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Spatially Varying Costs of GHG Abatement with Alternative Cellulosic Feedstocks for Sustainable Aviation Fuels

Background/Objective

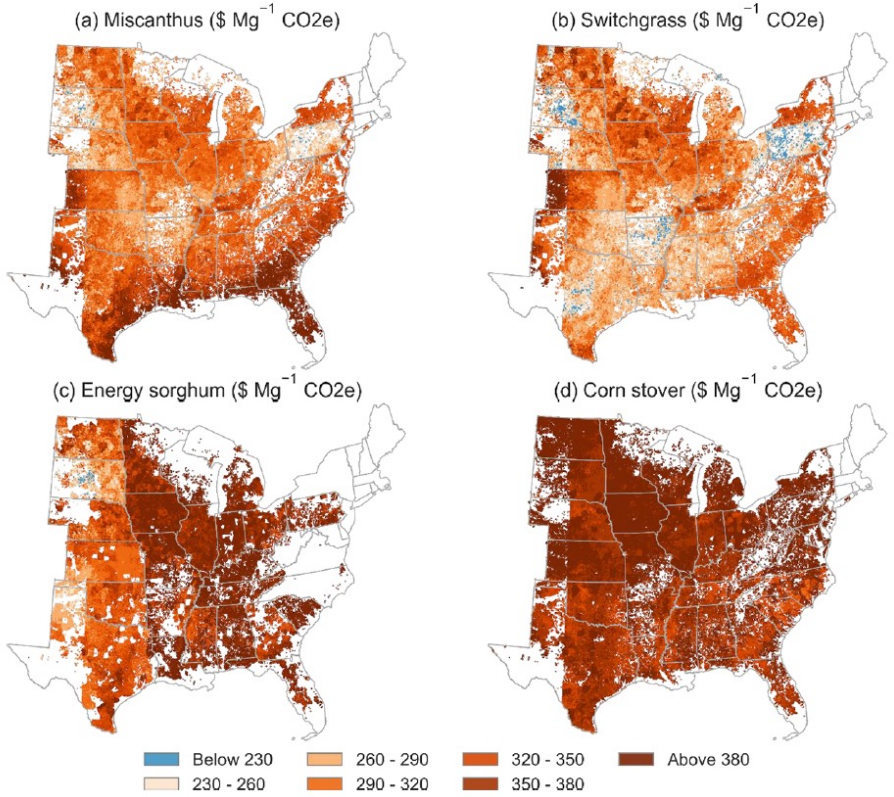
- Cellulosic feedstocks offer a promising source for scaling up production of sustainable aviation fuels (SAF), a promising alternative to fossil-derived aviation fuels.
- This work offers a comprehensive analysis of the feedstock- and location-based variability in key policy-relevant sustainability metrics associated with SAF production.

Approach

Feedstock to fuel supply chain economics and life cycle carbon accounting were integrated within the same system boundary to quantify and compare spatially varying greenhouse gas (GHG) intensities, breakeven prices, and costs of GHG abatement with SAF derived from four feedstocks (switchgrass, miscanthus, energy sorghum, and corn stover) at 4 km resolution across the U.S. rainfed region.

Results

The optimal feedstock varied spatially and differed depending on whether the incentive was to lower breakeven price, carbon intensity, or cost of carbon abatement with biomass, or to have high biomass production per unit land. The cost of abating GHG emissions with SAF ranged from \$181 Mg^{-1} CO_2e to more than \$444 Mg^{-1} CO_2e and was lowest with miscanthus in the Midwest, switchgrass in the South, and energy sorghum in a relatively small part of the Great Plains. While corn stover had the lowest breakeven price per gallon, it had the highest abatement cost due to its high GHG intensity.



Spatial distribution of feedstock-specific annualized GHG abatement cost with SAF (\$ Mg^{-1} CO_2e)

Significance/Impacts

This work implies that different policy priorities such as volumetric targets, tax credits, or low-carbon fuel standards will incentivize different combinations of feedstocks and different spatial distributions over the U.S. rainfed region.

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