

**Summary of the May 2009 Forum
of the Center for BioEnergy Sustainability
“Land-Use Change and Bioenergy Workshop”**

The May Forum of the Center for BioEnergy Sustainability (CBES) was introduced by Raju Vatsavai, whose work focuses on spatiotemporal data mining and computational geoinformatics. Raju gave a brief introduction to the Workshop on Land-Use Change and Bioenergy that was held in Vonore, Tennessee, on May 11–14. He then introduced Keith Kline, whose research focuses on challenges faced by developing countries related to human needs, energy, and environment. As a member of the Steering Committee of the workshop, Keith contributed to the workshop design and the identification of participants who are leaders in global land-use change modeling and in the development of the land-cover and land-use data sets upon which the models rely.

The workshop participants reviewed the state of the art, identified limitations and uncertainties, pointed out opportunities for collaboration, and prioritized the research steps needed to address key issues in how bioenergy interacts with land-use changes.

The workshop was made possible thanks to support from the U.S. Department of Energy (DOE), which is committed to helping develop diverse, domestic, and sustainable energy resources. Life-cycle analysis helps DOE evaluate the sustainability of production pathways and of major scale-ups in biofuel production. As a part of this assessment, DOE is committed to addressing land use, soil health, water use, air quality, and greenhouse-gas (GHG) emissions. DOE is also seeking ways to develop improved methods to assess, monitor, and measure environmental impacts.

DOE’s current bioenergy mandates are based on the Energy Independence and Security Act (EISA, December 2007) guidelines for a new U.S. Renewable Fuels Standard, including the requirement for analysis of life-cycle impacts of energy to include "aggregate quantity of greenhouse-gas emissions (including direct emissions and significant indirect emissions, such as significant emissions from land-use changes) related to the full fuel life cycle.” To investigate the implications of EISA targets (e.g., 36 billion gallons of biofuels by 2022), DOE has contributed to cooperative projects coordinated by the Biomass Research and Development Interagency (BRDI) Board. One recent BRDI report compares pre-EISA USDA baseline projections for crop and feedstock production to EISA scenarios with no net loss in Conservation Reserve Program lands. One of the report’s findings is that targets can be met with relatively small shifts in crop and forage production.

Accurately quantifying land-use change is critical and is currently a “game-changer” in the United States, California, and European regulatory arenas. The role of biofuels in land-use change is also part of a larger strategy for energy security and economic growth. Under the current dwindling fossil fuels and growing fuel demand, it is important to understand the implications of increased biofuel use.

The objectives set forth prior to the workshop covered eight areas:

1. Identifying the key requirements, characteristics, and mechanisms for more-effective modeling of the interactions among energy, agriculture, land use, and economics at regional, national, and global scales
2. Developing a strategy to improve modeling tools for understanding the energy/agriculture/land-use nexus and for enabling simulations of the interaction between bioenergy choices and land-use changes
3. Discussing the process and structure that would lead to the development of a benchmark data set that could be used for determining bioenergy land-use impacts
4. Developing an understanding of the level of certainty associated with data and modeling outputs currently used to support policy decisions and steps that can be taken in the near and medium terms to reduce uncertainty levels
5. Identifying opportunities to improve the quality and consistency of research and monitoring of the land-use impacts of bioenergy programs and policies, such as
 - a. collaborations to measure and analyze land-use and land-cover changes around the world and
 - b. comparing and linking data sets and models to understand the bioenergy-related driving forces behind those changes
6. Developing plans for enhanced information sharing, networking, and collaboration to embrace the opportunities identified and to provide more reliable information in support of decisions and policies related to bioenergy
7. Clarifying “best practices” for presenting land-use change research and modeling results that enhance transparency regarding assumptions, data sources, uncertainty, and limitations
8. Beginning to develop a strategic research plan for DOE/OBP (and DOE laboratories) to fill key gaps and to develop improved science-based approaches for measuring the impacts of U.S. biofuel policies and programs on land use and related emissions.

The workshop was designed to facilitate exchanges between disciplines and to improve understanding of what is known and not known about land-use implications of biofuel choices. The workshop emphasized small-group discussions that allowed participants to develop suggestions to make scientific progress in each of the objective areas so that policy could be better informed. Time was allotted for participants to identify and discuss intersecting research and plans. Plenary sessions presented the background behind the workshop, reviewed key modeling and data issues, and allowed for discussion of breakout-group products to include strategies and plans for coordinated research agendas. The workshop was highly participatory and involved a team-building approach led by a professional facilitator. About 75% of the time focused on participation; the participants were involved via rotating roles and were mixed into various small groups. Extended breaks during the work promoted discussion. The structure also allowed participants to introduce themselves and share brief descriptions of their relevant work. Innovations of the workshop included web-page communications before, during, and after the workshop; integrated participatory report writing; task-oriented work groups from the beginning; invited, short “3 in 5” presentations (presenting three slides in a maximum of five minutes); a focus from the beginning on workshop goals; and web broadcast of plenary sessions for off-site observers. The approach led the group toward the primary result of the workshop: a framework that enables better estimates of how the use of bioenergy affects land, both directly and indirectly.

Participants also identified specific activities that could be launched in the near term to improve the scientific underpinning for analyzing land-use effects in expanding the global bioenergy economy. For example, the organizing committee agreed to distribute a draft Workshop Report – developed with active contributions from many participants on the final day of the workshop – to quickly share the workshop findings and research needs suggested by participants. Other next steps included the development of a policy-relevant Executive Summary of the Workshop Report to inform decision makers, collaborators on topic-specific white papers, and participants in subsequent meetings and conferences. DOE agreed to assess workshop results to identify research priorities relevant to DOE’s biofuel mandate that could be considered in planning future work with the national laboratories and other partners.

DOE expressed interest in several key areas of land-use change and bioenergy that were discussed at the workshop:

- Improving the framework for understanding driving forces for land-use change and relative degrees of bioenergy attribution
- Characterizing underutilized lands and their potential for biofuels feedstock production
- Developing better interfaces between land-use data/models and economic models for biofuel indirect land-use change estimates
- Developing a “dynamic reference case” and systems approach for land-use change modeling to permit fair comparisons of biofuel policy options
- Conducting systematic analyses in selected nations with relatively good historic data and bioenergy production trends for past market-mediated land-use change patterns, with a system for allocation of biofuels among all other factors

Workshop participants recognized the importance of biofuels in a sustainable energy future and suggested that the development of a comprehensive framework to understand the impact of bioenergy policy on land-use decisions is necessary. There was strong consensus regarding the uncertainty surrounding the current use of global economic models to project land-use change effects. Research is needed to improve the understanding of (1) land-use change related to bioenergy and (2) the environmental effects of the many variations and transitions inherent with land-use changes. Research is also needed to link the land-use change framework to existing global economic models. It was recognized that integrating those approaches is no small task. A strong push to improve land-use change research is important now because policy and public determinations are moving forward without well-informed science, discourses, and models.

[Presentation Slides](#)