

Wednesday, February 20

Atlanta Continued

- CSO reduced 97% from 2004-2010
- March 2010 - September 2012: Atlanta had 24 major spills totaling over 28 million gallons
- over \$2 billion spent so far
- Atlanta water bills average \$151/month
- 2009 storm - Nancy Creek sewage tunnel was overwhelmed by inflow of rainwater into old, leaky sewer pipes
- 8 mile tunnel overflowed a combination of raw sewage and rainwater

Unforeseen Effects from CSO

- The risk of West Nile Virus infection is associated with combined sewer overflow streams in urban Atlanta, GA

Chemical Input: Pollution from Toxics

- Savannah River, which ranks as one of the top ten most toxic rivers in the country
- examples of non-point source pollution are sediment and nutrients
- due to sediment input, Georgia's rivers sometimes are red, but they are not naturally that way
 - this is impacted by development - road construction, commercial and home building
- clearing dumps sediment into streams - changes physical environment of stream, covering rocky bottoms, damaging filter feeders

Nutrient Pollution

- increased use of nitrogen and phosphorus fertilizers (agricultural and residential)
- nitrogen fixation by leguminous crops
- atmospheric deposition of oxidized nitrogen from the combustion of fossil fuels
- agricultural sources - 70% of nitrogen, phosphorous delivered to the Gulf of Mexico from the United States

Hypoxic Zone in Northern Mexico: Dead Zone

- make sure to watch this link to review for the test:
http://www.gulfhypoxia.net/Overview/hypoxia_flash.asp
- hypoxia = low levels of dissolved oxygen
- water near the bottom of the Gulf has less than 2 ppm dissolved oxygen

Hypoxia Stages

- 1. Nutrient-rich water flows in
- 2. Algae grow, feed, and die
- 3. Zooplankton eat algae
- 4. Bacteria feed on fecal pellets and dead algae
- 5. Bacteria deplete the water of oxygen
- 6. Marine life flees or dies

Solving the Problem?

- Three “Actions to Accelerate the Reduction of Nitrogen and Phosphorus” will have the most direct effect on the size of the zone
 - focus on state nutrient strategies
 - introduce complementary federal strategies
 - utilize existing programs to enhance the protection of the Gulf and local water quality

AIR QUALITY

Carbon Cycle

- Don't worry about the numbers on the carbon cycle diagram but make sure to understand the process.
- Fossil fuel combustion and reduced uptake by plants result in carbon storage in the atmosphere.
- Plants and consumers respire, which also sends up carbon. Gross primary production makes the carbon come down. Carbon is temporarily stored in land plants and consumers. It is also found in soil and soil biota.
- Human modifications to the carbon cycle, such as fossil fuel storage, release more carbon into the atmosphere.

Productivity in Ecosystems

- gross primary production
- net primary production
- net ecosystem production

Photosynthesis

- carbon dioxide + water + sun's energy = oxygen + sugar

Respiration

- oxygen + sugar = carbon dioxide + water + released energy

Ocean Carbon Cycle

- a lot of carbon is dissolved in the ocean
- the ocean can be like a sink for carbon dioxide

Role of Ocean Micro-Organisms

- phytoplankton:
 - diatoms - temperate and polar regions
 - coccolithophores
 - cyanobacteria
 - dinoflagellates

Marine Net Primary Production

- highest productivity takes place along coastlines because water is shallow, giving easier access to sunlight
- open, deep oceans are not as productive (though they are still relatively productive, just not as much as shorelines)

Why Do Oceans Have High Primary Productivity?

- phytoplankton reproduce quickly and are consumed quickly by zooplankton or other marine organisms
- production by phytoplankton is not bound up in storage (roots, wood)

Understanding Carbon Cycle

- it's important in understanding global climate change issues
- one of the things that limits productivity is that some basic minerals are limited, including iron
- "Give me half a tanker of iron, and I'll give you an ice age" - John Martin, Moss Marine Lab

Fertilizing the Ocean

- study done off the coast of Argentina
- 12 small-scale experiments - iron additions draw carbon into the ocean
 - Is it permanent? (carbon sinking to the bottom)
- Changes in fish stocks and whale populations?
 - Increased decomposition of sinking organic matter could deprive deep waters of oxygen or produce other greenhouse gases more potent than carbon dioxide, such as nitrous oxide and methane. The plankton-choked surface waters could block sunlight needed by deeper corals, or warm the surface layer and change circulation patterns.