Model Captures the Interaction Between Agriculture and the Environment

Agricultural production and its impact on land, water, and air quality is the focus of policies and programs aimed at improving the environmental performance of the U.S. farm sector. These policies can have varying economic and environmental effects, depending on how they are designed. A framework that considers the interactions between farm product supply, production practices, the environment, and prices for crop and livestock products can help better inform policymakers about the potential effects of agri-environmental policies. Statistical analyses of historical data allow researchers to draw inferences about these relationships. Such inferences, however, say little about the policy effects (intended or otherwise) across sectors of the agricultural economy.

The Regional Environment and Agriculture Programming (REAP) Model helps address this informational need. REAP (formerly named the U.S. Mathematical Programming Agricultural Sector Model, or USMP) was developed in the mid-1980s to augment ERS's economic analysis. Model extensions over the last 20 years have substantially expanded the resource and environmental underpinnings of the model, increasing its value to research efforts.

For example, REAP greatly enhanced ERS analysis of the potential economic and environmental effects of requirements to improve the way farmers manage animal waste. Each region in the model faced a constraint on manure nutrient applications to cropland, and the economic effects were conveyed throughout the agricultural economy. Increased costs in animal waste management led to changes in animal production and revenues (affecting livestock producers), the price of feed grains (affecting crop producers), and the prices of final products (affecting consumers). Model results indicate significant regional differences in the effects of the requirement: production increased in the Corn Belt, where land for spreading manure is relatively plentiful, and decreased in Appalachia, where cropland is relatively scarce. The model also showed how shifts in production affected regional soil erosion and losses of nutrients to water and the atmosphere.

The regional disaggregation of the effects of U.S. agri-environmental policy is a key feature of REAP that helps distinguish it from other models used to analyze agricultural issues on a national or global scale. REAP describes agricultural adjustments to policy shocks across 90 regions, based on soil type and location. Agricultural production and environmental activities in REAP are modeled using the Environmental Policy Integrated Climate Model. REAP determines regional land use, crop and animal production levels, and production practices—including multiyear crop rotations, tillage practices and nitrogen fertilizer application rates—endogenously with market-clearing prices. Crop and livestock sectors (primary and secondary) interact in the model's solution process.

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This finding is drawn from . . .

Regional Environment and Agriculture Programming Model, by Robert Johansson, Mark Peters, and Robert House TB-1916, USDA, Economic Research Service, March 2007, available at: www.ers.usda.gov/publications/tb1916/

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