

The End of Nature

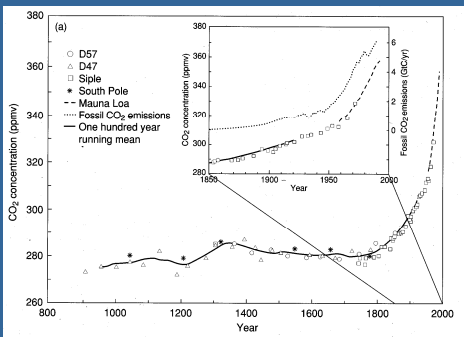
“... any clear dichotomy between pristine ecosystems and human-altered areas that may have existed in the past has vanished ...”

Peter Vitousek 1994

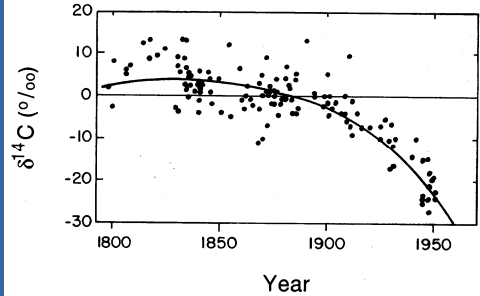
Global Change is More Than Global Warming

- Changes in global nutrient cycles
- Land-use change
- Loss of biodiversity
- Stratospheric ozone depletion
- Changing atmospheric composition
- Climate change
- Changing atmospheric chemistry

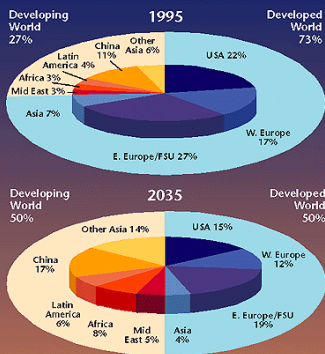
CO₂ Concentrations Have Increased



CO₂ Has Increased Primarily from Fossil Fuel Burning

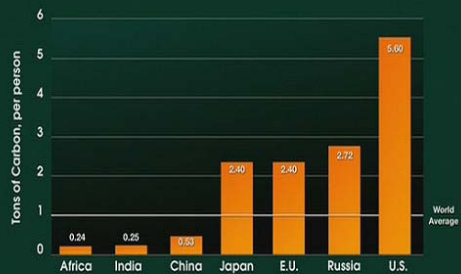


Total World Emissions

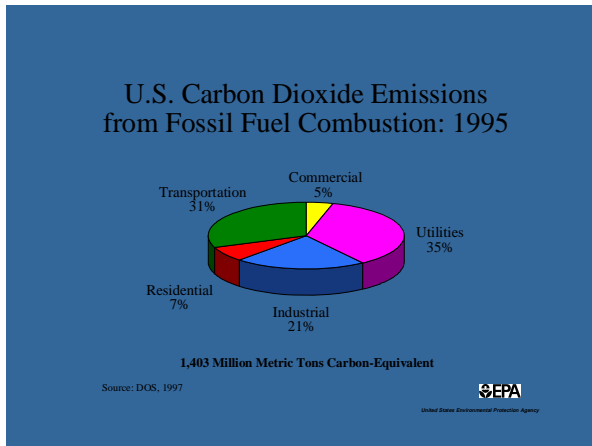


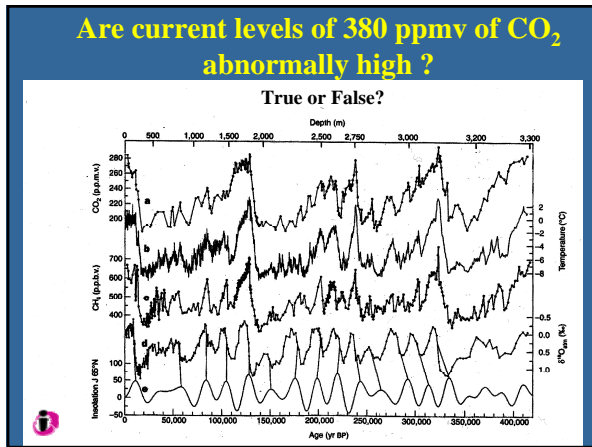
1995 total emissions is 6.46 billion tons CO₂; in 2035 total emissions is estimated to be 11.71 billion tons CO₂

Carbon Emissions Per Person

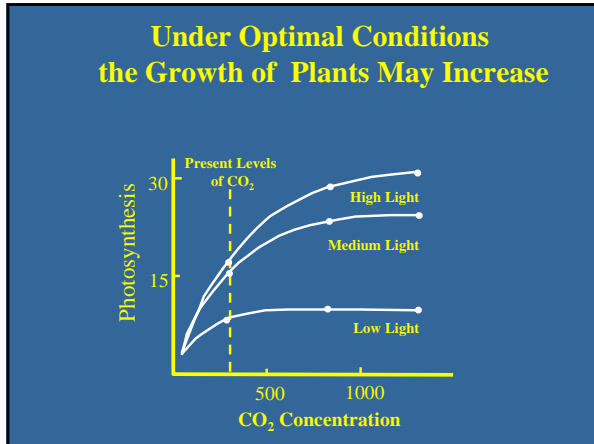


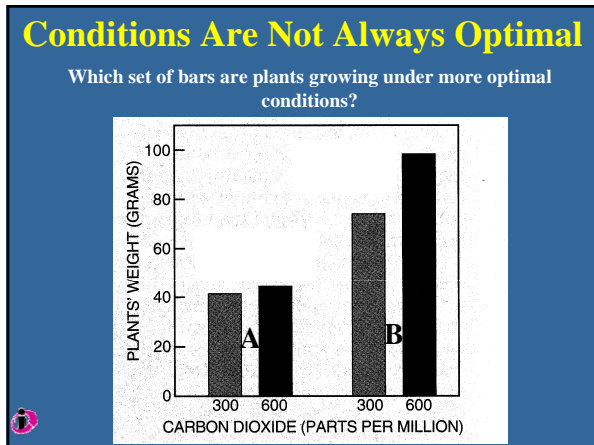
Source: World Resources Institute
Underlying data source: U.S. DOE, Energy Information Administration, International Energy Annual 1999.
Note: Shows carbon emissions associated with fossil fuel combustion.

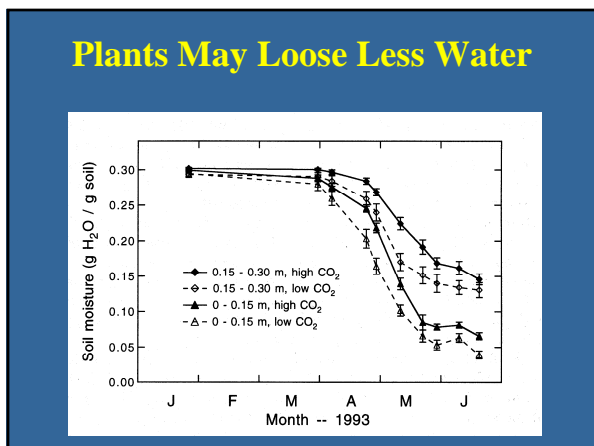




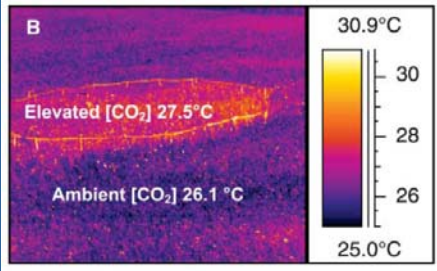
So What ?



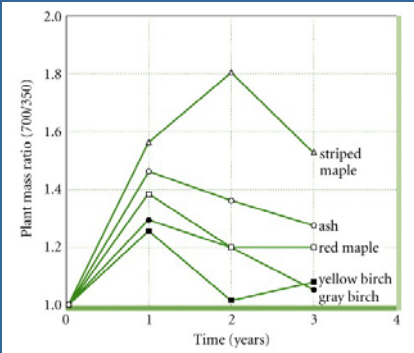




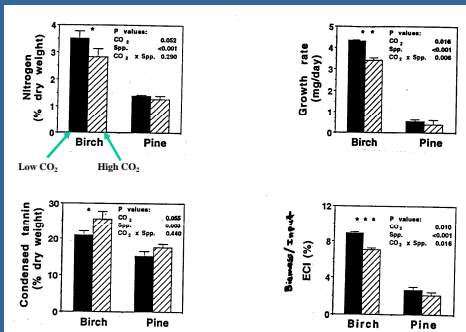
What is causing the difference shown here?

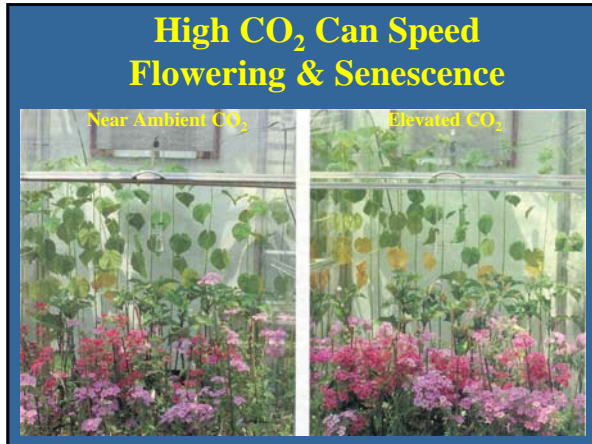


Effects May Change Over Time And Be Species Specific



Changes in Tissue Composition Could Effect Herbivory





Recent Discoveries

Poison ivy may grow more & become itchier

Causes ~350,000 cases of contact dermatitis per year.

The higher the ratio, the more allergenic urushiol is to humans

Fig. 2 Mean production increases standardized by dividing by the initial year amount in 1999 ($n = 30$ linear data points) \pm SE. The rate of increase is greater at elevated CO₂ ($P = 0.0003$ in a repeated-measures analysis).

Mohan et al. 2006

The effects may be something to sneeze at!

Production of allergenic pollen by ragweed (*Ambrosia artemisiifolia* L.) is increased in CO₂-enriched atmospheres

Peter Wayne, PhD¹; Sumanth Foster, BS²; John Connolly, PhD²; Fakhr Bazzaz, PhD²; and Paul Epstein, MD¹

Annals of Allergy, Asthma and Immunology 2002;8:279-282.

Background: The potential effects of global climate change on allergenic pollen production are still poorly understood.

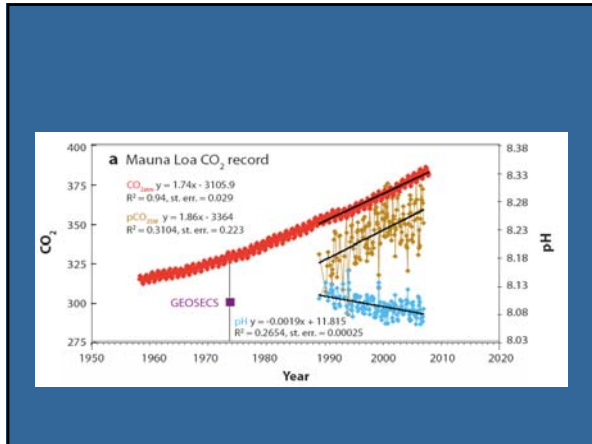
Objective: To study the direct impact of rising atmospheric CO₂ concentrations on ragweed (*Ambrosia artemisiifolia* L.) pollen production and growth.

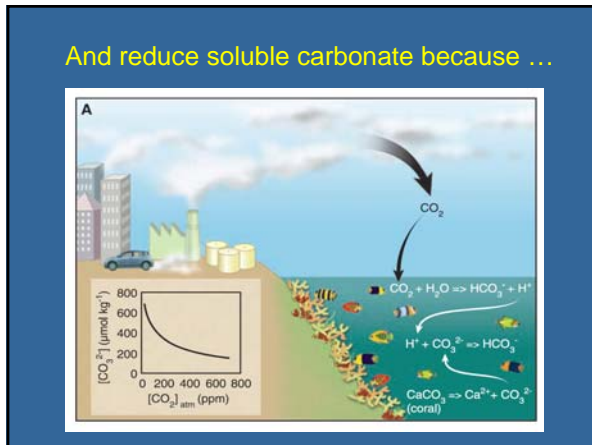
Methods: In environmentally controlled greenhouses, stands of ragweed plants were grown from seed through flowering stages at both ambient and twice-ambient CO₂ levels (350 vs 700 µL L⁻¹). Outcome measures included stand-level total pollen production and end-of-season measures of plant mass, height, and seed production.

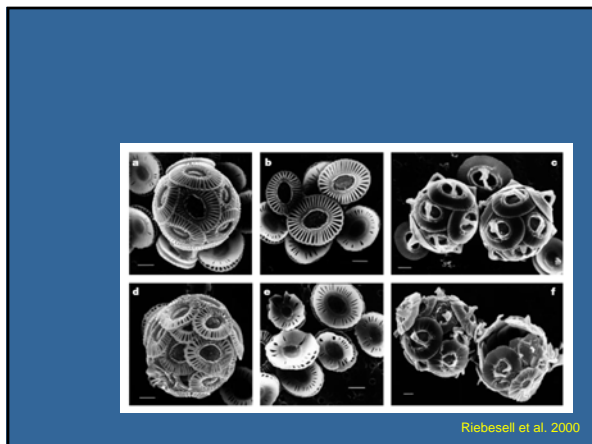
Results: A doubling of the atmospheric CO₂ concentration stimulated ragweed pollen production by 61% ($P < 0.005$).

Conclusions: These results suggest that there may be significant increases in exposure to allergenic pollen under the present scenarios of global warming. Further studies may enable public health groups to more accurately evaluate the future risks of hay fever and respiratory diseases (eg, asthma) exacerbated by allergenic pollen, and to develop strategies to mitigate them.

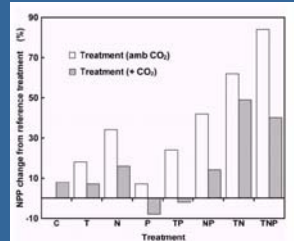
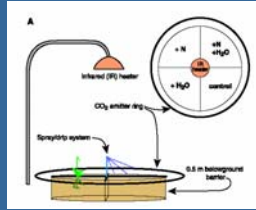
Annals of Allergy, Asthma, & Immunology ©2002;88:279-282.







Interactive Effects Can Lead to Unexpected Changes



Article # 6 Shaw et al 2002
