**9/17/2014**

Contributions to smog events

* + High pressure systems (cold air is dense)
  + Industrial air emissions
    - Residential Air Emissions
  + Inversions which prevent air circulation

Inversion Layer: Air near the ground is more dense (cold) than the air higher up.

* Pollution can’t be lifted away
  + Smog

**Photochemical Reaction** -> any chemical reaction activated by light (sun)

**Photochemical smog** -> mixture of *primary* and *secondary* pollutants formed under UV radiation (sun)

Primary Pollution­ – Placed directly into the atmosphere

Secondary Pollutants – Primary pollutants that react in the atmosphere to create new pollution  
 In many cases creates acid rain.

*VOC’s + Nox + heat + sunlight = ground level ozone (O3) / aldehydes / 2o pollutants*

**‘Good’ ozone** -> Want it in stratosphere 911-16 miles above earth  
 protects us from 95% of the suns harmful UV radiation

**‘Bad’ ozone** -> Produced from urban smog  
 Close to the ground  
 BAD to breathe  
 Bad for plants, etc.

**9/19/2014**

Why do we have economics?

* Businesses
* $
* Government regulation
* Makes life simpler
* *To use resources to do the most good for society as possible*

Market Failures:

* Monopolies
* Oligopolies
* Government Regulation
* Asymmetry of information
* Oversaturation
* Distribution of wealth
* Hidden costs

Terms:

* **Public goods**
  + Really valuable
  + Anyone can have access to them
  + They don’t run out
  + Examples
    - Solar Energy
    - Air (Clean)
    - Water (Clean)
  + Problem?
    - Free rider situation – nobody takes control of this, no profit
* **Common Pool**
  + Really valuable
  + Anyone can access them
  + Can run out
  + Examples
    - Oil
    - Timber
    - Fisheries
    - Natural Resources (other not listed)
* **Tragedy of the Commons**
  + “I’m going to get mine before it runs out!”
* **Externalities**
  + Air Pollution
  + Types
    - Negative
      * Cost of good is less than it should be
    - Positive
      * Cost of good is more than it should be

**Group Project:**

Evan Mahoney  
Bryce Howe  
Brianna Freeman  
Toni Donofrio

**Team Name:** Unicorn Princesses

**Group:** Energy

Who suffers more from climate change?

Poor and developing countries!  
 Economic resources not available  
 Poor Infrastructure  
 Low-laying areas  
 Already hot temperatures

**Adaptation –** Making ourselves less vulnerable to the effects of climate change

**Mitigating –** Refers to efforts to reduce or prevent emission of greenhouse gases.

Power mainly used for:  
 Transportation  
 Electricity  
 Heating

J – Joule (Energy)

J/S = Watt

1kW = 1,000 Watts

1kWh = 3,600,000 J (The amount of energy used when you user 1,000kV for 1 hour.

**Biofuels -** Biogas  
 Corn Ethanol  
 Biodiesel  
 Biomass

Geothermal – Heat which is constantly escaping from Earth’s interior.

**10/1/2014**

Price != Cost

|  |  |  |  |
| --- | --- | --- | --- |
| Price | Cost | External Costs | Who Pays? |
| $94 / barrel oil | 54% crude oil extraction/transportation | $490 million on campus for US Navy 5th fleet | Taxpayers |
| $3.49 / gal gas | 19% refinery | Iraq $2-$3 trillion war cost 500 million in vet benefits | Insurance Companies |
|  | 6% distribution + marketing | CO2 NOx SOx VOC Cause hospital visits | Developing Countries |
|  | 21% taxes | Crop + Forest yields drop |  |

**10/10/14**

Uses for water:

* Drinking
* Industry
* Agriculture
* Cleaning
* Recreation
* Transportation
* Ecosystems
* Health + Sanitation

To produce 1 kilo of grain requires 3 cubic meters of H­2O.

To produce 1 kilo of beef requires 15 cubic meters of H2O.

**Sustainability** means to use only as much as is resupplied.

**Virtual Water** is water that it takes to produce a product.

**10/15/14**

Direct Water Usage: Approximately 100 gals used per day per person.

* Drinking
* Sanitary
* Recreational
* Appliances

Virtual Water Usage: Approximately 1,177 gals per person per day

* Agriculture
* Clothing
* Processing Materials

Biggest Contributor: Thermoelectric Power

*Extraction: Natural Gas and Oil*

* 200-383 million gals used per day
  + Allegheny College Pool: 118,000 gallons or 3,300 swimming pools daily used
  + Woodcock Creek Lake 7 billion gallons
    - Would be drained in 5 days if used for fracking.

*Extraction: Coal*

* 70-260 million gals used per day
  + 8 days for draining Woodcock
  + 2,000 Allegheny Pools per day
* Uses
  + Dust remediation
  + Coal cleaning

*Cooling the Power Plants*

200 billion gallons of water per day needed

**10/17/2014**

Green Revolution

A series of technological improvements that lead us to be able to produce more food per capita of land.

What were the improvements?

* Fertilizers
* Irrigation
* Transportation
  + Primarily railroad
* Mechanized tools
  + Monocropping
* Pesticides / Herbicides
* New hybrid crops

Modern Agriculture:

* GMO’s
* Consolidation Business/Power
* Increased Transportation
* New Chemicals

What is wrong with conventional agriculture?

* Habitat destruction – Land use
* Pollution
* Soil erosion
* Water use
* Economic consequences of consolidation

Biogeochemical Cycles

* Why do we care about N?
  + Critical for life
  + Abundant
  + Air Pollution NOx
  + Water pollution
  + Nitrogen Fixation
    - Through Plants
      * Legumes, etc
        + Nitrogen fixation N­2 -> NH3, NH4+
    - Through lightning
      * Rips N­2 apart through sheer force and it can work its way into the soil.
    - Through Decomposition
      * Anaerobic digestion breaks down organic matter.
  + Nitrogen Removal from soil
    - Denitrofication
    - Through bacteria primarily
  + Nearly 1/3 of N in soil is added through fertilizer.
* Where does P come from?
  + Mountain Ranges
    - In rock, eventually breaks up with erosion etc and drains down the slopes.
  + Organic waste
    - Bacteria converts P into something that can be absorbed by plants again

**10/22/2014**

Pesticide treadmill

500bc - Farmers used sulfur

1400s – 1900s - Arsenic, Lead, Mercury

Learning disability, mental health, miscarriage, carcinogens

1600’s – Natural botanicals, etc

1939 – Major revelation in insecticides

Won nobel peace prize because chemical he discovered killed mosquitoes

Dropped malaria and yellow fever levels

What’s so great about DDT?

1. Toxic to a wide range of insects
2. Persistent
3. Not water soluble
4. Very cost effective

Biomagnification

Amount of a chemical increases in concentration as it moves up the food chain

Example:

In water => 0.000003 ppm  
 Zooplankton => 0.04 ppm  
 Minnows => 0.5 ppm  
 Large Fish => 2.0 ppm  
 Osprey => 25.0 ppm