BIOFUELS, CLIMATE POLICY, AND WATER MANAGEMENT: ASSESSING POLICY-INDUCED SHIFTS ON AGRICULTURE’S EXTENSIVE AND INTENSIVE MARGINS

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INTRODUCTION

Biofuel expansion efforts and climate mitigation policy could fundamentally alter land management trends in U.S. agriculture and forestry (AF). Previous research has shown that biofuel mandates can induce agricultural land expansion and more intensive forms of production. Meanwhile, terrestrial greenhouse gas (GHG) mitigation efforts could limit agricultural expansion, reduce current cultivation, and lower management intensity by incentivizing emissions reduction and carbon sequestration within AF. To date, little empirical work has addressed the combined implications of biofuel and GHG policies on agricultural land management at both the intensive and extensive land use margins.

RESEARCH QUESTIONS

This study uses a comprehensive and detailed economic model of the U.S. AF sectors to simulate land management responses to biofuel expansion and GHG policies. Specifically, we seek to address the following questions:

1. To what extent will varying existing biofuel mandates (Renewable Fuels Standard, or RFS2) affect U.S. cropland movement to the extensive margin?
2. How might the addition of GHG mitigation incentives further alter cropland trajectories?
3. What are the different implications of biofuel and climate policies on land management intensity?
   - Measured as changes in total nitrogen (N) and water use, and intensity per-unit area

MODELING FRAMEWORK AND SCENARIOS

- Simulation using the U.S. Forest and Agricultural Sector Optimization Model with Greenhouse Gases (FASOMGHG)²
- Model enhancements reflected in this study:
  1. Updated land categorization system
  2. Updated bioenergy transportation and storage costs
  3. Multiple N application rates, including an intensification option (Base, 85%, 70%, and 15%); yield and N emissions derived DAVCENT model output

SIMULATION SCENARIOS

1. BASELINE: Simulation includes biofuel mandates consistent with RFS2 legislation, run for the 2000-2070 horizon using an aggregated 5-region version of FASOMGHG
2. BIOFUEL SCENARIOS: Scenarios alter the total volume of mandated biofuels in positive and negative directions, holding the proportion of conventional ethanol, cellulosic ethanol, and biodiesel constant. Includes:
   - RFS2 50% (lowest), RFS2 75%, RFS2 125%, and RFS2 150% (highest)
3. GHG MITIGATION SCENARIOS: An exogenous CO2 equivalent (e) price is use to incentivize GHG reductions relative to the BASELINE. Prices include:
   - $15/tCO2e, $30/tCO2e, and $50/tCO2e

REFERENCES

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