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The cost of cultivating cooling: quantifying the contributions of financial incentives for soil carbon sequestration in agriculture to reducing global surface temperatures

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Sequestration of atmospheric carbon in agricultural soils presents a low-tech, and inexpensive strategy to contribute to meeting climate goals. While agricultural management practices to improve soil carbon are often beneficial from a holistic perspective, their use as a carbon removal strategy are not guaranteed to continue indefinitely and stored soil C could possibly be re-emitted back to the atmosphere under future management. The combination of the potential impermanence of soil carbon, patchwork spatial and temporal aspects of contracted agricultural land, and measurement and verification challenges require that financial incentive structures be carefully considered from an atmospheric climate forcing perspective.

We modeled and compared the potential climate forcing reduction for three common financial incentive structures for agricultural carbon sequestration: private market contracts that pay per-ton of additional C sequestered, 5 year payment-for-practice contracts that require instating a new (fully additional C removal) management practice, and 10 year payment-for-practice contract with a historical 40% renewal rate (60% additional C removal). For each contract structure, we estimated the associated cost for each fraction of a degree Celsius reduced over the next 25 to 150 years. We compare these with the predicted costs of paying for fully permanent geologic storage of CDR. We hypothesize that the trade-off between active carbon removal in the short term and maintaining stored carbon in the long-term favors longer, renewable (15+ year) contracts for climate-smart management practices as the most cost-effective strategy to reduce climate forcing over the next 50 to 100 years, when the balance will eventually favor payment for geologic storage of CDR. We anticipate that the results of this study will clarify the optimal balance and financial value of purely additional carbon removal from the atmosphere and maintenance of soil carbon stocks over time and will quantify their relative contribution to reducing global surface temperatures.

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