



ECOSYSTEM SERVICES RESEARCH PROGRAM

ECOSYSTEM SERVICES RESEARCH IN COMMUNITIES – FUTURE MIDWESTERN LANDSCAPES STUDY

Issue:

EPA’s Ecosystem Services Research Program (ESRP) in the Office of Research and Development (ORD) is focused on the study of ecosystem services, or the benefits to human well-being provided by ecological systems. The program is initiating studies of ecosystem services in a number of specific places in the United States to better understand these services, and to develop analytical tools that enable decision makers to take these benefits into account.

One study will be conducted in the Midwest region, which is critically important in supplying national and global demand for food, fiber, and fuel. Midwestern landscapes also play essential roles in the supply of water to homes and farms, recreation, flood control, and a host of other benefits essential to quality of life.

The rapid growth of the biofuels industry, which uses crops and other biomass to make liquid fuel, is causing changes in agricultural practices and land uses across the U.S., and most

strikingly in the Midwest. EPA’s Regional offices are interested in the long-term environmental implications of these changes. Therefore, the Future Midwestern Landscapes (FML) Study will examine projected changes in landscapes and ecosystem services in the Midwest. Given its immediate influence, biofuel production will be studied as a primary driver of landscape change.

Scientific Objectives:

The study goals are to:

- Understand how current and projected land uses affect the ecosystem services provided by Midwestern landscapes.
- Provide spatially explicit information that will enable EPA to articulate sustainable approaches to environmental management.
- Develop web-based tools depicting alternative futures so users can evaluate trade-offs affecting ecosystem services.



Figure 1. Bioethanol plants in the U.S. as of May, 2007 and proposed ecosystem services study area

Application and Impact:

For a large area of the Midwest, researchers will work with decision makers and use economic and spatial modeling tools to construct alternative landscapes that reflect different assumptions about biofuels policy, technology, and landscape management over the next 10 – 20 years.

Based on discussions with potential users of study results, including participants in an EPA Region 7 stakeholder forum, two future scenarios are envisioned:

Biofuel Targets Scenario

This scenario is the one implied by current policies emphasizing large increases in biofuels production. It

continued on back

ECOSYSTEM SERVICES RESEARCH PROGRAM

continued from front

anticipates a ramp-up of biofuels from 2008 to 2022, beginning with increases in corn starch ethanol and later including cellulose-based ethanol, derived from a variety of sources such as corn stover, wood chips and switchgrass. Under this scenario corn production will increase, some lands currently enrolled in conservation programs will revert to cropland, and stover utilization will further augment the pressure on soil and water quality.

Multiple Services Scenario

This scenario envisions incentive policies aimed at encouraging the production of a more balanced set of agricultural commodities and environmentally beneficial outcomes. Incentives will tend to favor enhanced agronomic and conservation practices and will pay for societal benefits such as water quality, flood control, carbon storage and wildlife production.

The ecosystem services associated with each alternative landscape will be described and compared. A base year of 2001 also will be analyzed to capture a realistic, yet recent “pre-biofuels” landscape. For some ecosystem services, descriptions are expected to be highly quantitative and include estimates of monetary value; for others only rough approximations will be possible. Evaluating many ecosystem services will require that we draw upon the expertise of other federal agencies.

Ecosystem services we will seek to assess include:

- Carbon balance (affects climate)
- Soil productivity (affects food and energy security)
- Hydrology and water quality (affect water supply, flooding, downstream aquatic ecosystems, recreation)
- Wildlife habitat and other natural areas (affect biodiversity and recreation)
- Air quality (affects health)

The landscape analysis methods developed for the study will be implemented as a web-based environmental decision toolkit, similar to other toolkits previously created under EPA’s Regional Vulnerability Assessment Program (ReVA). Scientists anticipate that the toolkits will allow users to compare alternative Midwestern futures by examining tradeoffs—that is, changes in the provision of a wide variety of ecosystem services—at both local and regional scales.

For local-scale decision makers, we will also investigate the feasibility of incorporating ecosystem services into two existing software applications. The first is I-FARM, a popular online tool that integrates crop and livestock production as well as biomass planning. I-FARM is operated by the Leopold Center for Sustainable Agriculture at

Iowa State University, and provides a profitability analysis of different crops.

The second is Purdue University's Long-Term Hydrologic Impact Assessment / Environmental Quality Incentives Program (L-THIA/EQIP), which offers decision support on best management practices to protect water quality.

REFERENCES:

Liu, Y., M. Mahmoud, H. Hartmann, et al., 2007. Formal scenario development for environmental impact assessment studies, in Jakeman, A., A. Voinov, A. E. Rizzoli, and S. Chen (eds), *State of the Art and Futures in Environmental Modeling and Software*. Elsevier (accepted).

USDA, 2007. An Analysis of the Effects of an Expansion in Biofuel Demand on U.S. Agriculture. USDA, ERS. 69 pp.

Westcott, P.C., 2007. Ethanol Expansion in the United States: How Will the Agricultural Sector Adjust? USDA FDS-07D-01. 20pp.

EPA CONTACTS:

ORD: Randy Bruins
bruins.randy@epa.gov
513-569-7581

Region 7: Brenda Groskinsky
groskinsky.brenda@epa.gov
913-551-7188

Region 5: David Macarus
macarus.david@epa.gov
312-353-5814

Region 8: Suzanne Stevenson
stevenson.suzanne@epa.gov
303-312-6030

JULY 2008