The spatial and temporal domains of natural climate solutions

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Abstract

Natural climate solutions (NCS) have been proposed to mitigate climate change by removing CO_2 from the atmosphere and increasing organic carbon storage in ecosystems. Adoption is required at global scales, but implementation of NCS have been limited by the lack of a systematic framework to prioritize ecosystem restoration or conservation at local and regional scales. Current carbon sequestration policies at the national scale often fail to consider local and regional ecological feedback systems and tradeoffs among finite natural resources. These have unintended effects on the carbon permanence of ecosystems, defined as the residence time of carbon (C) before release to the atmosphere as CO_2. By combining estimates of soil organic C stocks, land use, projected precipitation changes, and landscape-level analysis of carbon and water flux in Oregon and Washington, we show that NCS efforts should be prioritized in natural areas with low soil C stocks and projected future precipitation increases. On the other hand, conservation may be more appropriate for regions with high soil C stocks and projected decreases in precipitation. Our consideration of geography acknowledges the ecological and socioeconomic challenges to NCS implementation and allows for the identification of high-priority sites for NCS. This protocol can be adapted at local and regional scales to guide policy for targeting the highest-priority locations for implementation of NCS.