Disturbing the Cycles

S2-1-02 Discuss factors that may disturb biogeochemical cycles. *Include: natural events, human activities.*

Disturbing the Carbon/Oxygen Cycle

1. Natural Events

Examples include:

- **FOREST FIRES**
  - the **COMBUSTION**, or burning of plant material such as wood, leaves, or stubble **RELEASES LARGE AMOUNTS** of **CARBON DIOXIDE** into the atmosphere

- **VOLCANOES**
  - volcanic activity can break down rocks containing carbon compounds and **RELEASE CARBON DIOXIDE** into the atmosphere
  - the ash generated from a volcano can also **BLOCK SUNLIGHT** from reaching the Earth's surface and this may **REDUCE** the amount **PHOTOSYNTHESIS** done by plants, which could cause the amount of **CARBON DIOXIDE** in the atmosphere to **INCREASE**

Disturbing the Carbon/Oxygen Cycle

2. Human Activities

Examples include:

- **DEFORESTATION**
  - deforestation results in fewer plants **REMOVING LESS CARBON DIOXIDE** from the atmosphere

One large tree can:

- Lift up to 4000 litres of **WATER** from the ground and release it into the air
- Absorb as many as 7000 **DUST PARTICLES** per litre of air
- Provide a day's **OXYGEN** for up to **FOUR** people

Trees reduce carbon by:

- **STORING CARBON** in trunks, branches, leaves and roots
- **ABSORBING CARBON** produced by vehicles
- Storing carbon in wood-based by-products (paper, lumber, furniture)
- Remove carbon through **PHOTOSYNTHESIS**

Disturbing the Carbon/Oxygen Cycle

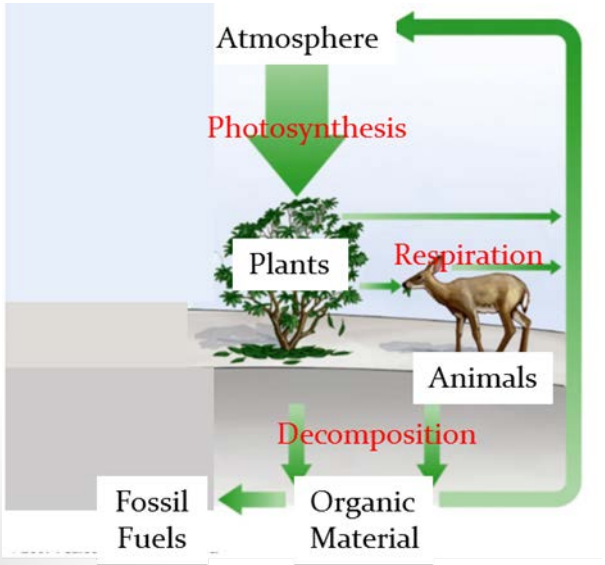
2. Human Activities

Examples include:

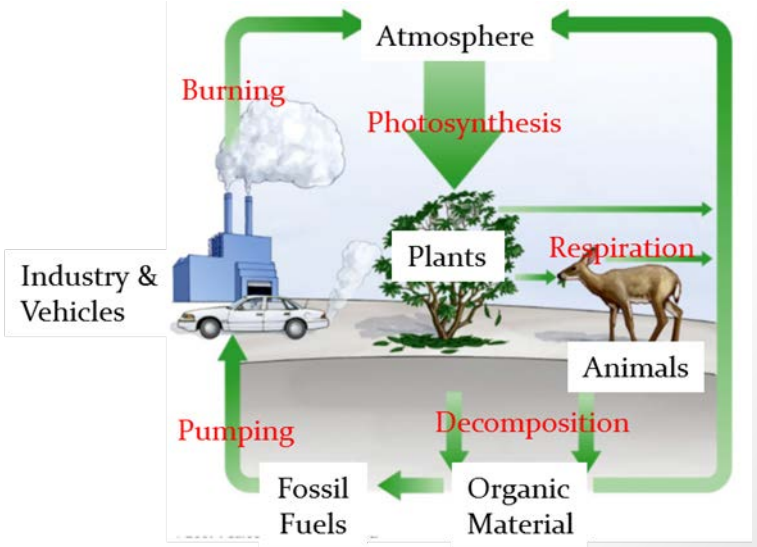
- **BURNING OF FOSSIL FUELS**
  - fossil fuels such as **GASOLINE**, **COAL** and **NATURAL GAS** that we burn to produce energy also release carbon dioxide into to Earth's atmosphere (combustion reactions)

Human impact on Carbon Cycle

In 1750, WITHOUT industry & vehicles, there was around 280 CO_2 molecules in every million air molecules



In 2007, WITH industry & vehicles, there is now 380 CO_2 molecules in every million air molecules (35% increase)



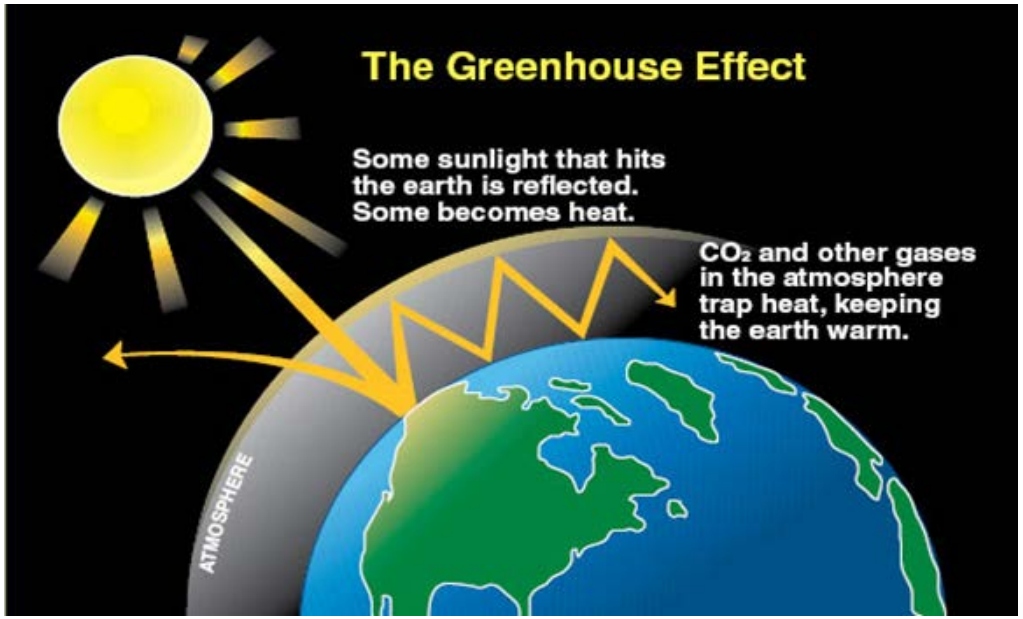
Disturbing the Carbon/Oxygen Cycle

Calculate YOUR carbon footprint:

http://www.carbonfootprint.com/calculator.aspx

Current Issue – The Greenhouse effect/Climate Change

The amount of carbon dioxide in our atmosphere has increased in the past 150 years corresponding to our increased use of fossil fuels for home heating, transportation, and production of goods by industry there is a concern that the increased amount of carbon dioxide in the atmosphere will lead to global warming (**THE GREENHOUSE EFFECT**) and climate change



Disturbing the Nitrogen Cycle

Too much nitrogen can be a problem:

- In the **ATMOSPHERE** → can produce acid rain.
- In the **WATER** → causes algae blooms
- On **LAND** → leeches into watersheds/gases into atmosphere.

The disruption of the nitrogen cycle is due mostly to **HUMAN ACTIVITIES**:

Examples include:

- Farmers will **ADD FERTILIZER** to their fields in the late spring, which contains **NITRATE** and **AMMONIA** to improve plant growth.
- Nitrate and ammonia are also found in a wide variety of substances including:
  - **HUMAN SEWAGE**
  - **PET AND LIVESTOCK FECES (SOLID WASTE)**
  - **LAWN AND GARDEN FERTILIZERS**
  - **ERODED SOIL**
  - **INDUSTRIAL WASTE**
  - **HOUSEHOLD WASTEWATER (DETERGENTS)**

Disturbing the Nitrogen Cycle

Nitrates, Ammonia and Aquatic Ecosystems

- Most of the nitrogen (nitrates/ammonia) from the above sources will eventually end up in an **AQUATIC ECOSYSTEM**.
  - A recent study concluded that the amount of nitrogen-containing compounds in Lake Winnipeg increased by 13 % in the last thirty years.

- Excess **NITRATES** and **AMMONIA** results in frequent **ALGAL BLOOMS** and **EXCESSIVE WEED BEDS** along the shoreline.

- Algal blooms:
  - Can produce dangerous **TOXINS**, which can harm **FISH**, **WILDLIFE,** and **HUMANS.**
  - Can cause skin irritation, nausea, diarrhea, etc.
  - Affects drinking water quality (taste, smell)
  - Chokes out aquatic plants by preventing sunlight from reaching them.

Disturbing the Nitrogen Cycle

Disturbing the Nitrogen Cycle

Lake Winnipeg

Lake Winnipeg is the tenth largest freshwater lake in the world and it is in trouble!

June 28, 2010

No Signs of Algae

July 20, 2010

Algae bloom clearly visible

- Eventually the algal blooms "**CRASH**" and the algae begin to die. The **DECOMPOSING** **WEEDS** and **ALGAE** deplete **OXYGEN** from the water.

→Many fish will die due to a **LACK OF OXYGEN**.

Disturbing the Nitrogen Cycle

Farm Runoff

The **AGRICULTURAL INDUSTRY** is another source of **NITRATE** and **AMMONIA** entering Manitoba's **LAKES** and **RIVERS**.

LIVESTOCK OPERATIONS

- produce large quantities of **ANIMAL FECES**.
- The disposal of this **MANURE** is monitored/ controlled so that large amounts of manure are not washed into lakes and rivers during **SNOWMELT**, or heavy **RAINSTORMS**.

FERTILIZERS

- Soil may erode and fertilizers may **WASH OFF** farmland during the spring **SNOWMELT**, or in heavy **RAINSTORMS**.
- The ammonia and nitrates can also **SEEP** into the **GROUND** and enter the **GROUND WATER**.
  - The ingestion of nitrates can cause anemia, a blood disorder, in children.

Disturbing the Nitrogen Cycle

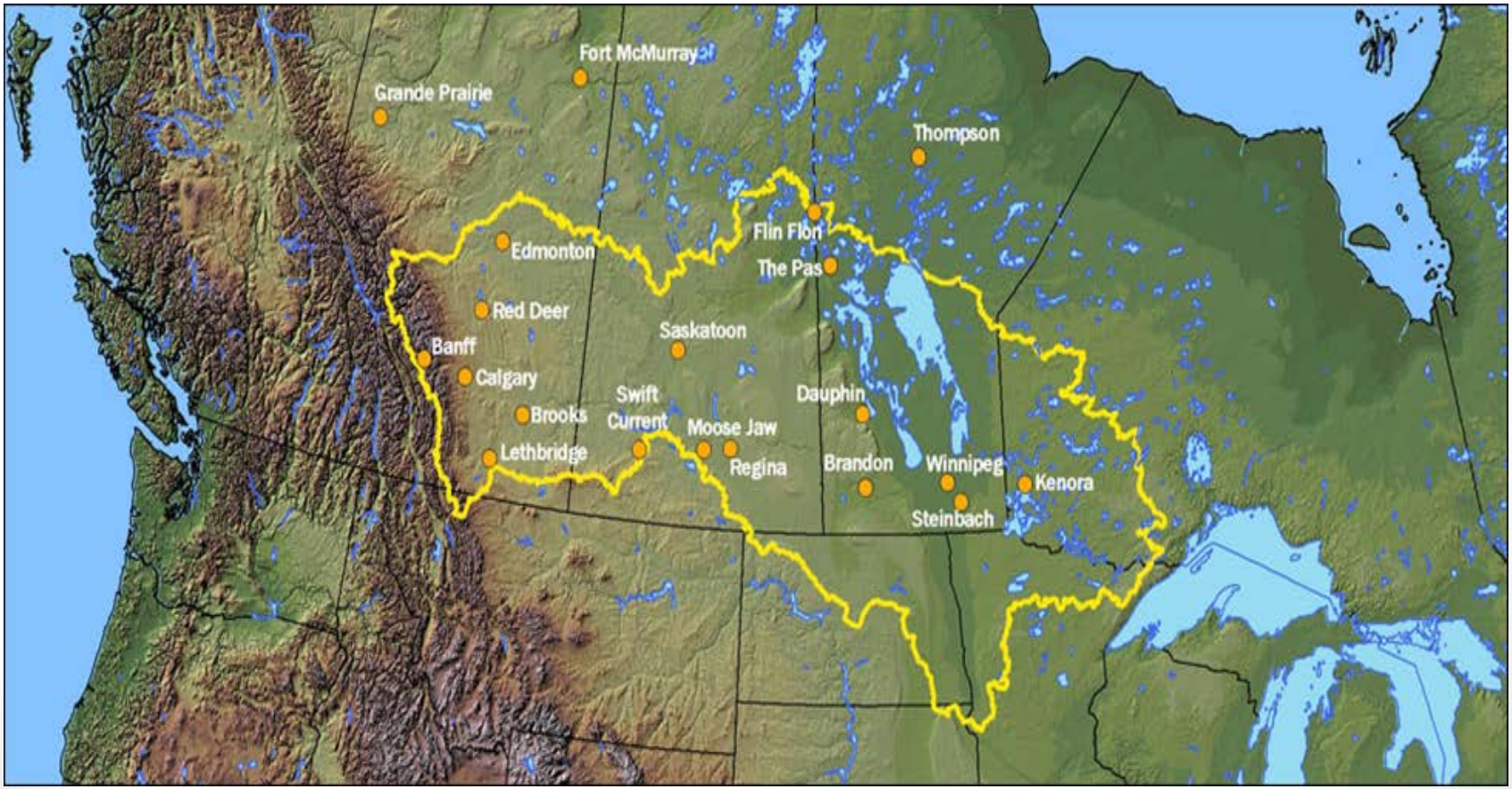
Human Sewage and Wastewater

- In larger communities, **SEWAGE** (human liquid and solid waste) and **WASTEWATER** (dirty water from sinks and showers) is collected and sent to a water treatment plant.
- When the water is mostly cleaned of the waste, the water is **RETURNED** to a **LAKE** or **RIVER**.
- In rural communities, homes are connected to individual **SEPTIC FIELDS** where wastes are broken down by bacteria. The clean water then drains into the ground.
- Occasionally problems with septic fields and treatment plants occur, releasing wastewater and sewage into the ground/lake/river.

Disturbing the Nitrogen Cycle

These are not just local problems!

- The water that enters a lake like Lake Winnipeg can come from thousands of kilometers away! These areas are called **WATERSHEDS**.



The Lake Winnipeg Watershed