AAEA American Agricultural Economics Association

Meeting: 2004 AAEA Annual Meeting

Tracking Id: 119157

Abstract Type: Poster

Status: Accepted

Author: David Archer (AAEA)
Agricultural Research Service (ARS) - Midwest Area
803 Iowa Ave.
Morris, MN United States 56267
Entered By, Primary Author, Presenting Author

Alan Olness (Other (Co-Author))
Agricultural Research Service (ARS) - Midwest Area
803 Iowa Ave.
Morris, MN United States 56267
Co-author

Title: Valuation of Soil Organic Carbon as a Drought Mitigation Tool

Text: **Summary**

There has been considerable research in recent years related to policies aimed at sequestering carbon in agricultural soils and identifying the incentives necessary to encourage producers to adopt carbon sequestering practices (Antle et al.; McCarl and Schneider 2000; McCarl and Schneider 2001; Pautsch et al.). However, there has been more limited analysis of the incentives that producers may already have to preserve soil organic carbon through its effect on crop productivity (Smith et al. 2000; Burt, 1981). These analyses have typically focused on optimum management based on the dynamics of soil attributes. While this interaction is important, another approach is to focus on the direct impact of soil organic carbon on crop productivity holding management constant. This approach provides greater insight into the value of the resource independent of the costs needed to maintain the resource.

Soil organic carbon has many functions in the soil. Perhaps one of the most important functions as related to crop production is its effect on plant available water capacity. While the effect of organic carbon on available water varies with soil texture, generally available water capacity increases with increased organic carbon (Hudson; Rawls et al.; Olness and Archer). While increased available water capacity has clear benefits to crop production in arid regions, it may also benefit crop production in regions where water is not typically limiting.

A crop simulation modeling approach was used with Soil Survey Geographic Database (SSURGO) soils data to quantify the effect of soil organic carbon on corn and soybean production for soils in the northern Corn Belt. Model output showed the potential response of crop yields to increased soil organic carbon under varying weather conditions. Simulation results were integrated with land use maps to estimate potential county-wide impacts of increased soil organic carbon on crop productivity under varying weather conditions. Distributions of yield responses under varying weather conditions for contrasting soil types illustrate differences in the value of organic carbon in mitigating drought conditions. Although the value of organic carbon was expected to be greatest in years when precipitation was lowest, the analysis showed this was only the case if precipitation in the previous year was high enough to provide some carryover. In other words, soil organic carbon is only useful in mitigating short-term drought conditions.

The information will be conveyed using color graphs and GIS maps. The GIS maps will provide a visual

representation of the integration of map layers for the analysis. The maps also will be an effective means for showing variability of effects across soil types and differing effects for contrasting weather conditions. The poster format is particularly well-suited to the display of map-based results. This material has not been previously presented.

References

Antle, J.M., S.M. Capalbo, S. Mooney, E.T. Elliott, and K.H. Paustian. "Economic Analysis of Agricultural Carbon Sequestration: An Integrated Assessment Approach." Journal of Agricultural and Resource Economics 26, no. 2 (2001):344-367.

Burt, O.R. "Farm-Level Economics of Soil Conservation in the Palouse Area of the Northwest." American Journal of Agricultural Economics 63(1981):83-92.

Hudson, B.D. "Soil Organic Matter and Available Water Capacity." Journal of Soil and Water Conservation 49 no. 2(1994):189-194.

McCarl, B.A. and U.A. Schneider. "U.S. Agriculture's Role in a Greenhouse Gas Emission Mitigation World: An Economic Perspective." Review of Agricultural Economics 22 no. 1(2000):134-159.

McCarl, B.A., and U.A. Schneider. "CLIMATE CHANGE: Greenhouse Gas Mitigation in U.S. Agriculture and Forestry." Science 294, no. 5551(2001): 2481-2482.

Olness, A.E. and D.W. Archer. "Using an Energy Model to Describe the Contribution of Organic Carbon to Soil Water Holding Capacity." In Annual Meeting Abstracts [CD-ROM]. ASA, CSSA, and SSSA, Madison, WI. 2004.

Pautsch, G.R., L.A. Kurkalova, B.A. Babcock, and C.L. Kling. "The Efficiency of Sequestering Carbon in Agricultural Soils." Working Paper 00-WP 246. Center for Agricultural and Rural Development, Iowa State University, Ames, IA. August 2000.

Rawls, W.J., Y.A. Pachepsky, J.C. Ritchie, T.M. Sobecki, and H. Bloodworth. "Effect of Soil Organic Carbon on Soil Water Retention." Geoderma 116(2003):61-76.

Smith, E.G., M. Lerohl, M. Teklay, and H.H. Janzen. "Soil Quality Attribute Time Paths: Optimal Levels and Values." Journal of Agricultural and Resource Economics 25, no. 1(2000): 307-324.

Subject Code: Natural Resource Economics

Close Window