Highlights

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Soil Carbon Sequestration in Grazinglands: Societal Benefits and Policy Implications

Ronald F. Follett and Debbie A. Reed

Sequestration of soil organic carbon in grazinglands provides important societal benefits and is potentially influenced by existing and future policies and legislation. USDA conservation and farmland protection and restoration programs and climate change policies for grazinglands that encourage retention and enhancement of grazingland soil carbon stocks are discussed. Planning efforts to improve rangeland management can have greater impact if done at the watershed, state, or local level and with active participation by land managers and owners. Important opportunities exist to sequester soil carbon in grazingland soils if mandatory reductions are included in future greenhouse gas emissions strategies.

Productivity, Respiration, and Light-Response Parameters of World Grassland and Agro-Ecosystems Derived From Flux-Tower Measurements

Tagir G. Gilmanov, L. Aires, Z. Barcza, V. S. Baron, L. Belelli, J. Beringer, D. Billesbach, D. Bonal, J. Bradford, E. Ceschia, D. Cook, C. Corradi, A. Frank, D. Gianelle, C. Gimeno, T. Gruenwald, Haiqiang Guo, N. Hanan, L. Haszpra, J. Heilman, A. Jacobs, D. A. Johnson, M. B. Jones, G. Kiely, Shenggong Li, V. Magliulo, E. Moors, Z. Nagy, M. Nasyrov, C. Owensby, K. Pinter, C. Pio, M. Reichstein, M. J. Sanz, R. Scott, J.-F. Soussana, P. C. Stoy, T. Svejcar, Z. Tuba, and Guangsheng Zhou

The role of grasslands, wetlands, and agroecosystems as sinks or sources for atmospheric CO_2 remains uncertain. Data from 118 global flux-tower sites (316 site-years) partitioned into gross photosynthesis and ecosystem respiration using light–temperature response methods were analyzed. On average, 80% of the sites were apparent sinks for atmospheric CO_2, with mean net uptake of 700 g $CO_2 \cdot m^{-2} \cdot yr^{-1}$ for intensive grasslands and 933 g $CO_2 \cdot m^{-2} \cdot yr^{-1}$ for croplands. However, part of these sinks is accumulated in crops and forage and harvested, transported, and decomposed in off-site carbon pools, so that these ecosystems are not necessarily increasing their carbon stock.

Climate-Driven Interannual Variability in Net Ecosystem Exchange in the Northern Great Plains Grasslands

Li Zhang, Bruce K. Wylie, Lei Ji, Tagir G. Gilmanov, and Larry L. Tieszen

There have been few long-term studies investigating interannual variability in carbon exchange and its responses to climatic change across Northern Great Plains grasslands. A model based on remotely sensed data was developed and run to achieve synoptic estimates of the variability in carbon exchange. Estimates characterize both temporal dynamics and geographic patterns of sink and source activity. Our study shows that Northern Great Plains grasslands were a weak carbon source during 2000–2006, which included three drought-affected years. The quantitative analysis provides insights into how this grassland ecosystem will respond to future climate under a variety of environmental conditions.

New Parameterization of a Global Vegetation Model for Steppe Ecosystem From Southern Siberian In Situ Measurements

Nicolas Vuichard, Philippe Ciais, Luca Belelli-Marchesini, and Riccardo Valentini

Global vegetation models need to be carefully compared with multiple-scale observations in order to ensure they provide accurate large-scale estimates of carbon, water, and