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The Impacts of Large-Scale Biofuel Use on Land Use and Conservation

Natural ecosystems provide valuable services such as purifying air and water, sequestering carbon, and providing habitats for diverse plant and animal species. Loss or degradation of natural ecosystems translates into the loss of these and other human life support systems.

1. **The use of corn ethanol on a large scale could put ecosystems and habitat at risk.**

   As the market for ethanol grows, farmers will meet increased demand for energy crops by substituting corn for relatively less profitable crops like soy and wheat, by increasing productivity of their crops, and also by expanding corn crops into land not currently cultivated. In the U.S., the new cropland likely will come from retired agricultural lands, some of which is enrolled in conservation reserve programs in which farmers are paid to plant long-term vegetative cover – rather than crops – on environmentally sensitive lands. Internationally, much of the new agricultural land could be converted from ecologically valuable rainforests, wetlands and grasslands.

   The type of land converted determines the environmental impacts. Agricultural development of important habitat and sensitive ecosystems could impose significant environmental costs in the form of, for example, reduced biodiversity. In contrast, cultivation of land previously degraded by human activities could produce environmental benefits such as the mitigation of soil erosion.

2. **Farmers' agricultural practices can significantly influence the environmental effects of biofuels.**

   The choices farmers make – which crops are grown and how crops are grown – can have far-reaching impacts on soil quality, water quality, climate change, and biodiversity. The importance of these choices will be magnified as farmers, prompted by high energy-crop prices, seek to increase productivity of lands currently under cultivation, increase the total amount of land under cultivation, and expand cultivation into less naturally productive lands.

   Farmers can minimize environmental damage by following best management practices such as optimizing pesticide, herbicide and fertilizer use (minimizes leaching and runoff); optimizing the amount of residual matter left in fields (minimizes soil erosion and enhances soil fertility); reducing irrigation (minimizes soil erosion and runoff); and employing conservation tillage (reduces soil erosion and preserves carbon sequestration).

Recommendations for Further Research

The following issues and ideas should be investigated further:

- **Guidance as to what types of lands are converted to croplands**. Public policies should direct expansion of biofuel crops to lands previously degraded by human actions and to areas with adequate soil quality to support intensified agriculture in a sustainable

manner; and away from repositories of unique wildlife and diversity, and fragile lands. In order to guide which CRP lands go back into production, USDA should adopt mechanisms that would send price signals based on the ecosystem services – such as carbon storage and avoided soil erosion – provided by various tracts of land.

- **Adjusting land prices to reflect the true value of land.** Foreign governments should find ways to incorporate the true value of land into its price – for example, include the value of carbon sequestration provided by the land – so when markets determine the use of lands, valuable ecosystems are preserved. This is particularly important where markets are distorted by energy crop subsidies.
- Development of bioregional centers. Building on state extension services for farmers, create bioregional centers that can manage conversion of uncultivated lands and oversee management practices at the watershed scale. Management at the regional level is important since the impacts of land conversions, crop choice, and various management practices depend on site-specific factors such as soil type, slope, and climate. The centers should take a multidisciplinary approach, with ecologists, energy, agriculture, and rural development experts on staff. Centers could provide farmers with resources and incentives to select sustainable management practices suited to particular regions.
- **Creating incentives for farmers to follow best management practices**. For example, USDA could require that ethanol plants receiving federal subsidies accept corn only from farms that have a nutrient management plan in place. Critical to any program requiring or providing incentives for best management practices is the creation of a certification system which would enable documentation of – and then allow credit for – such practices.
- **Encouragement of scientists, working to optimize corn yield for energy feedstock, to take into account environmental factors**. Public grants and subsidies to research institutions working to develop high-yield corn for use as energy feedstock could encourage the development of corn varieties that are not heavily dependent on high levels of product inputs such as fertilizer and water. To the extent possible, new varieties should reflect a balance between high corn yield and environmental sustainability.
- **The effects of management practices**. Better information is needed on the environmental effects of various agricultural practices. Research should be conducted specific to region and land characteristics since effects differ depending on soils, slopes, water availability, climate, and current land use.
- **Technologies that could alleviate the pressure for agricultural expansion associated with ethanol including**:
    - Sustainably achieved crop yields. More research is needed to improve conventional feedstock crop yields while minimizing the use of chemical inputs and water. (See K. Cassman, V. Eidman, E. Simpson, "Convergence of Agriculture and Energy: Implications for Research and Policy", QTA 2006-3; http://www.cast-science.org)
    - Cellulosic ethanol. Accelerate efforts to make cellulosic technology scalable.
    - Variable-feedstock processors. Develop processing technologies that could accept a variety of feedstocks, thus enabling the establishment of agricultural polycultures which could increase local biodiversity, rather than monocultures which provide an entry point for exotics or predators. (B. Paulos, G. Bonfert, "The Machine in the Garden"; http://www.ef.org/biofuels)