



CRC Workshop on Life Cycle Analysis of Biofuels

PERSPECTIVES ON LAND USE CHANGE ANALYSES

KEITH L. KLINE, GBADEBO OLADOSU, VIRGINIA DALE, ALLEN MCBRIDE

Center for Bioenergy Sustainability <http://www.ornl.gov/sci/besd/cbes/>

Environmental Sciences Division, Oak Ridge National Laboratory (ORNL)

Bldg 2040, MS-6301, Oak Ridge, Tennessee 37831-6301

The current state of modeling the effects of bioenergy on land use is reviewed with an emphasis on where improvements are needed to better link scientific approaches and emerging empirical data to modeling efforts. Gaps are identified between the evidence in recent empirical studies and the assumptions of models used to estimate land-use change (LUC). Limited data (e.g. for land supply and quality) and a lack of clear and consistent definitions (e.g. for terms including “LUC”) hinder current LUC research. Other challenges include:

- representing policy in model specifications;
- incorporating appropriate decision-making assumptions;
- building a conceptual framework that distinguishes drivers of initial land conversion from those contributing to subsequent land-use changes;
- accounting for pre-existing trends, variability and dynamics of land use;
- modeling yield changes caused by innovations and redistribution of crops;
- identifying relevant temporal and spatial scales of processes;
- understanding interactions between changing land cover, management, market factors, GHG emissions, and cycles of land disturbance, especially fire; and
- characterizing causal relationships (and contributing and mitigating factors) accurately, instead of relying on correlations.

The presentation identifies opportunities to advance understanding and reduce some of the current uncertainties. A systems perspective that is multi-scale, adaptive, and long term can help identify “win-win” strategies for improving land management while addressing social concerns. Policies designed to improve resilience, reduce susceptibility to market volatility, and increase the capacity of production systems to provide multiple services to society are recommended. Policies need to be complemented by monitoring to assess whether goals are being achieved and to guide adjustments in future policy and regulations. Performance-based incentives could help achieve well-defined and measurable outcomes such as:

- Improved soil & water management;
- Increased efficiency (e.g., reducing inputs, increasing yields, minimizing transaction costs); and
- Diversified markets and bases of production.

In conclusion, despite large uncertainties surrounding estimates of land-use change, there are actions that most parties can agree will be beneficial. We suggest that by focusing on the most important of these actions, even researchers who may disagree about the potential effects of current bioenergy policy can contribute to significant improvements in the environmental and socioeconomic sustainability of future policies and practices.