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Yale School of Environment Scientists Emphasize Importance of Forest Management in Reaching Net Zero Emission Goals

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Body

(TNSres) -- Yale School of Environment issued the following news:

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Forests play a key role in mitigating climate change by removing and storing carbon dioxide, but they are facing increasing challenges. In the new Department of Energy report "Roads to Removal," a team of YSE scientists map out a plan to reach critical climate goals by increasing carbon uptake in forests.

* * *

A new U.S. Department of Energy report co-authored by Yale School of the Environment (YSE) scientists lays out a pathway to remove at least 1 billion tonnes of carbon dioxide per year from the atmosphere by 2050 and storing it on a gigaton scale -- a figure that is needed to reach the Biden administration's net-zero emissions goals and avoid the worst impacts of climate change. A key component of this pathway centers on forests, which have the potential to yield a cumulative removal of 1.5 to 1.8 billion tonnes of carbon dioxide equivalent (CO2e) by 2050 with careful intervention and management, YSE scientists say.

The atmosphere contains billions of tonnes of carbon dioxide that has been accumulating since the industrial age. To reduce global warming, carbon dioxide must be removed from the atmosphere. Forests play a significant role in removing carbon. The most recent U.S. Environmental Protection Agency inventory of greenhouse gas emissions and sinks estimated that the more than 700 million acres of forestland in the U.S. and the wood products they produce sequestered about 800 million tonnes of CO2e in 2021. But U.S. forests are under increasing stress from climate change-induced droughts, wildfire, extreme weather, and pests. Without intervention, the amount of carbon dioxide forests can capture could decrease by one-third by mid-century, the scientists say.

"Forests are part of our carbon budget. They are living direct air capture machines. We know how to manage forests and the report sets out three options that promote carbon dioxide removal and storage that are scalable. The real challenge is making a decision to act," says DOE report co-author Sara Kuebbing, a research scientist and director of the Yale Applied Science Synthesis Program, which is an initiative of The Forest School at the Yale School of the Environment and the Yale Center for Natural Carbon Capture, a university-wide effort within Yale's Planetary Solutions Project.

The DOE "Roads to Removal" report, written by scientists from Lawrence Livermore National Laboratory and more than a dozen institutions including Yale, answers the question "How much CO2 is it possible to remove in the

United States and at what cost?" It charts a path to decarbonize the U.S. economy by increasing the carbon uptake in forests, working agricultural lands, converting waste biomass into fuels and carbon dioxide, and using purpose-built machines to remove carbon dioxide directly from the air.

"Roads to Removal enables local, informed decision-making and shows us that we can prevail in our quest to reverse climate pollution," says Lawrence Livermore National Laboratory scientist Jennifer Pett-Ridge '94, '96 MFS, the report's lead author.

Case Studies on Forest Practices in Three U.S. Regions

In the report, YSE scientists presented case studies that evaluated forest management practices in three major forested regions of the U.S. (the Northeast, the Western U.S., and Southeastern U.S.) that could help promote and enhance carbon capture and storage by forests. These management techniques include forest harvesting practices that promote natural regeneration of climate resilient forests (New England), managing fire-prone forests near communities to reduce the risk of catastrophic wildfires (the Western U.S.), and planting new pine forests (the Southeastern U.S.) that could be used for forest restoration or for novel wood product markets. The scientists considered the ecological condition of forests, as well as the social and economic contexts of carbon dioxide removal (CDR) efforts in each particular region and excluded highly productive lands that are being used to meet the housing and agricultural needs of the U.S. population.

"An important aspect of this report is that it recognizes that there is no single solution for reducing greenhouse gases," says report co-author Mark Bradford, professor of soils and ecosystem ecology and a member of the YCNCC leadership team. "Each forested region requires a tailored set of practices recognizing their unique ecology, disturbance threats, and socio-economic needs and opportunities. This is necessary if we are to successfully manage our forests into the future for the many services, including carbon storage, they provide to us to make our planet a healthy, sustainable place to live."

The case studies found:

* In southern New England as well as southeastern New York, applying regenerative silvicultural practices to promote the growth of diverse forests and to build forest resilience to natural disturbances on 2.6 million hectares (6.4 million acres) of hardwood forestlands could provide up to 68 million tonnes of cumulative carbon dioxide removal, including carbon stored in wood products and avoided emissions benefits, by 2050.

* In dry, fire prone forest regions of the western U.S., applying selective fire-resilient management practices to about half a million hectares (1.19 million acres) of forest at high risk of wildfires near human homes and workplaces may remove up to 16.21 million tonnes cumulative CO2 e by 2050.

* Planting 2.1 million hectares (5.2 million acres) of available land in the Southeastern region of the U.S. coastal plain areas and Piedmont, (which is outside the Appalachian Mountain range) in 2025 would lead to total removal of 1.51 to 1.78 billion tonnes CO2e by 2050 (71.14 million tonnes CO2e per year).

"Effective forest management can change the CDR conversation. Our forests are both a sink and a source of carbon dioxide, essentially our green infrastructure. But they are in trouble, and we must act now," says Kuebbing.

Action Needed To Preserve Forests As Carbon Sinks

Forests are under increasing pressure from land use conversion and climate change, with wildfires increasingly turning forests from carbon sinks to carbon emitters. When trees die or forest soils are disturbed, carbon in these pools return to the atmosphere. The 2023 U.S. greenhouse gas inventory reports the majority of forest carbon loss annually is from conversion to human settlements (63.7 million tonnes CO2e), cropland (48.5 million tonnes CO2e), and grassland (19.6 million tonnes CO2e).

Conserving and sustainably managing forests will insure they remain carbon sinks rather than carbon emitters, the YSE co-authors say.

"Trees are part of the answer to most of the world's environmental problems," says Mark Ashton, senior associate dean of The Forest School at YSE, and professor of silviculture and forest ecology. "Most people assume forests are not changing and if they store large amounts of carbon today, they will continue to do this into the future. But they are impacted by climate and many other interacting human origin effects. Yet, they are still serving human needs, but only if we recognize that we need to protect them and steward them (and in many cases restore them) toward more resilient combinations of themselves."

YSE doctoral student Reid Lewis '20 MF, who researched the effect restoration treatments have on carbon in the western dry forests, says the report calls national attention to the fact that some wood can help the forest it came from. Improved forest management practices, such as reducing stocking densities in high fire risk areas, lengthening rotations, and routing of timber to long-lived forest products have the potential to increase forest carbon stocks and decrease forest carbon emissions by promoting tree growth while still supplying critical wood products for market, the report notes.

"With this realization, we'll start sourcing wood from forests that would benefit from it, increasing the chance that these forests survive the climate crisis we've put them in," Lewis says..

Other YSE and Yale co-authors of the report include Yuan Yao, assistant professor of industrial ecology and sustainable systems; Eric Slessarev, assistant professor of ecology and evolutionary biology at Yale; Anastasia O'Rourke '09 PhD, managing director of the Carbon Containment Lab; Sinead Crotty, associate director of science at the Carbon Containment Lab; Abby Lunstrum, project manager of the Carbon Containment Lab; postdoctoral associates Weier Liu and Bingquan Zhang; doctoral student Thomas Harris; and Jimena Terrazas Lozano '24 MESc. Nicholas Dahl '21, who interned at the Carbon Containment Lab, and Mark Ducey '90, '92 MFS, '96 PhD, who is professor of natural resources and the environment at the University of New Hampshire, are also co-authors.

Collaborating institutions on "Roads to Removal" include Oak Ridge National Laboratory; Lawrence Berkeley National Laboratory; University of Texas at Austin's ***Bureau of Economic Geology***; North Carolina State University; University of California, Berkeley; Colorado State University; Indiana University; University of New Hampshire Iowa State University; Michigan State University; and University of Pennsylvania.

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Note: In the report, the authors refer to "tonnes" of carbon dioxide equivalent, which is slightly different from a "ton." A "tonne" is a metric unit, used across much of the world for scientific and industrial reporting, that is equal to 1,000 kilograms. A "ton," a unit of measurement commonly used in the U.S., can refer to either approximately 907 kilograms or approximately 1,016 kilograms.

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Original text here: *https://environment.yale.edu/news/article/yse-scientists-emphasize-importance-forest-management-net-zero-emissions*

Contact:

Fran Silverman, Associate Director of Communications, 203/436-4842, *fran.silverman@yale.edu*

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