WORLD RESOURCES INSTITUTE

SCALING CARBON REMOVAL IN THE U.S.

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The world is outpacing its carbon budget and the pressure is on to steeply reduce emissions as well as remove carbon dioxide from the air and store it safely underground. The latest science suggests that to limit warming to 1.5˚C and avoid the worst climate impacts, U.S. and global emissions pathways will need to reach net-zero emissions by mid-century—requiring removal of at least as much carbon from the atmosphere as we put into it. How much carbon removal we will ultimately need depends on how quickly we reduce emissions to as close to zero as possible.

Scaling up carbon removal to meaningful levels by mid-century requires starting today. Carbon removal can be achieved through both natural means (e.g., restoring trees to the landscape and managing agricultural soils) and technological approaches (e.g., direct air capture, carbon mineralization). Both natural and technological pathways require sustained investments in research and development, commercialization support and deployment. The U.S. has made great strides in clean energy technologies with similar large, sustained public and private investments. 2020 begins a new decade of innovation, and an opportunity for the U.S. to strengthen investments in carbon removal approaches so they are ready when we need them most.

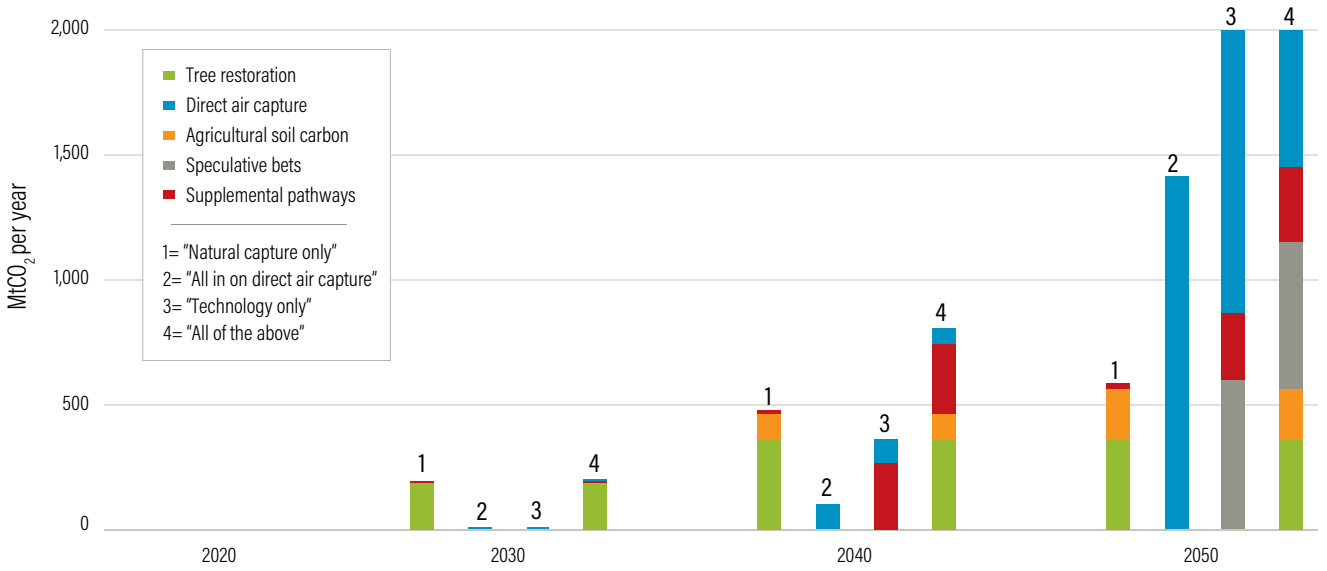
The United States is especially well-placed to play a meaningful role in meeting our national and global carbon removal needs.

- **Why should the U.S. lead in scaling carbon removal?** The United States has several advantages, including significant potential for carbon sequestration in land, a long history of technological innovation and a jump start with pilots of various carbon removal approaches already underway. Additionally, carbon removal can bring other significant benefits for people and land—including soil health, restored ecosystems and enhanced agricultural yields—and presents an opportunity for the U.S. to lead on cutting-edge technologies.
- **How much carbon removal should we aim for in the U.S. by mid-century?** The U.S. Mid-century Strategy for Deep Decarbonization left roughly 2.55 $GtCO_2$ of gross annual emissions unaddressed in its benchmark scenario. The current U.S. land sink offsets roughly 720 $MtCO_2$ per year but is projected to decline through 2050 due to aging forests, forest disturbance, and forest conversion. Remaining net annual emissions—about 2 $GtCO_2$—would need to be offset by carbon removal for the U.S. to achieve climate neutrality.
- **How does this goal for the U.S. compare to our global needs?** Carbon removal will need to be scaled globally to 5–15 $GtCO_2$ per year* by 2050 (Fuss et al. 2018). Accordingly, if the U.S. removes 2 $GtCO_2$ per year* by 2050, carbon removal on this order of magnitude could significantly contribute to our global goals. If other countries are not able to scale up removal and if emissions are not reduced quickly enough, then both U.S. and global carbon removal goals must be even higher. Therefore, the benchmark of removing 2 $GtCO_2$ may be best viewed as a starting point rather than an endpoint for U.S. investment in carbon removal.
- **What are plausible scenarios for pursuing these carbon removal approaches?** Our analysis finds that an all-of-the-above portfolio would enable considerably more cumulative carbon removal through 2050 than any other scenario. Natural carbon capture pathways alone are incapable of reaching a 2 $GtCO_2$ per year* target. A technology-only or direct-air-capture-only portfolio

*1 $GtCO_2$ is roughly equivalent to taking 217 million cars off the road for a year (EPA 2018)

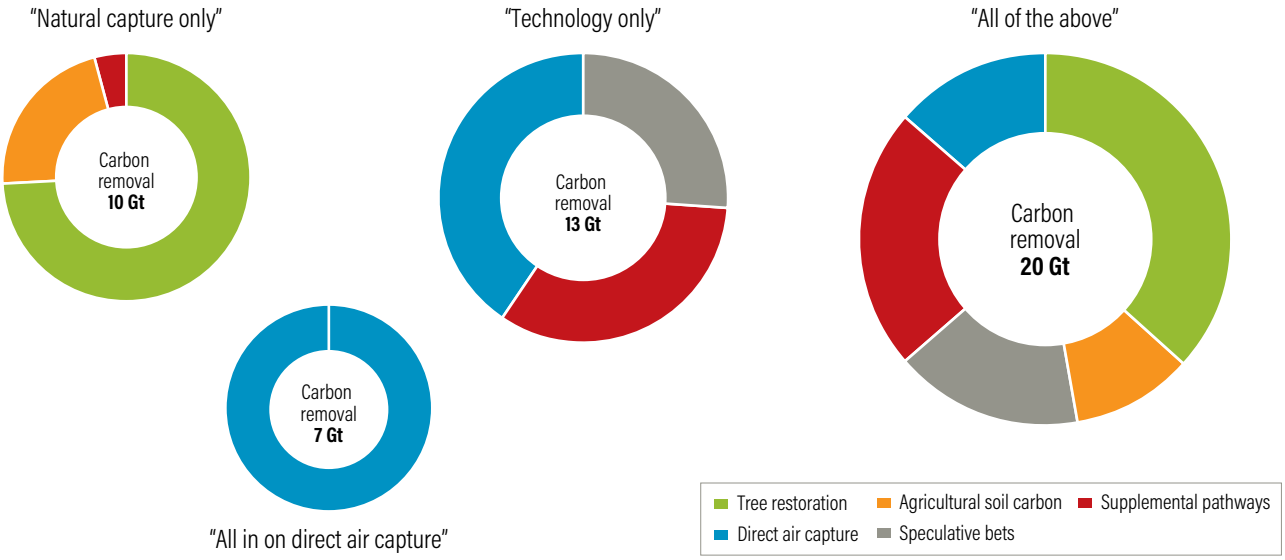
could reach this level of deployment by 2050 (or shortly thereafter) but would yield considerably less cumulative removal over that period, as it will take time to scale up the technology. An all-of-the-above portfolio is also the most risk-averse strategy as it creates the most options for achieving the 2 Gt target by 2050, should any single pathway fail to realize its expected potential. Assuming direct air capture remains the highest-cost pathway, the all-of-the-above portfolio is also the cheapest scenario.

Carbon Removal Deployment Scenarios



Source: Author calculations based on estimates in the literature and assumed rates of deployment; see "Pathway-by-Pathway Deployment Scenarios" section for more information.

Cumulative Carbon Removal in 2050 of Each of the Above Scenarios ($GtCO_2$)



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