

SOIL CARBON SEQUESTRATION

WHAT IS SOIL CARBON SEQUESTRATION?

Soil carbon sequestration, also known as “carbon farming” or “regenerative agriculture,” includes various ways of managing land, especially farmland, so that soils absorb and hold more carbon. Increasing soil carbon is accomplished in various ways, including: (1) reducing soil disturbance by switching to low-till or no-till practices or planting perennial crops; (2) changing planting schedules or rotations, such as by planting cover crops or double crops instead of leaving fields fallow; (3) managed grazing of livestock; and (4) applying compost or crop residues to fields. In addition to providing local environmental and economic benefits, these practices can capture carbon dioxide (CO₂) from the atmosphere and store it in soils, making them a form of carbon removal.

CO-BENEFITS AND CONCERNS

- + **Improved soil health:** soil carbon sequestration helps restore degraded soils, which can improve agricultural productivity.
- + **Increased climate resilience:** healthier soils make farms more resilient against both droughts and heavy rainfall.
- + **Reduced fertilizer use:** healthier soils require less fertilizer, saving farmers money and reducing environmental impacts.
- **Saturation:** soils can only hold a finite amount of carbon; once they are saturated, societies will no longer be able to capture more carbon using soil carbon sequestration.
- **Reversibility:** the carbon captured via soil carbon sequestration can be released if the soils are disturbed; societies would need to maintain appropriate soil management practices indefinitely.
- **Difficulty of measurement:** monitoring and verifying carbon removal via soil carbon sequestration is currently difficult and costly.

POTENTIAL SCALE AND COSTS

Soils hold three times the amount of carbon currently in the atmosphere or almost four times the amount held in living matter. But over the last 10,000 years, agriculture and land conversion has decreased soil carbon globally by 840 billion metric tons of carbon dioxide (GtCO₂), and many cultivated soils have lost 50–70% of their original organic carbon. Because soils have such a large storage capacity, enhancing soil storage by even a few percentage points makes a big difference. A recent expert assessment estimates that **soil carbon sequestration** could be scaled up to **sequester 2–5 GtCO₂ per year by 2050**, with a **cumulative potential of 104–130 GtCO₂ by the end of the century** at a cost of between **\$0 and \$100 per ton of CO₂**.

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TECHNOLOGICAL READINESS

Soil carbon sequestration techniques are already in widespread use, but they would need to be scaled up substantially to achieve significant climate benefits.

GOVERNANCE CONSIDERATIONS

- **Technical assistance:** good technical assistance can help farmers, ranchers, and land managers learn techniques that are most suitable for their land.
 - **Financial incentives:** accessible, well-designed financial incentives can help drive adoption, especially by enabling farmers to cope with transition costs and financial risks of adopting new techniques.
 - **Encouraging research:** more research is needed to improve understanding of the variation in soil carbon sequestration across soil types and climatic conditions.
 - **Monitoring, verification, and reporting:** processes, standards, and technologies need to be developed to reliably measure carbon sequestration.
 - For **cross-cutting considerations**, see the [What Is Carbon Removal? fact sheet](#) on our web site.
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FURTHER READING

- Fuss, S., et al. 2018. "Negative emissions—Part 2: Costs, Potentials and Side Effects." *Environmental Research Letters* 13: 063002. doi [10.1088/1748-9326/aabf9f](https://doi.org/10.1088/1748-9326/aabf9f)
- Smith, P. 2016. "Soil carbon sequestration and biochar as negative emission technologies." *Global Change Biology* 22:1315–24. doi [10.1111/gcb.13178](https://doi.org/10.1111/gcb.13178)
- Zelikova, J., et al. 2020. [Leading with Soil: Scaling Soil Carbon in Agriculture](#). Oakland, CA: Carbon180.

For more fact sheets on carbon removal, visit <https://carbonremoval.info/factsheets>.