

Global Climate Change Discussion – 10/16/03

The dramatic increase in atmospheric CO₂ concentrations is alarming to many people. While reduction in emissions is the obvious solution, some people are proposing more immediate actions to reduce the amount of CO₂ in the atmosphere. Some proposed ideas are iron-fertilization, deep-sea injection of CO₂ and carbon sequestration in terrestrial plants. There is also a lot of debate about whether increasing CO₂ concentrations will lead to greater terrestrial and aquatic productivity, which could serve as a feedback mechanism to absorb some of the extra atmospheric CO₂.

We're going to spend a lecture evaluating these topics. To make the discussion more informative, I've assigned some readings pertinent to each topic. Each person is responsible for reading one set of articles. You should be prepared to talk about the answers to the questions below, drawing on the major points of the below articles and any other information you find (these articles were some that I found briefly searching through *Nature & Science*).

When you get to class, you will break into groups, share your answers to the questions, and prepare to explain your topic to the class.

As you read these articles, keep the following questions in mind:

- What is the rationale behind each approach? How will this approach work to reduce atmospheric CO₂?
- In which compartment of the environment will the C be stored? What is the MRT?
- Can it work in the short-run? In the long-run?
- What are other effects besides decreasing atmospheric CO₂?
- What are the major uncertainties?
- Overall, do you think it's a good idea? Would your answer be different if you lived in Holland or on a tiny island barely above sea level?

Everyone (focus on pages 422-426A)

Betts KS. 2000. Engineering maintainable development. *Environmental Science and Technology*. **34**:422A.

1. Ecological responses to high CO₂ concentrations (*Adrienne, April, Ayse, Ben, Candace, Cynthia*)

Norby R. 1997. Inside the black box. *Nature*. **388**:522.

Sarmiento J. 2000. That sinking feeling. *Nature*. **408**:155.

Schlesinger WH and JH Lichter. 2001. Limited carbon storage in soil and litter of experimental forest plots under increased atmospheric CO₂. *Nature*. **411**:466.

DeLucia EH. 1999. Net primary productivity of a forest ecosystem with experimental CO₂ enrichment. *Science*. **284**:1177.

Gill RA *et al.* 2002. Nonlinear grassland responses to past and future atmospheric CO₂. *Nature*. **417**:279.

2. Deep-Sea or Mineral Injection of CO₂ (*Genevieve, Helen, Jason, Jennifer, Jessie, Jonathon, Katie*)

Dalton R. 1999. US warms to carbon sequestration research. *Nature*. **401**:315.

Kaiser J. 1998. A way to make CO₂ go away: Deep-six it. *Science*. **281**:505.

Seibel BA and PJ Walsh. 2001. Potential impacts of CO₂ injection on deep-sea biota. *Science*. **294**:319.

Celia MA. 2001. How hydrogeology can save the world. *Ground Water*.

Caldeira K and ME Wickett. 2003. Anthropogenic carbon and ocean pH. *Nature*. **425**:365.

Lackner KS. 2003. A guide to CO₂ sequestration. *Science*. **300**:1677.

3. C sequestration in terrestrial systems (*Kelly, Ling, Liz, Lynn, Marion, Maywa, Melissa*)

Smaglik P. 2000. United States backs soil strategy in fight against global warming. *Nature*. **406**:549.

Körner C. 2003. Slow in, rapid out – carbon flux studies and Kyoto targets. *Science*. **300**:1242.

Goodale CL and EA Davidson. 2002. Uncertain sinks in the shrubs. *Nature*. **418**:593.

Betts RA. 2000. Offset of the potential carbon sink from boreal forestation by decreases in surface albedo. *Nature*. **408**:187.

Fang J *et al.* 2001. Changes in forest biomass carbon storage in China between 1949 and 1998. *Science*. **292**:2320.

4. Iron Fertilization of Open Oceans (*Michael, Nicole, Nina, Priya, Schuyler, Tom*)

Buesseler KO and PW Boyd. 2003. Will ocean fertilization work? *Science*. **300**:67.

Chisholm SW, PG Falkowski, and JJ Cullen. 2001. Dis-crediting ocean fertilization. *Science*. **294**:309.

Watson AJ *et al.* 2000. Effect of iron supply on Southern Ocean CO₂ uptake and implications for glacial atmospheric CO₂. *Nature*. **407**:730.

Lawrence MG. 2002. Side effect of oceanic iron fertilization. *Science*. **297**:1993.

Lam PJ and SW Chisholm. 2002. Iron fertilization of the oceans: Reconciling commercial claims with published models. <http://web.mit.edu/chisholm/www/Fefert.pdf>. accessed 10/8/03.