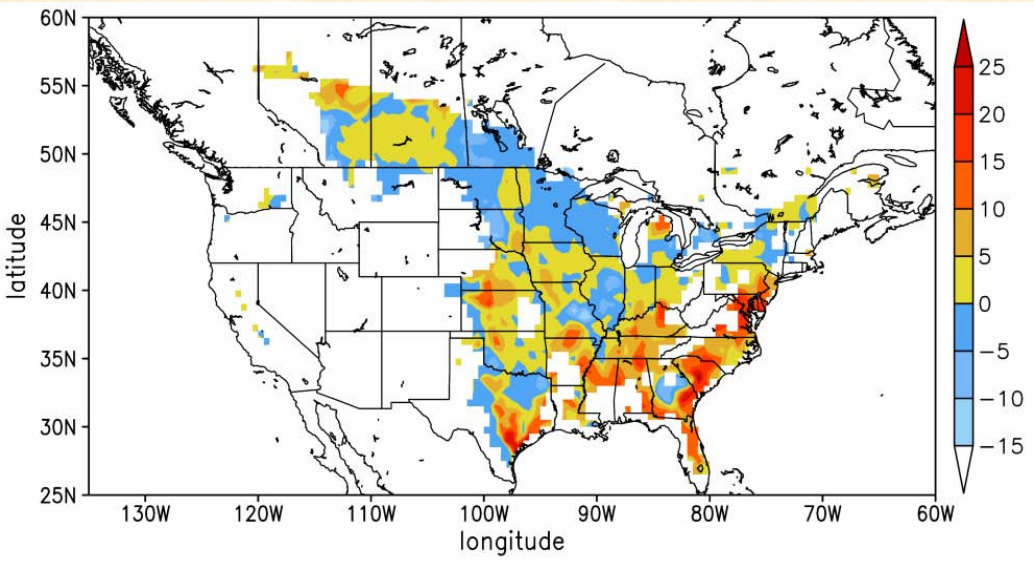
Estimating the impact of recent climate change on soil carbon sequestration

Contact: Tris West, *westto@ornl.gov*, 865-574-7322

- Field experiments indicate that changes in climate will impact soil carbon stocks differently depending on the soil and regional climate.
- We coupled estimates of potential soil carbon change with an Integrated Assessment model to look at the impact of recently observed climate change on soil carbon sequestration activities
- Results indicate approximately 5% of soil carbon sequestered from no-till cropping practices in the U.S. and Canada is due to recent changes in climate.
- Modeling enables estimates of where soil C sequestration may be augmented or lessened due to climate change, as shown in the adjacent figure.



Positive and negative values (in %) indicate an increase or decrease, respectively, in soil C sequestration occurring between 1981-2000.

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DOE/SC/BER - Integrated Assessment, Carbon Sequestration, and Terrestrial Carbon Programs

The prediction of changes in carbon stocks and fluxes due to human activites is complicated by changing climate. Integrating potential carbon sequestration dynamics into the Integrated Science Assessment Model (ISAM), a coupled climate-biosphere-ocean model, allows for (a) estimates of climate change impacts on sequestration activities and (b) the separation of changes in carbon stocks occuring from purposefully implemented sequestration strategies from changes occurring due to regional weather patterns and climate change. Changes in soil carbon following a change to no-till in croplands was incorporated into the terrestrial component of ISAM. Results indicate that 5% of the soil carbon sequestered from no-till activities between 1980-2000 was caused by changes in climate. The extent to which soil C sequestration was augmented or lessened is due to soil attributes and feedbacks between climate and biophysical variables (e.g., temperature, soil moisture, decomposition rates, and changes in crop yields and residue production). Model results also indicate that an additional 3% of soil carbon accumulation in 2000 was due to previous changes in land cover (e.g., conversion of cropland to forest).

Reference: Jain, A.K., T.O. West, X. Yang, and W.M. Post. 2005. Assessing the Impact of Changes in Climate and CO_2 on Potential Carbon Sequestration in Agricultural Soils. Geophysical Research Letters 32, L19711, doi:10.1029/2005GL023922.