

Modeling and Evaluating Competitive Markets for Agricultural Short-Rotation Wood Fiber Crops

Since 1999, the USDA Forest Products Laboratory (FPL) has coordinated research aimed at modeling and evaluating the competitive market outlook for agricultural short-rotation wood fiber crops, such as fast-growing hybrid poplars or cottonwoods planted on agricultural land for pulpwood. The research has been a collaborative effort of FPL, Oak Ridge National Laboratory (ORNL), Department of Energy, Agricultural and Policy Analysis Center (APAC) at University of Tennessee, and Oregon State University (OSU).

In the 1980s and 1990s, with the help of USDA Economic Research Service (ERS), APAC developed POLYSYS, an agricultural sector model that simulates competitive allocation of agricultural land to annual crops and livestock in all 305 U.S. Agricultural Statistical Districts (ASD) based on the USDA agricultural market outlook. In the 1990s, ORNL worked with APAC on expanding POLYSYS to include projection of the acreage planted in biomass energy crops by ASD (including hybrid poplars and switch-grass) as a function of projected biomass energy prices.

FPL initiated research in 1999, in collaboration with ORNL, APAC, and OSU, linking Forest Service long-range forest sector economic models to POLYSYS



Photo courtesy of NREL.

and evaluating the market outlook for hybrid poplars or cottonwoods as wood fiber crops. POLYSYS was linked first to the FPL North American Pulp and Paper model (NAPAP) to provide 25-year projections of the market outlook for agricultural wood fiber crops in competition with conventional sources of wood fiber, such as pulpwood and recycled paper. Published results indicated limited market potential under current economic trends but greater potential under alternative scenarios. Subsequently, OSU linked POLYSYS to the broader Forest Service timber market-modeling framework (TAMM-NAPAP-ATLAS, or TNA).

The POLYSYS-TNA system shows that it is feasible to develop nationwide economic models encompassing the full spectrum of forest product markets and agricultural crops to evaluate competitive markets for agricultural wood fiber crops that might someday provide a larger share of pulpwood or energy needs.

Background

For several decades, research in tree physiology, genetics, and horticulture has focused on developing fast-growing trees suitable for agricultural fiber

plantations. Trees such as hybrid poplars (hybrids of various poplars or cottonwood species) can be grown rapidly on agricultural land, reaching maturity for pulpwood in as little as 6 to 8 years. Tens of thousands of acres of hybrid poplars and cottonwoods were planted in the 1990s by the forest industry and farmland owners in various U.S. regions (including the upper Midwest, the South, and the Pacific Northwest), demonstrating the biological feasibility of growing such crops.

However, information on the market potential for such crops was broadly lacking, and farmers needed a crop market outlook to aid planting decisions. Furthermore, pulpwood markets became relatively depressed in recent years, although prices for hardwood pulpwood (such as hybrid poplars) have been firmer than prices for softwoods (such as pines). Until recently, no integrated modeling system was available to evaluate the competitive market outlook for tree crops such as hybrid poplars in relation to agricultural markets and the broader forest product demands or pulpwood markets.

Objective

The objective of this study is the development of models to evaluate the competitive market outlook for agricultural short-rotation woody crops by linking, testing, and using two large-scale economic models, the POLYSYS model of competitive land allocation and annual crop planting activities in the agricultural sector and the TNA model of annual market equilibria for timber and wood products.

Approach

Researchers developed and tested computer program linkages between POLYSYS and NAPAP (or TNA) that involve transferring data on pulpwood and biomass prices at equilibrium, woody crop harvest volumes, and wood fiber demands, with a procedure for running the models sequentially toward a convergent market equilibrium (where projected annual supplies, demands, and prices by region for agricultural wood fiber in both models converge).

Preliminary results indicate that it is possible to link the models and provide reasonable projections of the

competitive market outlook for agricultural wood fiber crops in the context of the broader market outlooks for both agriculture and forest products. Ongoing research will provide projections under different scenarios related to incentives for carbon sequestration in forestry and agriculture and various future levels of hardwood pulpwood supply from forestland.

Expected Outcomes

This research will produce (1) a detailed modeling system capable of analyzing and projecting the competitive market outlook for agricultural wood fiber crops in relation to the broader market outlooks for all agricultural crops and forest products, (2) an evaluation of alternative market and policy scenarios that will provide increased awareness of factors that influence the market outlook for agricultural short-rotation woody crops, and (3) a solid basis for future model development and policy analysis in this important area.

Opportunities and funding are being sought to use the modeling framework in evaluating policy and management options where short-rotation woody crops may make economic or environmental contributions, such as in the areas of carbon sequestration, agricultural land conservation, or forest resource conservation, or to evaluate the full biological and genetic potential of such crops in the broader agriculture, energy, and forest product sectors.

Timeline

The current study is expected to be completed in 2003, with final results to be presented in 2004 at the national *Forestry and Agriculture Greenhouse Gas Modeling Forum* (sponsored by ERS and others) and in other presentations and publications.

Contact Information

Peter J. Ince, Research Forester
USDA Forest Service
Forest Products Laboratory
One Gifford Pinchot Drive
Madison, Wisconsin 53726-2398
Phone: 1-608-231-9364
Fax: 1-608-231-9592