Summary of IALE Symposium on Bioenergy and Land-Use Change
Oak Ridge National Laboratory
April 7, 2010

The International Association for Landscape Ecology (IALE), U.S. Chapter 25th Anniversary Symposium was held in Athens, GA April 5-9, 2010. ORNL organized Symposium VIII, "**Reshaping Landscapes: Bioenergy and Land-use Change**," held Wednesday April 7, 2010. This summary provides the outline, abstracts and links to available presentations.

Session Objective: Large-scale integration of bioenergy into the global energy landscape is likely to drive changes in natural and agricultural landscapes. Changes in agricultural landscapes are likely to be influenced by region-specific economic, ecological, and historical drivers. Future bioenergy landscapes will produce a patchwork of different feedstocks, including crop residues, perennial grasses, and woody crops. This symposium describes research on how landscapes are projected to change in response to economic and energy drivers. Estimating future changes requires knowledge in several disciplines. This symposium involves economists, modelers, ecologists, social scientists and regulators, all working to advance our understanding of future, post-bioenergy landscapes.

Presentations include:

- The global sustainable bioenergy project: Reconciling large-scale biofuel production with land use priorities. John Sheehan, University of Minnesota, et al.
- Identifying potential wildlife impacts of bioenergy biomass production: Future landscape scenarios in a case study of planned biomass co-firing in Wisconsin. Carol L Williams, University of Wisconsin Madison; Christine A Ribic, USGS, Wisconsin Cooperative Wildlife Research Unit: David W Sample, Wisconsin Department of Wildlife, et al.
- Modeling direct and indirect effects of US bioenergy policy on global land use. Gbadebo A Oladosu, Keith L Kline, Oak Ridge National Laboratory
- Regional land use conversion involving forestry and agriculture land in the context of using biomass for bioenergy. Eric M White, Oregon StateUniversity; Ralph J Alig, USDA Forest Service; Gregory Latta, Oregon State University. [abstract only]
- Cellulosic biomass production in the Chesapeake Bay watershed. Donna Perla, US EPA, Office of Research and Development, Washington DC. [abstract only]
- Models, science, and the precautionary principle: Land-use change and the sustainability of biomass systems. Keith L Kline, Virginia Dale, Gbadebo A Oladosu, Oak Ridge National Laboratory

Abstracts

1. The Global Sustainable Bioenergy Project: Reconciling Large-Scale Biofuel Production with Other Land Use Priorities. Presented by John Sheehan on behalf of Lee Lynd et al.

Abstract: The world is currently confused and uncertain about whether to look to bioenergy to play a prominent role in the future, and if so, what policies are needed to ensure a sustainable result. The Global Sustainable Bioenergy (GSB) project seeks to bring needed clarity to this situation within a three-stage framework: 1) Hold workshops on each of the world's five continents; 2) Test the working hypothesis that it is physically possible for bioenergy to sustainably meet a substantial fraction of future demand for energy services (> 25% of global

mobility or equivalent) while feeding humanity and meeting other needs from managed lands, preserving wildlife habitat, and maintaining environmental quality. And 3) Analyze and recommend transition paths and policies in light of Stage (2) results, incorporating analysis of macroeconomic, environmental, ethical and equity issues as well as local-scale effects on rural economies. This presentation will report on progress with the GSB project mid-way through stage (1) along with perspectives and selected analytical results related to potential bioenergy effects on global land use and landscapes.

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2. Identifying potential wildlife impacts of bioenergy biomass production: future landscape scenarios in a case study of planned biomass co-firing in Wisconsin. Presented by Carol Williams.

Abstract: Demand for bioenergy is increasing in Wisconsin due to concerns about climate change, energy self-sufficiency and local air quality in association with combustion of coal for heat and power. Simultaneously, demand is also increasing for ecological services provided by agricultural systems. Little is known, however, about potential landscape-level ecological consequences of large-scale transformation of current agricultural ecosystems to those with greater bioenergy production. To fill current research and knowledge gaps, and to provide information that may assist policy analysts and decision-makers, we have proposed a modeling-based analysis of potential landscape-level wildlife impacts of lignocellulosic biomass production in a south-central Wisconsin co-firing case study. In the first of a two-phased process we will render landscape scenarios that describe plausible markets (i.e., geographic areas of commercial-scale biomass production) according to different levels of lignocellulosic biomass diversity (e.g., single or multiple plant species), productivity class(es) of lands used in biomass production, and spatial distribution of potential biomass markets (e.g., geographic extent and proximity to the model facility). In the second phase, for a set of focal wildlife species, we will generate habitat suitability maps describing current land use/land cover conditions, as well as that of each future landscape scenario. Difference maps will then be generated to describe and quantify changes (positive, negative, neutral) in habitat suitability resulting from potential land use/land cover change associated with future biomass production systems in Wisconsin.
Keywords: bioenergy, ecological services, wildlife impacts, land use/land cover, scenario

Co-authors and affiliations:
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3. Modeling Direct And Indirect Effects Of US Bioenergy Policy On Global Land Use. Presented by ‘Debo Oladosu.

Abstract: Land use change (LUC) associated with bioenergy production is a topic receiving great attention from scientists, landscape ecologists, economists and the media. Unlike the direct effects of land conversion for bioenergy production processes, indirect land use change (iLUC) cannot be directly measured. Thus, estimates of iLUC depend on the ability to model the multitude of intervening market and non-market variables that govern land-use decisions and the transmission of indirect effects of bioenergy production within this broader milieu. This presentation examines existing approaches to model the iLUC effects of biofuel production on the landscape, outlines key issues with past estimates of iLUC, and recommends components needed to improve modeling frameworks to estimate the iLUC impacts of U.S. biofuel policy. The results of research and recent simulations that highlight and address a few of the identified weaknesses will be shared along with suggested next steps towards comprehensive modeling of the iLUC effects of biofuel policy.

Co-authors and affiliations:
Gbadebo Oladosu and Keith Kline, Oak Ridge National Laboratory

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4. Regional land use conversion involving forestry and agriculture land in the context of using biomass for bioenergy. Presented by Eric White. [Abstract only]

Biomass is expected to be an important source of renewable energy as part of comprehensive climate change policy. Currently, biomass represents about half of U.S. renewable energy consumption (mostly associated with on-site energy production from timber mills) and the primary biomass feedstocks are waste residues (e.g., timber milling residues). Increased reliance on feedstocks produced specifically for bioenergy may yield changes in traditional production from the forest and agriculture sectors, the rate of land conversion between the two sectors, and resource management practices. As demand for bioenergy increases, biomass production from short-rotation woody crops (SRWC), logging residues, and non-merchantable trees will likely increase. Currently, SRWCs are estimated to comprise less than 0.1% of the agriculture and forest landscape. Timber harvests residues are currently believed to amount to about 64 million dry tons of woody biomass. Using existing research results, we identify considerations and some potential implications of increased use of woody biomass feedstocks. To examine possible future conditions, we use the Forest and Agriculture Sector Optimization Model-greenhouse gases (FASOM-GHG), an economic dynamic optimization model of the U.S. forest and agriculture sectors, to project future biomass feedstock consumption under both reference and climate policy scenarios and possible effects on forest age classes, forest types, and other forest resource conditions. We report regional-level projections of feedstock consumption for future decades from the forest and agriculture sectors. Additionally, we examine projected impacts to land conversion (e.g., afforestation or deforestation involving agriculture) and management intensity as result of increased demand for bioenergy. Keywords: biomass feedstock, land use change, economic modeling, forests

Co-authors and affiliations:

Eric M White, Oregon State University, Ralph J Alig, USDA Forest Service, Gregory Latta, Oregon State University

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5. Cellulosic Biomass Production in the Chesapeake Bay Watershed - Landscape and Environmental Effects. [Abstract only]

Abstract: The State Governors within the Chesapeake Bay watershed appear committed to furthering the development of biofuels and have been developing a Biofuels Action Plans related to this vision. Alternatively, President Obama signed Executive Order 13508, designating the Bay as a National Treasure, and calling for implementation of a strategy to coordinate, expand, and bring greater accountability to speed the Bay's recovery. Given the critical need to understand and mitigate stressors to the Bay, and the high economic and political pressure to develop biofuels within this watershed, it is critical to develop a scientifically based understanding of how biofuels production and use within the watershed may impact priority environmental outcomes, such as water quality, biodiversity, and soil productivity. The Biofuels Advisory Panel to the Chesapeake Bay Commission has identified some critical immediate scientific needs, including:

- Developing state specific biomass harvest guidelines (both agricultural and forest).
- Verify how the use and harvest of winter crops (such as barley, rye, canola) as biofuels feedstocks and other energy crops (such as switchgrass) can be not only sustainable grown in specific locations within the watershed, but also contribute to reductions of nutrients affecting water quality within the watershed.
- Proactively identify non-invasive and potentially invasive species specific to this watershed and develop tools to assess invasiveness.

There is a critical need to accelerate the science behind these and other priority scientific questions relating to biofuels within this watershed.
Keywords: Chesapeake, Bay, watershed, nutrients, invasiveness

Author and affiliation:
Donna Perla, U.S. EPA, Office of Research and Development (presentation not available as Ms. Perla was unable to attend)

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6. Models, science and the precautionary principle: land-use change and the sustainability of biomass systems. Presented by Keith Kline.

Abstract: The future of biomass energy programs increasingly depends on their perceived environmental costs and benefits. Land-use change (LUC) is a predominant determinant of environmental effects but its estimation relies on modeling. Data limitations, along with specifications and assumptions that are difficult to validate, make modeling LUC a challenging and uncertain process. This presentation will focus on what can be done in the near term to address uncertainties and develop estimates of the effects on land that are scientific, equitable and facilitate more sustainable biomass supplies. The presentation will highlight points of agreement and disagreement from the prior presentations and fill any key gaps to capture current debates on biofuels and LUC. Research from Oak Ridge National Laboratory will be shared to illustrate key uncertainties in LUC modeling, recent efforts to establish indicators of sustainability for biofuels, and application of the precautionary principle. Prior speakers will be

invited to respond to the following questions to enliven a discussion: How can biomass policies better address land-use change and avoid or mitigate degradation and loss of productive lands? What are priorities for future research? This presentation and panel discussion will contribute to building scientific consensus around what we know, don't know, and what we need to find out regarding biomass production and LUC. [This presentation and key question for panel discussion will be designed to complement the content of the other five presentations in this session.]
Keywords: land use, modeling

Author and affiliations:
Keith L Kline, Virginia H Dale, and Gbadebo A Oladosu, Oak Ridge National Laboratory

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See: http://www.usiale.org/athens2010/index.php?id=printedAbstract for more information on the IALE Symposium.