

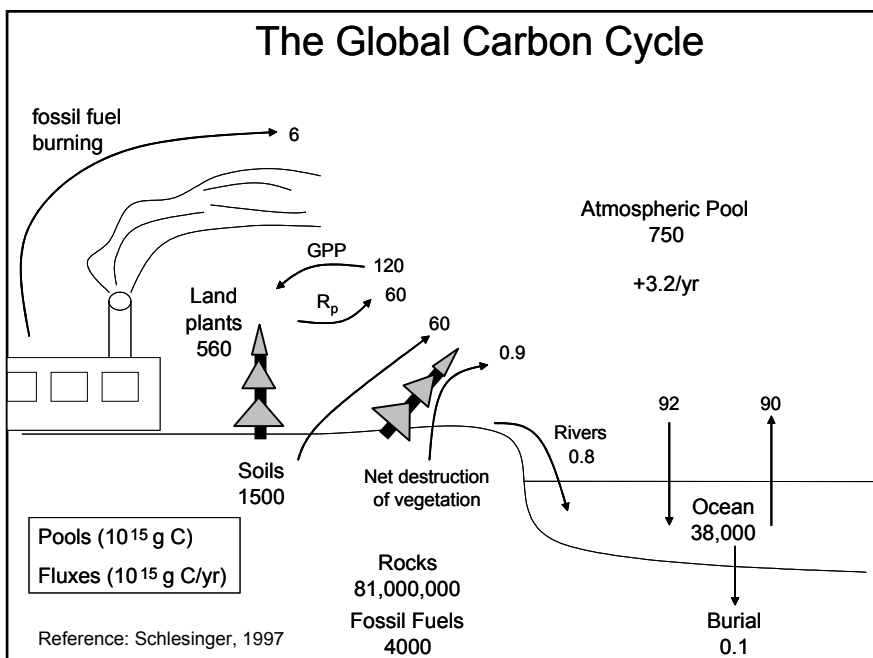
## Lecture 11 – Carbon Cycle

### READINGS FOR NEXT LECTURE:

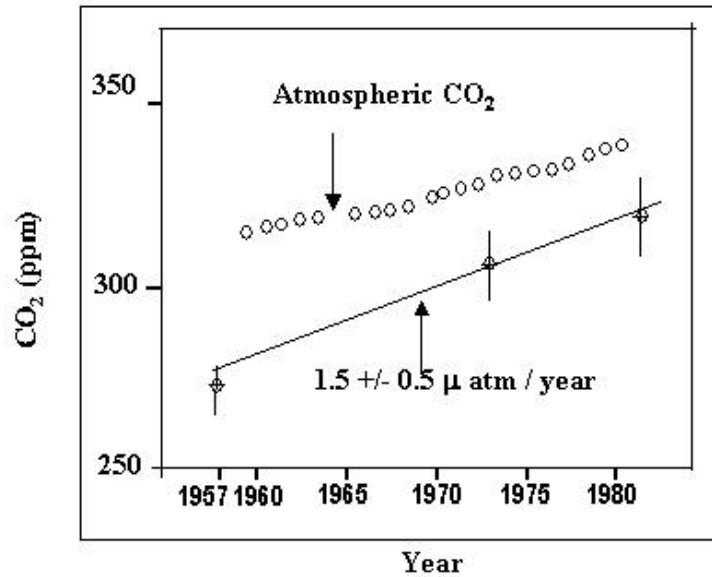
- Global climate change articles (handed out last class)
- Whitehouse D. 2003. Photosynthesis puzzle solved. BBC.  
<http://news.bbc.co.uk/2/hi/science/nature/3174582.stm>. accessed 10/10/03
- Bentley M. 2003. Synthetic trees could purify air. BBC.  
<http://news.bbc.co.uk/2/hi/science/nature/2784227.stm>. accessed 10/10/03

### Outline for today:

- I. Finish S cycle / Stable Isotope Analyses
- II. Global Carbon Cycle
  - A. C in the news
  - B. Global cycle
  - C. Carbon and temperature
  - D. Ecological effects of increasing CO<sub>2</sub>

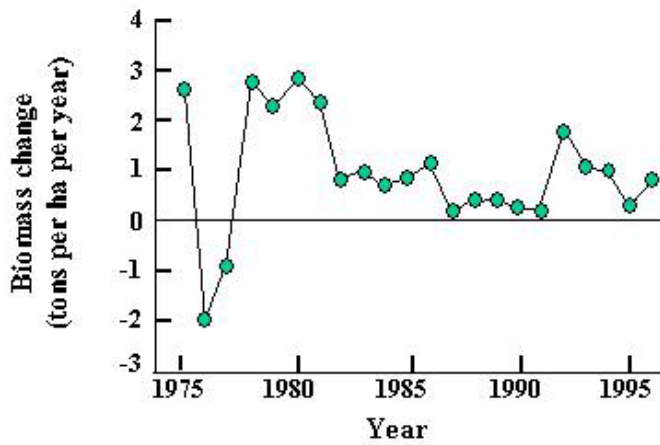


Measured changes in CO<sub>2</sub> dissolved on the surface of the Atlantic ocean.



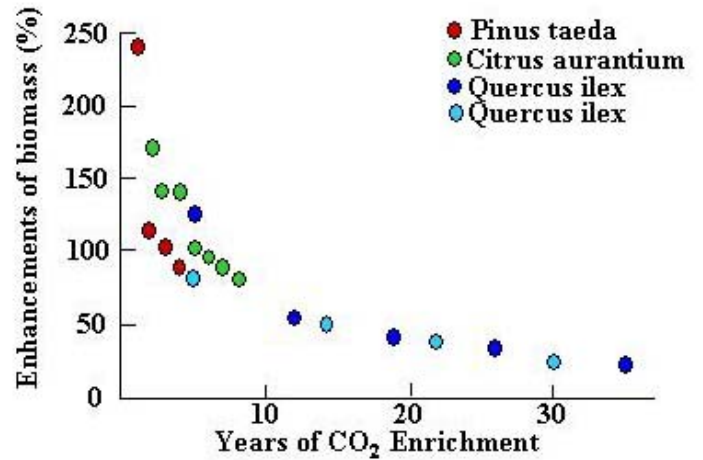
Adapted from: Schlesinger, 1997 (Figure 9.10)

Adapted from Krebs, Fig. 28.13

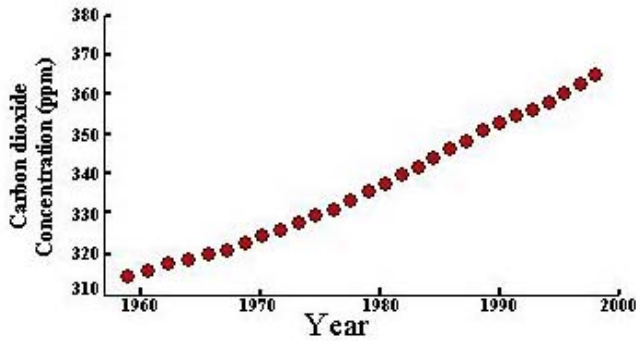


Adapted from Krebs, Fig. 28.11

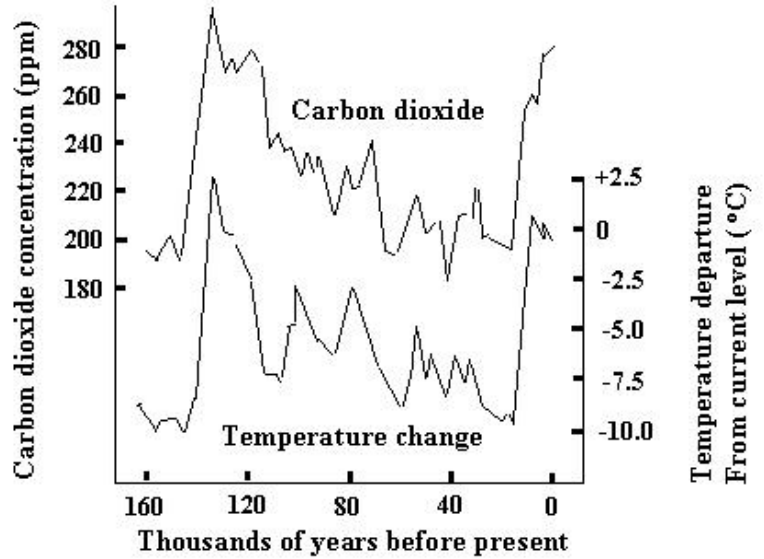
Trees from Arizona, North Carolina and Italy



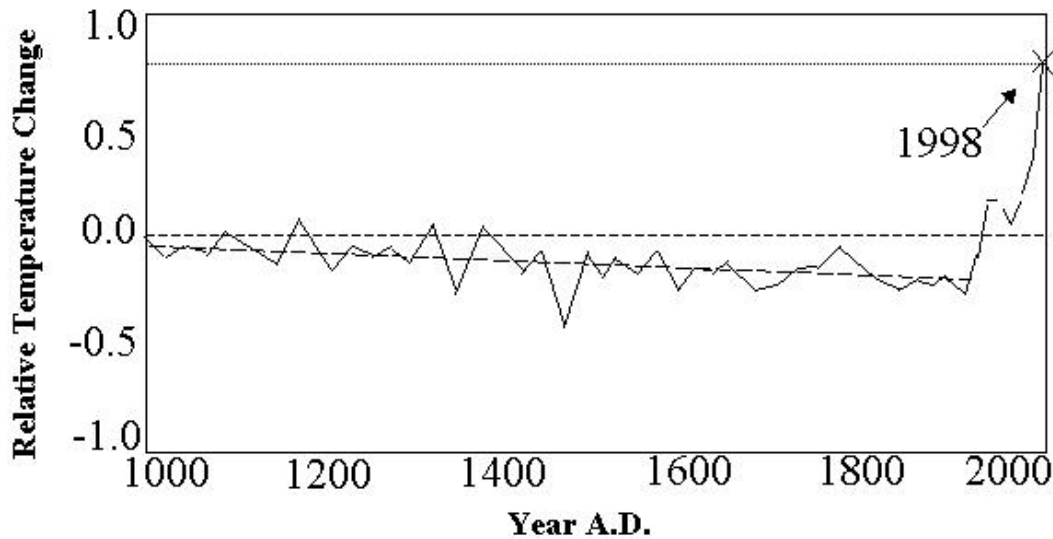
Concentration of CO<sub>2</sub> at Mauna Loa Observatory In Hawaii. Adapted from Krebs Fig 28.9.



Long-term variation in global temperature and atmospheric CO<sub>2</sub> concentration determined from the Vostok Ice Core, Antarctica. Adapted from Krebs. Fig. 28.15



Temperatures Relative to Millenial Average\*. Adapted from Mann et.al., 1999



\* 1998 and 2001 are the warmest years in 100 years

## It's not just CO<sub>2</sub>

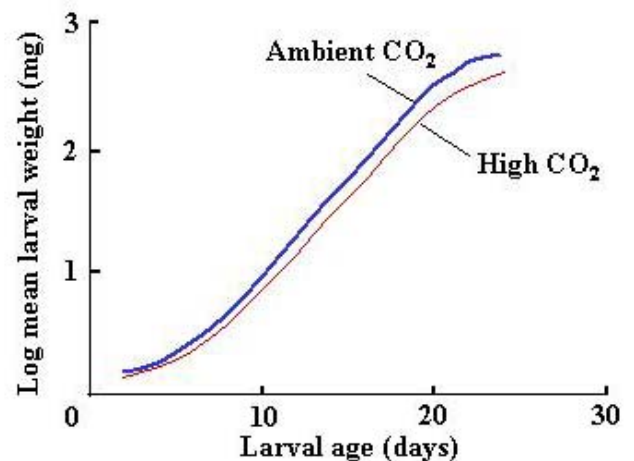
Gas	Atmospheric Concentration (ppm)	Annual Concentration Increase (%)	Relative greenhouse efficiency (CO <sub>2</sub> = 1)	Current Greenhouse Contribution (%)	Principal sources of gas
Carbon dioxide	351	0.4	1	57	Fossil fuels, deforestation
CFC's	0.00225	5	15 000	25	Foams, aerosols, solvents, refrigeration
Methane	1.675	1	25	12	Wetlands, rice, livestock, fossil fuels
Nitrous oxide	0.31	0.2	230	6	Fuels, fertilizer, deforestation

Source: Schlesinger, 1997

### Effects of increased CO<sub>2</sub> on Phytoplankton:

Riebesell U., et. al. "Reduced calcification of Marine phytoplankton in response to increased Atmospheric CO<sub>2</sub>. Nature **407**:364 (2000).

### Time variation of Larval weight (adapted from Krebs Fig. 28.17)



### Read:

AGNIESZKA BISKUP, "GET THE OCEANS SOME TUMS"

*Published on October 7, 2003, Boston Globe, Page C2 Col 2*

### Study questions

- What are the largest C reservoirs and fluxes in the environment?
- What do we mean by the "missing carbon"? Where is this "missing" carbon likely to be?
- How do temperate forests respond to elevated CO<sub>2</sub> after 1-5 years? 30 years?
- How can stable isotopes be used to determine temperature 1000s of years ago?
- By what mechanism do oceans primarily absorb CO<sub>2</sub>?