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Land-based Resources for Engineered Carbon Dioxide Removal in the United State Exceed the Expected Needs

Background/Objective

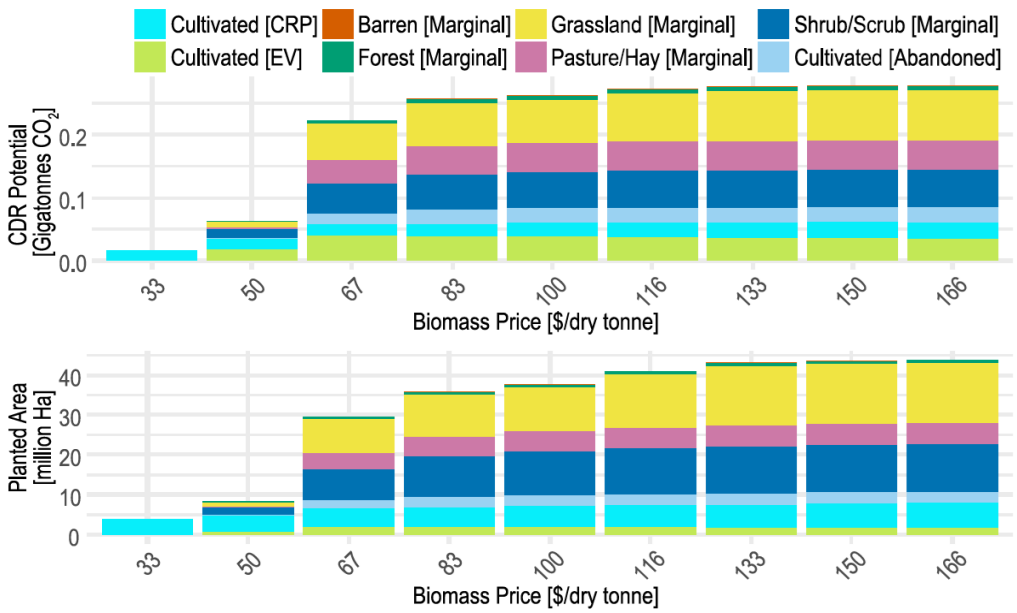
Gigaton-scale atmospheric CO_2 removal (CDR) along with deep emissions cuts are critical to stabilizing the climate. However, some of the most scalable CDR technologies are also energy- and land-intensive. In this study, researchers examined the adequacy of U.S. land resources to meet CDR targets while prioritizing grid emissions reduction, food production, and protection of sensitive ecosystems.

Approach

Researchers conducted a detailed spatial analysis (30-m spatial resolution) of the USA locations and costs of land-based resources available to support biomass carbon removal and storage (BiCRS) and direct air capture and storage (DACS) development. They identified optimal land for energy and biomass supply by excluding sensitive ecosystems and protected lands and setting aside land that will be needed for grid decarbonization.

Results

Suitable lands exceed the expected needs. 37.6 million hectares are available for BiCRS, with potential for 0.26 $GtCO_2$ of CDR/year. 34 million ha are suitable for wind- and solar-powered DACS, with potential for 4.8 $GtCO_2$ of CDR/year if facilities are co-located with geological CO_2 storage. This work identifies biomass and energy supply hotspots to meet CDR targets while ensuring land protection and minimizing land competition.



CO_2 removal potential and the amount of land suitable for carbon crop cultivation vary as biomass price increases.

Significance/Impacts

This work identifies the highest-potential regions for scale-up of BiCRS and DACS and shows that U.S. land can be managed in conjunction with CDR technology deployment to achieve carbon-neutral or negative emissions without causing land-use conflicts.

Dai et al. 2025. "Land-based Resources for Engineered Carbon Dioxide Removal in the United States Exceed the Expected Needs." *One Earth.* DOI: 10.1016/j.oneear.2025.101349.