Transforming agriculture from carbon source to sink: Study shows potential of carbon sequestration options

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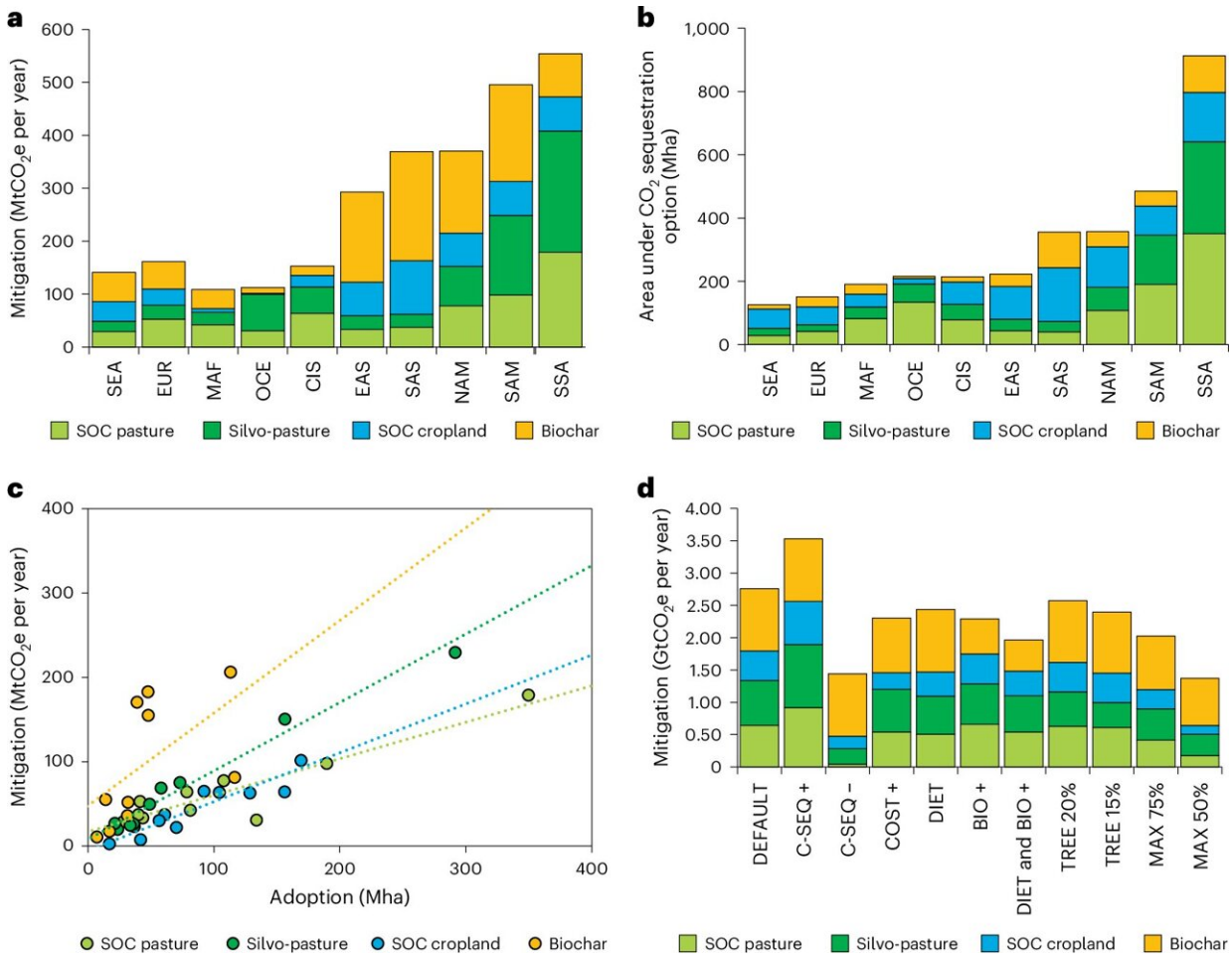

Adoption of agricultural CO_2 sequestration options in the '$agCO_2$' scenario with a GHG price of 160 USD_{2022} tCO_2e^{-1} by 2050. Credit: *Nature Food* (2024). DOI: 10.1038/s43016-024-01039-1

The food system is one of the most significant sources of greenhouse gas emissions on the planet, making the reduction of emissions in this sector a priority for policymakers around the world. IIASA researchers explored the potential of carbon sequestration on farmland to combat climate change, offering insights into economic effects as well as its climate change mitigation potential.

Carbon sequestration on agricultural land refers to the process of capturing and storing carbon dioxide (CO_2) from the atmosphere in soil and plants on farms. According to the authors of a new IIASA study just published in *Nature Food*, these practices hold great potential for reducing global warming while reducing economy wide mitigation costs.

"We set out to assess novel carbon sequestration options on agricultural land and their dynamics in an economic model. To date, these options were only assessed in bottom-up engineering studies and hence not considered in Integrated Assessment Model-based climate stabilization pathways that underpin the forward-looking chapters of the reports of the Intergovernmental Panel on Climate Change (IPCC)," explains lead author Stefan Frank, a senior researcher in the Integrated Biosphere Futures Research Group of the IIASA Biodiversity and Natural Resources Program.

"Given the interlinkages across mitigation options, economic sectors, and world regions, integrated economic assessments like ours can provide valuable insights on the system-wide effects of these options."

To help absorb carbon dioxide from the air and store it in the soil or in plants on their farms, farmers can, for example, use techniques like planting cover crops, using biochar (a type of charcoal made from organic waste), or practicing agroforestry (planting trees alongside crops or pastures), thereby turning their agricultural land into a carbon sink.

But why does this matter? The study results indicate that by 2050, these agricultural practices could reduce as much greenhouse gas emissions as planting new forests, particularly in regions like sub-Saharan Africa and South America.

Carbon sequestration on agricultural land is not only important for climate change mitigation efforts but can also enhance agricultural productivity and resilience to climate change, and could help the agriculture, forestry, and land use sectors achieve net zero emissions globally by 2050 at costs between US$80 and $120 per ton of CO_2 equivalent.

"These efforts would not only cut overall economy-wide emission reduction costs when compared to a 1.5°C scenario without agricultural carbon sequestration practices, but also reduce losses of global economic output by 0.6% by mid-century under a climate stabilization scenario aiming to limit warming to 1.5°C," notes study co-author Andrey Lessa Derci Augustynczik, a researcher associated with the same program at IIASA.

"In addition, farmers could earn substantial income from these activities—up to $235 billion by 2050—if they receive financial incentives for every additional ton of CO_2 stored in soils and biomass at a projected greenhouse gas price of $160 per ton of CO_2 equivalent in 2050."

The authors highlight that implementing these changes will require strong institutions and monitoring of systems globally to ensure that farmers adopt these practices correctly and are paid fairly for their efforts.

"Despite the large mitigation potential at rather low cost, agricultural carbon sequestration potentials are mainly located in the Global South,

which warrants caution as several structural, institutional, or social barriers exist. To unlock these potentials and provide meaningful contributions to ambitious climate stabilization efforts, highly efficient institutions and monitoring systems must be deployed in the short-term and the necessary policy incentives need to be put in place fast," Frank concludes.

More information: Frank, S. et al. Enhancing Agricultural Carbon Sinks Provides Benefits for Farmers and Climate, *Nature Food* (2024). DOI: 10.1038/s43016-024-01039-1

Improved modelling of carbon sequestration potential on agricultural land, *Nature Food* (2024). DOI: 10.1038/s43016-024-01056-0 , doi.org/10.1038/s43016-024-01056-0

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