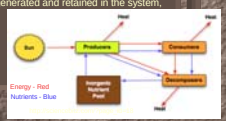
Nutrients and Nutrient Cycling

Ecosystems
Nutrient cycles
Nutrient regeneration

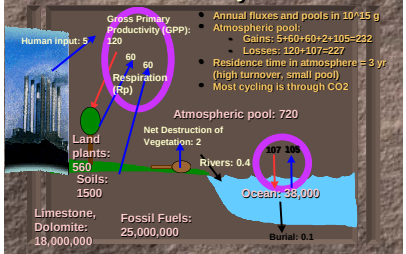
Energy and Nutrients

- Energy Flow - Covered in the Food Chain section
  - Energy enters as sunlight, exits as heat
  - Energy transformations follow the laws of thermodynamics
- Nutrients behave differently than energy - they cycle
  - Nutrients are regenerated and retained in the system, unlike energy



Global C cycle

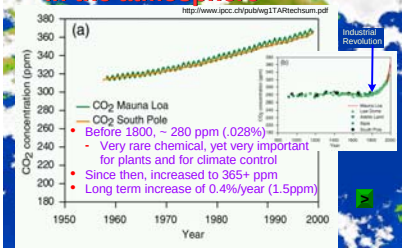
- Annual fluxes and pools in 10^{15} g
- Atmospheric pool:
  - Gains: 5+60+60+2+105=232
  - Losses: 120+107=227
- Residence time in atmosphere = 3 yr (high turnover, small pool)
- Most cycling is through CO_2



Summary of Carbon Cycle

- **Photosynthesis and Respiration are the major transfers in this cycle**
- **Most carbon is in rocks**
  - **Small pool of C in air (<1%), so even small changes in inputs can have large effects**
- **Inputs to atmosphere currently exceed outputs because of**
  - **Fossil fuel burning**
  - **Vegetation burning**
  - **Reduced primary productivity**

Increasing Carbon Dioxide in the atmosphere



- Before 1800, ~ 280 ppm (.028%)
  - Very rare chemical, yet very important for plants and for climate control
- Since then, increased to 365+ ppm
- Long term increase of 0.4%/year (1.5ppm)

Can't the cycle buffer this?

- **Net gain of 0.4%/year (1 billion tons)**
- **The inputs and outputs in the diagram we saw earlier predict an EVEN LARGER increase of 0.7% (5/700)**
- **Why are things better than expected? Where's the extra Carbon going?**

Where's the extra C going?

- Unknown "sinks" must be absorbing the excess
  - Ocean increases capacity?
  - Plants absorb more than thought?
  - Flows vary over time?
- How much these sinks absorb, for how long?
- Despite this unexpected help, there's still a net gain of C