Third Symposium on Greenhouse Gases and Carbon Sequestration in Agriculture and Forestry

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Complications for Carbon Uptake

1. Geographical and management dependence of carbon uptake
2. Weather/climate effects on carbon uptake
3. Pollution policy interactions and effects on carbon uptake.
4. Permafrost, methane, carbon, and warming

Leads to Some "Rules" for Good Sinks Policy

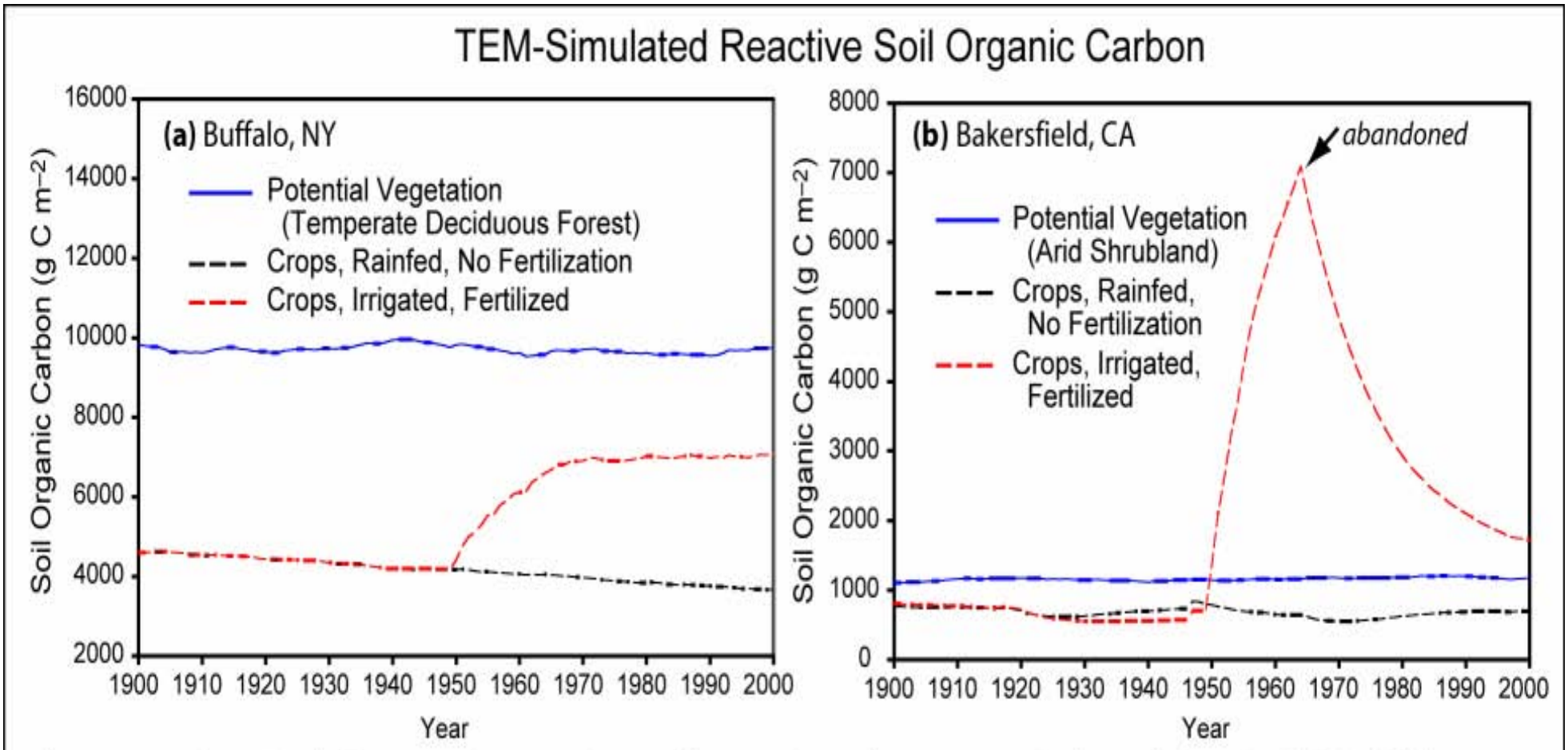
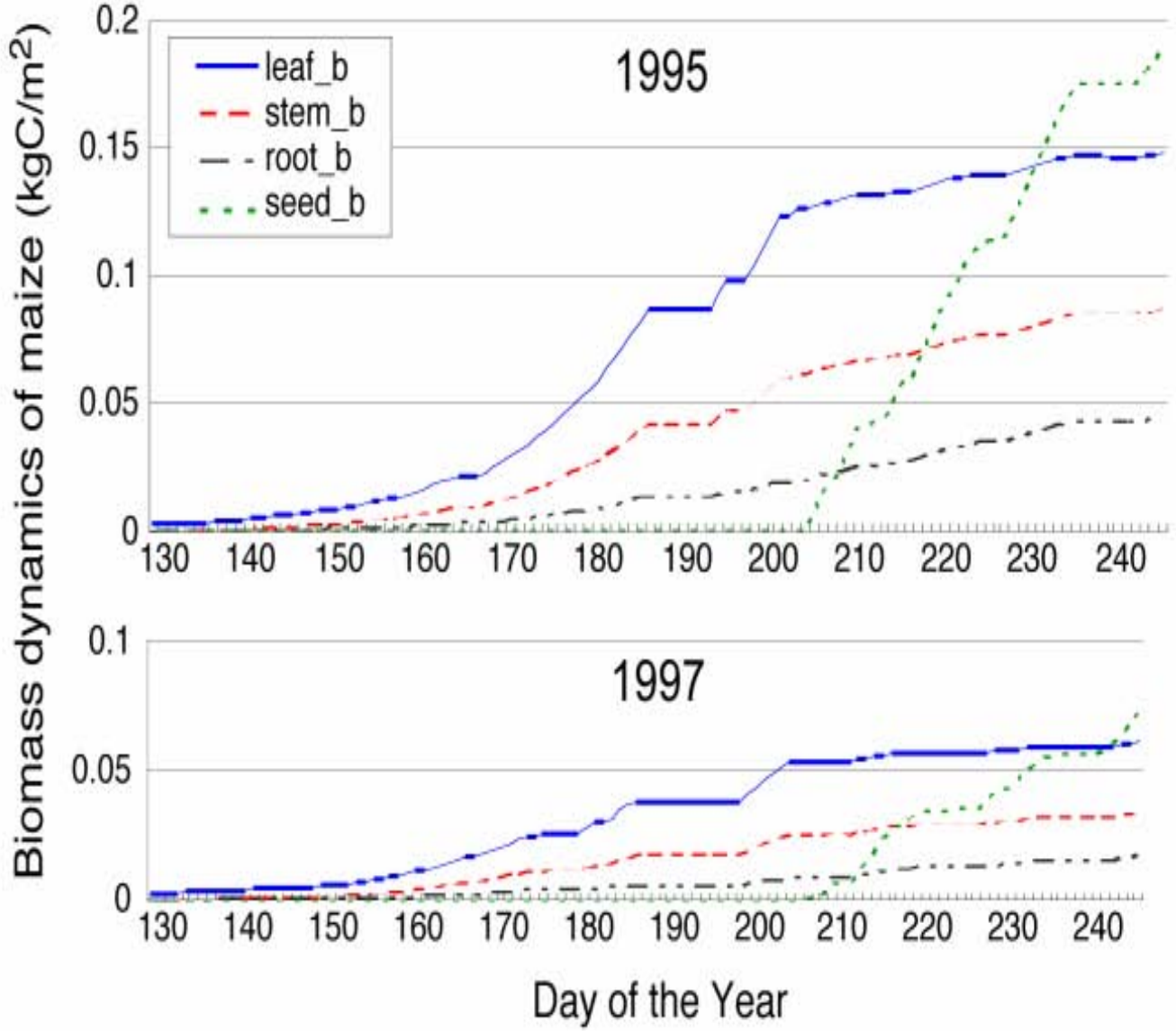


Figure 1. Historical changes in reactive soil organic carbon at agricultural sites in **(a)** Buffalo, New York, and **(b)** Bakerfield, California, under three management scenarios. Please note that fertilizer application did not occur until 1950 in the fertilized scenario and that cropland at the Bakersfield site was abandoned in 1965.

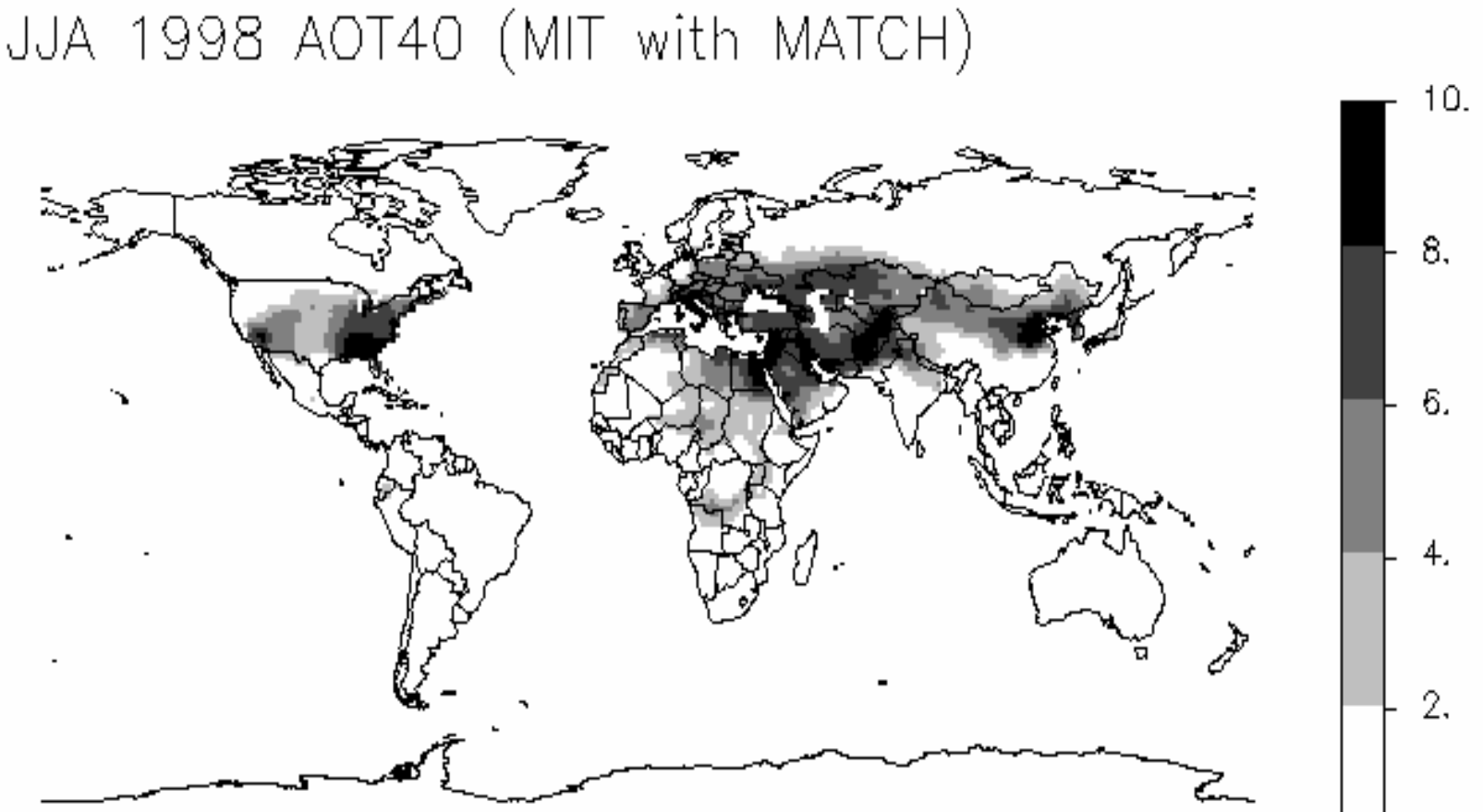
Preliminary Results: Jerry Melillo, David Kicklighter, Benjamin Felzer, MBL:
Acknowledging Francesco Tubiello and Cynthia Rosenzweig (GISS) and NOAA (NA16gp2290) funding of joint GISS, MBL, MIT, IIASA project.

Figure 3. Simulated carbon allocation among major plant parts from TEM's new agricultural ecosystem module for maize grown at a site in Northeastern China (117˚12' W 39˚06' N). Actual daily climate data for 1995 (wet) and 1997 (dry) years were used in the simulations.



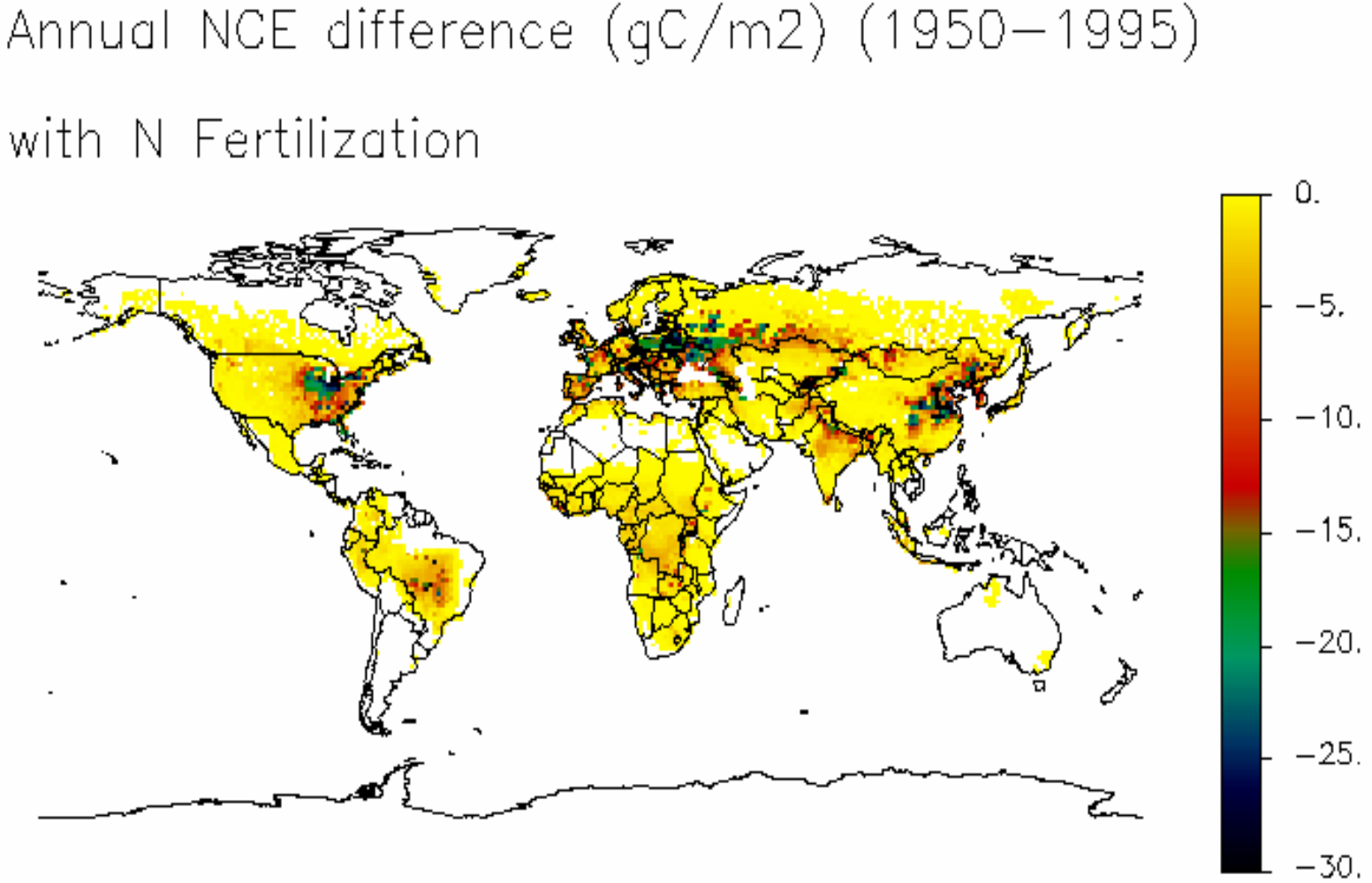
Preliminary Results: Hanqin Tian (Auburn University) Jerry Melillo, David Kicklighter, Benjamin Felzer (Marine Biological Laboratory). NSF (BCS-0410344) and other funding.

Current Ozone Levels (AOT40)



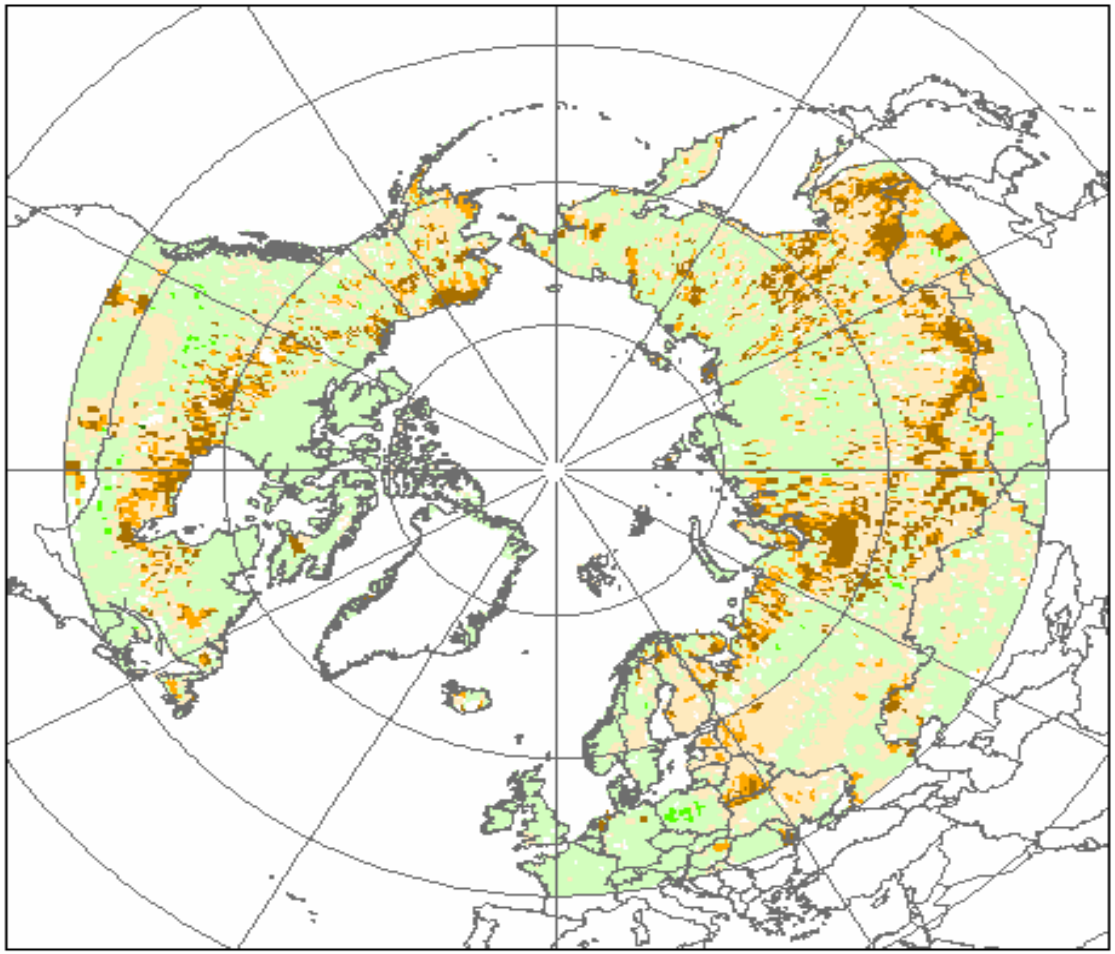
Felzer, B., Reilly, J., Melillo, J., Kicklighter, D., Wang, C., Prinn, R., Sarofim, M. & Zhuang, Q., 2004. Past and future effects of ozone on net primary production and carbon sequestration using a global biogeochemical model, Climatic Change, forthcoming.

Effects of Ozone on Carbon Uptake by Vegetation



Felzer, B., et al., 2004. op cit.

Pan-Arctic Greenhouse Gas Budget for the 1990s



Sink **(g CO_2-eq. m^{-2} yr^{-1})** **Source**

GHG Sources
2.1 Pg CO_2-eq. yr^{-1}

Source: Q. Zhuang. 2004, Methane Fluxes Between Terrestrial Ecosystems and the Atmosphere at Northern High Latitudes During the Past Century: A Retrospective Analysis with a Process-Based Biogeochemistry Model Global Cycles

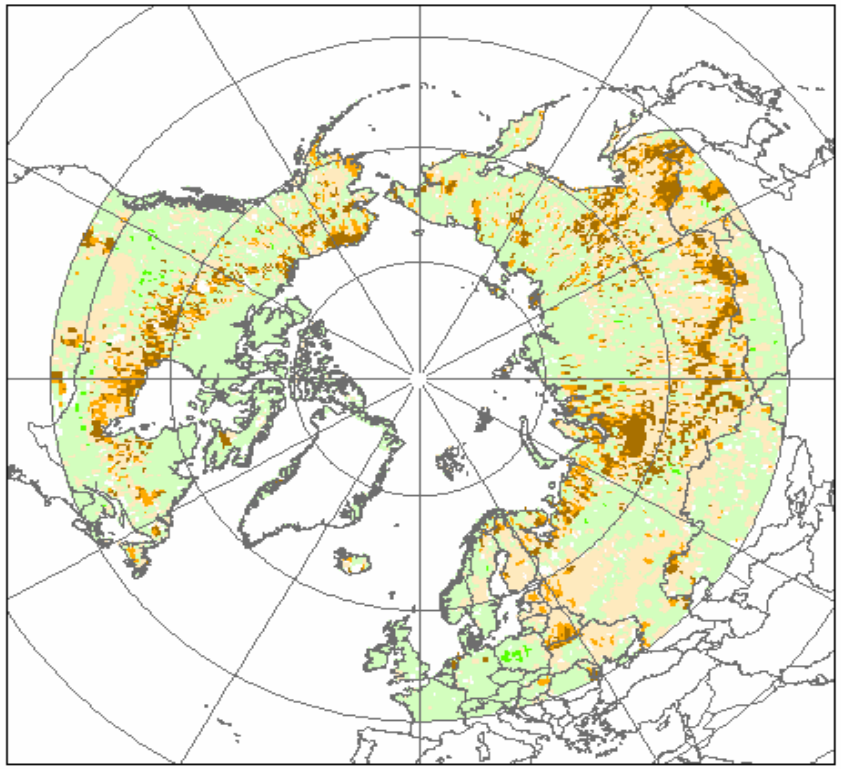
Biogeochemical 18: GB3010

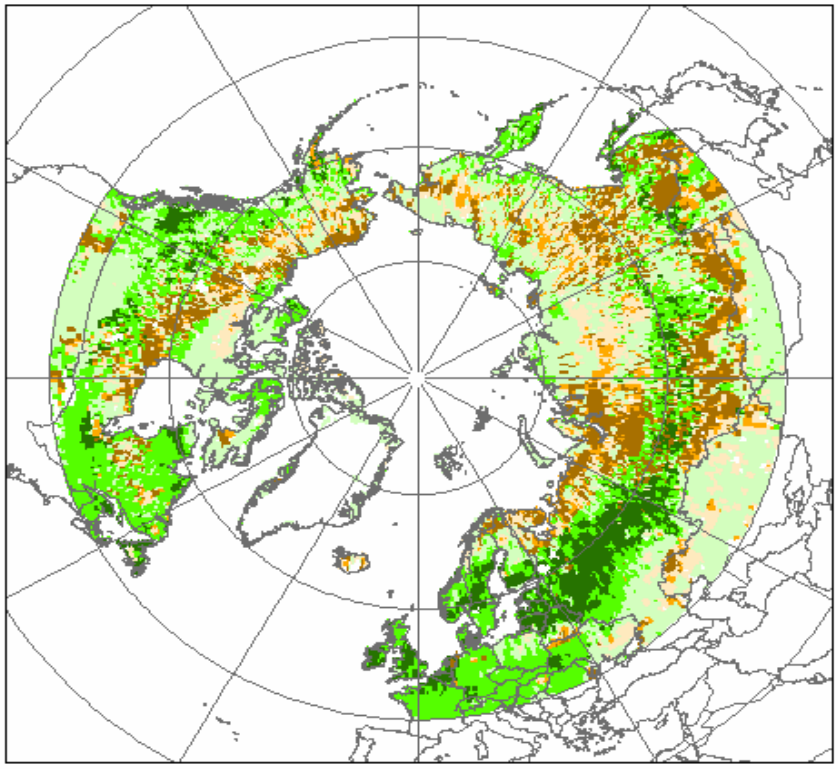
1990s:

Source 2.1 Pg CO2-eq.yr-1

2090s:

Source 0.4 Pg CO2-eq.yr-1





Sink (g CO_2-eq. m^{-2} yr^{-1}) Source

Rules for Good Sinks Policy

1. Cap NOT Credit (or mandatory baseline if C tax or other instrument)
   - Opt in choice for small land-owners

2. Sell as you sequester, pay as you emit—NO payment for 'discounted' tons.
   - By public agency—contractual deals among private market participants can take any form as long as..

3. Measured quantities NOT payments based on practices.

   - Sequestration very different for same practice depending on location, climate, etc.

Rules for Good Sinks Policy, cont.

4. Permanent liability—once capped, always under cap.
   - But preserve flexibility to emit stored carbon by paying carbon price at the time.

5. Transactions costs (I.e. measurement, verification) borne by the market participants NOT a public Agency
   - symmetric treatment with fossil fuel emitters

6. Enforcement

7. Allow market participants to bank credits for disasters, less than expected results from sequestration NO bailouts or limited liability provisions.

8. Pay for the 'partial interest' of GHG emissions sequestration-DO NOT make a big program based on multiple benefits—value and incentivize each benefit separately.