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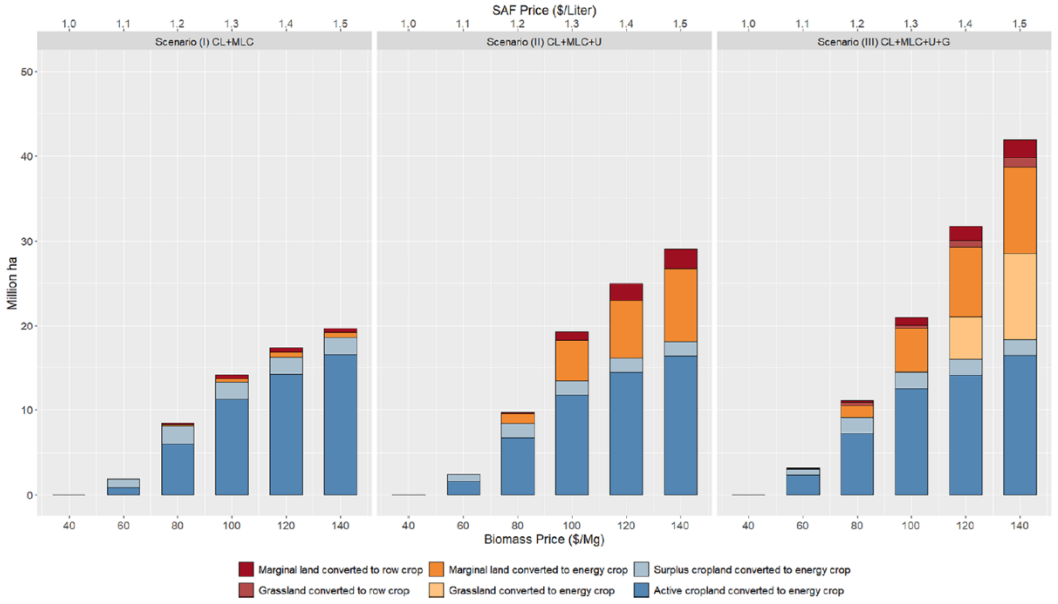
Land Conversion to Energy Crops for Sustainable Aviation Fuel Production Reduces Greenhouse Gas Emissions in the United States

Background/Objective

Scale-up of bioenergy crop production will be critical for increased production of sustainable aviation fuel (SAF) to 35 billion gallons in the United States. This work examines economic incentives for the extent and type of land conversion needed to scale up fuel production from cellulosic feedstocks and quantifies its greenhouse gas (GHG) intensity.

Approach

Researchers developed three scenarios differing in their definition of land assumed to be available for conversion to crop production. With each scenario, they simulated the economic incentives to produce a variety of energy crops and crop residues over a range of selling prices. The BEPAM model was used to determine economically optimal land use and feedstock mix at the U.S. scale over the 2016-2030 period. GHG savings from the aviation sector were assessed by comparing the sum of the life-cycle and indirect land use change emissions with SAF production to corresponding emissions from petroleum jet.



Modeled land use change under alternative price incentives and availability scenarios in 2030.

Results

Even with available marginal non-cropland, there will be incentives for converting cropland to produce energy crops as the price of SAF increases. However, the conversion of cropland and non-cropland from existing uses to energy crops lowers net GHG intensity due to high soil C sequestration by energy crops, even after considering emissions from land-use change. Potential emissions savings are greater than the foregone soil C accumulation benefit of keeping that land in its current uses.

Significance/Impacts

This analysis shows the trade-offs that SAF production scale-up will pose for land use change, GHG intensity, and food crop prices. This understanding can help inform policy choices influencing the land types used for producing energy crops to meet SAF demand.

Wang et al. 2025. "Land Conversion to Energy Crops for Sustainable Aviation Fuel Production Reduces Greenhouse Gas Emissions in the United States." *Communications Earth & Environment.* DOI: 10.1038/s43247-025-02913-x.