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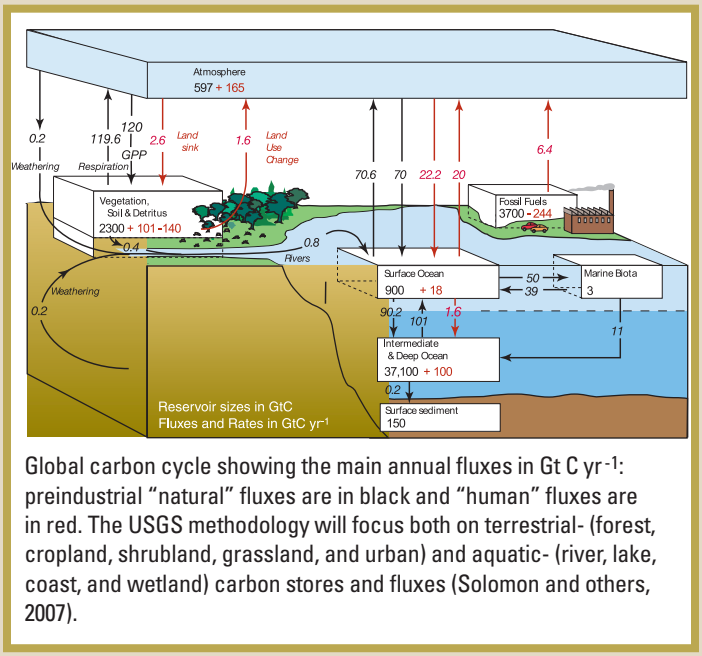
U.S. Geological Survey Methodology Development for Ecological Carbon Assessment and Monitoring

Ecological carbon sequestration refers to transfer and storage of atmospheric carbon in vegetation, soils, and aquatic environments to help offset the net increase from carbon emissions. Understanding capacities, associated opportunities, and risks of vegetated ecosystems to sequester carbon provides science information to support formulation of policies governing climate change mitigation, adaptation, and land-management strategies. Section 712 of the Energy Independence and Security Act (EISA) of 2007 mandates the Department of the Interior to develop a methodology and assess the capacity of our nation's ecosystems for ecological carbon sequestration and greenhouse gas (GHG) flux mitigation. The U.S. Geological Survey (USGS) LandCarbon Project is responding to the Department of Interior's request to develop a methodology that meets specific EISA requirements.

U.S. Geological Survey Response to EISA

The project approach is to use the best science and available data, leverage existing capabilities, and follow established science practices to deliver a validated and peer-reviewed methodology. In meeting the legislative requirements, the USGS relies on an interagency and interdisciplinary science team with expertise in ecosystem ecology, aquatic ecology, biogeochemical cycles and modeling, land-use change modeling, ecosystem-disturbance modeling, economic and policy analysis, remote sensing, and statistics.

The project team consults the scientific community and partner Federal agencies (for example, U.S. Department of Agriculture, Environmental Protection Agency, Department of Energy, and the National Oceanic and Atmospheric Administration). The team also collaborates with both governmental and nongovernmental organizations. A draft of the methodology will be delivered by summer 2010.



Global carbon cycle showing the main annual fluxes in Gt C yr^{-1}: preindustrial "natural" fluxes are in black and "human" fluxes are in red. The USGS methodology will focus both on terrestrial- (forest, cropland, shrubland, grassland, and urban) and aquatic- (river, lake, coast, and wetland) carbon stores and fluxes (Solomon and others, 2007).

Requirements of EISA

In response to requirements of EISA Section 712 the USGS is developing a methodology to:

- Assess the nation's ecosystems for carbon stocks and rates of sequestration under baseline and potential climate, policy, and land-management scenarios.
- Assess the nation's ecosystems for fluxes of three GHGs: carbon dioxide, nitrous oxide, and methane under baseline and potential climate, policy, and land-management scenarios.
- Provide science data to inform development of ecosystem mitigation and adaptation strategies.
- Address land-use changes, effects of disturbances such as wildland fires, and monitoring needs.

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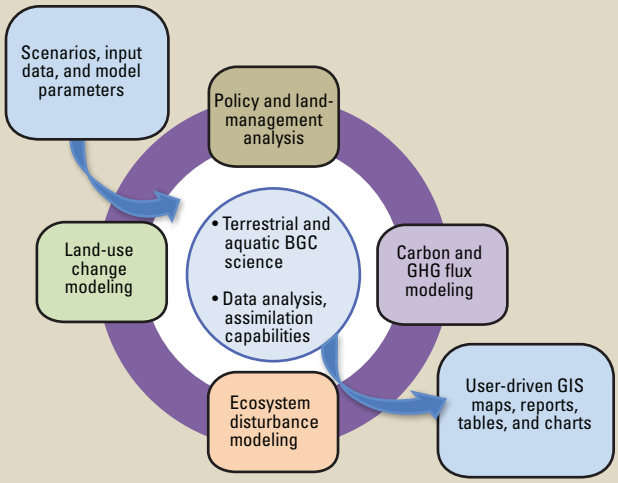
Major Elements of the Methodology

The USGS LandCarbon project team is developing an operational methodology to provide a comprehensive national assessment of baseline and potential carbon pools and GHG fluxes. To accomplish this task, the team will:

- Define ecosystem-reporting units for the national assessment. Baseline and potential carbon-sequestration characteristics and GHG fluxes for major vegetation types will be summarized within the reporting units.
- Use Intergovernmental Panel on Climate Change future climate trajectories and scenarios to define and model baseline and potential carbon sequestration and GHG fluxes.
- Develop and refine spatially explicit land- and ecosystem-simulation models as well as statistical methods to produce carbon and GHG estimates.
- Develop and refine data assimilation methods that integrate remotely sensed data and information from national inventory programs and flux towers with modeled data to improve consistency and accuracy of results.
- Define ecosystem monitoring goals and plans to ensure that policy makers and land managers are informed of ecological integrity of the nation's lands, including but not limited to ecosystem carbon sequestration capacities, other ecosystem services, and potential ecological risks.



The USGS LandCarbon methodology framework showing the main inputs, models and analysis, and products: "BGC" refers to biogeochemical cycles and "GIS" refers to geographic information systems.

Reference Cited

Solomon, S., Qin, D., Manning, M., Chen, Z., Marquis, M., Averyt, K.B., Tignor, M., and Miller, H.L., eds., 2007, Climate change 2007: The physical science basis—Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change: Cambridge, Cambridge University Press, 996 p., accessed November 16, 2009, at *http://www.ipcc.ch/publications_and_data/publications_ipcc_fourth_assessment_report_wg1_report_the_physical_science_basis.htm.*

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