

## Topic 5 Photosynthesis & Respiration



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### IV. Applying Your Knowledge

#### A. Understanding Dead Zones

1. Defined

Hypoxic waters with no life.

e.g., the Mississippi River Delta – Gulf of Mexico Dead Zone



Data source: N.N. Rabalais, Louisiana Universities Marine Consortium, R.E. Turner, Louisiana State University  
Funded by: NOAA, Center for Sponsored Coastal Ocean Research

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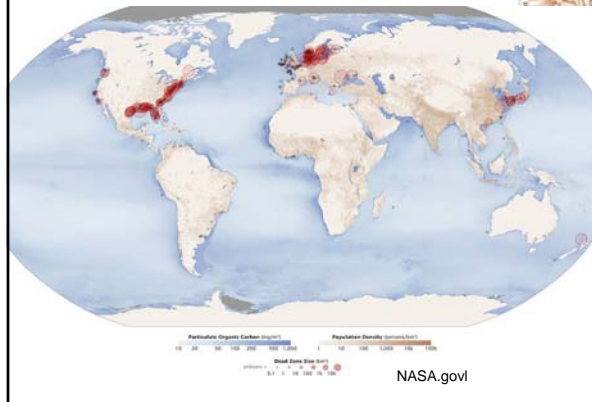
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### IV. Applying Your Knowledge



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### IV. Applying Your Knowledge

2. Economic Impact

Bottom-water dissolved oxygen across the Louisiana shelf from July 22-28, 2013

Data sources: N. H. Rabalais, Louisiana Universities Marine Consortium, R.E. Turner, Louisiana State University  
Funded by: NOAA, Center for Sponsored Coastal Ocean Research

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### IV. Applying Your Knowledge

3. Cause in the Gulf

a. **Eutrophication**  
N and P-rich freshwater runoff from Mississippi watershed.

Space Science and Engineering Center, University of Missouri, Rolla  
This satellite image shows plumes of sediments emptying into the Gulf of Mexico from the Mississippi River.

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### IV. Applying Your Knowledge

3. Cause in the Gulf

a. **Eutrophication**  
N and P-rich freshwater runoff from Mississippi watershed.

b. **Algal Blooms & Photosynthesis**  
Sunlight, N and P,  $\text{CO}_2 + \text{H}_2\text{O}$ , = algal blooms @ & near surface.

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**IV. Applying Your Knowledge** 

3. Cause in the Gulf

a. **Eutrophication**  
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b. **Algal Blooms & Photosynthesis**  
Sunlight, N and P,  $CO_2 + H_2O$ , = algal blooms @ & near surface.

c. **Respiration with herbivory & decomposition**

- Zooplankton feed on algae
- Algae & zooplankton die, sink, & decompose

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**IV. Applying Your Knowledge** 

3. Cause in the Gulf

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Sunlight, N and P,  $CO_2 + H_2O$ , = algal blooms @ & near surface.

c. **Respiration with herbivory & decomposition**

- Zooplankton feed on algae
- Algae & zooplankton die, sink and decompose

d. **Hypoxia**

- Mussels, clams, sponges die
- Fish and shrimp die or leave

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**IV. Applying Your Knowledge** 

4. Factors affecting dead zone formation and size

a. Precipitation and runoff volume

b. Summer temperatures and light availability

c. Farming, landscape, and land development practices

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IV. Applying Your Knowledge

B. Understanding Global Warming & The GH Effect



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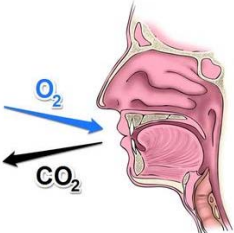
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IV. Applying Your Knowledge

1. CO<sub>2</sub> is **not** toxic



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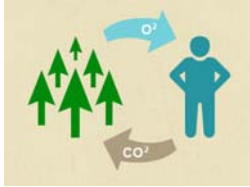
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IV. Applying Your Knowledge

1. CO<sub>2</sub> is **not** toxic

- a. Makes plants & food grow.
- b. We/plants/fungi/microbes release it through respiration.
- c. This is the biological C-cycle



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**IV. Applying Your Knowledge**

2. CO<sub>2</sub> is a greenhouse gas



- a. Earth absorbs SR.
- b. Warming masses dissipate energy as IR.
- c. Some IR escapes but other is absorbed by GH gases.

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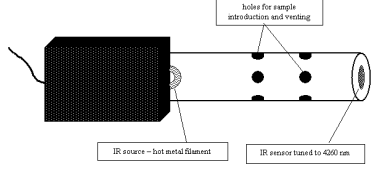
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**IV. Applying Your Knowledge**

2. CO<sub>2</sub> is a greenhouse gas

This is the way your lab's CO<sub>2</sub> probe worked.




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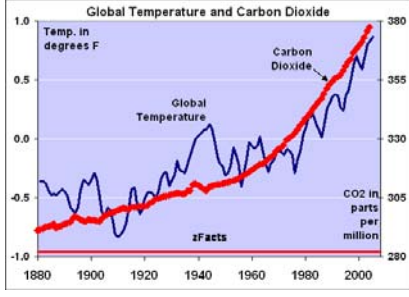
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**IV. Applying Your Knowledge**

2. CO<sub>2</sub> is a greenhouse gas




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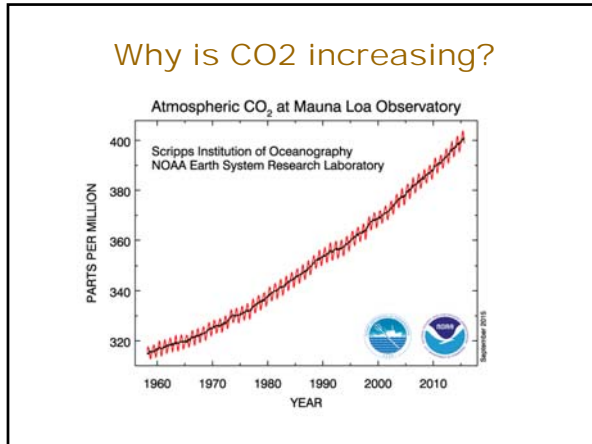
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### IV. Applying Your Knowledge

3. Fossil fuel combustion releases long-ago sequestered carbon (CO<sub>2</sub>)

a. The nature global carbon cycle is ~ carbon-neutral

CO<sub>2</sub> fluxes in gigatons / yr (IPCC 2011)

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### IV. Applying Your Knowledge

3. Fossil fuel combustion releases long-ago sequestered carbon (CO<sub>2</sub>)

b. Naturally, some C is sequestered in organic deposits that get buried and do not decompose.

The Carboniferous Period (ca. 360-300 mya)

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**IV. Applying Your Knowledge**

3. Fossil fuel combustion releases long-ago sequestered carbon (CO<sub>2</sub>)

c. Net addition of CO<sub>2</sub> into the atmosphere

1) Fossil fuel use is not C-neutral

Combustion (like respiration) releases CO<sub>2</sub>:  
 $C_6H_{12}O_6 + 6O_2 \rightarrow 6CO_2 + 6H_2O$

The diagram illustrates the carbon cycle with three main components: Fossil Fuel Burning + Land Use, Vegetation & Land, and the Ocean. Arrows indicate the flow of CO<sub>2</sub> into and out of the atmosphere. From Fossil Fuel Burning + Land Use, 29 units of CO<sub>2</sub> are released. From Vegetation & Land, 439 units are released and 450 units are taken up. From the Ocean, 332 units are released and 338 units are taken up.

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**IV. Applying Your Knowledge**

3. Fossil fuel combustion releases long-ago sequestered carbon (CO<sub>2</sub>)

c. Net addition of CO<sub>2</sub> into the atmosphere

1) Fossil fuel use is not C-neutral

2) Land use (clearing of forests) shifts balance further.

The diagram is identical to the one above, showing CO<sub>2</sub> fluxes between Fossil Fuel Burning + Land Use, Vegetation & Land, and the Ocean. Arrows indicate the flow of CO<sub>2</sub> into and out of the atmosphere. From Fossil Fuel Burning + Land Use, 29 units of CO<sub>2</sub> are released. From Vegetation & Land, 439 units are released and 450 units are taken up. From the Ocean, 332 units are released and 338 units are taken up.

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