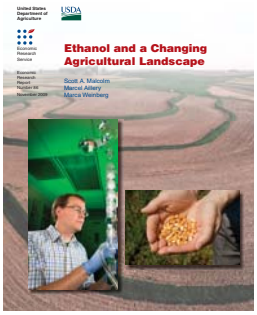
ERS Report Summary

Economic Research Service | November 2009 | U.S. Department of Agriculture



This is a summary of an ERS report.

Find the full report at *www.ers.usda.gov/publications/err86*

Ethanol and a Changing Agricultural Landscape

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U.S. policy to expand the production of biofuel for domestic energy use has significant implications for agriculture and resource use. While ongoing research and development investment may radically alter the way biofuel is produced in the future, for now, corn-based ethanol continues to account for most biofuel production. As corn ethanol production increases, so does the production of corn. The effect on agricultural commodity markets has been national, but commodity production adjustments, and resulting environmental consequences, vary across regions. Changes in the crop sector have also affected the cost of feed for livestock producers. As the Nation demands more biofuel production, and markets for new biofuel feedstocks, such as crop residues, emerge, the agricultural landscape will be further transformed.

What Is the Issue?

The Energy Independence and Security Act of 2007 (EISA) specifies a minimum total amount of U.S. biofuel production through 2022, and also sets target levels for fuels produced from specific feedstock categories. Together with volatile energy prices, this and earlier Federal legislation supporting biofuel processing have increased demand for biofuels and the agricultural feedstocks used to produce them. Greater demand for biofuel increases pressure on the agricultural land base as more land is put into production and/or more inputs, such as fertilizer, water, and pesticides, are applied to cropland. Rising demand for corn, the principal biofuel feedstock in the United States, changes the profitability of growing corn and other "energy crops". Farmers respond by changing their planting decisions, which alter crop mix, land use, and use of inputs, such as fertilizer, which then influence water quality, soil erosion, and other environmental indicators. The environmental consequences of shifts in agricultural production vary by region.

This report also looks at the economic and environmental implications should crop residues, such as corn stover and wheat straw, become commercially viable as biofuel feedstocks. Widespread harvesting of crop residues as an alternative biofuel feedstock has implications for input use, nutrient runoff, erosion control, and soil productivity.

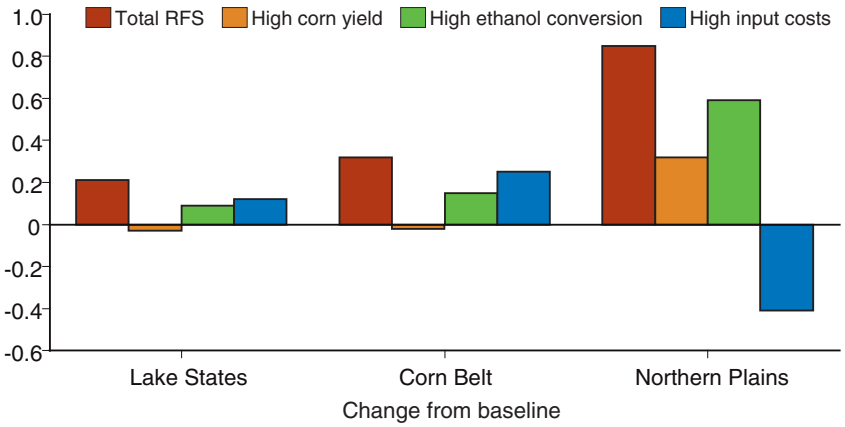
What Did the Study Find?

Land for new biofuel feedstock production comes from two main sources: acreage not currently in production and acreage shifted from other crops. The amount of additional land and displaced crops associated with increased biofuel production differs by region. If the RFS targets are met, total cropland is projected to increase by 1.6 percent over baseline conditions by 2015, with corn acreage expanding by 3.5 percent and accounting for most of the cropland increase. While corn acreage expands in every region, traditional corn-growing areas would likely see the largest

increases—up 8.6 percent in the Northern Plains, 1.7 percent in the Corn Belt, and 2.8 percent in Lake States. Prices are expected to increase slightly for most crops compared with the baseline, although the price increase could be reduced if corn yields increase at a faster rate than expected.

Change in continuous corn acres, by scenario, 2015

Million acres



RFS = Renewable fuel standard.

Source: USDA, Economic Research Service calculations based on Regional Environment and Agriculture Programming (REAP) model data.

Corn is a heavy user of nitrogen fertilizer. Given the RFS targets, the resulting increase in fertilizer use and shift from corn-soybean rotations to continuous corn production leads to deterioration of key environmental performance measures. Nitrogen losses to surface water and groundwater increase by 1.7 and 2.8 percent, respectively, while soil runoff increases by 1.6 percent from the baseline. Differences in geography, soil type, and prevailing agricultural production activities lead to considerable variation in environmental effects among regions. The increases in leaching to groundwater are greatest in the Lake States and Southeast, while increases in runoff to surface water are greatest in the Corn Belt and Northern Plains.

As energy feedstocks that are also used as animal feed move more toward biofuel use, higher costs of animal feed reduce returns to animal production. Production of livestock declines slightly by 2015 relative to the baseline—0.6 percent for farm-fed cattle and 0.5 percent for poultry—which may result in reduced manure nutrient runoff and leaching in some areas.

Technical advances in biofuel production may soon allow other plant material to be used as energy feedstock. One of the most readily available sources of "cellulosic" feedstock is crop residues. Increased use of residue could reduce demand for corn, reducing requirements for most agricultural inputs. But replacing corn-based ethanol with biofuel created from crop residues could have mixed results on environmental quality. Removal of large amounts of crop residues requires replacement of nutrients through increased application of fertilizer and increases runoff and soil erosion. Replacing 3 billion gallons of corn ethanol with crop residue ethanol could increase nitrogen runoff and leaching in the Corn Belt, although reduced corn plantings in other regions cause these measures to decline in much of the United States.

How Was the Study Conducted?

A regionalized agricultural sector mathematical programming model with linked environmental process models was used to simultaneously estimate profit-maximizing decisions on land use, livestock production, crop mix, crop rotations, tillage practices, and fertilizer application rates. In essence, we compare the market equilibrium prior to EISA's passage with the market equilibrium expected if the new RFS production targets are met in 2015, the year that the corn-ethanol target peaks. The environmental impacts of land use and agronomic practices were estimated by applying coefficients derived from a crop biophysical simulation model that incorporates soil, weather, and management information to estimate crop yields, erosion, and chemical (pesticide and fertilizer) discharges to the environment under various crop rotation and soil management regimes. Changes to U.S. agriculture and environmental outputs from meeting EISA's biofuel production targets for 2015 were evaluated against a baseline case that reflects 2007 U.S. Department of Agriculture (USDA) projections for biofuel demand in 2015 (developed just prior to EISA's passage).