CENTER FOR ADVANCED BIOENERGY AND BIOPRODUCTS INNOVATION

# Climate vs Energy Security: Quantifying the Trade-offs of BECCS Deployment and Overcoming Opportunity Costs on Set-Aside Land

## Background/Objective

- Bioenergy with carbon capture and storage (BECCS) has been presented as a cost-effective strategy for achieving net-negative emissions while providing clean energy. However, an optimal blueprint for BECCS deployment that would guarantee sufficient and sustainable negative emissions is still being debated.
- This work explores the trade-offs between climate stabilization and energy security outcomes for BECCS deployment on set-aside (*a.k.a.* marginal) land.

## Approach

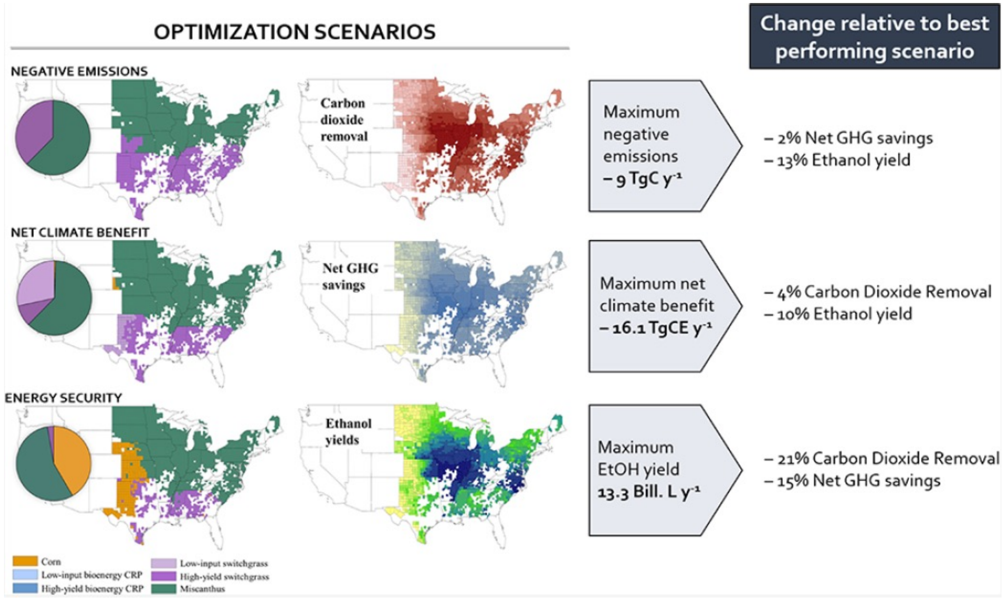
Researchers identified Conservation Reserve Program (CRP) land in the rainfed U.S. and used an integrated biogeochemical-life cycle emissions framework to assess optimal land allocation among six alternative energy crops under two optimized scenarios with a primary goal of climate stabilization (Negative Emissions (NE) and Net Climate Benefit (NCB)) and one prioritizing Energy Security (ES).

## Results

- Sidestepping indirect land use change takes a heavy toll on the climate benefit of BECCS, making geologic carbon capture and storage necessary to achieve net negative emissions.
- Deployment optimizations offset this opportunity cost but contributions to climate stabilization and energy security targets vary widely depending on the priorities of divergent policy-driven agendas.

## Significance/Impacts

This work provides evidence of significant potential for a BECCS landscape on set-aside land to contribute to climate stabilization and energy targets while also highlighting trade-offs between different policy-driven agendas.




**BECCS allocation to land enrolled in CRP could capture up to 9 TgC $y^{-1}$ (NE), deliver up to 16 TgCE $y^{-1}$ in emissions savings, and meet up to 10% of the US energy statutory targets (NCB), but contributions varied substantially as the priority shifted from climate stabilization (NE and NCB) to maximizing energy provision (ES). An energetically optimal deployment would generate 13.3 billion L of ethanol annually but would reduce negative emissions by 21% and the net climate benefit of BECCS by 15% relative to alternative optimization strategies (ES).**

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