



Unit 3

Biogeochemical Cycles

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.

On whiteboards...

What is the source of energy for the majority of life on earth?

Grab whiteboards...

What 6 elements comprise the majority of all organisms?

CHNOPS

Law of Conservation of Matter

Matter cycles!

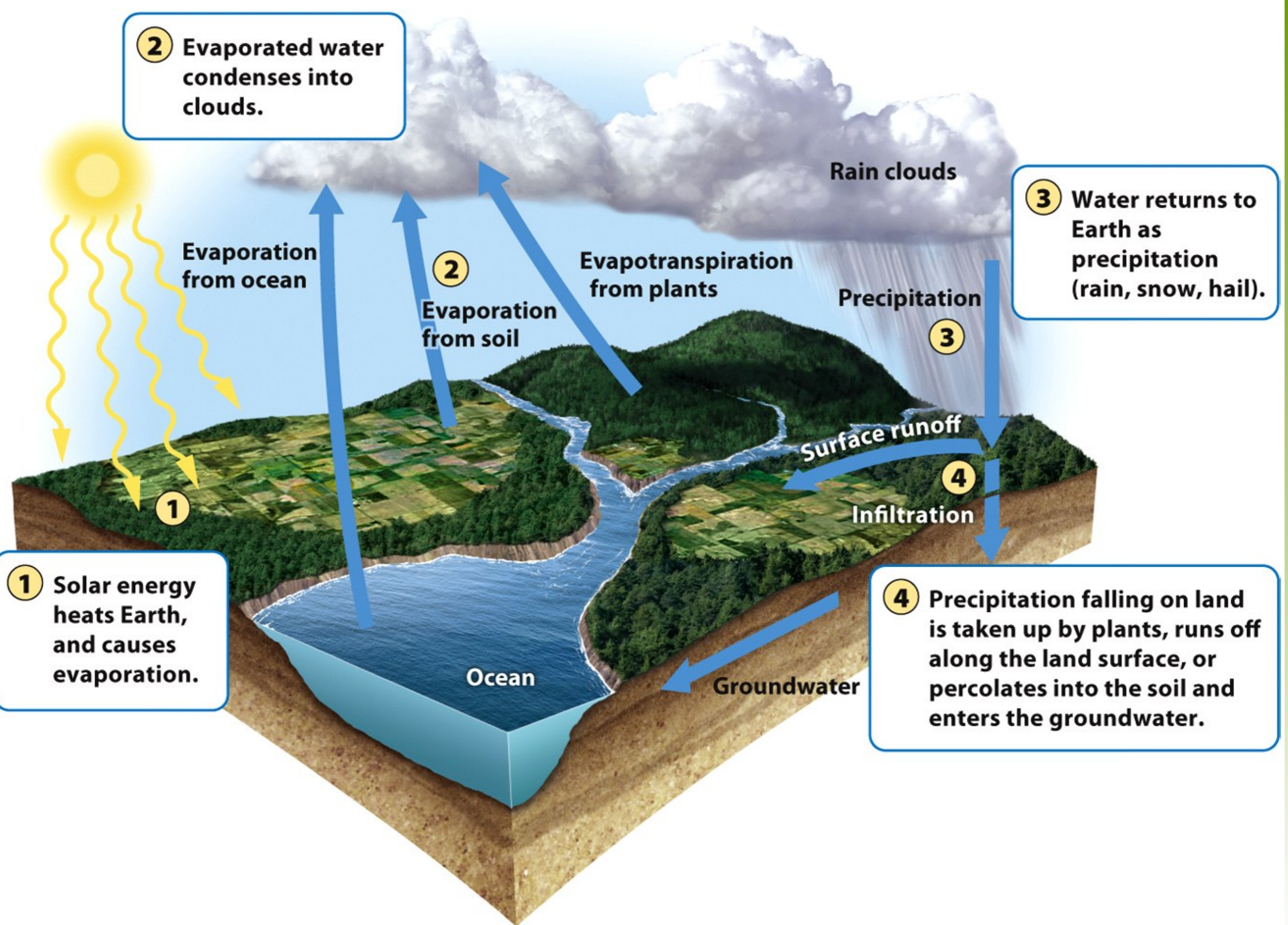
Earth is CLOSED system

There is NO AWAY!!!

Nature recycled everything,
until humans came along....

The Hydrologic Cycle

- The movement of water through the biosphere.



2 Evaporated water condenses into clouds.

3 Water returns to Earth as precipitation (rain, snow, hail).

1 Solar energy heats Earth, and causes evaporation.

4 Precipitation falling on land is taken up by plants, runs off along the land surface, or percolates into the soil and enters the groundwater.

Evaporation from ocean

2 Evaporation from soil

Evapotranspiration from plants

Rain clouds

Precipitation

Surface runoff

Infiltration

Groundwater

Ocean

Hydrologic Cycle

CHNOPS

Condensation

Evaporation

Precipitation

Transpiration (evapotranspiration)

Infiltration

Percolation

Runoff / Watershed

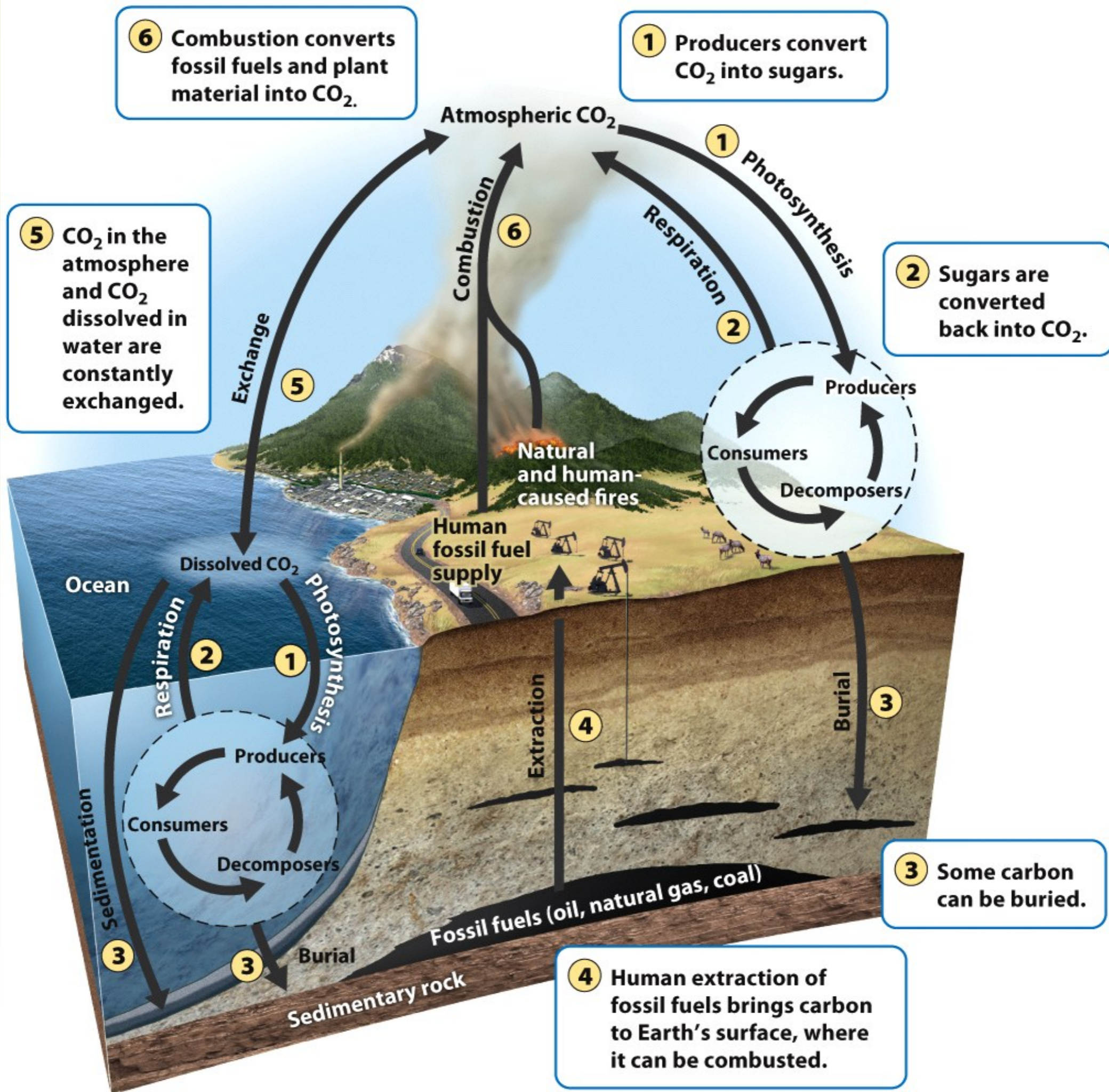
<http://youtube/Az2xdNuoZRk>

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.
- Percolation/infiltration: water flow through porous soil.
- Surface runoff vs ground water

Water's Special properties

- High Specific heat (long time to heat and cool)
- Solid form of water is less dense than liquid form (ICE floats)
- Cohesion, adhesion, and high surface tension



Carbon Cycle

CHNOPS

Photosynthesis ↔ Cellular Respiration

Sequestration

Carbon sinks

Anthropogenic carbon sources

Greenhouse effect

Carbon footprint

Diagram the Carbon Cycle Using the Following Terms and Chemical Formulas

Photosynthesis

Plants

- Volcanic Activity

Fossil Fuels

- Atmosphere

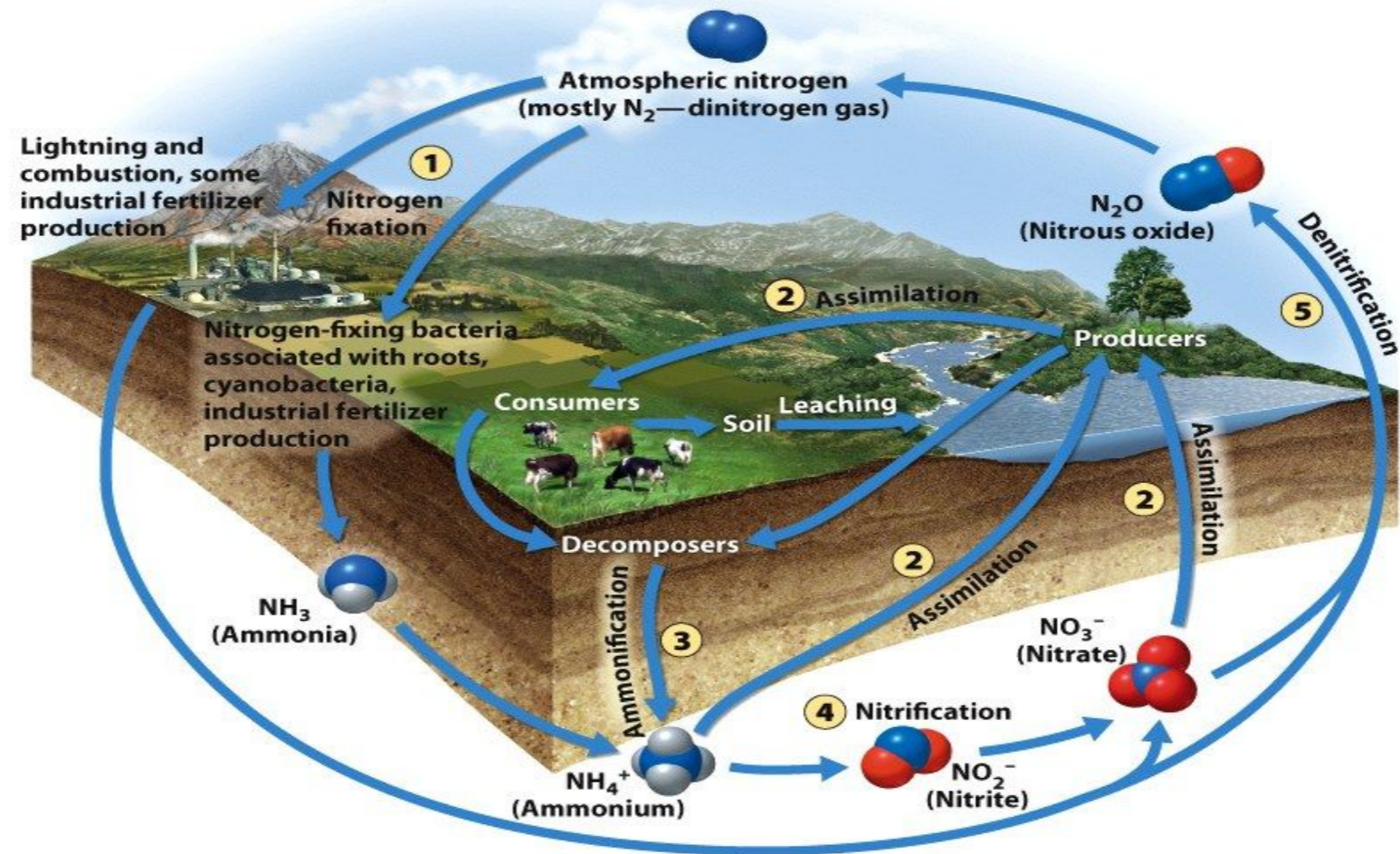
- Human activity

- Respiration

- CO_2

<http://youtube/OByqdUhWERk>

The Nitrogen Cycle








1 Nitrogen Fixation	2 Assimilation	3 Ammonification	4 Nitrification	5 Denitrification
Nitrogen fixation converts N_2 from the atmosphere. Biotic processes convert N_2 to ammonia (NH_3), whereas abiotic processes convert N_2 to nitrate (NO_3^-).	Producers take up either ammonium (NH_4^+) or nitrate (NO_3^-). Consumers assimilate nitrogen by eating producers.	Decomposers in soil and water break down biological nitrogen compounds into ammonium (NH_4^+).	Nitrifying bacteria convert ammonium (NH_4^+) into nitrite (NO_2^-) and then into nitrate (NO_3^-).	In a series of steps, denitrifying bacteria in oxygen-poor soil and stagnant water convert nitrate (NO_3^-) into nitrous oxide (N_2O) and eventually nitrogen gas (N_2).
				

Figure 3.12

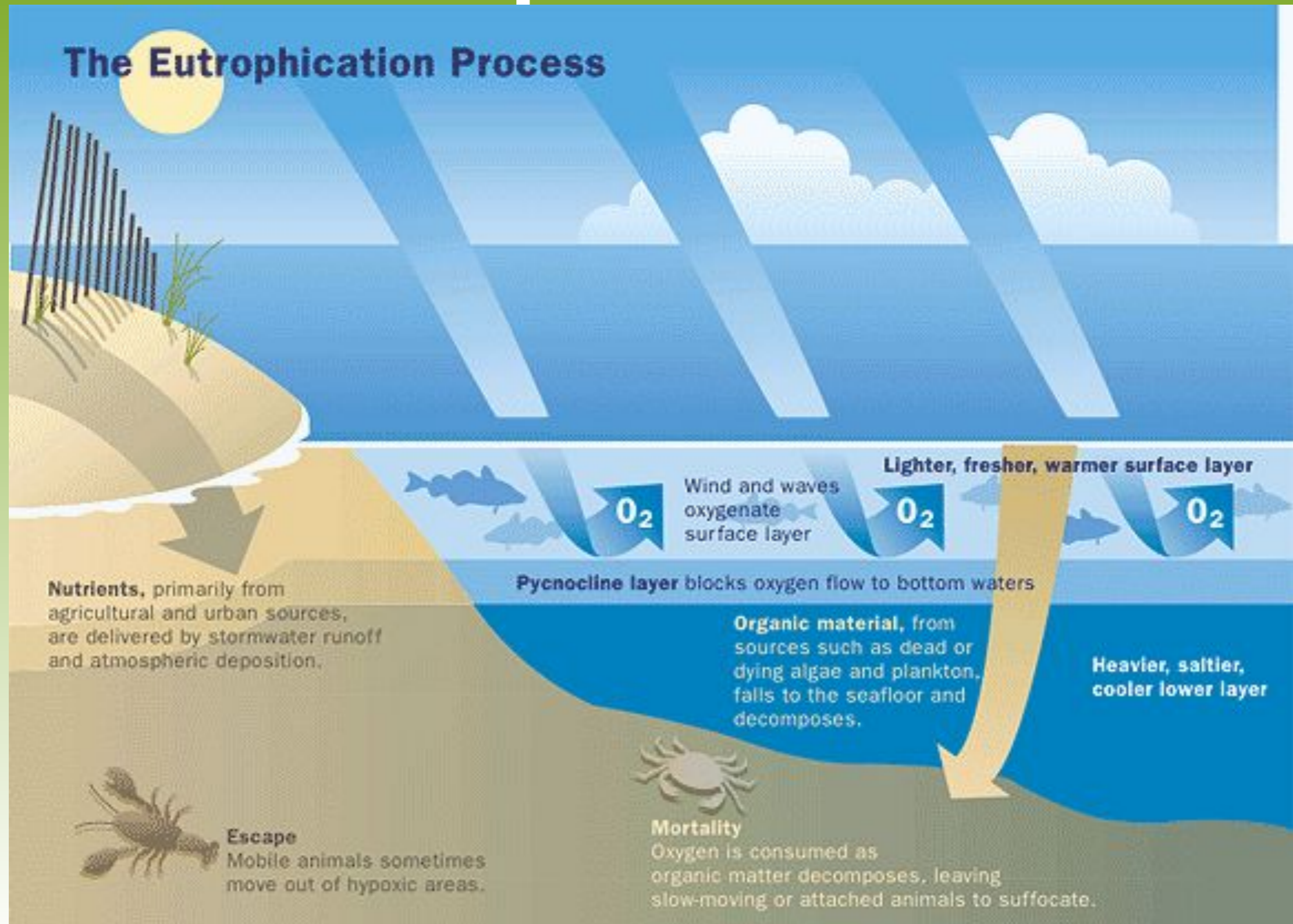
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Diagram the Nitrogen Cycle Using the Following Terms and Chemical Formulas

- N_2
- NO_3^-
- NO_2^-
- NH_4^+
- Bacterial Nitrogen Fixation
- Nitrification
- Denitrification

Eutrophication



The Phosphorus Cycle

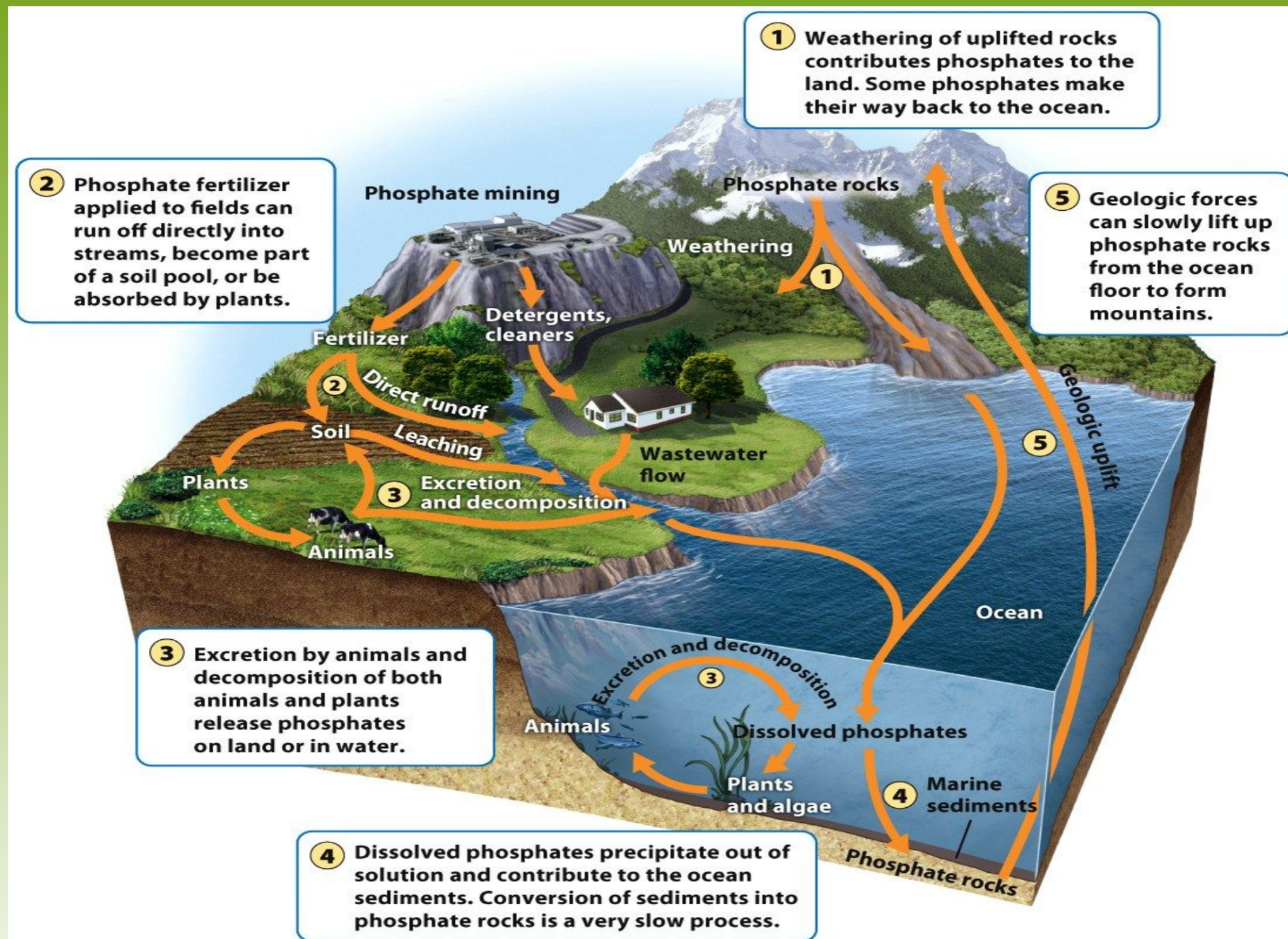


Figure 3.13

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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.



Figure 3.15a
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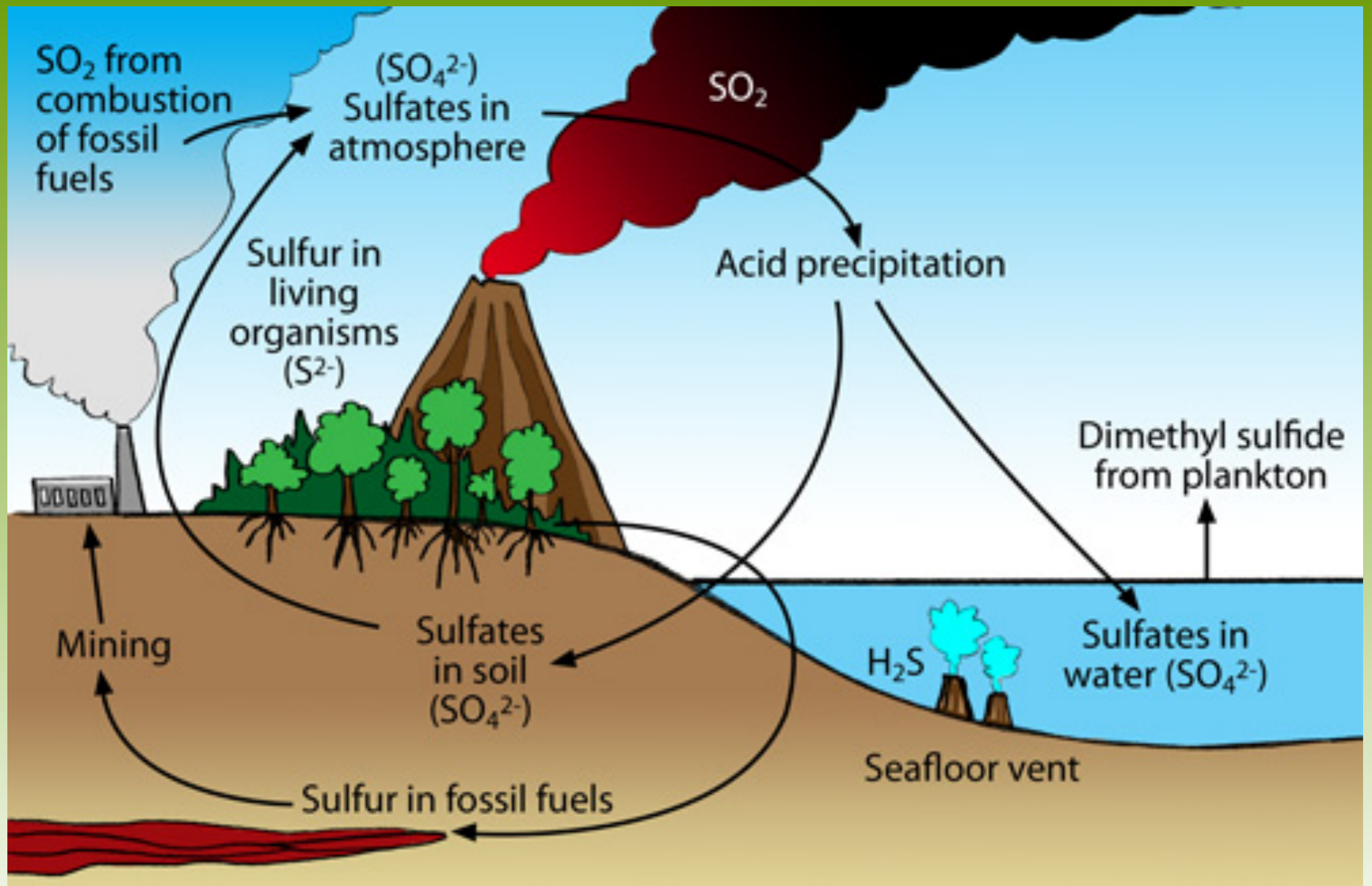
Figure 3.15b
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Watershed Studies

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

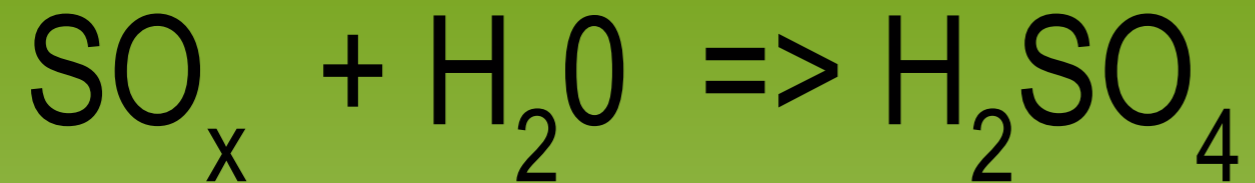


Figure 3.16
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Sulfur Cycle

CHNOPS



Main sources: volcanic eruptions
combustion of fossil fuels

Acid deposition

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.

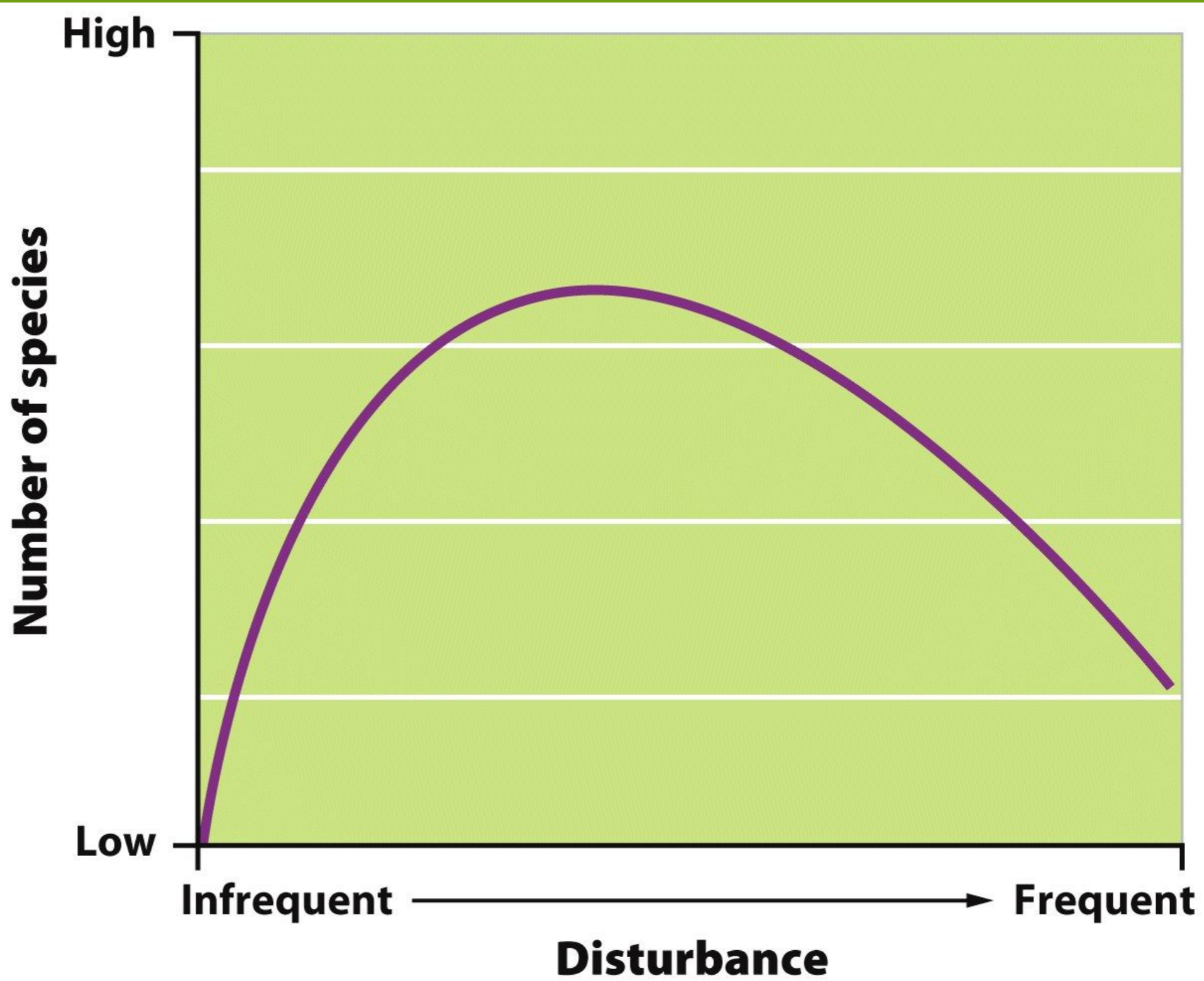


Figure 3.19

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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.