

# Biogeochemical Cycles

**Biogeochemical Cycles** refers to the cycling of materials between living things and the environment.

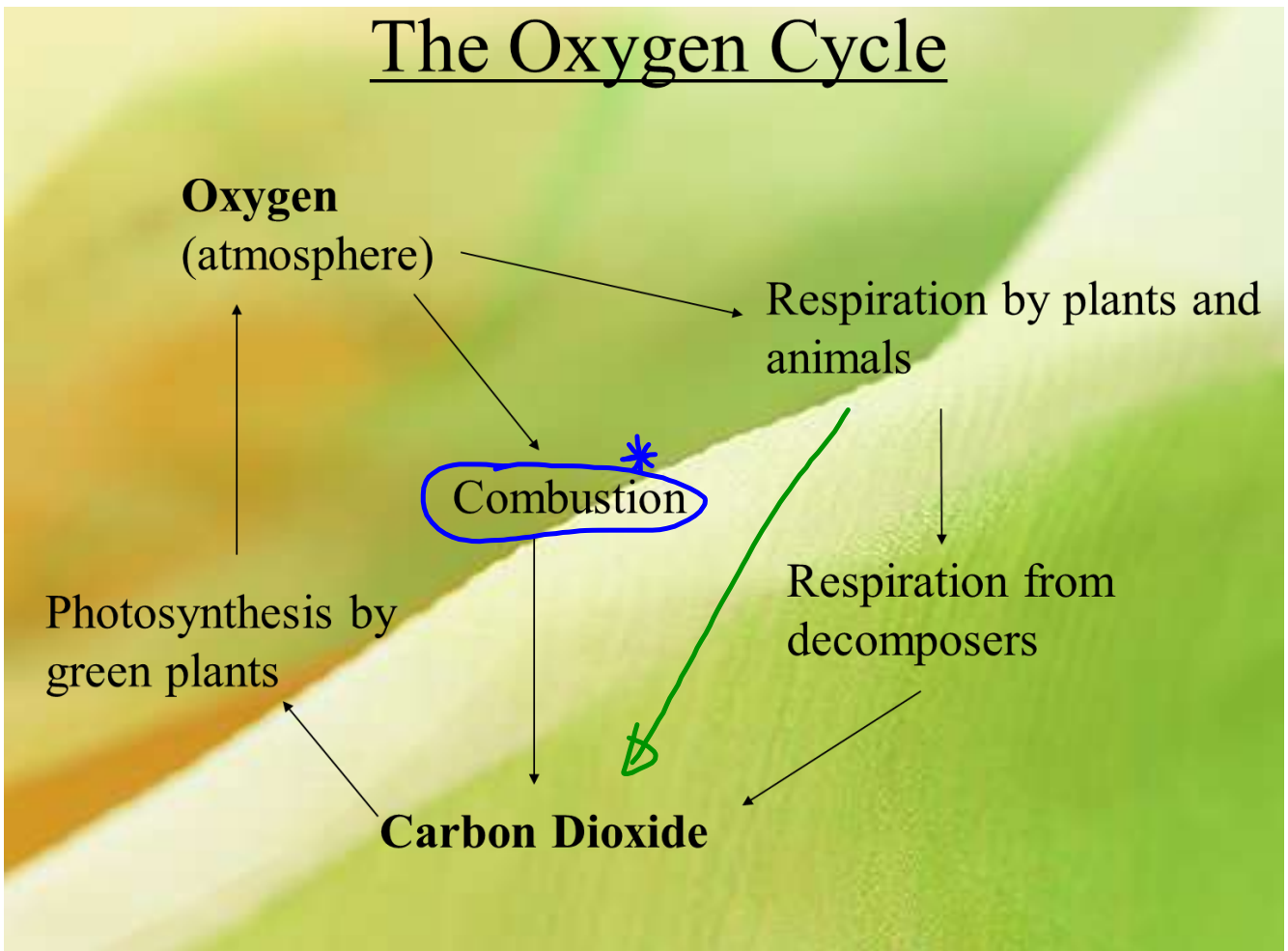
**Text Pages 50-51, 62-69**

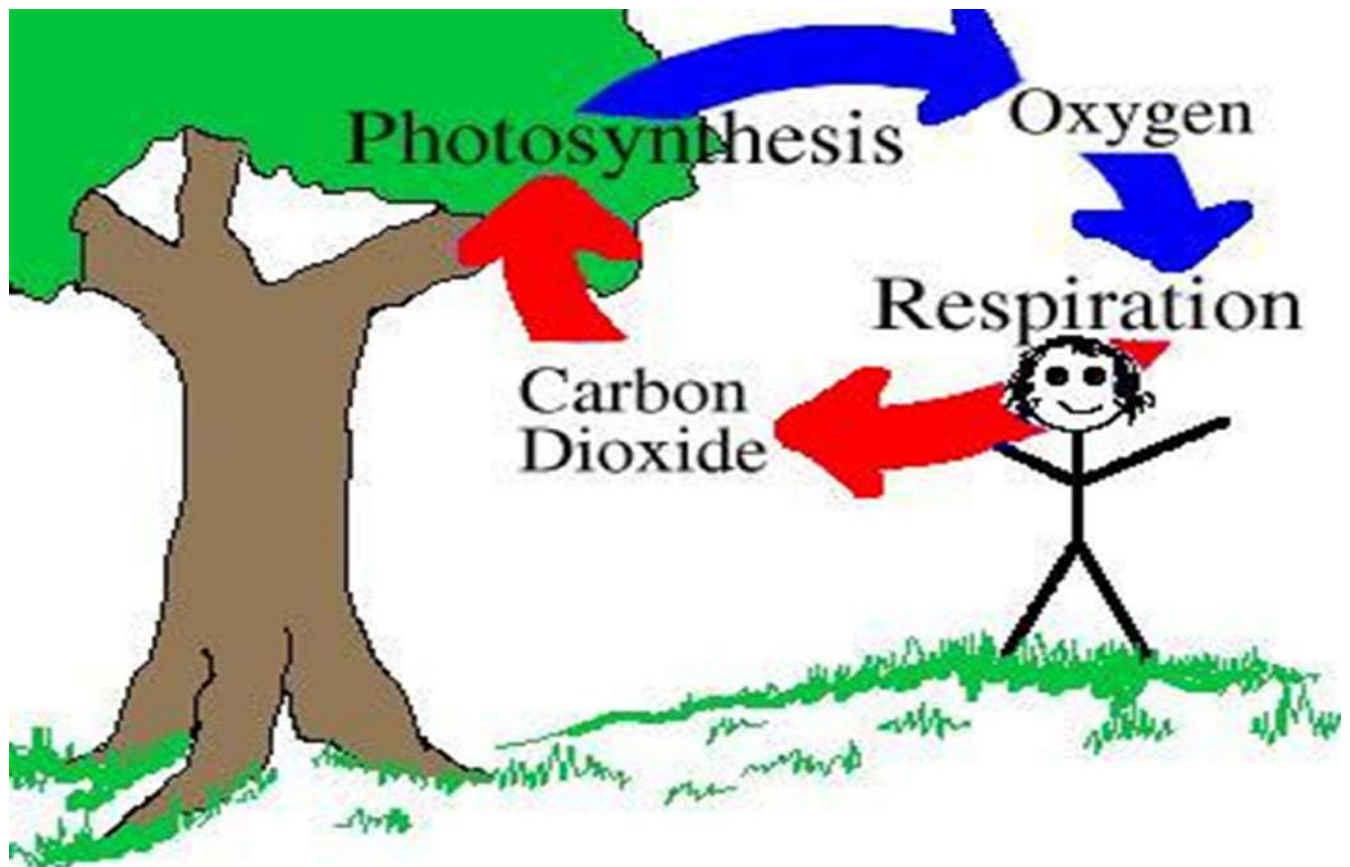
## The Oxygen Cycle

- the movement of oxygen between the atmosphere and living things by means of respiration, evaporation and photosynthesis



# The Oxygen Cycle

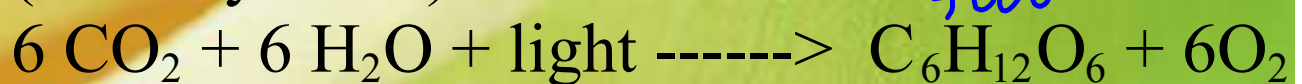




Note: The complementary processes of photosynthesis and respiration ensure that not only oxygen, but also carbon and hydrogen are repeatedly cycled

### Photosynthesis:

Green plants (other autotrophs) use the energy from the sun to convert inorganic carbon (CO<sub>2</sub>) into organic forms food molecules (carbohydrates)



Carbon dioxide

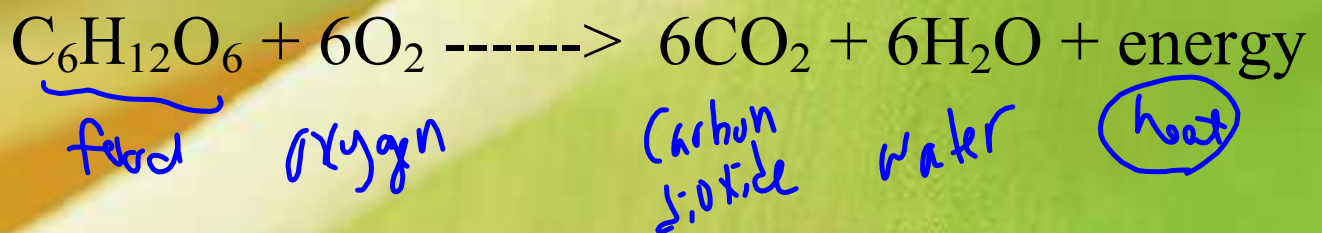
water

food

oxygen

## Respiration

- The chemical breakdown of complex organic substances, such as carbohydrates and fats, that takes place in the cells and tissues of animals and plants, during which energy is released and carbon dioxide and water are produced.



### **Oxygen is important because:**

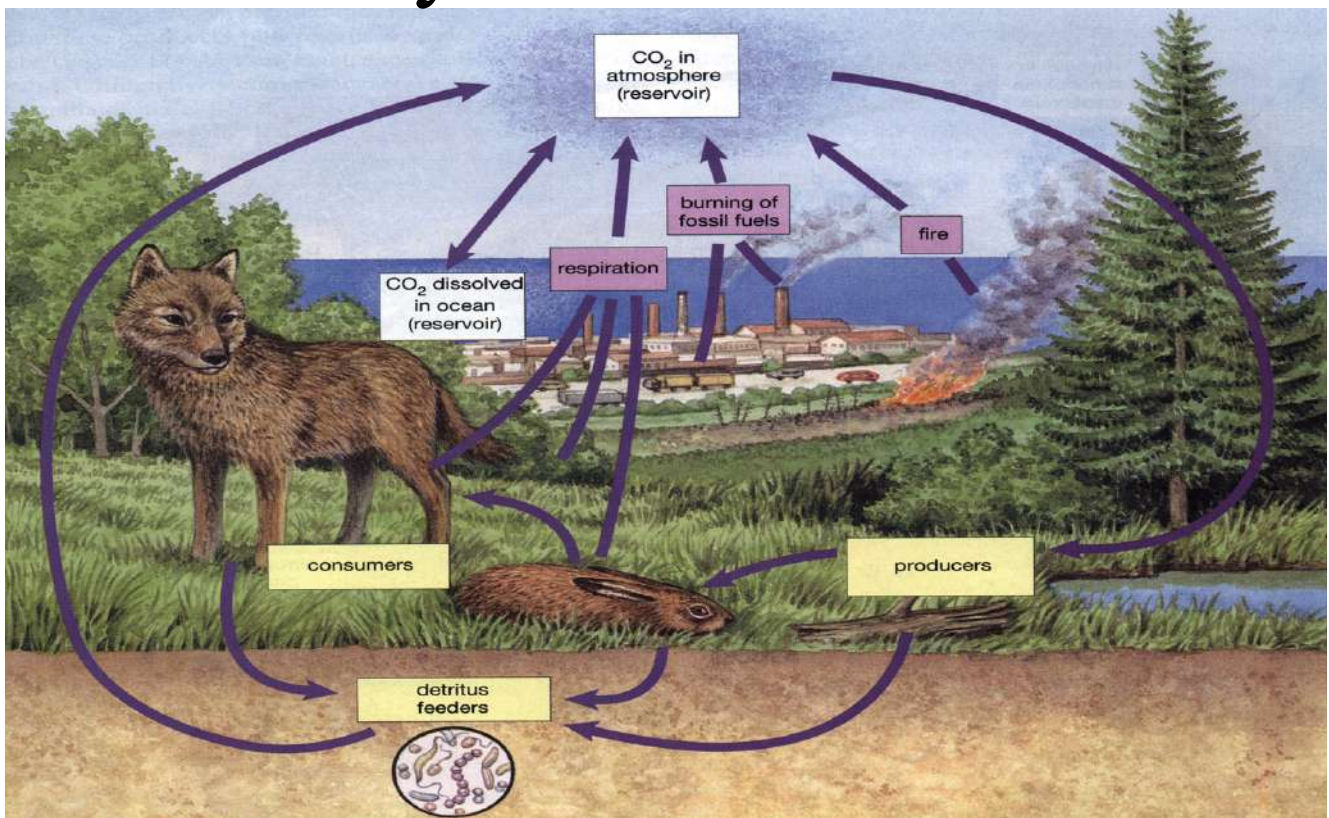
- It is recycled as part of the carbon, hydrogen, and oxygen cycles.
- It is cycled between the atmosphere and the living organisms of both aquatic and terrestrial ecosystems.
- It is absorbed by the water in aquatic ecosystems.
- It is produced as a byproduct of the photosynthetic organisms that live in the aquatic ecosystems.
- Heterotrophs (consumers) require oxygen for cellular respiration but aquatic organisms receive their oxygen from the dissolved oxygen in the water.



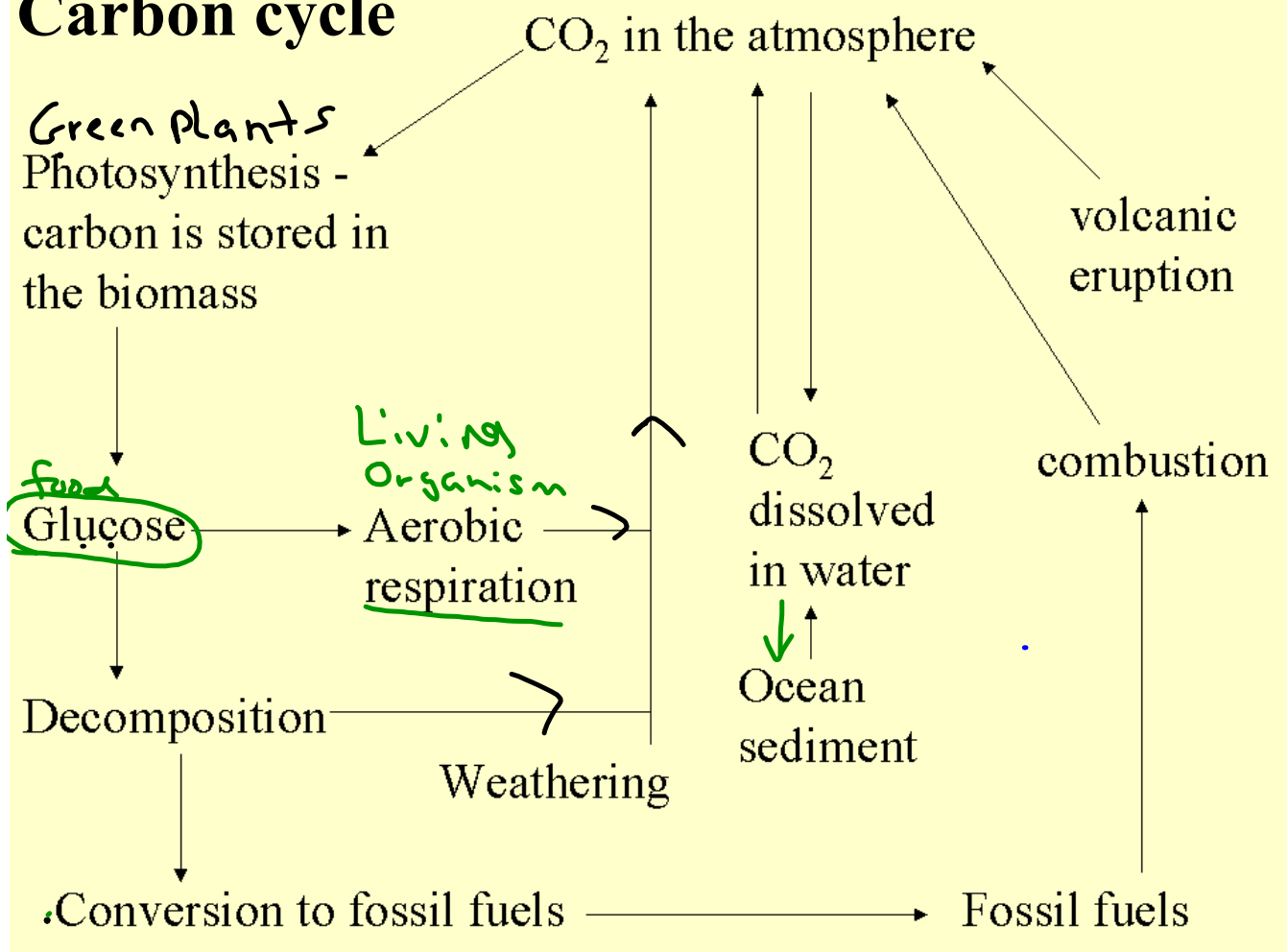
# Video carbon cycle

<http://www.youtube.com/watch?v=HrIr3xDhQ0E&safe=active>

# Carbon cycle



# Carbon cycle



## Inorganic Reservoirs that Delay the Cycle [CO<sub>2</sub>]

- Carbon stored in
- Atmosphere
- Oceans (major)
- Earth's Crust (limestone)

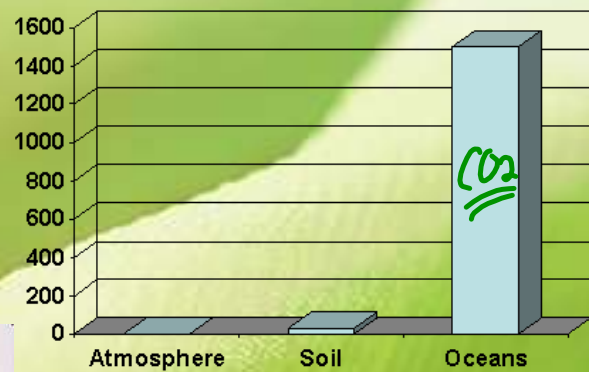
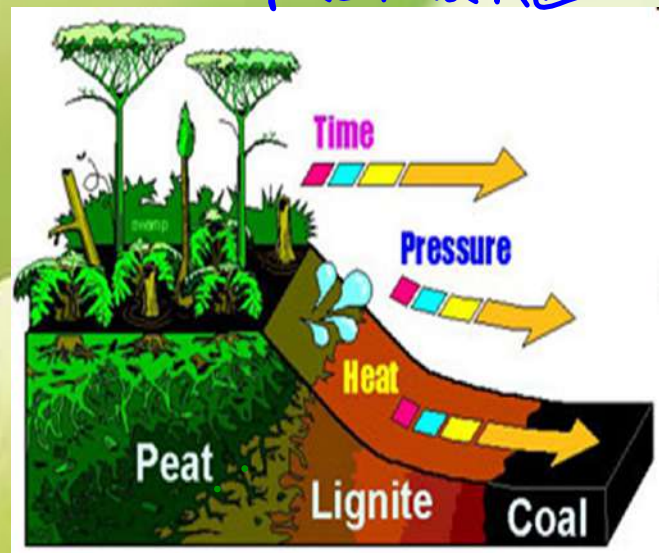


Diagram Pg 63

## Organic Reservoirs that Delay the Cycle

[CH<sub>4</sub>]  
methane

- Carbon stored in:
- Bodies of living things
- Peat bogs
- Fossil fuels



## Human Impact on the Carbon Cycle

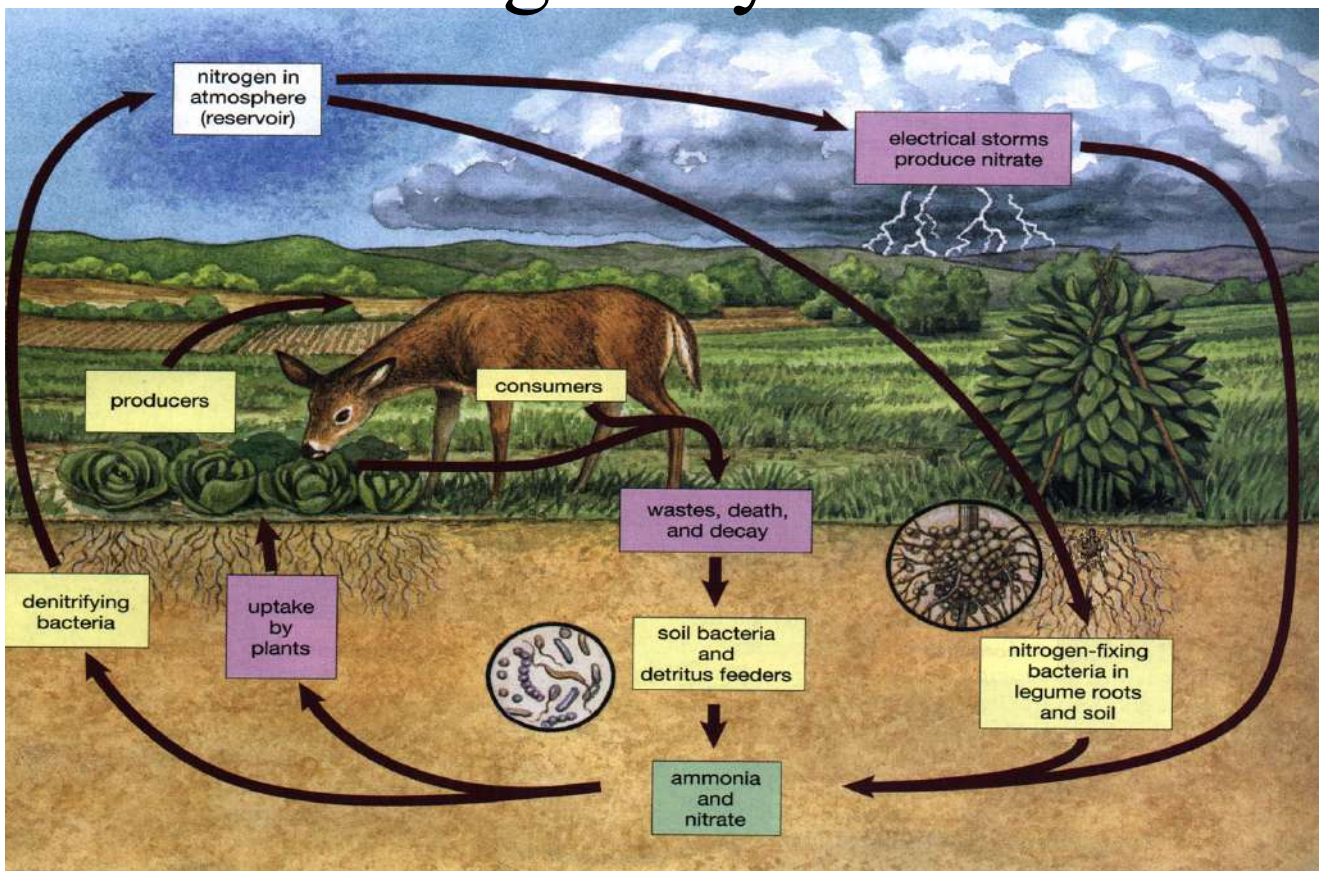
- Releasing carbon from organic reserves (removing fossil fuels from the ocean) faster than it occurs naturally
- Increasing amounts of carbon in inorganic reserves (oceans) by combustion



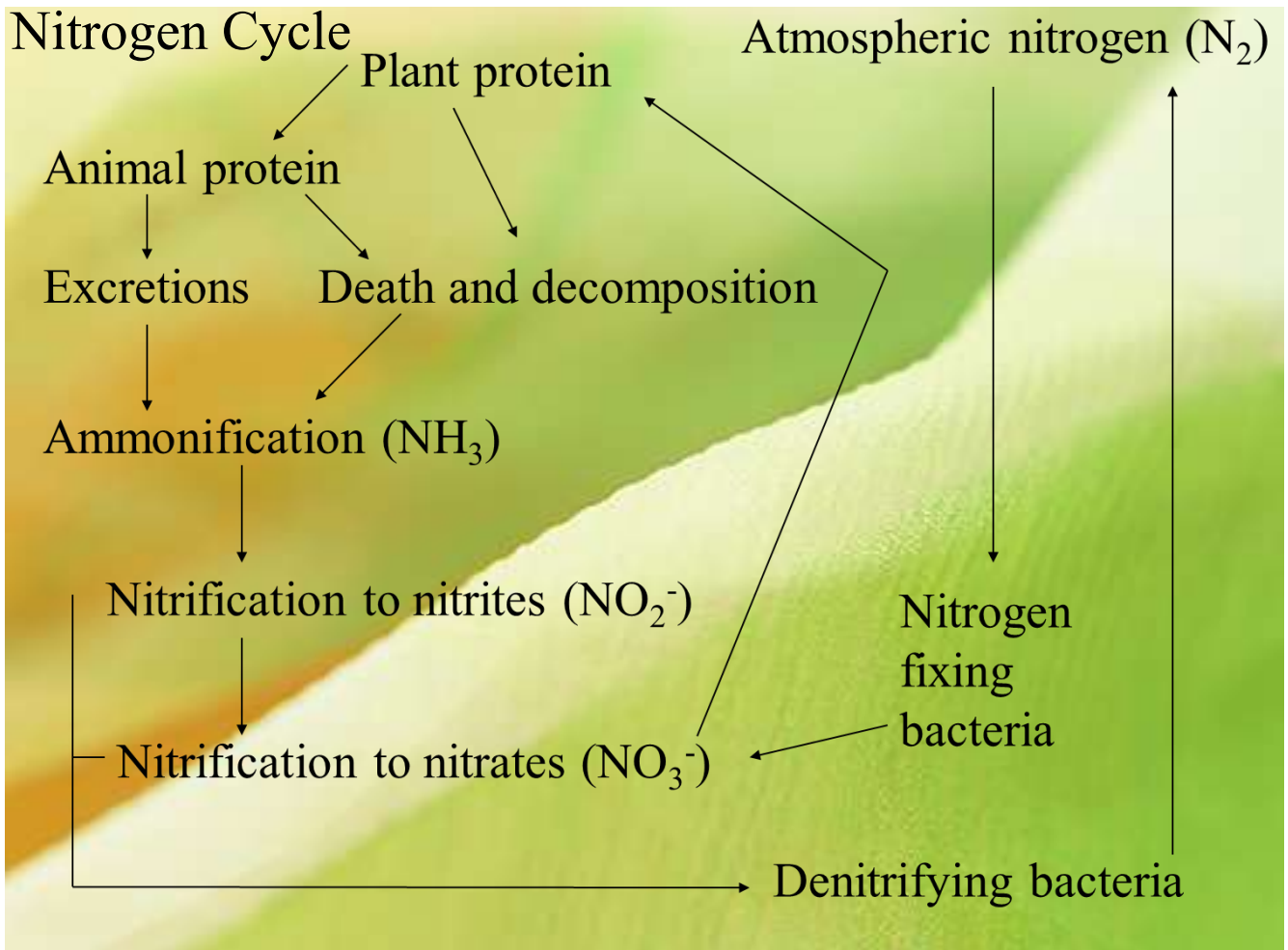


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# Nitrogen Cycle







## The Nitrogen Cycle

- The movement of nitrogen through the ecosystems, the soil, and the atmosphere is called the **nitrogen cycle**.
- In order for nitrogen to be useful to organisms, it must be available as a **nitrate ion** ( $\text{NO}_3^-$ ).
- Atmospheric nitrogen is converted into nitrates by the process of **nitrogen fixation**, or **nitrification**, either by lightning or by bacteria in the soil.
- Nitrogen is required to make proteins and DNA which is the genetic material found in every cell.

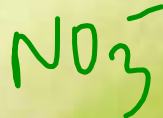
## Nitrogen fixation

Atmosphere (by lightning)

The energy of lightning breaks nitrogen molecules into nitrogen atoms which react with oxygen in the air to produce nitrogen oxides. These compounds then dissolve in rain to produce nitrates which seep into the soil.



water



# Nitrogen fixation



Biological:

Nitrogen-fixing bacteria found live in root legumes plants (such as peas, clovers, alfalfa, beans) and in the soil convert nitrogen gas from the air into ammonia ( $NH_3$ ) and ammonium ( $NH_4^+$ )

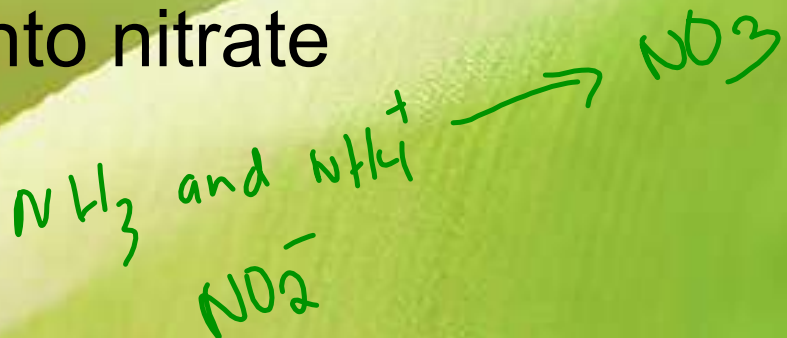
$N_2$   $\longrightarrow$   $NH_3$   $\longrightarrow$  nitrates  
 $NH_4^+$

## **Role of Decomposers**

Organisms produce waste and eventually die . Decomposers break down the nitrogen compounds in the decaying material into ammonia which reacts with hydrogen ions to produce ammonium which, in turn undergo nitrification to give nitrates.

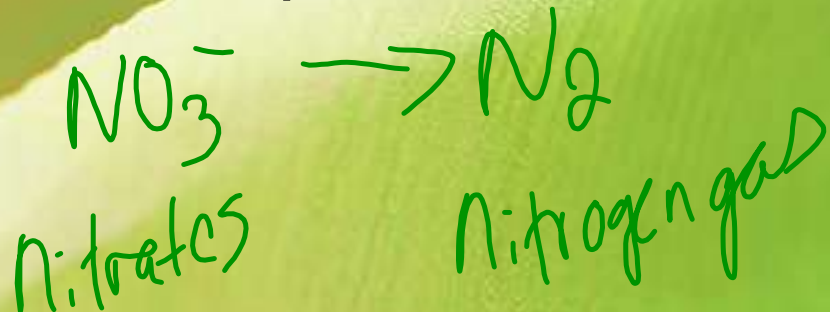
# Nitrification

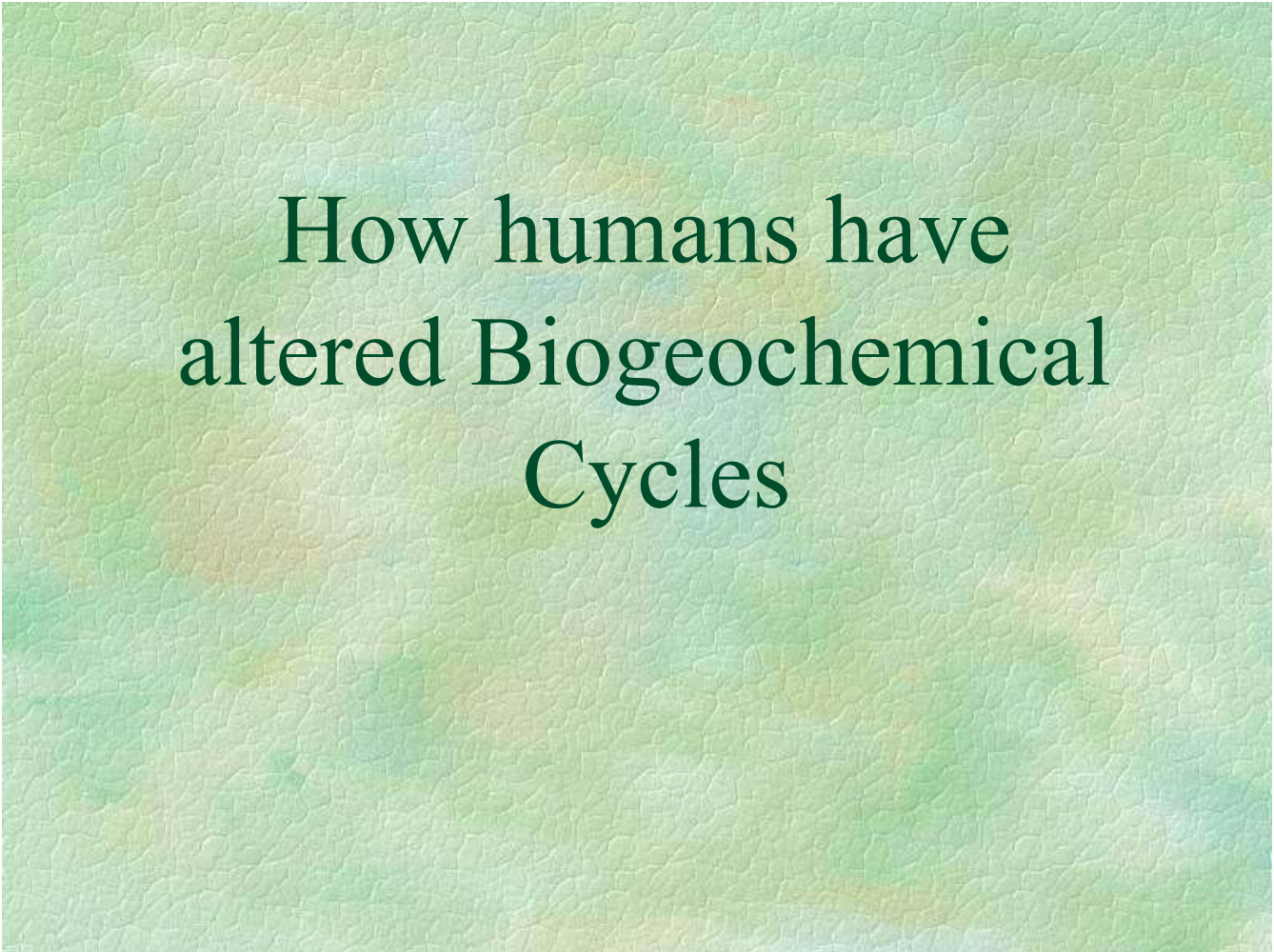
- a biological process during which nitrifying bacteria convert ammonia ( $\text{NH}_3$ ) and ammonium ( $\text{NH}_4^+$ ) into nitrites than into nitrate



# Denitrification

a biological process during which denitrifying bacteria convert nitrates back into nitrogen gas and release it back into the atmosphere.





# How humans have altered Biogeochemical Cycles



# Human Influence

- Humans have influenced the biogeochemical cycles in four ways:
  - > Deforestation
  - > Greenhouse effect
  - > Ozone Depletion
  - > Eutrophication

# 1. Deforestation

- Deforestation refers to the total removal of trees and/or vegetation from a particular area or site.
- Large areas are being cut for wood and also for farming. Once vegetation has been removed, the soil loses its fertility quickly
- algal growth increases in the logging valleys because the soil loses nitrates by run off.
- Dead logs dry out and lightning strikes causing a fire which results in more nutrients leaving the soil.



- In a few years, the land will be abandoned.
- Plant and animal life do not usually recover from such destruction. (p.72)
- It will have an effect on the cycling of materials in an ecosystem.
- The tropical rainforest is a fragile environment that is threatened by human activities. It is one of the major world supply of oxygen

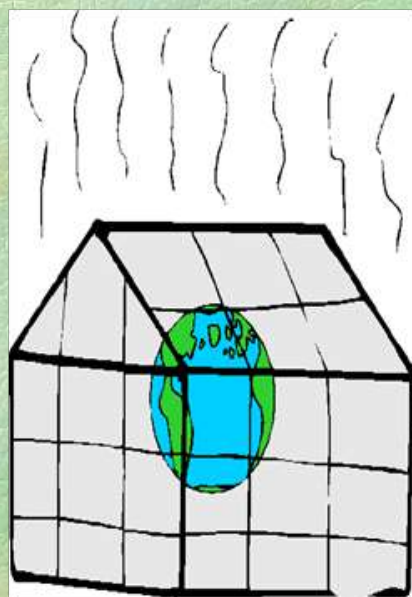
# Video: Greenhouse Effect

[http://www.youtube.com/watch?  
v=oJAbATJCugs](http://www.youtube.com/watch?v=oJAbATJCugs)



## 2. Greenhouse Effect

- It is the gradual increase in carbon dioxide levels in the atmosphere
- Excess  $\text{CO}_2$  causes more heat to be trapped by the atmosphere.



- Where does the CO<sub>2</sub> come from?
  - > Burning of fossil fuels in factories and cars
  - > Mining → removing more carbon from the earth
  - > Burning of rainforests → clearing farmland
  - > Destruction of rainforests reduces the number of trees to remove the CO<sub>2</sub>

- The atmospheric temperature will rise gradually, leading to the phenomenon called **global warming** (the overall warming of the earth's temperature).

## Effects of Global Warming

- Increase in global temperature
- Changes in climate
- Increasing ocean levels
- Decreased Ozone layer

## What Are We Doing About It?

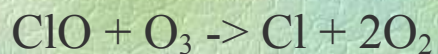
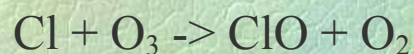
- Reducing CO<sub>2</sub> output
  - > Use electric/ hybrid cars
  - > Cutting back on energy consumption
  - > Global agreement to reduce emissions
- Reducing deforestation





### 3. Ozone Depletion

- The **ozone layer** is a thin layer of a bluish gas located in the stratosphere ( $O_3$ ) that helps to screen out ultraviolet radiation.
- CFC's (Chlorofluorocarbons) are the main cause of ozone depletion, in which turns  $O_3$  into oxygen,  $O_2$ .

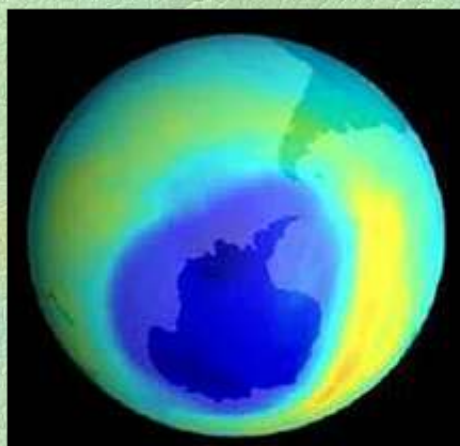


# Video: Ozone

<http://www.youtube.com/watch?v=qUfVMogIdr8>



- Ozone holes above the Canadian Arctic and Antarctica have been identified.
- An ozone hole is a region in the ozone layer in which ozone levels have been considerably reduced and the layer has become thin.
- This causes an increase in UV radiation reaching the earth's surface which can lead to increases in skin cancer.



## 4. Eutrophication

- > Fertilizer runoff increases growth in water
- > A buildup of nutrients (such as nitrogen and phosphate fertilizers) in water can lead to the environmental problem.
- > These nutrients cause algae to grow rapidly and lead to the problem of an algal bloom.
- > Masses of blue-green algae can literally choke the life out of a lake or pond by depriving it of much needed oxygen.



- Under extreme conditions, a eutrophic lake or pond may be left entirely deprived of fish. (p. 70) or organisms die off
- A eutrophic lake are shallow and warm bodies of water which contain an abundant supply of nutrients. (p. 127)

## Affects on Carbon & Oxygen Cycles

