

SENSITIVITY OF THE AGRICULTURE AND FOREST SECTORS TO CLIMATE CHANGE POLICIES AND ADAPTATION

En (John) Zhu, Argonne National Laboratory, 630-252-7283, ezu@anl.gov
Bruce McCarl, Agricultural Economics, Texas A&M University, 979-845-1706, mccarl@tamu.edu

Overview

The mitigation cost for reducing greenhouse gas (GHG) emissions from the U.S. energy sector has been argued to be particularly high. The agriculture and forest (AF) sectors can provide some low-cost, near to medium term strategies to help reduce greenhouse gases including soil sequestration. To understand the complex land use effects, including the effects of increased demand for biofuels, requires a detailed agriculture and forest model.

Methods

The Forest and Agriculture Sector Optimization Model (FASOM) is a very large GAMS linear programming model which we use for this study. FASOM has been developed over 25 years. Bruce McCarl is the principal author although many researchers have contributed to the model's development.

Variables of interest included in the model are production of various crops, prices and export demands; land use and rents; biofuel production and price; consumer and producer welfare; water and fertilizer use; and fossil fuel use.

Normally the FASOM model takes a couple hours to run. Here we sweep out the response surface from many runs and report the results.

Results

The results show that the AF sectors have significant GHG mitigation potential. Higher carbon prices lead to more sequestration, less emissions, reduced consumer and total welfare, improved environmental indicators, and increased producer welfare.

We argue, as we have previously, that the AF sectors may be very important in a world that requires time and technological investment to develop low-cost climate mitigation options.

For this research it is important to take into account that GHG emission mitigation in soils and forests are sensitive to saturation of sequestration sinks.

Conclusions

With the apparent need for both food crops and biomass for energy use it is important to understand the impacts of policies that affect the agriculture and forest sectors. These sectors can also be contributors to GHG emissions or play a role in GHG mitigation.

The response surface from many FASOM runs can be integrated into other models to represent the behaviour of the agriculture and forest sectors. These response surfaces have been used within economy-wide computable general equilibrium models. They can also be used within stochastic models or decision analysis problems to capture the effects of uncertainties.

References

En Zhu, *The Role of U.S. Agricultural and Forest Activities in Global Climate Change Mitigation*, Ph.D. dissertation, Texas A&M University, August 2007.

Bruce McCarl, FASOM Model Documentation, Department of Agricultural Economics, Texas A&M University, 2007