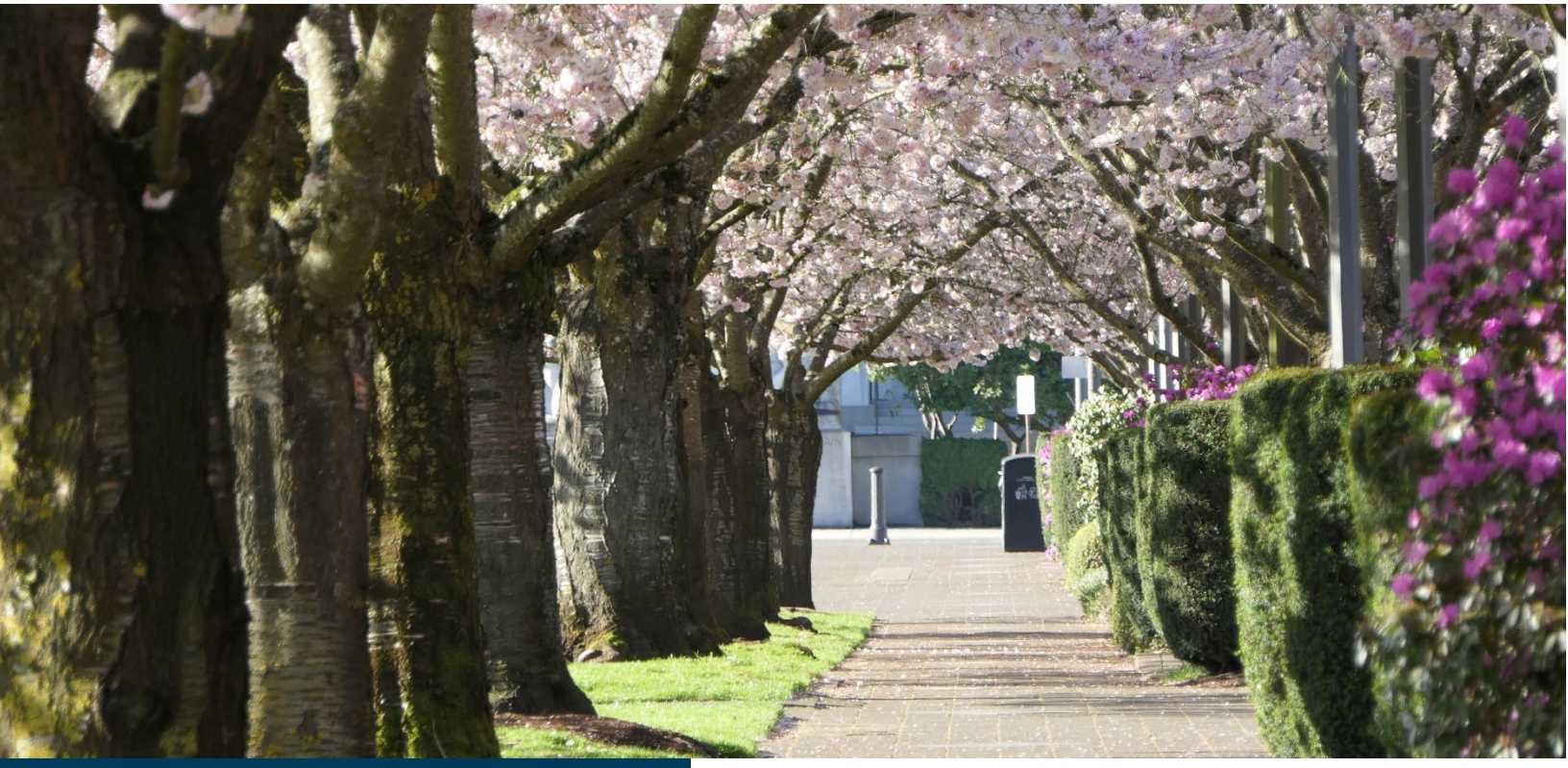
Goal Setting for Natural & Working Lands



DRAFT FOR PUBLIC COMMENT

For the

OREGON CLIMATE ACTION COMMISSION

by the

OREGON DEPARTMENT OF ENERGY

June 8, 2026

Executive Summary

The purpose of this report is to respond to ORS 468A.193 that directed the Oregon Department of Energy and the Oregon Climate Action Commission, in coordination with the land managing agencies, to establish a non-binding net sequestration and storage goal for Oregon's natural and working lands and update the goal as new information becomes available. ODOE presents three goal options for the Commission's consideration. The goal that will be established, while voluntary, will provide a guidepost for considering land management as part of climate action.

Background

Natural climate solutions (NCS) are activities that enhance or protect net biological carbon sequestration on natural and working lands, while maintaining or increasing ecosystem resilience and human well-being.[i] They are carbon removal strategies that can be taken immediately to remove carbon from the atmosphere and help Oregonians adapt to the impacts of a changing climate. Natural climate solutions are already being deployed across Oregon. Increasing the pace and scale of their implementation by state agencies and willing participants would improve Oregonians' quality of life of today and into the future.

The natural climate solutions statute section directs ODOE, the Oregon Climate Action Commission, and natural resource agencies to establish a non-binding net carbon sequestration and storage goal on natural and working lands (ORS 468A.193(6)). The goal is voluntary, rather than being regulatory, and is intended to increase awareness and provide direction for collaborative action. It is not intended to pose any type of burden or additional requirements on industry, landowners, or others if they do not participate.

In an average year, Oregon's land-based net sequestration of carbon ranks as the seventh highest in the nation according to the national greenhouse gas inventory. Recent data shows that the nation's natural and working lands sequester carbon at a net rate equivalent to 14 percent of the United States' sector-based greenhouse gas emissions. Oregon contributes roughly 5.4 percent toward the national annual rate. Oregon's lands are already sequestering carbon at large scales and additional actions like natural climate solutions would allow for greater increases.

Land-based net sequestration rates are often compared against sector-based greenhouse gas emissions to communicate scale.

It's important to note that lands do not reduce sector-based emissions and the term 'net' is used to indicate whether the balance is an emission or sequestration.

The statute directs the state to leverage existing programs to implement natural climate solutions, and it is Oregon's land use and land managing policies, programs, and plans that will guide where and how natural climate solutions are implemented across Oregon. Planning efforts by Tribes, public and private partners, and land stewards are crucial to strategic implementation. This report highlights these

[i] Ellis et al. (2024). The principles of natural climate solutions. *Nature Communications*, *15*, 547. https://doi.org/10.1038/s41467-023-44425-2

connections. A comprehensive discussion of agency programs that implement natural climate solutions in Oregon will be in the forthcoming Natural Climate Solutions and Metrics Analysis.

Goal Options

Three options for a voluntary net sequestration goal are presented within this report for Commission consideration: 1) Maintaining the net sequestration goals the Commission recommended in 2021, 2) Modifying the 2021 goals to align time horizons with other state goals and address the possibility of meeting a net sequestration goal while Oregon's net removals continue to experience a declining trend, and 3) Calibrating the goal based on new data available from Oregon's land-based net carbon inventory and the U.S. national greenhouse gas inventory.[ii] While there are practical constraints on implementation like the time it takes to build partnerships, permit projects, align agency infrastructure, build a workforce, and secure investments; Option 3 focuses on the science that provides information about what is needed to contribute to solving the climate crisis rather than the policy and implementation challenges at hand. The goal language options are presented in the box below.

Goal Options for Commission Consideration:

Option 1: Original 2021 Proposal

- Sequester at least an additional 5 MMTCO2e per year by 2030
- Sequester at least an additional 9.5 MMTCO2e per year by 2050

Option 2: Modified 2021 Proposal

- Achieve net sequestration of at least 53 MMTCO2e per year across all land categories by 2035
- Achieve net sequestration of at least 57.5 MMTCO2e per year across all land categories by 2050

Option 3: New Proposal for 2026

- Achieve net sequestration of at least 57.6 MMTCO2e per year across all land categories by 2035
- Achieve net sequestration of at least 62.4 MMTCO2e per year across all land categories by 2050

ODOE included Option 3 to meet the statutory direction that requires ODOE and the Commission to consider new information as it becomes available. To craft Option 3, we used the information from Oregon's Land-based Net Carbon Inventory (2025) and the most recent U.S. national greenhouse gas inventory (2024). Options 1 and 2 use the same target rates of sequestration based on information, including published research, that was available at the time the first goal was recommended (2021). However, Option 2 applies Oregon's most recent five-year average annual sequestration rate to produce the total goals and compensate for the state's declining trend of removals ensuring that at a minimum,

[ii] United States Environmental Protection Agency (2024). *Inventory of U.S. Greenhouse Gas Emissions and Sinks*: 1990-2022. https://www.epa.gov/ghgemissions/inventory-us-greenhouse-gas-emissions-and-sinks-1990-2022

the desired annual net sequestration rate is achieved; however, depending on the rate of continuing decline, additional efforts may be necessary. All three options are within the science-based range of net sequestration potential identified by ODOE. ODOE recommends the Commission select Option 2 or Option 3.

Policy goals could accompany the net sequestration goal to recognize the related information gaps that are important to address in order to accomplish the policy goal. Four options are presented within the report to address important needs and information gaps including: 1) establishing a cross-agency reporting system, 2) modeling natural climate solutions pathways toward achieving the goal, 3) gathering information on incentives for natural climate solutions implementation, and 4) conducting a land-based stock assessment to track and potentially set a future goal to preserve carbon stocks.

Once the goal is established, ODOE and the Commission will need to evaluate progress toward its achievement. While the statute requires ODOE, the Commission, and the agencies to identify metrics to track progress toward a statewide goal, agency capacity and gaps in data infrastructure present challenges to acquiring and applying the necessary data to the metrics in order to evaluate such progress.

Table of Contents

Land-based Climate Action in Oregon

To address the climate crisis, society must quickly take two actions to meet national and global climate goals:

1. We must rapidly reduce emissions, which includes making a clean energy transition.
2. We must also rapidly increase efforts to remove carbon already in the atmosphere.

Taking these actions is necessary to stop global temperatures from rising beyond thresholds that experts say would be disastrous for humanity and the ecosystems on which it relies.

In 2007, Oregon lawmakers passed House Bill 3543, which set sector-based state emissions reductions goals. The same year, lawmakers established the Oregon Global Warming Commission, now called the Oregon Climate Action Commission (Commission), and charged it with tracking the state's progress to achieve these goals.

In recent years, climate specialists and technologists have turned their attention toward actions to remove carbon already in the atmosphere. Oregon has followed suit. In 2020, Governor Brown directed the OCAC to recommend a goal for increased sequestration in Oregon's Natural and Working lands which the Commission adopted in 2021. In 2023, the Oregon legislature passed House Bill 3409, a broad-based package of laws on climate including natural climate solutions. In addition to directing ODOE and the Commission to establish a goal, it defined natural and working lands and natural climate solutions and established a policy to use natural climate solutions as a tool to combat climate change.

What does "non-binding" mean?

The natural climate solutions statute section directs ODOE, the Commission, and natural resource agencies to establish a non-binding net carbon sequestration and storage goal (ORS 468A.193 (6)). This means the goal is voluntary, not regulatory, and is not intended to pose any type of burden or additional requirements on industry, landowners, or others if they do not participate.

Why set a goal that is voluntary?

A voluntary goal can set an intention, increase awareness about the subject of the goal, and provide direction for collaborative action. For the natural and working lands goal, this means land stewards and landowners that would like to bolster carbon sequestration and storage have a guidepost by which to measure progress, additional information to help decision-making, and ideally will be able to track their progress alongside other participants and state land managing agencies.

Purpose

The purpose of this report is to respond to ORS 468A.193 that directed the Oregon Department of Energy and the Oregon Climate Action Commission, in coordination with the land managing agencies, to establish a non-binding net sequestration and storage goal for Oregon's natural and working lands and update those goals as new information becomes available.[iii]

The goal that will be established, while voluntary, will provide a guidepost for considering land management as part of climate action.

[iii] Oregon Revised Statute 468A.193. https://oregon.public.law/statutes/ors_468a.193

Land Management as Climate Action

Natural climate solutions are activities that enhance or protect net biological carbon sequestration on natural and working lands, while maintaining or increasing ecosystem resilience and human well-being.[iv,v] They are carbon removal strategies that can be taken immediately and help Oregonians adapt to the impacts of a changing climate. Unlike other technological carbon removal strategies, NCS also protect land-based stocks, increase resilience, and reduce land-based emissions. NCS strategies are already being deployed across Oregon. Increasing the pace and scale of their implementation by the state agencies and willing participants would improve Oregonians' quality of life today and into the future.

All types of carbon removal strategies should be investigated and potentially invested in; however, NCS sequester carbon now while also providing other important societal benefits. For example, planting trees in cities removes carbon, but also helps achieve multiple other goals by providing shade and temperature refuge for humans and wildlife more equally across neighborhoods, increasing energy efficiency, and offering mental health benefits.[vi]

Deploying natural climate solutions now will also pay future dividends for the climate and society.

Carbon Removal Strategies

Technological carbon removal strategies are already being pursued in Oregon, such as direct air capture. For example, a facility currently operating in Oregon removes approximately 500 metric tons of CO2e per year. While promising; proponents are still working on ensuring their cost-effectiveness and scaling up project size. For comparison, existing trees in developed areas across Oregon currently remove, on average, 1,750,000 metric tons of CO2e per year, per ODOE's recent inventory accounting, representing a 3,500-fold difference in scale.

The National Context

Every year, lands in Oregon, and the U.S. more broadly, sequester carbon at very large scales. In recent years, natural and working lands in the U.S. sequestered carbon at an average net rate of 890 million MTCO2e per year, equivalent to approximately 14 percent of the U.S. sector-based greenhouse gas emissions.[vii] Oregon's lands currently sequester carbon at an average net rate of 48 million MTCO2e per year. This means that Oregon contributes roughly 5.4 percent of the national average net rate of annual sequestration.[viii] Out of the 50 states, Oregon ranks seventh in the nation in net carbon sequestration.[ii]

[iv] Oregon Revised Statute 468A.183. https://oregon.public.law/statutes/ors_468a.183

[v] Ellis et al. (2024). The principles of natural climate solutions. *Nature Communications*, *15*, 547. https://doi.org/10.1038/s41467-023-44425-2

[vi] Pataki et al. (2021). The benefits and limits of urban tree planting for environmental and human health. *Frontiers in Ecology and Evolution*, *9*, 603757. https://doi.org/10.3389/fevo.2021.603757

[vii] Land-based sequestration rates are often compared against sector-based greenhouse gas data to communicate scale. It's important to note that lands do not reduce sector-based emissions and the term 'net' is used to indicate whether the balance is an emission or sequestration.

[viii] Oregon Department of Energy (2025). *Land-based Net Carbon Inventory Appendix F: Inventory Results*. 2025 Carbon Inventory Appendix F

Oregon and the U.S. have a unique opportunity to be world leaders in land-based removals. With additional actions like natural climate solutions, Oregon may enhance its land-based carbon sink and help increase global net sequestration rates.

What Makes a Good Natural & Working Lands Goal?

As part of the approach to coalescing information to establish the goal, staff asked one question to multiple individuals and organizations: What makes a good goal? The feedback we received and synthesized helped guide the contents of this document and the development of goal options for consideration by ODOE and the Commission.

What Makes a Good Goal?

- Science-based
- Understandable
- Measurable
- Ambitious, yet achievable
- Multi-benefit

A good natural and working lands goal should be science-based, understandable, measurable, ambitious yet achievable, and spur actions that result in multiple benefits. Oregon's approach and goal should be based on the best-available scientific literature and reports available to us at this time. The rationale behind it should be clear and understandable to a variety of audiences. Progress toward the goal needs to be measurable, take into consideration carbon dynamics information and data, and be consistent with Oregon's reporting infrastructure where possible (these measuring and tracking needs are discussed more in depth in the Draft Natural Climate Solutions and Metrics Analysis). The goal should be consistent with Oregon's climate ambitions—and be achievable. Overall, goals are successful when the trade-offs are understood, negative consequences minimized or mitigated, and it is believed that the collective benefits outweigh the consequences.[ix]

Integration with Existing Programs and Policies

The goal will establish a guidepost for Oregon, enable us to track our progress, and identify implementation challenges. However, it is Oregon's land use and land managing policies, programs, and plans that will guide where and how natural climate solutions are implemented across Oregon. The planning efforts of Tribes, public and private partners, and land stewards are crucial to strategic implementation. The statute directs the state to leverage existing programs. Below, we briefly highlight a few examples of programs and policies that provide context within which the goal will sit and how land use planning and land management plans underpin maintaining or enhancing Oregon's rich carbon stores. A more comprehensive compilation of agency programs will be presented in the forthcoming Natural Climate Solutions and Metrics Analysis.

[ix] Gardali et al. (2021). Multiple-Benefit Conservation defined. *Conservation Science and Practice*, *3*(6), e420. https://doi.org/10.1111/csp2.420

Oregon's Land Use System

Land conversion is a major driver of land-based carbon emissions and removals. Oregon's landmark land use system was created fifty years ago by leaders and advocates who understood the ramifications of potential future land conversion. With that understanding, they created a system to balance conservation and development. Former Governor Tom McCall, passionately railed against "sagebrush subdivisions, coastal condomania, and the ravenous rampages of suburbia" as a threat to Oregonians' quality of life. Today, the benefits of Oregon's land use system are evident out every window and at every vista. Farms, forests, rivers, wetlands, estuaries, and other natural resources exist alongside developed land. ODOE's Land-based Net Carbon Inventory (LCI) documents this sustainable development framework noting the relatively low rate of land conversion between land categories (forest, cropland, wetlands, grassland/arid lands, and developed land) over the last 35 years compared to other states. Yet, even as zoning has remained relatively consistent, Oregon has experienced changes in its lands throughout the last three decades in both land use and management practices, which are reflected in significant changes in statewide rates of land-based emissions and removals. Continued protection of Oregon's landmark land use laws are vital for future net carbon removal as this program may be the largest statewide policy lever to meet an adopted net carbon sequestration goal.

Land and Water Management

Tribal Nations, state and federal agencies, local governments, and the private sector guide Oregon land and water management. The programs and plans discussed below are not an exhaustive list but were selected by ODOE and the Inter-Agency Working Group as examples that provide a clear connection between goal setting and natural resource management and adaptation/resilience planning in Oregon. Programs like those offered below provide the strategic implementation across land categories necessary to achieve a net land-based carbon sequestration goal and "optimize the social, health, ecological, climate resilience, and economic benefits of natural climate solutions" listed in ORS 468A.185(3)(d)(F) to the right.

Tribal Nations Planning and Action:

Tribes in Oregon are climate action leaders. Many Tribes have assessed, or are in the process of assessing, their vulnerabilities,

ORS 468A.185 (3)(d)(F) provides the following list of benefits from NCS implementation:

- Reducing heat island effects;
- Improving air quality;
- Improving flood control;
- Improving soil health and productivity;
- Improving wildfire resilience and community protection;
- Improving drought resilience and response;
- Improving stream health, wetland recovery and riparian functionality;
- Protecting and recovering drinking watersheds for enhanced water quality and quantity;
- Maintaining or increasing short-term, mid-term and long-term fiber supplies;
- Maintaining or increasing food supplies;
- Increasing the climate resilience of fish, wildlife and their habitats;
- Improving protection for coastal communities from the impacts of storm surge; and
- Improving public health.

identifying priorities, and creating strategic actions to enhance climate resilience. As an example, in 2025, the Coquille Indian Tribe published the Coquille Resilience Management Plan. An excellent model of holistic resilience planning, the document weaves together all the actions the Tribe will take to make progress on climate mitigation and adaptation to create climate resilience. The strategic priorities below from the Coquille's plan guide where and how nature-based actions are implemented and can bolster how the natural and working lands goal will be achieved:

- **"Food and Water Sovereignty:** Restore traditional food systems, protect native freshwater and marine fisheries, develop Tribal-led agriculture and aquaculture, advocate for sustainable ocean and river policies, and establish Tribal water rights.
- **Land Acquisition and Sovereignty:** Land tenure is fundamental to self-determination. By controlling our own land and acquiring additional lands, we can increase access to traditional food sources, protect water resources, and implement sustainable agricultural practices. This strengthens our food security and ensures long-term resilience in the face of climate change.
- **Land and Resource Management:** Strengthen Tribal control over forest lands, promote carbon sequestration, reduce wildfire risk, protect sacred sites, and ensure that resources are available for generations to come.
- **Healthy Waters, Lands, and Oceans:** Restore terrestrial, riverine, and marine habitats, integrate Traditional Ecological Knowledge (TEK) with modern science, and advocate for climate-smart resource management policies.
- **Policy Advocacy and Partnerships:** Ensure Tribal sovereignty is recognized in water, energy, food, and environmental policies, and engage in leadership roles at state and federal levels.
- **Ecosystem and Cultural Preservation:** Implement coastal wetland restoration, reforestation, and pollution reduction efforts while integrating cultural knowledge into resource management."

Federal Agency Planning and Action

Just over half of Oregon's Natural and Working Lands are federally owned. Federal agency planning and actions, therefore, are part of how well Oregon's lands sequester and store carbon. Many federal agency programs partner with Oregon to deliver land management services, assistance, and funding that support NCS implementation. State agency partnerships with federal agencies will be part of the forthcoming NCS and Metrics Analysis.

Oregon State Agency Planning and Action

Forests: The Oregon Department of Forestry has studied Oregon's forestland conversion, forest ecosystem carbon, and harvested wood products carbon. These analyses, strategic planning, and cross-agency implementation coordination will contribute to the overall goal that is set; by supporting and encouraging resilience ecosystems, avoiding emissions from wildfires, and protecting long-term forest stores of Western Oregon.

Plant Material Supplies: The Oregon Department of Agriculture's Native Seed Strategy and Oregon Department of Forestry's Seed Programs are needed to coordinate and expand Oregon's native seed supply chain in response to increasing environmental challenges and restoration demands. These programs can contribute to the overall goal established by removing barriers for native plant materials and accelerating the pace and scale of restoration implementation across the state. They will also provide a source of climate-ready seeds for reforestation and ecosystem function restoration either post management or post disturbance.

Water and Wetlands: Intact wetlands hold significant carbon stocks. The Department of State Lands regulates this resource, which delivers multiple climate benefits like defending landscapes against drought, managing floods, and protecting communities from storm surges. Department of State Lands' five-year strategic plan includes direction to incorporate these considerations into removal-fill permit decision-making. This strategic direction and regulation will contribute to the overall goal that is set by enhancing, restoring, or protecting wetlands and waterways.

Coastal Resources: The Department of Land Conservation and Development developed Estuary Resilience Action Plans with coastal communities to identify where nature-based strategies like coastal wetland restoration can increase community resilience. OCMP is working with communities to develop coastal resilience plans that address all aspects of coastal communities and coastal resources. Additionally, the Department of Land Conservation and Development supports the implementation and update of regulatory Estuary Management Plans, which are implemented by cities and counties. This water-focused zoning approach supports the protection and enhancement of carbon stocks within tidal wetlands, eelgrass meadows, and other tidal riparian vegetation. These plans and regulations can contribute to the overall goal that is set and provide direction on what NCS to implement to increase water quality, protect wetlands, or safeguard communities.

Watersheds and Habitat: Multiple land managing agencies have created plans and priorities to guide *where* adaptation, resilience, and conservation projects should be implemented based on overarching conservation priorities, like Oregon's state wildlife action plan, including the Oregon Department of Fish and Wildlife's priority wildlife connectivity areas. The Oregon Watershed Enhancement Board has established ecological priorities of significance to the state for use in their focused investment partnership grant program. A broad array of agency programs carry out restoration and conservation actions in coordination with a deep network of partners and grantees.

ODOE estimates that there are approximately 106 state and local agency programs currently implementing or supporting NCS implementation in the state. These implementation programs and projects can contribute to the overall goal that is established by avoiding emissions from habitat degradation, increasing carbon sequestration via restoration, or protecting stocks through long-term stewardship of habitat. Financial and technical assistance programs support the pipeline of projects and can contribute to the overall goal being established.

The plans and programs above detail the effects that stewarding, protecting, and managing natural and working lands can have on the environment and Oregon's communities. Setting a goal for nature-based

climate action will have effects on any of the elements displayed in Figure 1, are generally aligned with the land managing agency missions, and can help forward overarching state landscape resilience aims described in Executive Order 25-26. Many resilience actions increase carbon sequestration and storage, or protect existing carbon stocks, which mitigate climate change and in turn may reduce the need for future expensive adaptation measures. Each Tribal Nation and natural resource agency have their specific priorities; however, land-based greenhouse gas emissions and removals are a common denominator, trackable across all land managers and stewards, and can help build new understanding and innovative partnership.

Figure 1. Effects of natural climate solution implementation

Goal Options for Commission Consideration

Below, ODOE offers three options for the Commission to consider. The Commission has the option of maintaining the goals as they were recommended in 2021; however, if maintaining the goal is desired, ODOE recommends a modification to the original goal in Option 2. In Option 3, ODOE recommends a larger net sequestration rate based on available new data. While there are practical constraints on implementation like the time it takes to build partnerships, permit projects, align agency infrastructure, build a workforce, and secure investments, Option 3 focuses more on the science that provides information about what is needed to contribute to solving the climate crisis rather than the policy and implementation challenges at hand.

The directive in ORS 468A.193 sets the expectation that whatever goal or goals are established, they are meant to be revised as new information on climate change and the success of Oregon's efforts become available or as the challenges become clearer. ODOE recommends the Commission revisit the goals as needed since this is an emerging field of science and new information is being published on a regular basis.

Option 1: "Original 2021 Proposal"

The Commission could maintain the goal recommendations adopted in 2021 for net sequestration on Oregon's natural and working lands:

- Sequester at least an additional 5 MMTCO2e per year by 2030
- Sequester at least an additional 9.5 MMTCO2e per year by 2050

The annual net sequestration rates are within the science-defined range of potential net sequestration ODOE calculated (see Appendix A) and based on certain actions that were able to be quantified by the research community at the time.

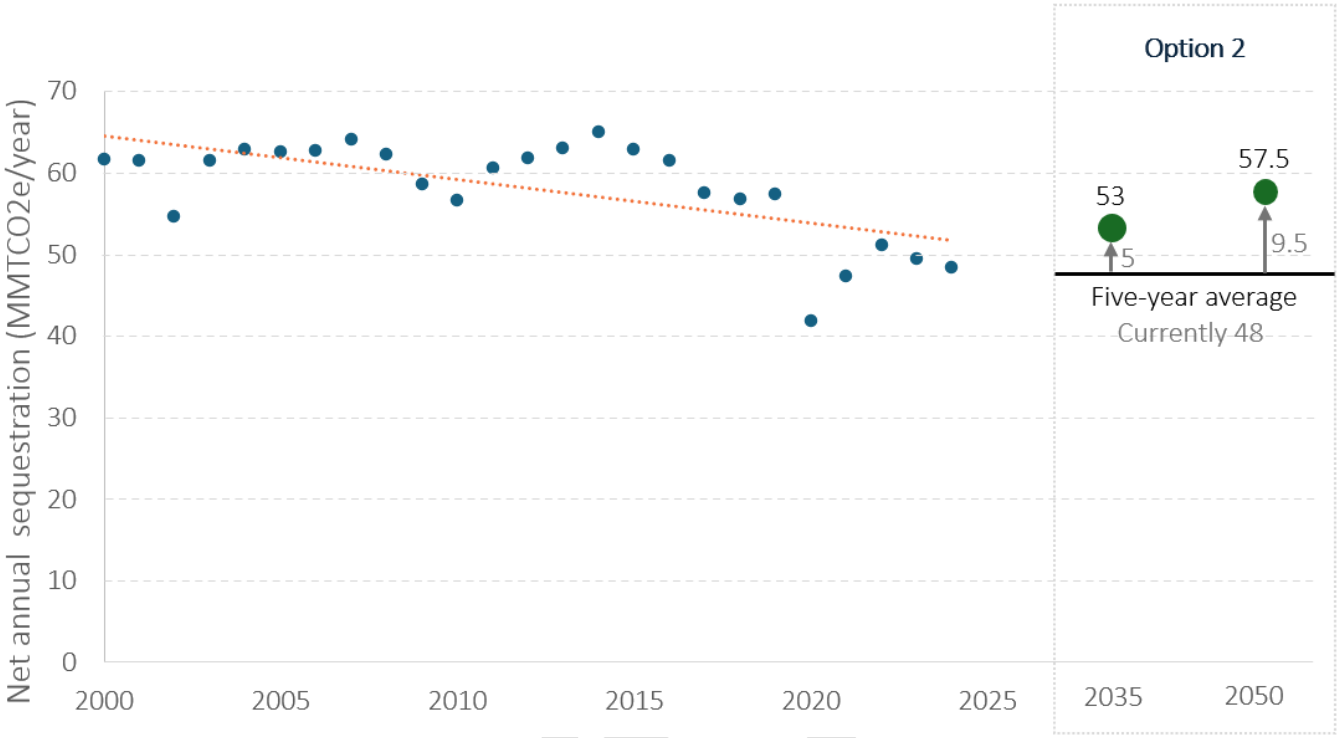
Option 2: "Modified 2021 Proposal"

If the Commission maintains the current goals, ODOE recommends changes to align the time horizons with other state goals and allow for additional time to meet the goal and also to set a target net sequestration rate rather than as an 'additional' amount per year as written in Option 1. With these adjustments the current goals would be modified to read:

- Achieve net sequestration of at least 53 MMTCO2e per year across all land categories by 2035.
- Achieve net sequestration of at least 57.5 MMTCO2e per year across all land categories by 2050.

The Considerations Section discusses time horizons and strategies to account for the declining trend in removals in more detail which support ODOE's recommendation for these minor adjustments (Figure 2).

Figure 2. Representation of Goal Option 2



The goal rates of sequestration would be set to 53 and 57.5 MMTCO2e per year for the years 2035 and 2050, respectively, representing an increase of 5 and 9.5 MMTCO2e over the five-year average rate of net sequestration estimated by the Land-based Net Carbon Inventory.

Option 3: "New Proposal for 2026"

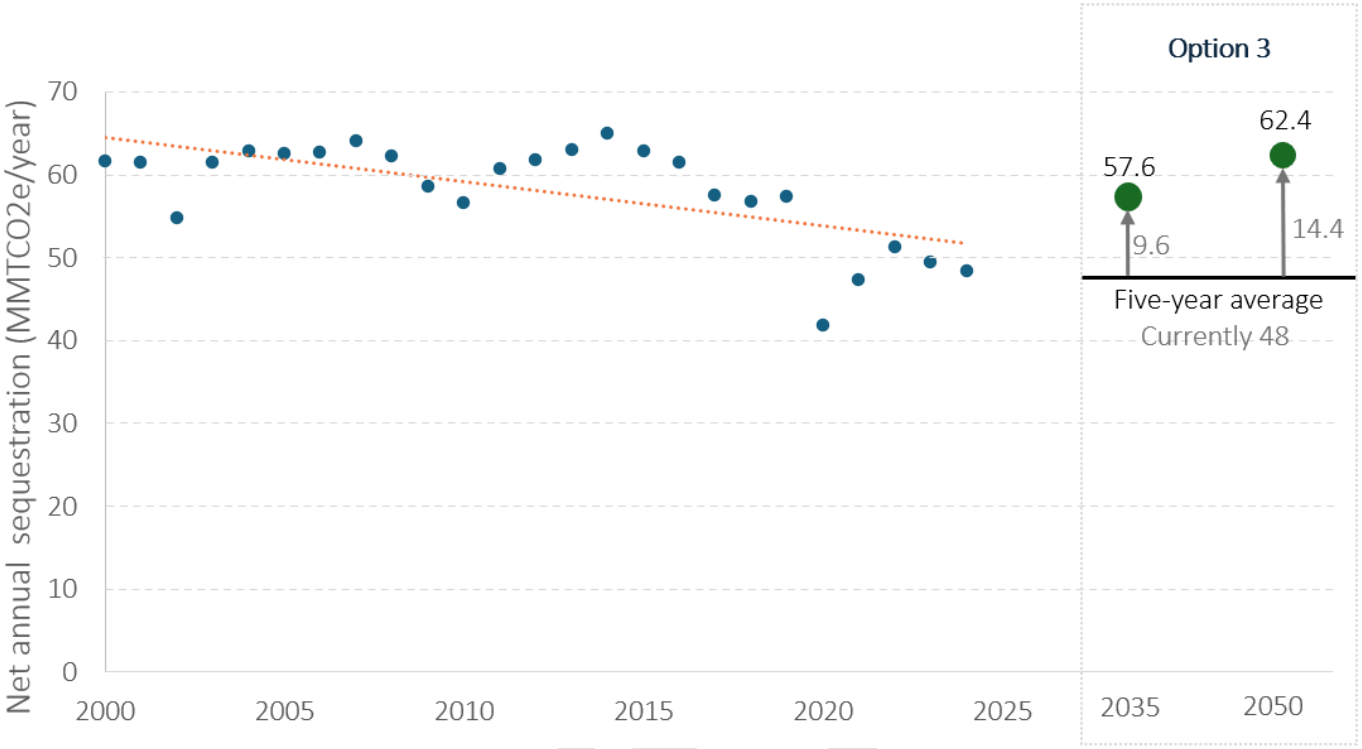
Alternatively, if the Commission wants the goal to be more ambitious, it could update the current goal based on the new data available to Oregon from the Land-based Net Carbon Inventory (LCI) and the U.S. National Greenhouse Gas Inventory, which were not considered previously to produce annual net sequestration rates.

Similar to the changes recommended in Option 2, in Option 3 ODOE set the goal as a total annual rate in the goal year based on the last five-year average in order to avoid a scenario of meeting a yearly net sequestration goal while also still experiencing a declining trend overall. We discuss this reasoning more the Declining Trend of Removals Section. The new goals would read:

- Achieve net sequestration of at least 57.6 MMTCO2e per year across all land categories by 2035.
- Achieve net sequestration of at least 62.4 MMTCO2e per year across all land categories by 2050.

Option 3 is informed by the three data sources used to calculate a range of potential net sequestration rates (see Appendix A): 1) Intergovernmental Panel on Climate Change and U.S.-based analyses, 2) Oregon's new data from the LCI, and 3) mitigation potentials from annual net sequestration rates of NCS per the academic literature. ODOE selected annual net sequestration rates of 9.6 and 14.4 MMTCO2e in addition to the five-year average to create new targets. Figure 3 shows the goal net annual sequestration rates alongside rates reported by the LCI.

Figure 3. Representation of Goal Option 3



The goal rates of sequestration would be set to 57.6 and 62.4 MMTCO2e per year for the years 2035 and 2050, respectively, representing an increase of 9.6 and 14.4 MMTCO2e over the five-year average rate of net sequestration estimated by the Land-based Net Carbon Inventory.

A nature-based climate goal should reflect the best available science and acknowledge the work ahead to remove barriers and leverage opportunities to achieve the established goal. ODOE recommends an ambitious sequestration goal over the next 10 years to capitalize on the effectiveness of nature-based strategies. Carbon sequestered or protected now helps future climate conditions and resiliency efforts in order of magnitudes greater than acting later in terms of climate benefits and also cost.[x]

Weighing the Options

ODOE supplied Option 3 to meet the statutory direction that requires ODOE and the Commission to consider new information as it becomes available. We used the information from Oregon's land-based inventory and the most recent U.S. national greenhouse gas inventory to help craft the recommendation.

Options 1 and 2 are based on the potential that is understood, at this time, about what can be achieved in Oregon based on certain actions that were able to be quantified by the academic community. Both options are within the calculated science-based range of net sequestration potential presented.

[x] Sanderson, B. M., & O'Neill, B. C. (2020). Assessing the costs of historical inaction on climate change. *Scientific Reports*, *10*, 9173. https://doi.org/10.1038/s41598-020-66275-4

A question to summarize the issue at hand: Should Oregon's goal focus on global climate needs or the feasibility of potential action in Oregon? A focus on global climate needs leads to a higher net sequestration goal while a focus on practical limitations of implementation leads to a lower goal.

To answer this question, particularly with the focus on feasibility, it would be ideal to have activity-based modeling completed as well as having identified baselines for each activity. In other words, ODOE recognizes that it would be helpful to have data on the carbon sequestration and storage potential for a robust set of NCS activities and modeling that reflected their real-world impact. However, currently, ODOE is limited in describing the ability to meet the goal via activities and we speak to the modeling needs in the next section; however, Appendix D provides information about the opportunity that exists in Oregon based on draft information from in progress work. All activities are worthwhile because of the multiple benefits to people, ecosystems, and resiliency efforts. However, because plants and soil sequester and store carbon differently across various land types, potential mitigation estimates vary greatly. The box below highlights three NCS and totals their mitigation potential estimates to illustrate the opportunity for nature-based climate action with only a few examples. More examples are in Appendix D.

Mitigation Potentials of Three Natural Climate Solutions

Taken together, the examples below total approximately **3.0 MMTCO2e** of additional net sequestration annually.

Urban Tree Planting

Currently, trees in developed areas across Oregon currently sequester, on average, 1,750,000 metric tons of CO2e per year. Using American Forest's Tree Equity Score, which is a spatial tool to help address environmental inequities by prioritizing human-centered investment, we can calculate the mitigation potential of urban tree plantings across Oregon. The tool calculates "tree canopy gap" which is the area that could be planted to reach the tool's stated neighborhood tree canopy goal. Employing this tool to calculate a potential area (137,730 acres) and multiplying by the average annual sequestration rate per acre per year (1.74 metric tons CO2e/acre/year), Oregon has the potential to sequester an **additional 240,000 metric tons of CO2e each year**, while delivering resilience, equity, and energy benefits.

Coastal Wetland Restoration

Forested tidal wetlands have the highest sequestration rates because of the trees above ground and the soil carbon stored below. By relying on the median sequestration rate per acre per year (3.81 metric tons CO2e) and the higher area extent provided in Appendix D, Oregon has the potential to sequester an **additional 80,000 metric tons of CO2e each year**, while delivering resilience, recreational, and fishing industry benefits.

Riparian Area Plantings

Riparian area plantings are a strategy employed to provide shade, reduce water temperatures, capture and contain sediment, slow flood flows, and restore salmon habitat. This strategy also sequesters carbon. Appendix D provides a median sequestration rate of 5.41 tons of per acre per year and estimates the area of potential implementation to be 500,180 acres, potentially sequestering an **additional 2,710,000 metric tons of CO2e per year**.

While these examples can be illustrative, ODOE does not recommend activity-specific targets at this time. Robust public engagement and additional, deliberate analysis will be necessary to build a target based on what is feasible. Per statute, ODOE also needs to establish baselines for each NCS, which has not occurred because we, in collaboration with partner agencies, first needed to create a list of the activities that are relevant to Oregon and compile programs that implement these activities. Finally, the mitigation potential for each of the NCS cannot simply be summed; they must be modelled in order to ensure exclusive NCS are not being applied to the same geographic area, which could result in overestimation of mitigation potential. Scenarios employing complementary NCS must be modelled in order to accurately create activity-specific targets. However, ODOE is supportive of accomplishing this type of work in the future, subject to available funding for engagement and modeling.

Optional: Policy, Capacity, and Analysis Goals

Achieving the newly established goal will rely on cross-agency collaboration, statewide reporting infrastructure that does not exist today, and additional modeling. Recognizing this, the Commission's NCS committee[xi] recommended including goals that speak to capacity building. In the next 3-5 years, the state of Oregon should allocate funding and build capacity to:

1. Develop a cross-agency reporting infrastructure that is crafted to track activity-based progress toward meeting the sequestration goal.
2. Conduct NCS modeling in the next three years to identify nature-based action pathways for achieving the natural and working lands net sequestration goal and recommend voluntary activity targets for natural lands, forest, agriculture, and developed areas for Commission consideration.
3. Conduct a study on the incentives available to support uptake and transitioning to NCS actions as well as policy changes that could support action on local and private lands.

Lastly, ODOE is not recommending a stock protection goal at this time (see Carbon Stocks section). Given additional funding, more information on important Oregon stocks and NCS that protect stocks could be coalesced, and ODOE could return to the Commission with a recommendation. In the next five years, the state of Oregon should:

4. Conduct a land-based stock assessment to inform a net carbon stocks goal

Some of these requests may best be accomplished through a scenario modeling effort similar to that of ODOE's Transformational Integrated Greenhouse Gas Emissions Reductions (TIGHGER) reports.[xii] For example, different levels of NCS implementation could be modeled, with a range of potential climate mitigation potentials under different climate pathways that would provide a range of potential options for recommending targets based on land category. Such modeling may also benefit from information on the relative costs of achieving climate targets for each pathway. All of these suggestions would need considerable engagement and iteration with Tribes, state and federal agencies, private landowners, and other external partners.

Partners have also expressed an interest in measurement, monitoring, reporting, and verification efforts to ensure that NCS implementation is achieving desired rates of climate mitigation potential and to understand the issues that may cause it to fall short of or exceed them. Similar work has been pursued in relation to sector-based emissions[xiii] and Natural Resources Conservation Service practices[xiv] in the U.S. and these frameworks could be built upon for use in Oregon. Such work would require capacity for collaboration and funding.

[xi] The Oregon Climate Action Commission Chair convened a Natural Climate Solutions Committee who met four times from November 2025 through May 2026 to talk about goal setting approaches and issues to consider during goal setting.
[xii] Oregon Department of Energy (2023). Transformational Integrated Greenhouse Gas Emissions Reduction Project Report. 2023-TIGHGER-Project-Report.pdf
[xiii] U.S. Department of Energy (2024). Greenhouse Gas Supply MMRV Fact Sheet Mar2024.pdf
[xiv] U.S. Department of Agriculture (2023). NRCS IRA MMRV Factsheet

Measuring NCS Implementation Progress

It is important to note the statute requires ODOE, the Commission, and the agencies to identify metrics and track progress toward a statewide goal but does not consider the current or future capacity needs of the implementing agencies, nor the data infrastructure needs required to gather and manage the metrics. In reality, certain metrics may or may not be currently tracked by any agency, some may be more complex than others to measure, and all of them will rely on implementing agency/partner capacity and the construction of statewide tracking infrastructure. These are major challenges to meet the each of the goals being considered. The forthcoming Draft Natural Climate Solutions and Metrics Analysis explores challenges further.

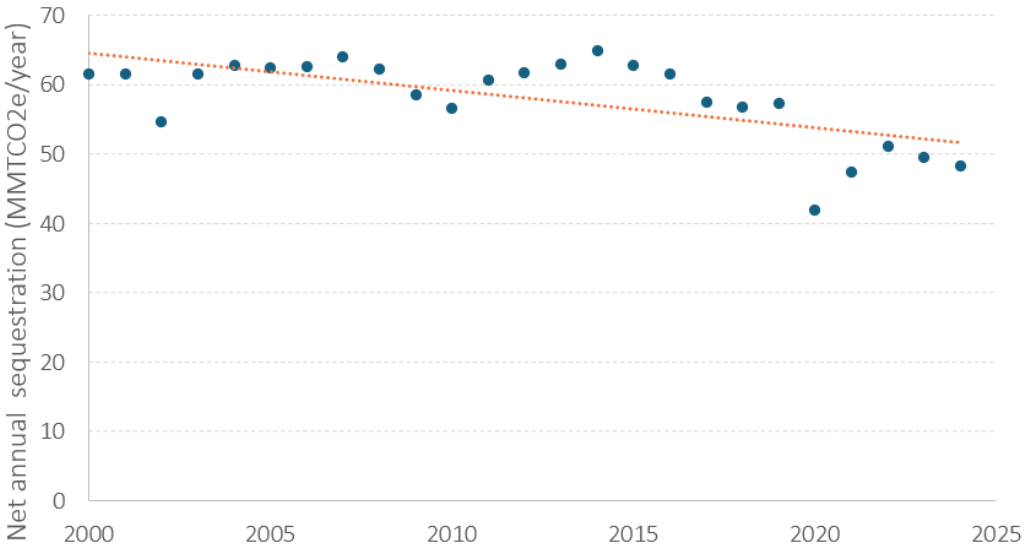
Issues To Consider During Goal Selection

ODOE considered several issues while developing the modifications in Option 2 and crafting Option 3 and recommends the Commission consider them while deliberating on the goal. Some issues discussed below helped shape the goal itself, while others were important to define the context in which the goal will operate, like a changing climate or landownership in Oregon.

Declining Trend of Removals

As can be seen in Figure 4, since 2000, the annual rate of sequestration has steadily decreased. The trendline indicates a statistically significant decrease in sequestration over time.

Figure 4. Annual net land-based sequestration over time



ODOE considered the following three strategies to address the declining trend in land-based sequestration reported in the LCI. One prominent cause of this decline is the increase in wildfire across land categories. In 2020 Oregon experienced very large wildfires primarily in carbon rich forests of the Cascade Mountains and the Coast Range, resulting in the lowest net sequestration value in the figure. Other causes of decline are less clear from the LCI, and staff will continue to improve their understanding in subsequent inventory cycles. Below are three approaches to setting a goal, while addressing this declining trend in overall sequestration in Oregon:

1) **Historic Rate:** This approach sets a goal based on a historic rate of sequestration. For example, 2014 is a year noted for being just prior to an observed uptick in wildfires. Returning to 2014's annual net sequestration rate would require increasing rates of sequestration every year to compensate for the declining trend.
2) **Annual "Buffer":** This approach compensates for the declining trend by adding the annual decrease to the annual net sequestration goal. For example, annual net sequestration could increase by adding an additional 0.5 MMTCO2e/year, which is the average rate that net sequestration has declined per year in recent years. Establishing a goal of 10 MMTCO2e/year by 2050 would then mean an additional buffer of 12.5 MMTCO2e/year (0.5 MMTCO2e/year/year for 25 years) for a total of 22.5 MMTCO2e/year by 2050.
3) **Future Goal Rate:** This approach selects a rate of net sequestration to achieve by a future date. It also compensates for the declining trend, whether the trend is positive or negative. For example, if Oregon's land removed approximately 48 MMTCO2e/year in 2024, a goal could be considered that would increase overall sequestration by a percent or rate by a certain date (e.g., 10%-20% by 2035 or 90 MMTCO2e/year by 2050).

ODOE selected the third approach for Option 2 and Option 3, which set future goal rates that ensure we avoid a scenario of meeting a yearly net sequestration goal while also still experiencing a declining trend overall.

Time Horizons

Appropriate time horizons by which to achieve these goals need to be selected. In 2021, the Commission recommended an increase of land-based removals of 5 MMTCO2e/year by 2030 and 9.5 MMTCO2e/year by 2050.[xv] Goals structured like this require more work in earlier years, provide more time for NCS to become established, and offer resilience benefits, which would help reduce future impacts of climate change.

These time horizons differ from those used in former Gov. Brown's Executive Order 20-04, which directed state agencies to reduce greenhouse gas emissions with 2035 and 2050 as the key milestone years.

Recognizing the relatively short time from new goal recommendations and 2030, and in an effort to be consistent with the greenhouse gas emissions target dates, ODOE crafted Option 2 and Option 3 using the years 2035 and 2050.

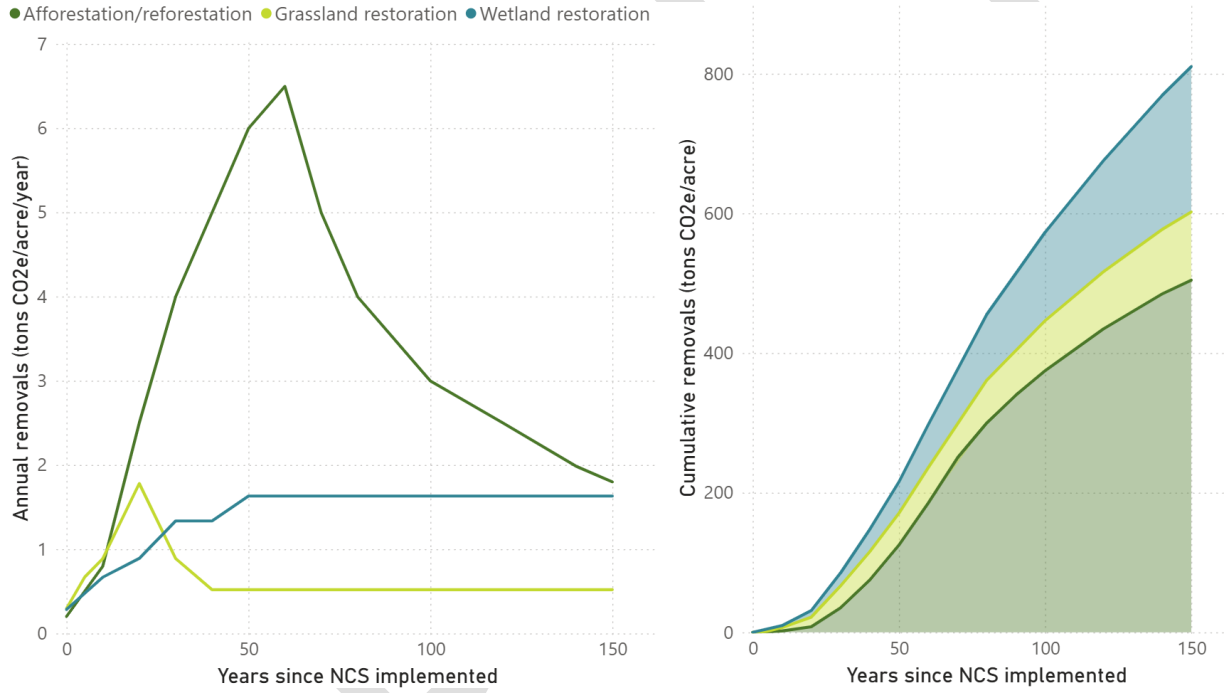
Additional analysis and modeling are needed to establish time horizons based on explicit NCS by certain target years. Measurement, monitoring, reporting, and verification are strongly recommended to ensure that Oregon is indeed meeting the recommended goals. This may require separate and additional goals for the mobilization of Oregon's resources toward this work.

[xv] Oregon Climate Action Commission (2021). *Natural & Working Lands Proposal*. 2021+OGWC+Natural+and+Working+Lands+Proposal.pdf

Net Sequestration Rates Over Time

ODOE took into consideration how nature sequesters carbon. Most NCS require years, decades, or even longer, to achieve their highest rates of removals (see Figure 5). Many NCS quickly reach a peak rate of sequestration and subsequently taper off or decline. As an example, forest types common to Oregon, such as Douglas-fir, may not achieve their maximum rates of biomass accumulation until they are 40-80 years old. Others types like western hemlock may peak sooner, but both forest types have declining rates of sequestration afterward.[xvi] Some NCS like wetland restoration may achieve peak rates of sequestration in early years after restoration and then plateau.[xvii] Pursuing a broad portfolio of NCS is a good strategy for achieving the levels set by any recommended goal while managing for NCS with different time horizons to reach their greatest removals potential. Considering these plant and soil carbon sequestration processes and their limitations, ODOE crafted Option 3 to maximize NCS sequestration by recommending a larger goal by 2035 than between 2035 and 2050.

Figure 5. Example curves showing different rates of carbon sequestration (left) and cumulative removals (right) over time by different NCS. Rates are based on small sample of available scientific literature and are meant to be examples; real rates in Oregon may differ.[xvi,xvii,xviii]



[xvi] Weiskittel et al. (2007). Annualized diameter and height growth equations for Pacific Northwest plantation-grown Douglas-fir, western hemlock, and alder. *Forest Ecology and Management*, *250*, 266-278. https://doi.org/10.1016/j.foreco.2007.05.026

[xvii] Wu et al. (2025). Wetland restoration is effective but insufficient to compensate for soil organic carbon losses from degradation. *Global Ecology and Biogeography*, *34*(5), e70063. https://doi.org/10.1111/geb.70063

[xviii] Yang et al. (2019). Soil carbon sequestration accelerated by restoration of grassland biodiversity. *Nature Communications*, *10*, 718. https://doi.org/10.1038/s41467-019-08636-w

Land Types and Ownership

To achieve any goal the State sets for carbon removals on natural and working lands, it is essential to partner with Tribal, federal, private, and local governments. Oregon's land base (approximately 62 million acres) is divided among many owners, each with a unique portfolio of land uses (Fig. 6).[xix,xx]

Figure 6. Area of land use by land category in Oregon for 2024[xix,xx]

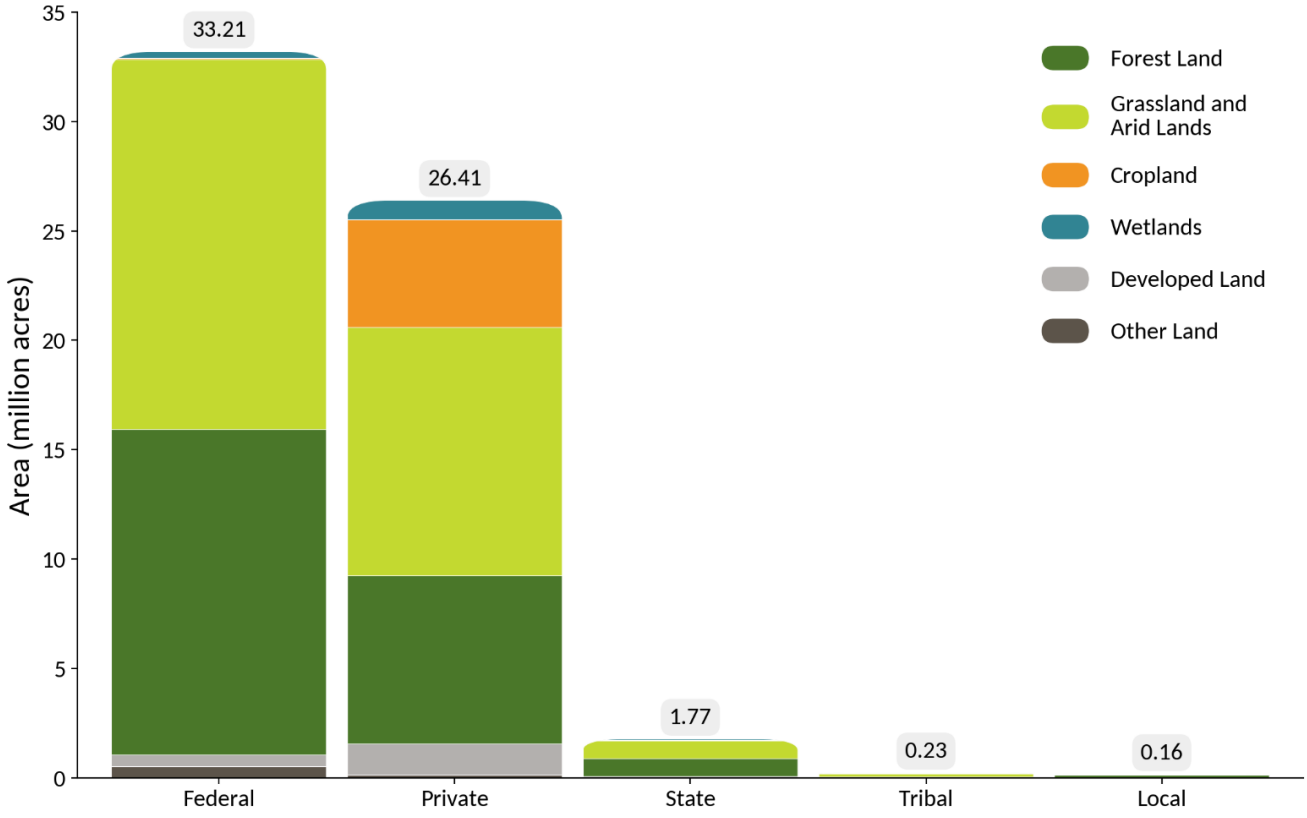


Figure excludes coastal areas that are entirely aquatic (approximately 0.224 million acres).

Approximately 63 percent of Oregon's forest land, 39 percent of its grassland and arid lands, and 24 percent of its wetlands are owned by the federal government, according to LCI methods for classifying land use in OR (see Appendix C Fig. C1). Roughly 94 percent of Federal ownership is divided between the U.S. Forest Service and the U.S. Bureau of Land Management (See Appendix C Fig. C2)—even greater collaboration and partnership with these two federal bodies presents a large opportunity for increasing removals in much of the state. Other land ownerships in the state represent significant opportunities to work toward achieving a land-based net carbon sequestration and storage goal as well. See Appendix C for more discussion on opportunities for NCS implementation in Oregon.

[xix] Land ownership data from: Oregon Department of Forestry (2024). Oregon Land Management. *Oregon Land Management | Oregon GEOHub*

[xx] Land category/land use data from: Oregon Department of Energy (2025). *Land-based Net Carbon Inventory*. Land-Based Net Carbon Inventory Report 2025

Climate Change

ODOE considered the impacts of climate change to Oregon's landscape while crafting the recommendation. Climate change is likely to negatively impact rates of sequestration and the durability of carbon storage on Oregon's lands and will also likely reduce the efficacy of natural climate solutions in many parts of the world.[xxi,xxii] Per the LCI, we have already seen a statistically significant decrease over time in the annual rate of carbon sequestration by Oregon's lands, driven in part by increases in wildfire. Studies in the U.S. and elsewhere have also indicated a decrease in rates of sequestration due to climate change — particularly due to projected increases in intensity and frequency of drought.[xxiii,xxiv,xxv] In goal setting and future NCS work, a diverse portfolio of NCS strategies should be considered given this uncertainty, focusing on what strategies reduce the risk of climate change across all ecosystems and communities. For example, wildfire risk reduction activities, waterbody and wetland protection, and restoration activities protect carbon stocks, and communities. These actions contribute to maintaining functioning habitats while creating more resilient working lands that provide food and fiber. For this reason, Option 3 requires intense implementation over the next nine years to provide ecosystems time to become established and increase the resilience and durability of those gains.

Carbon Stocks

While the recommended goal options are focused on carbon sequestration, it is also important to acknowledge the role of carbon stocks, their potential contribution to emissions, and how they might relate to goal setting. Some NCS, like reduced forest degradation or wetland protection, protect existing carbon stocks on natural and working lands. These carbon stocks have been built up over hundreds of years to millennia and their loss, which results in greenhouse gas emissions, represents a major threat to the global climate. Some types of Oregon wetlands may have a lower annual rate of sequestration relative to forests but have a far greater capacity for carbon storage.

For this reason and others, states like California have established goals concerned with maintaining and increasing carbon stocks rather than with rates of sequestration.[xxvi] In contrast to NCS that protect stocks, other NCS like grassland restoration, increase rates of sequestration by adding to or improving the environment and promote the building of carbon stocks over time.

Setting goals based on rates of sequestration or carbon stocks are both valid approaches for climate action. States may even be concerned with both increasing sequestration and maintaining carbon stocks as complementary climate goals. In the future, staff could produce an analysis of Oregon carbon stocks in order to inform additional goal setting focused on protecting Oregon's existing carbon stocks.

[xxi] Ellis et al. (2024). The principles of natural climate solutions. *Nature Communications*, *15*, 547. https://doi.org/10.1038/s41467-023-44425-2

[xxii] Buma et al. (2024). Expert review of the science underlying nature-based climate solutions. *Nature Climate Change*, *14*, 402-406. https://doi.org/10.1038/s41558-024-01960-0

[xxiii] Hogan et al. (2024). Climate change determines the sign of productivity trends in US Forests. *Environmental Sciences*, *121*(4), e2311132121. https://doi.org/10.1073/pnas.2311132121

[xxiv] Liu et al. (2025). Land change, fire, and climate weaken carbon sink in the conterminous United States. *Science Advances*, *11*(46). https://doi.org/10.1126/sciadv.adx7823

[xxv] Hertzog et al. (2025). Turning point in the productivity of western European forests associated with a climate change footprint. *Science of the Total Environment*, *967*. https://doi.org/10.1016/j.scitotenv.2025.178843

[xxvi] California Air Resources Board (2025). 2025 Natural and Working Lands Carbon Inventory Update. 2025 Natural and Working Lands Carbon Inventory Update | California Air Resources Board

Additionality

Additionality is a core principle in climate mitigation that refers to a need for climate mitigation strategies like NCS to provide sequestration in addition to what is already occurring on the land. While NCS are actions that have been occurring for decades by different names through various land management practices, tracking additional efforts is key to maximize their potential for carbon sequestration purposes and make progress toward increasing current rates of net sequestration.

To understand what is 'additional' to current land management in the state, baselines for each activity are important to identify. Baselines can be identified in multiple ways relying on large landscape scale spatial datasets, statewide tabular data, or through identifying program operational baselines that implement NCS.

Tracking NCS, and quantifying the additional sequestration they are providing, is an ongoing effort in Oregon that is necessary to ensure the state meets any recommended goal. At this time, ODOE has not calculated baselines for each NCS activity that is being identified in the forthcoming NCS and Metrics Analysis. Fundamental information is being compiled that is necessary to identify a method to calculate baselines for each activity, like identifying state agency programs that implement NCS and/or have relevant datasets, as well as creating a state list of NCS that are regionally relevant for Oregon.

Next Steps

ODOE is legislatively mandated to update and improve the LCI every odd-numbered year and is already planning improvements to be responsive to the feedback provided by partners during this goal-setting period. Such improvements would provide the Commission, agencies, and partners with information on changes in trends and magnitudes of emissions and removals, and more nuanced information within land sectors to be used to adjust or target its goals. Among planned improvements, ODOE plans to track emissions according to land ownership, potentially providing key information on how trends in emissions and removals are affected by, for example, changes in management policies of federal forests.

However, ODOE was unable to address some recommendations by Commissioners and partners to craft the recommended goal options. The analyses recommended at several points during this process, including modeling the consequences of federal or state policy actions, setting activity targets by land category or by NCS, or compiling and digitizing archived agency data and records to understand historic actions, are beyond the scope of this report. As a result, this report includes optional policy goals and articulates the need for additional funding and capacity. If the Commission adopts policy goals, next steps will include developing scopes of work to advance the additional infrastructure, analysis and ongoing implementation in partnership with others to inform future legislative action.

Appendix A- Approach for Providing Supporting Information for Goal Setting and Calculating Potential Net Sequestration Ranges for Oregon

As discussed in the body of the report, the Commission recommended goals in 2021 as required by Executive Order 20-04.

These goals are meant to be in addition to what the landscape is already sequestering. Per ODOE's Land-based Net Carbon Inventory (LCI), Oregon's natural and working lands removed approximately 48 MMTCO2e/year in 2024, which is also equal to the rate of removals averaged over the past five years.

However, what do Oregon's net land-based removals mean in the context of national and global greenhouse gas data and related goals? What do these estimates mean given the mitigation potential of various land management strategies? ODOE staff worked to answer these questions to aid goal setting.

Approaches to Setting a Goal

- Use data from national or global GHG emissions datasets or atmospheric GHG concentrations
- Use data from Oregon's Land-based Net Carbon Inventory
- Use data from mitigation potentials of specific activities
- Use existing frameworks to arrive at goal (e.g. Net Zero or Real Zero Framework)

Staff researched state and national jurisdictions to understand how others have created greenhouse gas-related goals in general, or natural and working lands goals, specifically. ODOE reviewed a range of resources from international, national, and state bodies that have been involved with setting goals for land-based removals. These include the Intergovernmental Panel on Climate Change, U.S. White House, the U.S. Climate Alliance, and California, Maine, and New Jersey, among others.

Countries have relied upon global data and their own national greenhouse gas inventories to establish goals for land-based removals. Some countries, such as those in the European Union, have set explicit annual removals targets for different time horizons[xxvii] but most have not. Others have instead set economy-wide emissions targets that include removals from their land sector, or set activity targets like the planting of a certain number of trees with an implicit benefit to land-based removals.[xxviii]

Similarly, there are only a few states that have established explicit land-based sequestration and storage goals; most are relying on conservation targets and goals as a surrogate goal to mark progress. See state progress on natural and working lands policies.

Staff synthesized this information into approaches and frameworks that were either common or promising in their utility for Oregon and are listed in the callout box.

[xxvii] European Commission (2023). Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions. EUR-Lex - 52020DC0562 - EN - EUR-Lex

[xxviii] United Nations Climate Change (2025). *2025 NDC Synthesis Report*. 2025 NDC Synthesis Report | UNFCCC

In January, ODOE conducted a workshop with the experts who have or currently are supporting the NCS work. Take-aways from the meeting included:

- The approaches ODOE presented are not necessarily exclusive of each other
- There are many ways to make a goal and much depends on the fundamental desire or aim that the goal will serve
- The goal will be achieved by land management activities and it is important that the goal is translatable to actions so that participants are empowered to act

Additionally, during the spring of 2026, ODOE discussed approaches to goal setting, their rationale, and preliminary calculations with the NCS Inter-agency Working Group, the Natural and Working Lands Advisory Committee, and held three meetings with Commissioners serving on an NCS Committee for the Commission. Committee members expressed a desire for additional information and discussion on land ownership and measures to address the declining trend in land-based removals in the LCI. This information is included in the report. Appendix B provides the underlying data used in the approaches that relied on data from federal and state sources.

Three Different Methods of Calculating Sequestration Ranges:

The calculations were created based on the Sixth Assessment Report of the Intergovernmental Panel on Climate Change[xxix] and the Long-Term Strategy of the United States,[xxx] both of which were released in 2021. A recent report from the United Nations Environmental Program indicated that global annual emissions have increased every year since 2021 and emphasized that, given the increased likelihood of overshooting our global warming targets, greater and faster measures must be taken by countries to achieve net zero by 2050.[xxxi] Per the United Nations analysis, the U.S. is currently far off track from achieving net zero by 2050 and ambitious targets for land-based removals in the U.S. are likely necessary to meet global climate goals.

Each method answered slightly different questions:

- What could the goal be if it is based on global or national greenhouse gas information, and is consistent with previous international and national commitments?
- What could the goal be if it is based on Oregon land-based greenhouse gas information?
- What could the goal be if it is based on net removals related to potential NCS mitigation activities?

[xxix] Intergovernmental Panel on Climate Change (2021). IPCC Sixth Assessment Report: Working Group 1: The Physical Science Basis. Climate Change 2021: The Physical Science Basis | Climate Change 2021: The Physical Science Basis

[xxx] U.S. Department of State and United States Executive Office of the President (2021). *The Long-term Strategy of the United States: Pathways to Net-Zero Greenhouse Gas Emissions by 2050*. The Long-Term Strategy of the United States, Pathways to Net-Zero Greenhouse Gas Emissions by 2050

[xxxi] United Nations (2025). Emissions Gap Report 2025. Emissions Gap Report 2025 | UNEP - UN Environment Programme

Calculations based on global and national information

The Intergovernmental Panel on Climate Change's 6th Assessment Report[xxxii] recommended that, globally, we must achieve net zero by 2050, and net negative thereafter, to limit warming to 1.5 degrees Celsius.

In keeping with the Intergovernmental Panel on Climate Change goal, the Long-term Strategy of the United States,[xxx] proposed by the Biden Administration, stated that the U.S. should reach net zero by 2050. It proposed that the U.S. should increase land-based net sequestration by 200 MMTCO2e per year by 2050. It did not establish by how much individual states should increase their land-based sequestration. This national goal was subsequently rejected by the current administration and no guidance for state contributions was ever produced.

However, using data from the U.S. National Greenhouse Gas Inventory,[ix] and the recent data from Oregon's Land-based Net Carbon Inventory,[viii] ODOE calculated that Oregon's land contributed on average 4.5 to 5.4 percent of national land-based removals over the last five years that data are available. Using these percentages, we can calculate the range of net sequestration by Oregon as its share of the total national net sequestration goal (200 MMTCO2e/year).

Range: 9 to 10.8 MMTCO2e/year

Calculations based on Oregon information

The recent Oregon Land-based Net Carbon Inventory calculated that over the last five years (2020 to 2024), total net land-based removals averaged 48 MMTCO2e/year.

To develop a range of potential additional removals, ODOE used the historical record in Oregon. ODOE looked for the maximum rate of net removals in a given year within the Inventory data between 2001 and 2024. Oregon's landscape sequestered 64.9 MMTCO2e/year in 2014, which represents a 36 percent increase in removals compared to the five-year average and offers a perspective on the range of feasible percent change.

ODOE calculated the increase in net land-based annual removals based on incremental percent increases in removals:

- 10 percent equals 4.8 MMTCO2e/year.
- 20 percent increase equals 9.6 MMTCO2e/year.
- 30 percent increase equals 14.4 MMTCO2e/year.

Range: 4.8 to 14.4 MMTCO2e/year

[xxxii] Intergovernmental Panel on Climate Change (2021). IPCC Sixth Assessment Report: Working Group 1: The Physical Science Basis. Climate Change 2021: The Physical Science Basis | Climate Change 2021: The Physical Science Basis

Calculations based on potential NCS Activities

A 2020 study on natural climate solutions in Oregon, from Graves and others,[xxxiii] estimated the additional removals from the potential implementation of 12 NCS activities. They found that by 2035, Oregon could sequester an additional 2.7 to 8.3 MMTCO2e/year, and by 2050, and Oregon could sequester an additional 2.9 to 9.8 MMTCO2e/year, depending on how aggressively each NCS activity was implemented. This information, along with a study on tidal wetlands by the PNW Blue Carbon Working Group, and another on agricultural land (citation forthcoming) informed the current existing goal that was adopted in 2021 (5 MMTCO2e/year by 2030 and 9.5 MMTCO2e/year by 2050).

ODOE is currently working on an NCS and Metrics Analysis with RTI International to estimate the removal potential from approximately 15 NCS activities (of the 32 total NCS examined), which includes the 12 NCS activities examined in the publication by Graves and others. Additional in-depth future analyses (which would require additional funding) would be needed to refine NCS removal potential based on factors like zoning, land ownership, workforce, capital, and other considerations. Draft information from the current NCS and Metrics Analysis may be available by the time a new goal is established; however, additional analyses as described are needed to understand the actions Oregon can take to meet an established goal regardless of the method used to establish it.

Oregon's potential additional contribution

In the Commission's NCS Committee March 2026 meeting, Commissioners were interested in understanding Oregon's contribution to the U.S.'s overall land-based removals, and if Oregon could provide more than our share because our ecosystems may have more capacity than that of other states. ODOE therefore explored a larger role for Oregon based on historical precedent. Oregon's maximum contributions to land-based removals since 2000 occurred in 2014 at 65 MMTCO2e/year, or about 7 percent (See Figure 6 and Table 9 in the Land-based Net Carbon Inventory Report). Using this percentage and relating it to the nationwide goal of increasing national removals by 200 MMTCO2e/year, Oregon's potential contribution could equal an additional 14 MMTCO2e/year. This is within the science-based range of sequestration potential ODOE calculated in the "calculations based on Oregon information" section above.

Range: 14 MMTCO2e/year

Total Range of Potential Net Sequestration Based on Data:

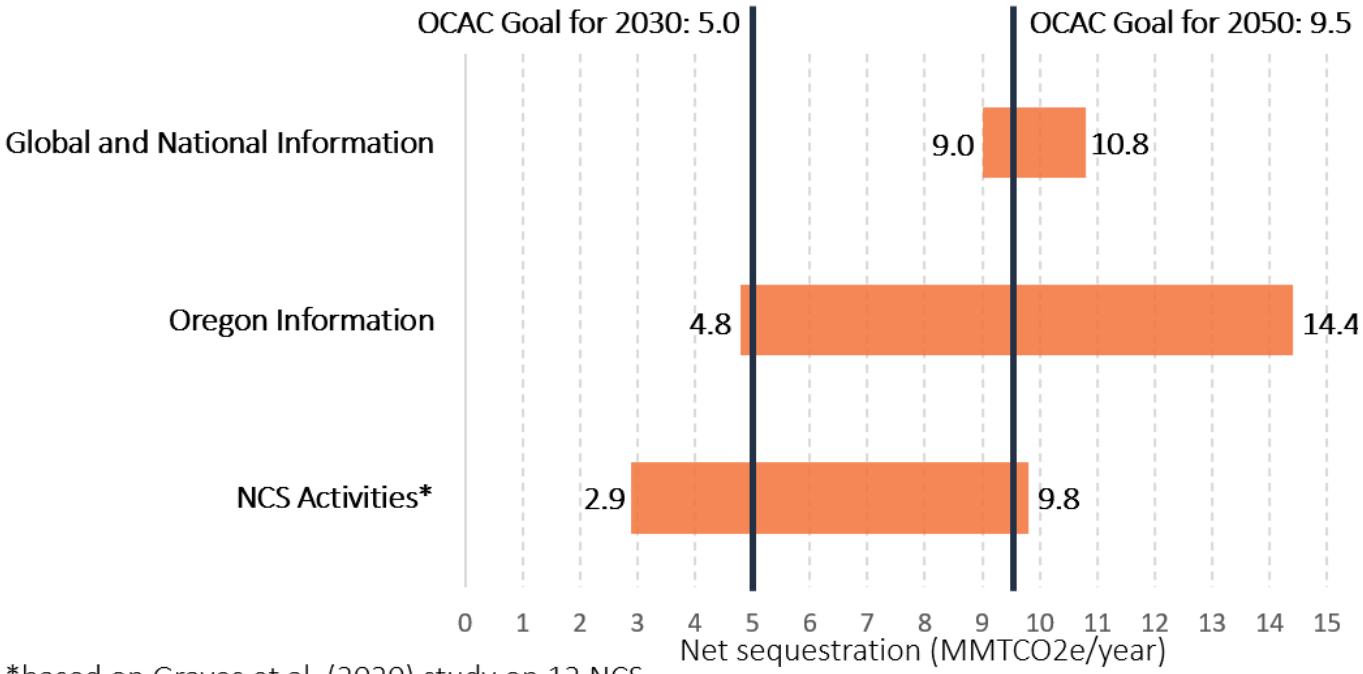
In summary, Figure A1 below illustrates the three ranges from the calculations described above. The dark vertical lines in the center of this figure represent the Commission's current recommended goals for 2030 and 2050 (5 to 9.5 MMTCO2e/year, respectively), while the horizontal, orange-colored bars represent the range of removals calculated above for each of the three methodologies. All three methodologies either span or cross the goals previously adopted by the Commission. The full range of science-based removals calculated ranges from a minimum of 2.9 and a maximum of 14.4 MMTCO2e/year. Appendix D lists the preliminary mitigation potentials of some natural climate solutions

[xxxiii] Graves et al. (2020). Potential greenhouse gas reductions from Natural Climate Solutions in Oregon, USA. *PLoS ONE*, *15*(4), e0230424. https://doi.org/10.1371/journal.pone.0230424

that could be implemented in the state. In its calculations of potential net sequestration ranges, ODOE did not include uncertainty related to atmospheric GHG concentrations, national GHG inventory estimates, or state GHG inventory estimates. However, ODOE did make its recommendation within the range of removals.

Full Range: 2.9 to 14.4 MMTCO2e/year

Figure A1. Summary graph of preliminary potential sequestration ranges from described methods



*based on Graves et al. (2020) study on 12 NCS

Appendix B- Data Tables

Table B1: Annual net removals of land use, land-use change, and forestry for the U.S. Environmental Protection Agency's Inventory of U.S. Greenhouse Gas Emissions and Sinks (also known as the National Greenhouse Gas Inventory, or NGHGI) and Oregon's Land-based Net Carbon Inventory (LCI).

Year	US (NGHGI)	Oregon (NGHGI)	Oregon proportion of US removals (NGHGI)	Oregon (LCI)	Oregon Proportion of US removals (LCI)
2000	983.7	39.7	4.0%	61.5	6.3%
2001	979.8	40.7	4.2%	61.4	6.3%
2002	924.8	37.1	4.0%	54.6	5.9%
2003	957.9	40.5	4.2%	61.5	6.4%
2004	860.2	41.0	4.8%	62.8	7.3%
2005	907.7	41.3	4.6%	62.4	6.9%
2006	951.9	41.9	4.4%	62.7	6.6%
2007	900.3	41.4	4.6%	64.0	7.1%
2008	912.8	41.9	4.6%	62.3	6.8%
2009	850.9	41.6	4.9%	58.6	6.9%
2010	886.3	42.3	4.8%	56.6	6.4%
2011	941.7	42.9	4.6%	60.6	6.4%
2012	929.2	42.4	4.6%	61.8	6.6%
2013	886.6	42.0	4.7%	63.0	7.1%
2014	923.7	42.4	4.6%	64.9	7.0%
2015	820.2	41.8	5.1%	62.8	7.7%
2016	916.8	41.0	4.5%	61.4	6.7%
2017	926.0	39.5	4.3%	57.4	6.2%
2018	915.5	41.2	4.5%	56.8	6.2%
2019	863.6	42.1	4.9%	57.3	6.6%
2020	904.4	37.3	4.1%	41.8	4.6%
2021	910.6	38.3	4.2%	47.3	5.2%
2022	854.2	39.2	4.6%	51.1	6.0%
2023	-	-	-	49.4	-
2024	-	-	-	48.3	-
Average, whole period	*909*	*41*	*4.5%*	*58*	*6.4%*
Average, last five years of data	*890*	*40*	*4.5%*	*48*	*5.4%*

Appendix C - Land Types and Land Ownership

Additional information and discussion on land types and land ownership is presented here.[xix]

Private landowners own about 33 percent of Oregon's forest land, 39 percent of its grassland, 71 percent of its wetlands, and 71 percent of its developed land (e.g., urban trees in yards; Figure C1). Investment in programs that support private land stewardship, whether through funding, incentives, real estate, or land use zoning will aid in increasing the pace and scale of NCS implementation. The infrastructure to do so already exists, through networks like Soil and Water Conservation Districts, Oregon State University extension offices, land trusts, and watershed councils, all of which already have wide reach in Oregon, and already work toward NCS implementation in other names.

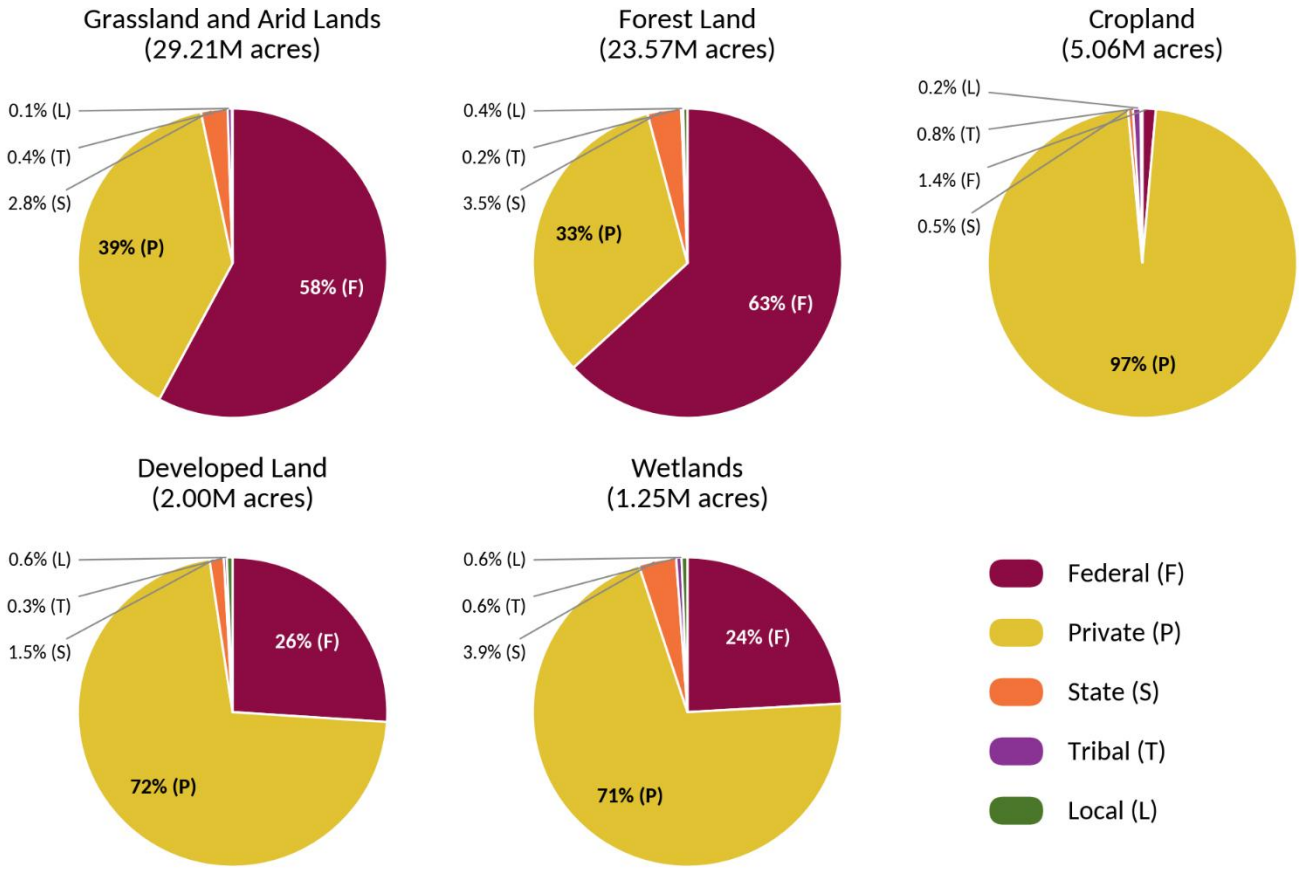
Tribes represent the next largest land stewards in Oregon other than the state itself, with over 0.2 percent of Oregon's forest land, 0.4 percent of its grassland and arid lands, and 0.5 percent of its wetlands (Figure C1). Strengthening partnership with Tribes and supporting Tribal Nation priorities like land acquisition, as directed by the NCS statute, will help achieve multiple types of goals.

Local governments are the smallest landowners in Oregon but manage a substantial proportion of the state's urban parks, which sequester and store carbon in their trees and soils. Cities in Oregon receive many benefits from urban trees and greenspace that include many related to climate resilience.[xxxiv] These lands can help reach a net sequestration goal if local government capacity is bolstered to implement NCS at scale to help meet adaptation aims at the same time and offers an additional opportunity to align with Oregon county Climate and Health programs and annual reporting established by Executive Order 20-04.

The State of Oregon, through its various agencies, directly manages around 1.77 million acres of land (2.8% of Oregon), including 3.5 percent of Oregon's forest land, 2.8 percent of grassland and arid lands, and 3.8 percent of its wetlands (Fig. C1). These represent lands that Oregon can most directly affect through restoration, invasive species management, fire management, and long-term stewardship, that can contribute to a carbon sequestration and storage goal.

[xxxiv] Miller et al. (2024). *The Economic Costs of Climate Change for Oregonians: A First Look*. Forum on Oregon Climate Economics. https://www.katu.com/resources/pdf/da93b656-0c7f-47e6-80c7-377a33c26635-economiccostofclimatechangeoregonians.pdf

Figure C1. Composition of land ownership by land category in Oregon for 2024. Figure excludes coastal areas that are entirely aquatic (approx. 0.224 million acres). M = million.[xix,xx]



While ODOE's LCI provides estimates of emissions and removals by land category, it does not provide information related to ownership. Within a given land category, emissions and removals are affected by land management decisions dependent on ownership.

As shown in Figure C2, land ownership in Oregon is dominated by two federal holders, the Bureau of Land Management and the U.S. Forest Service, which steward over a large amount of the state's forest land and grassland and arid lands. Private landowners comprise the second largest land-holding group, representing thousands of holders, and own a large amount of forest land, grassland and arid lands, and cropland.

Figure C2. Composition of the top 10 landowners in terms of land area in Oregon by title holder and land category for 2024[xix]

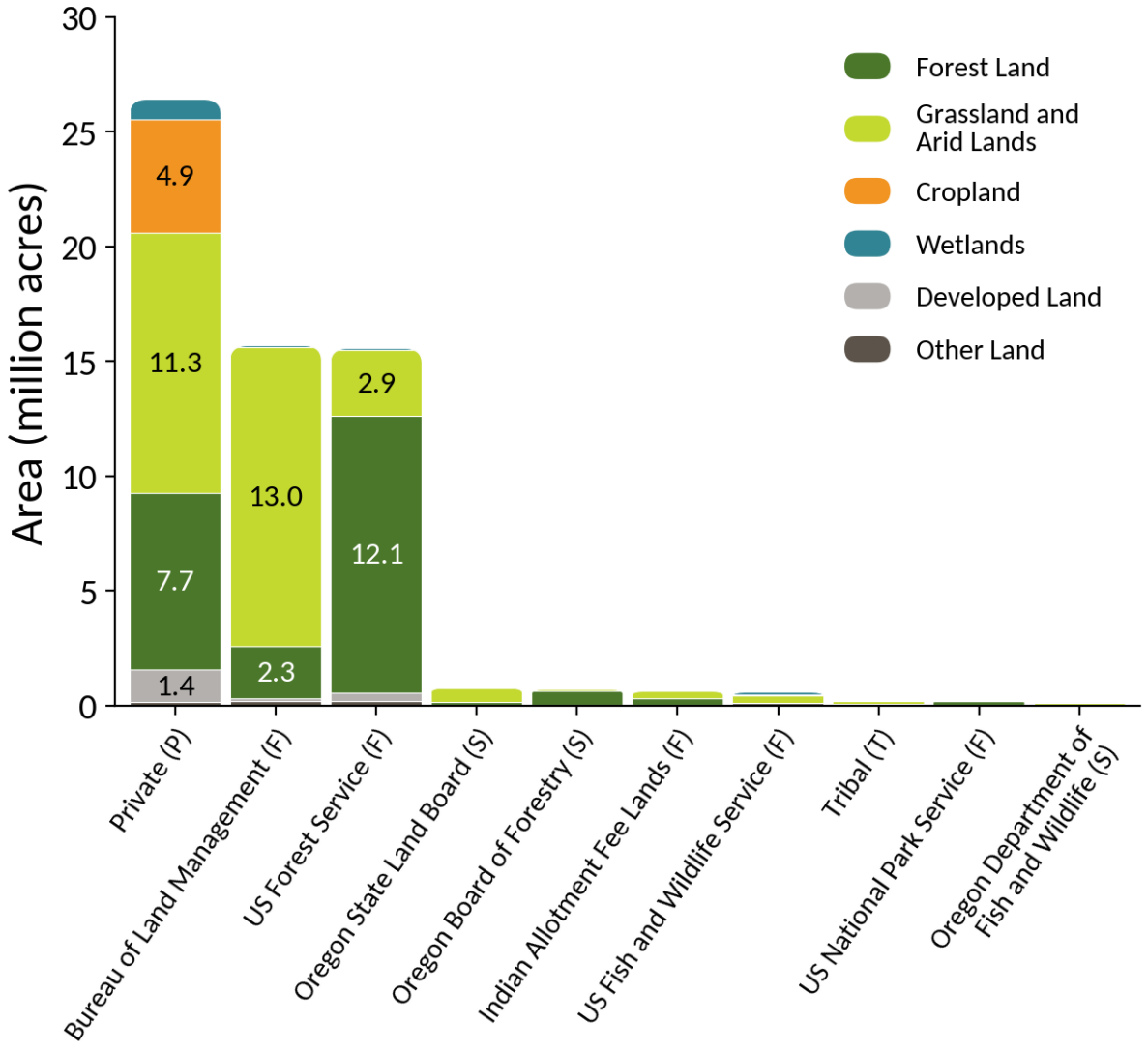


Figure excludes coastal areas that are entirely aquatic (approximately 0.224 million acres).

Appendix D- DRAFT Estimated Annual NCS Mitigation Potential with Sufficient Data Available

Table D1. Carbon metrics, eligible land areas, and annual mitigation potentials for Natural Climate Solutions (NCS) in Oregon for which sufficient data are available.

Median carbon metrics (in metric tons of carbon dioxide equivalent per acre of NCS activity per year, or tCO2e/acre/yr) are shown with minimum and maximum values in brackets, along with estimated eligible acreage (in thousand acres), and resulting climate mitigation potential (in million metric tons of carbon dioxide equivalent per year, or MMTCO2e/year; 1 MMTCO2e/year = 1,000,000 tCO2e/year). Maximum and minimum values reflect the maximum and minimum found during review. Negative values reflect potential net emissions under certain assumptions.
(a) indicates non-Oregon Specific values used; (b) indicates only one observation available. NCS may or may not be possible to implement in areas where other NCS are implemented; therefore, it is not appropriate to calculate a total climate mitigation potential by summing the values provided. Detailed information for these draft estimates will be published in the forthcoming Natural Climate Solutions and Metrics Analysis.

NCS activity	Median carbon metric [min, max] (tCO_2e/acre/yr)	Eligible land area (thousand acres)	Median climate mitigation potential [min, max] ($MMTCO_2e$/yr)	Eligible area description & source	Notes / caveats on area definition
Forest conservation, protection, and reduced deforestation	105.84 [49.40, 182.97]	37.79	4.00 [1.87, 6.91]	Average annual forest area converted per year (2006-2024) per the LCI.[7]	*Based on historical trends* Avoided conversion is difficult to establish without a forward-looking baseline.
Fire management[(a)]	0.43 [-0.04, 2.71]	3,734.48	1.61 [-0.14, 10.13]	Forest area eligible for fire management per Oregon's 20-Year Landscape Resiliency Strategy.[1]	*Use with caution* Net carbon effects vary by year and fire conditions; net sequestration is uncertain

Afforestation / reforestation	10.39 [3.05, 18.17]	680.13	7.07 [2.08, 12.36]	Cumulative forest area lost since 2006 per the LCI.[7]	*Use with caution* Reforestation may occur on areas that were lost prior to 2006. May include areas unsuitable for reforestation (e.g., recently converted to agriculture).
Afforestation in developed land	1.74 [0.46, 2.40]	137.73	0.24 [0.06, 0.33]	Area that could be planted to reach the neighborhood tree canopy goal across Oregon urban area ("tree canopy gap") per Tree Equity Score.[2]	-
Riparian area improvement	5.41 [4.75, 9.53]	500.18	2.71 [2.38, 4.77]	Land area suitable for riparian reforestation in ambitious scenario estimate per Graves et al. (2020).[8]	-
Reduced seagrass degradation and conversion; seagrass protection	171.69 [19.46, 411.40]	3.60	0.62 [0.07, 1.48]	Total estimated eelgrass acreage per Lyle et al. (2022).[3]	*May overestimate potential* Total eelgrass extent used, not area at risk; unlike other avoided-conversion categories where only at-risk or average converted area is counted.

Coastal wetland restoration	3.81 [-1.16, 7.90]	12.86–22.03	0.08 [-0.03, 0.17]	Coastal (tidal) potential area available for wetland restoration. Lower bound from Graves et al. (2020);[8] upper bound from Brophy (2019).[4] Only upper bound used to calculate the climate mitigation potential values (median and [min, max]).	*Use with caution* Wide range in eligible area (12.86–22.03k acres) reflects differences in methodology and scope between the two bounding sources.
Avoided grassland/arid lands conversion; grassland and arid lands protection	6.85 [1.78, 10.32]	81.90	0.561 [0.15, 0.85]	Average annual grassland area converted per year (2006-2024) per the LCI.[7]	*Based on historical trends* Avoided conversion is difficult to establish without forward-looking baseline.
Grassland/arid lands restoration	0.59 [0.15, 0.86]	6,798.84	4.02 [0.99, 5.85]	Area of Oregon grassland in poor condition per SageCon Landscape Planning Tool.[5]	*May overestimate potential* No adjustment for feasibility constraints
No-till / reduced tillage	0.25 [-0.17, 0.79]	613.02	0.015 [-0.10, 0.48]	Total cropland in Oregon using intensive or conventional tillage practices (2022) per USDA NASS.[9]	*May overestimate potential* No adjustment for agronomic or economic feasibility of adoption.

Conservation agriculture / cover crops / strip cropping	0.24 [0.08, 0.59]	2,977.13	0.71 [0.24, 1.76]	Total cropland that could feasibly transition to additional conservation agriculture practices. per CaRPE tool.[6]	
Legumes in pastures	0.27 [0.13, 0.42]	297.29	0.08 [0.04, 0.12]	Pasture and grazing land that could have been used for crops without additional improvement (2022) per USDA NASS.[9]	*Use with caution* May be conservative if additional pasture land could support legumes with modest improvement.
Trees in croplands / agroforestry	10.66 [0.31, 17.95]	418.02	4.46 [0.13, 7.50]	10% of total cropland in Oregon (2022) per USDA NASS[9] minus existing agroforestry percent.	*Low confidence* Eligible area based on a speculative 10% assumption with no suitability basis; regional variation between East and West Oregon not captured in this estimate.
Nutrient management	0.20 [-0.03, 2.43]	2,199.74	0.45 [-0.07, 5.35]	Total fertilized cropland in Oregon (2022) per USDA NASS.[9]	*May overestimate potential* Does not account for variation in current fertilizer practices or economic feasibility of adoption across all acres.

[1] Oregon Department of Forestry. (2025). *20-year Landscape Resiliency Strategy: 2025 Implementation Report*. https://www.oregon.gov/odf/aboutodf/documents/2025-odf-sb83-landscape-resiliency-strategy-implementation-report.pdf

[2] American Forests. (n.d.). *Tree Equity Score*. https://www.treeequityscore.org/

[3] Lyle, J. T., Graves, R. A., Carter, J., & Tabor, L. (2022). *Oregon's Blue Carbon Ecosystems: State of the Science, A Summary of the Current Understanding of the Climate Mitigation Potential of Oregon's Coastal and Marine Habitats*. The Nature Conservancy in Oregon. https://doi.org/10.25923/jw5w-t894

[4] Brophy, L. S., Greene, C. M., Hare, V. C., Holycross, B., Lanier, A., Heady, W. N., O'Connor, K., Imaki, H., Haddad, T., & Dana, R. (2019). Insights into estuary habitat loss in the western United States using a new method for mapping maximum extent of tidal wetlands. *PLOS ONE*. https://doi.org/10.1371/journal.pone.0218558

[5] SageCon Partnership. (2024). *Ecostate Maps and the SageCon Landscape Planning Tool* [Interactive mapping tool]. https://sageconpartnership.com/vegetation

[6] CaRPE Tool. (n.d.). *The Carbon Reduction Potential Evaluation Tool (CaRPE Tool™)*. https://carpe.shinyapps.io/CarpeTool/

[7]Oregon Department of Energy (2025). *Land-based Net Carbon Inventory: Appendix F: Inventory Results*. https://www.oregon.gov/energy/energy-oregon/Documents/2025-Carbon-Inventory-Appendix-F.pdf

[8]Graves, R. A., Haugo, R. D., Holz, A., Nielsen-Pincus, M., Jones, A., Kellogg, B., … Schindel, M. (2020). Potential greenhouse gas reductions from Natural Climate Solutions in Oregon, USA. *PLOS ONE*, *15*(4), e0232651. https://doi.org/10.1371/journal.pone.0232651

[9]U.S. Department of Agriculture (2024). *2022 Census of Agriculture: United States Summary of State Data*. https://www.nass.usda.gov/Publications/AgCensus/2022/index.php

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