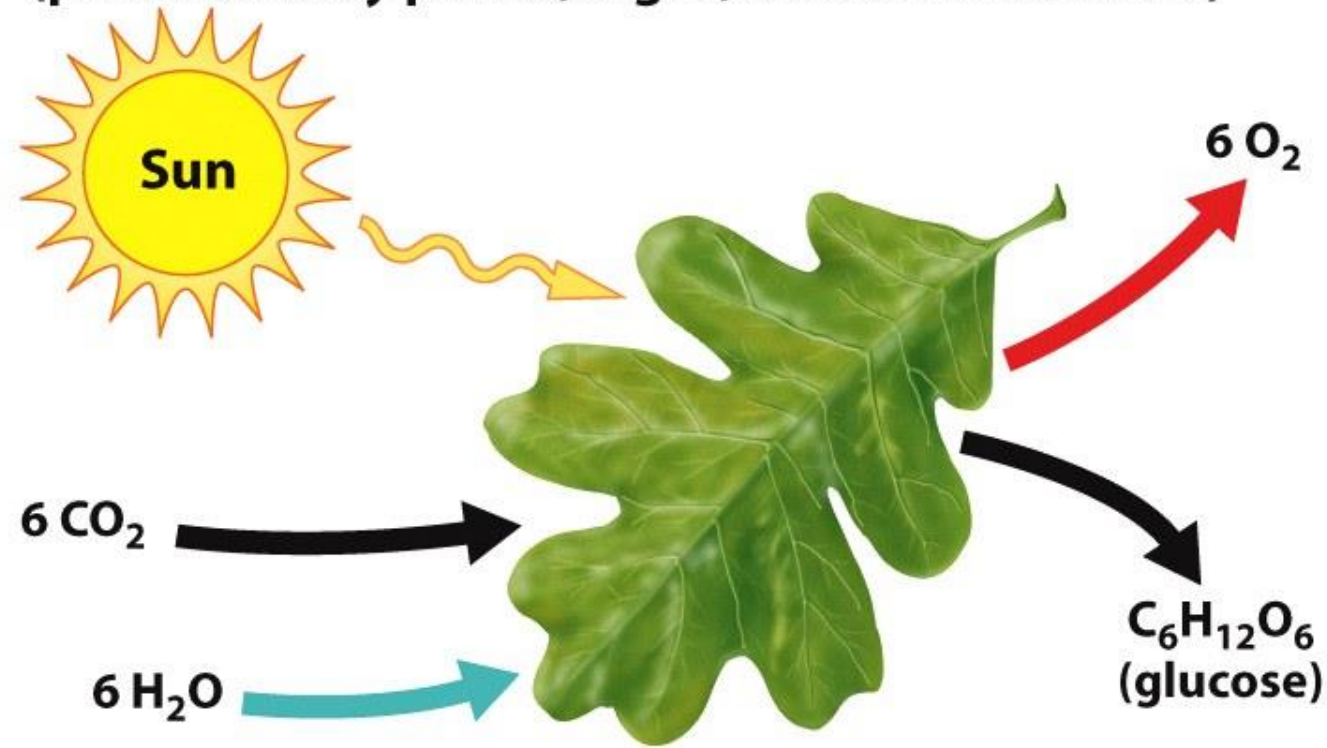


# Photosynthesis and Respiration

- Producers (autotrophs) are able to use the sun's energy to produce usable energy through the process called photosynthesis.

## Photosynthesis

(performed by plants, algae, and some bacteria)



## Respiration

(performed by all organisms)



**Figure 3.4**

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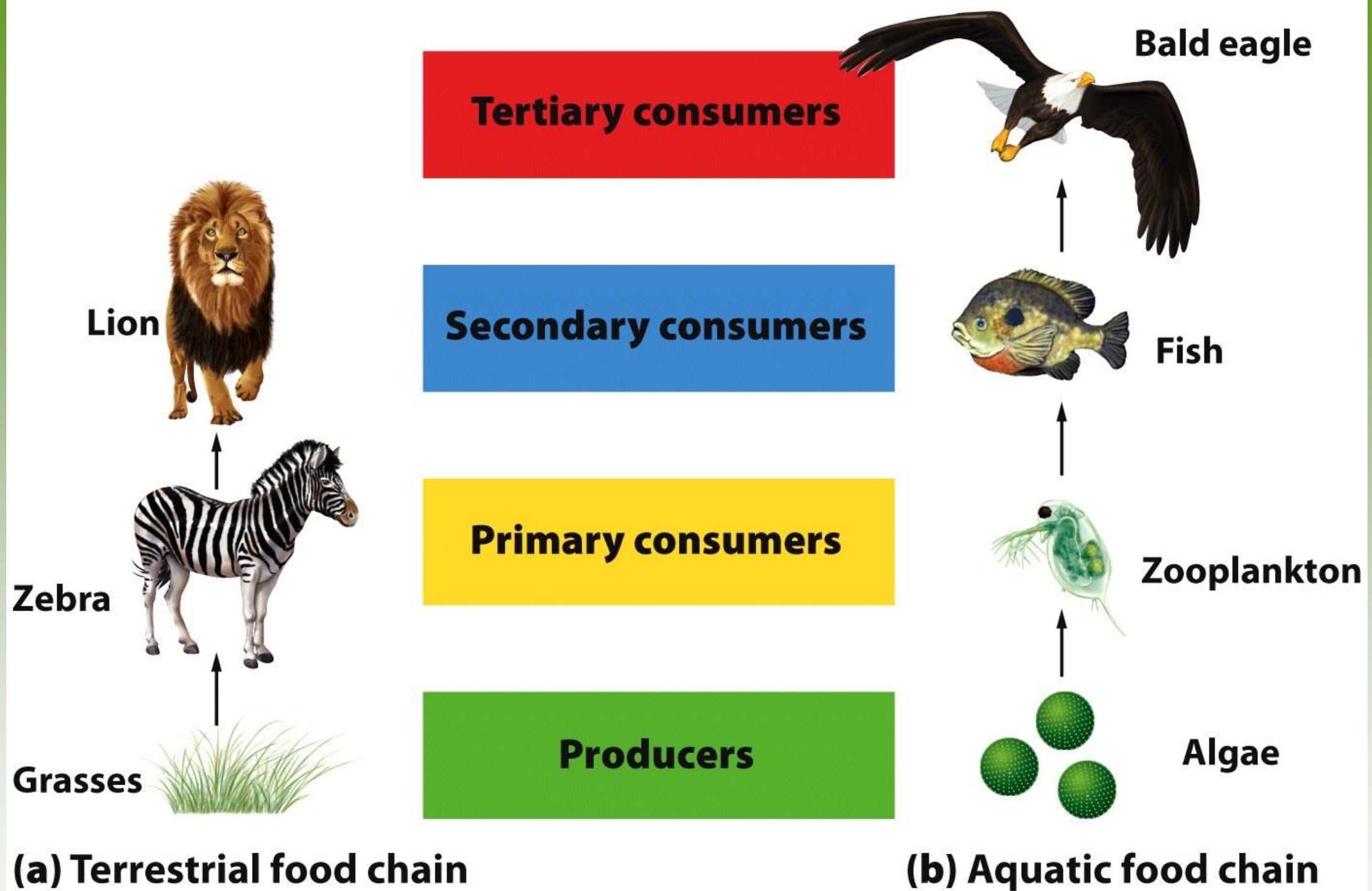


# Photosynthesis and Respiration

- Cellular respiration is the process by which other organisms gain energy from eating the tissues of producers.

# Trophic Levels, Food Chains, and Food Webs

- Consumers (heterotrophs)- obtain energy by consuming other organisms.
- Primary Consumers (herbivores)- consume producers.
- Secondary Consumers (carnivores)- obtain their energy by eating primary consumers.
- Tertiary Consumers (carnivores)- eat secondary consumers.



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- Food Chain- The sequence of consumption from producers through tertiary consumers.
- Food Web- A more realistic type of food chain that takes into account the complexity of nature.



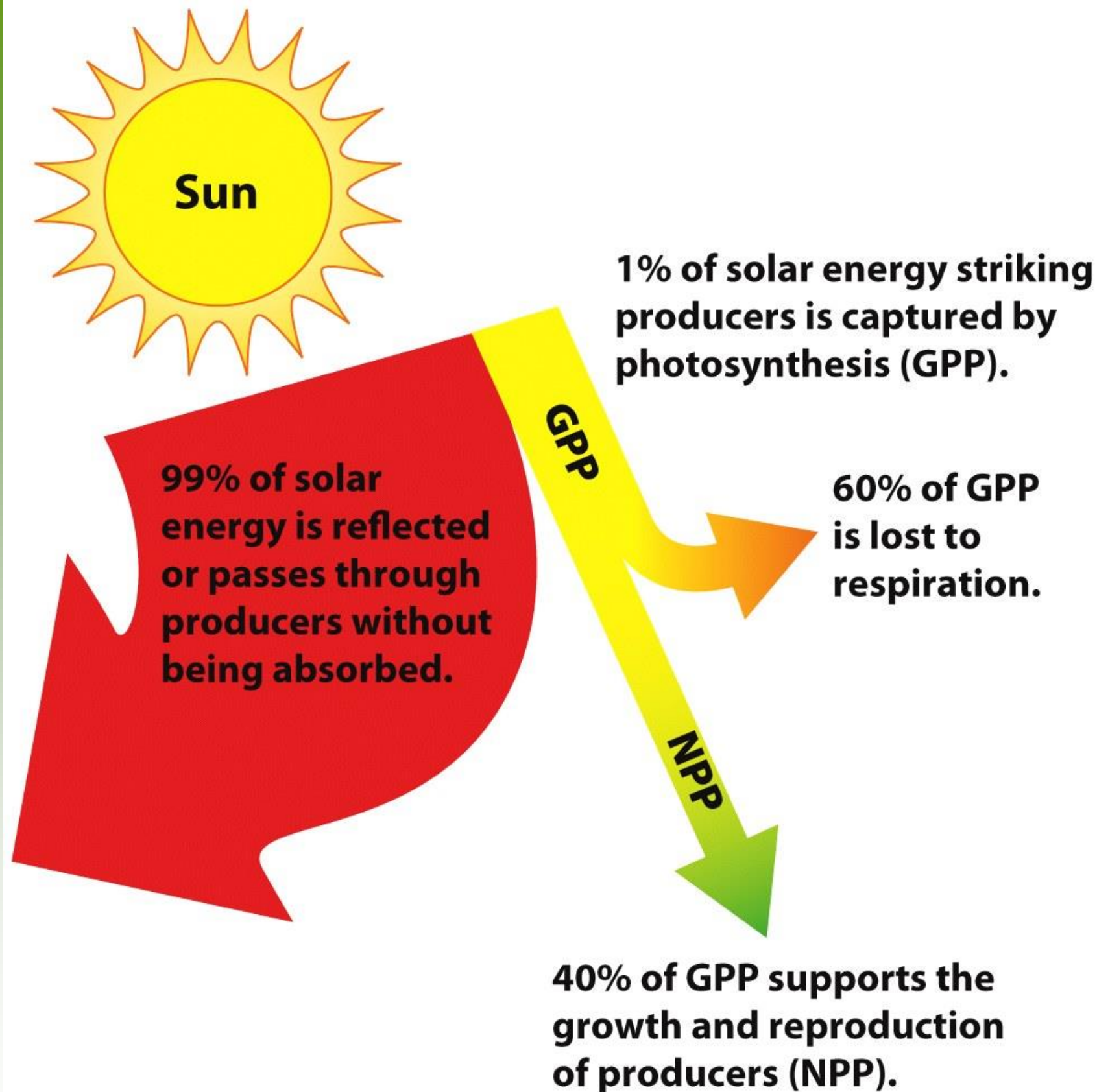
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# Ecosystem Productivity

- Gross primary productivity (GPP)- The total amount of solar energy that the producers in an ecosystem capture via photosynthesis over a given amount of time.
- Net primary productivity (NPP)- The energy captured (GPP) minus the energy respired by producers.





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# Energy Transfer Efficiency and Trophic Pyramids

- Biomass- The energy in an ecosystem is measured in terms of biomass.
- Standing crop- The amount of biomass present in an ecosystem at a particular time.
- Ecological efficiency- The proportion of consumed energy that can be passed from one trophic level to another.
- Trophic pyramid- The representation of the distribution of biomass among trophic levels.

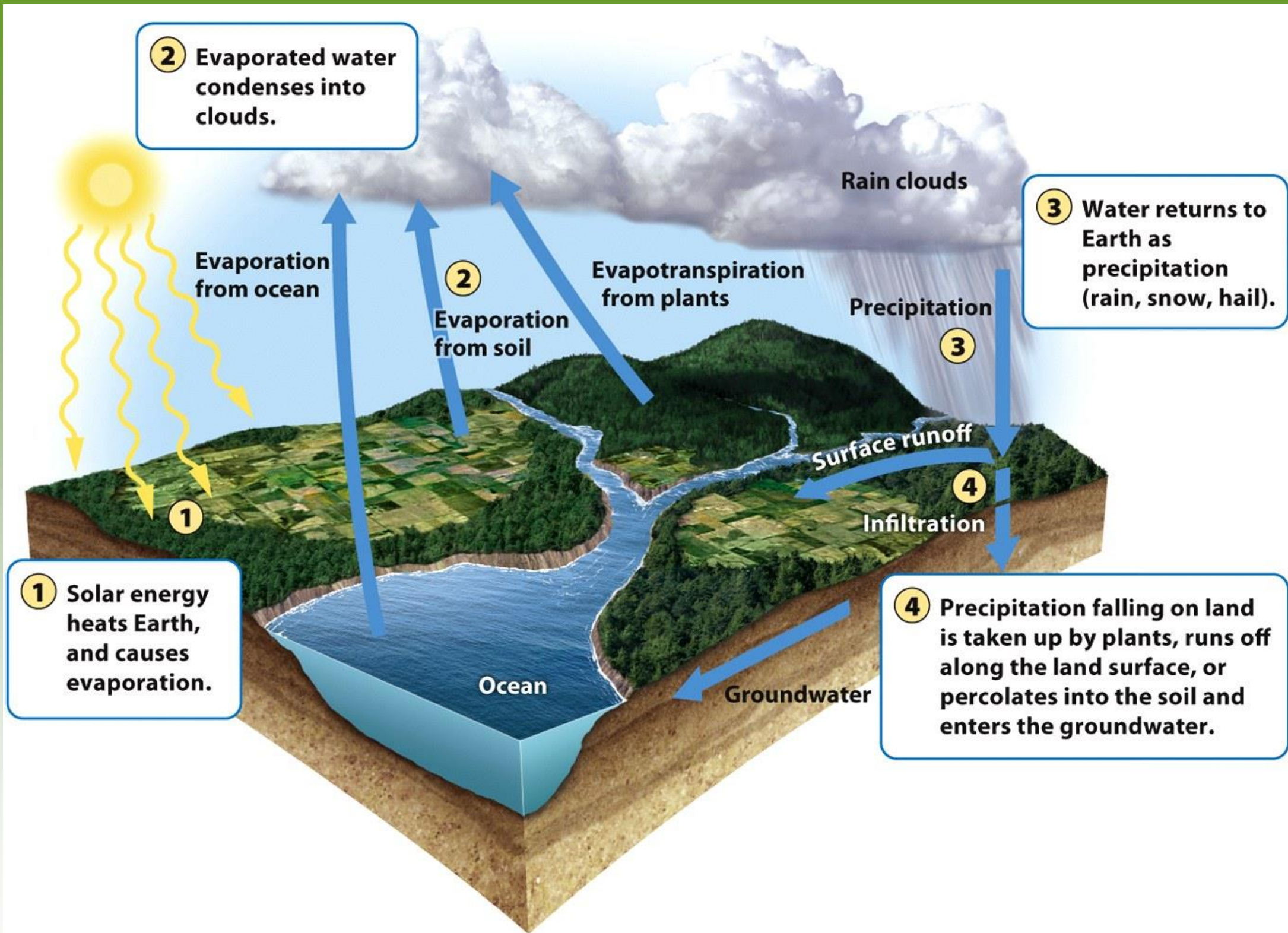
# Matter cycles through the biosphere

- Biosphere- The combination of all ecosystems on Earth.
- Biogeochemical cycles- The movement of matter within and between ecosystems involving biological, geologic and chemical processes.



# The Hydrologic Cycle

- The movement of water through the biosphere.



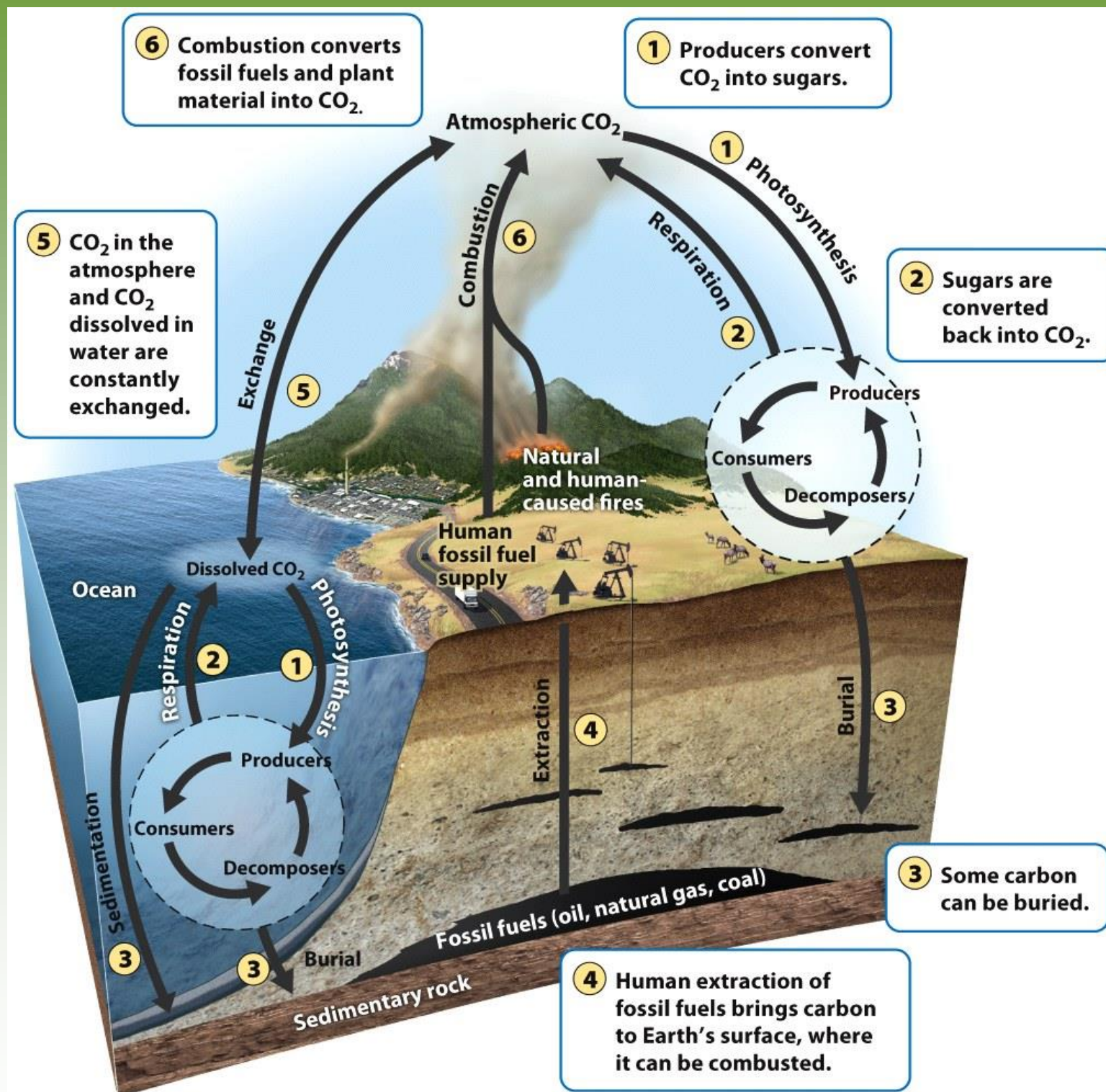
**Figure 3.10**  
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# The Hydrologic Cycle

- Transpiration- The process where plants release water from their leaves into the atmosphere.
- Evapotranspiration- The combined amount of evaporation and transpiration.
- Runoff- When water moves across the land surface into streams and rivers, eventually reaching the ocean.



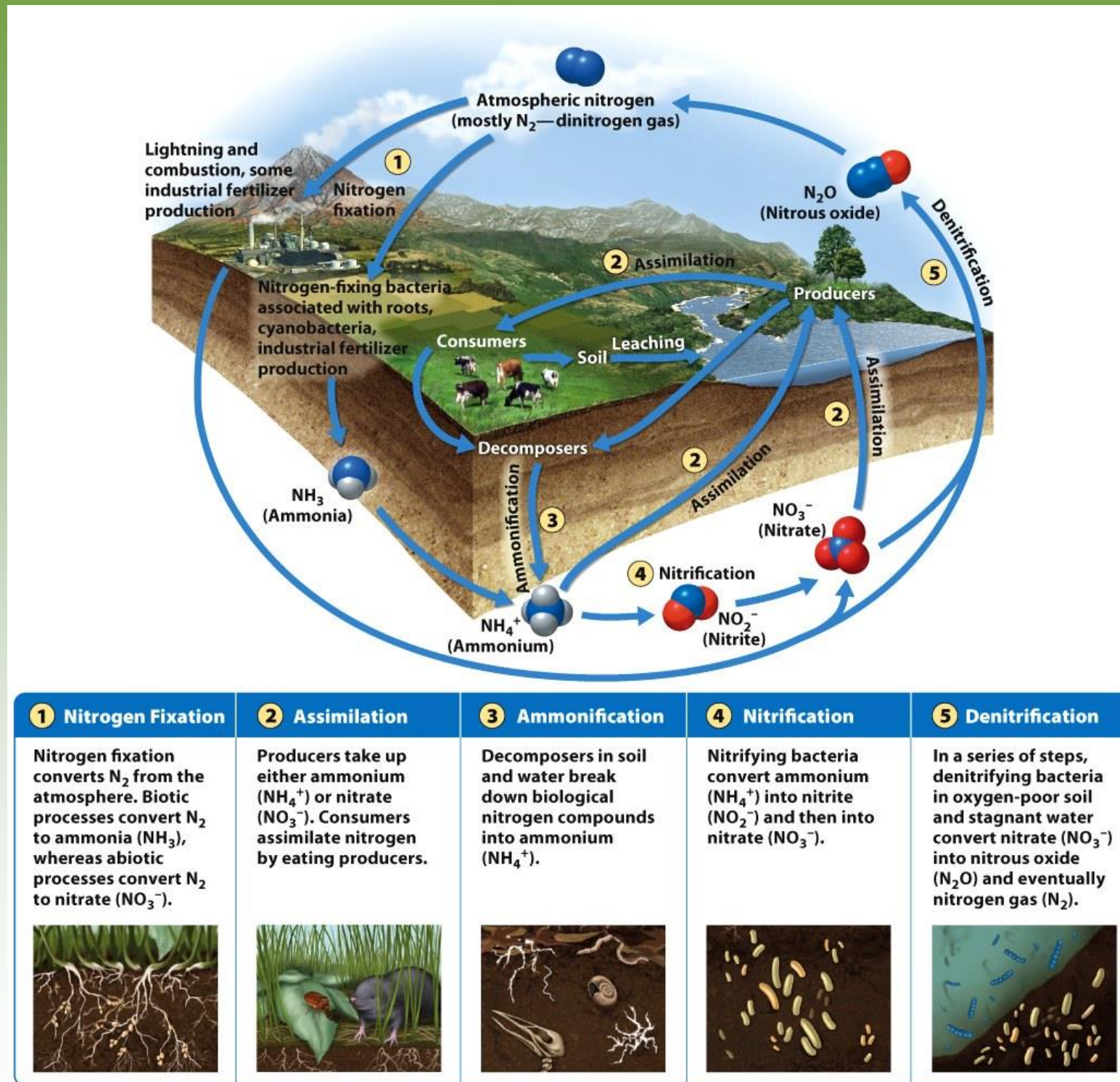
# The Carbon Cycle



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# The Nitrogen Cycle



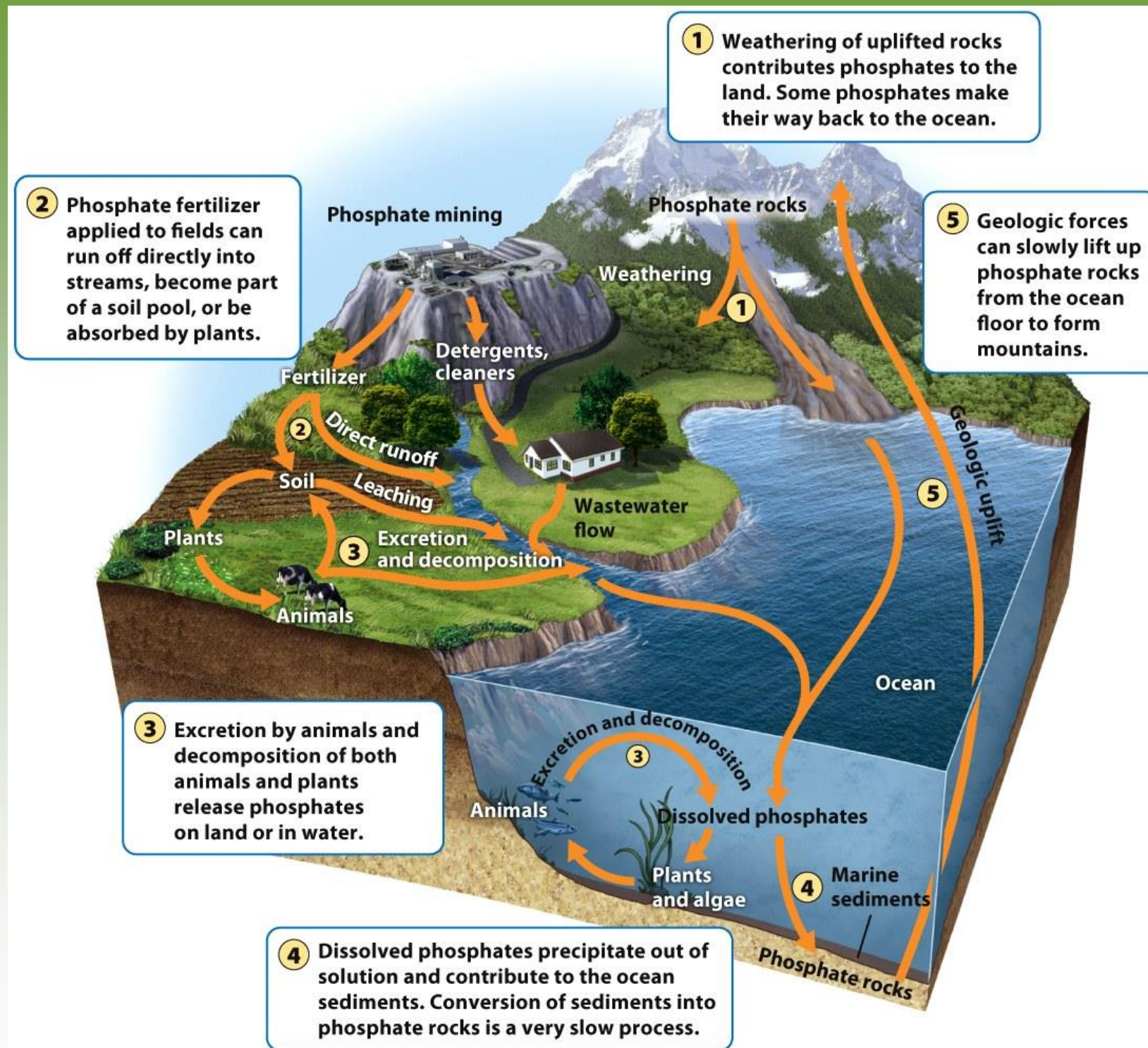
**Figure 3.12**

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# The Phosphorus Cycle



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# Ecosystems respond to disturbance

- Disturbance- An event caused by physical, chemical or biological agents that results in changes in population size or community composition.



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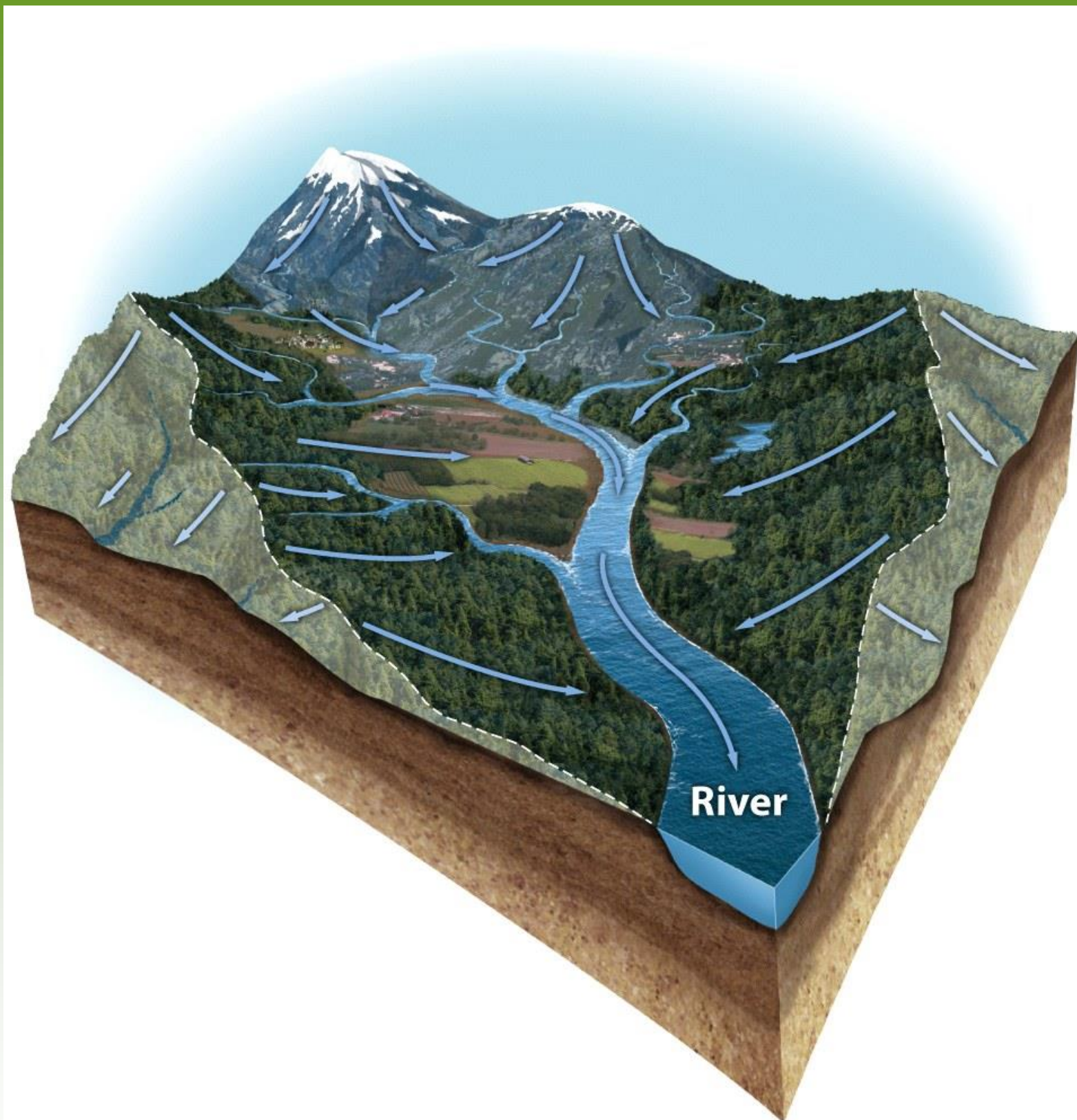


**Figure 3.15b**  
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# Watershed Studies

- Watershed- All of the land in a given landscape that drains into a particular stream, river, lake or wetland.





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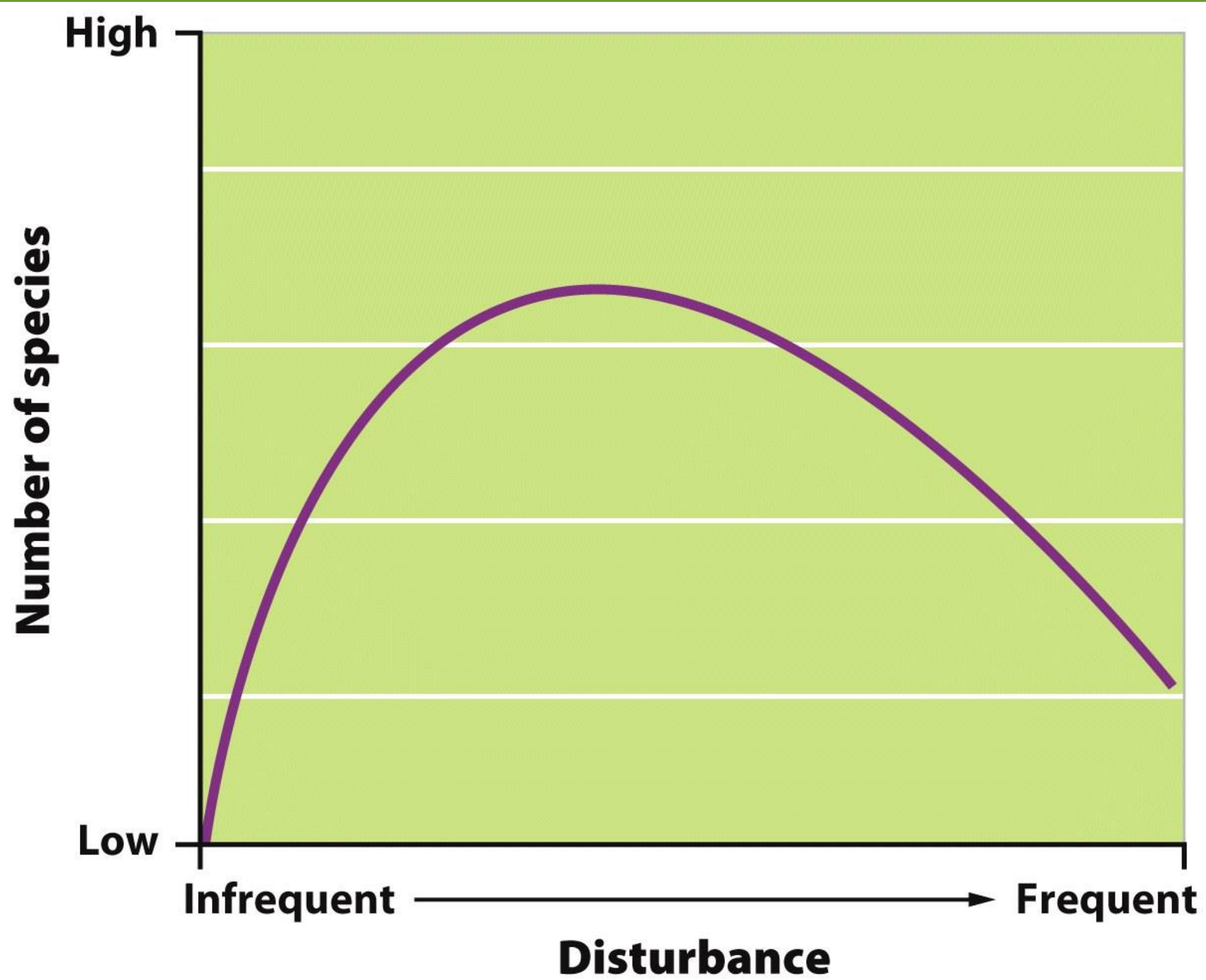
# Resistance versus Resilience

- Resistance- A measure of how much a disturbance can affect its flows of energy and matter.
- Resilience- The rate at which an ecosystem returns to its original state after a disturbance.
- Restoration ecology- A new scientific discipline that is interested in restoring damaged ecosystems.

# The Intermediate Disturbance Hypothesis

- The intermediate disturbance hypothesis states that ecosystems experiencing intermediate levels of disturbance are more diverse than those with high or low disturbance levels.





**Figure 3.19**

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# Ecosystems Provide Valuable Services

# **Instrumental Values of Ecosystems**

- **Provisions-** Goods that humans can use directly.
- **Regulating services-** The service provided by natural systems that helps regulate environmental conditions.
- **Support systems-** The support services that natural ecosystems provide such as pollination, natural filters and pest control.
- **Resilience-** Resilience of an ecosystem ensures that it will continue to provide benefits to humans. This greatly depends on species diversity.

**Cultural services-** Ecosystems provide cultural or aesthetic benefits to many people.