FEBRUARY 2023

THURSTON CLIMATE MITIGATION PLAN

CARBON SEQUESTRATION AS A CLIMATE MITIGATION STRATEGY FOR THE THURSTON REGION

Developed for the Climate Action Steering Committee

THURSTON REGIONAL PLANNING COUNCIL

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Acknowledgements

This report was funded by Thurston County, Lacey, Olympia, and Tumwater through an interlocal agreement to support implementation of the Thurston Climate Mitigation Plan.

The authors wish to gratefully acknowledge the many individuals who made valuable contributions to this report at various stages, including those who lent their time and expertise in interviews: Anne-Gigi Chan and Kathleen Farley Wolf (King County); Allan Warren (Pierce County Conservation District); Stephanie Bishop, Sarah Moorehead, and Karin Strelioff (Thurston Conservation District); Loretta Seppanen; Laurence Reeves (Capitol Land Trust); Joe Kane (Nisqually land Trust); Patrick Shultz and Stephen Bramwell (WSU Extension); Lynn Fitz-Hugh and members of the Thurston Climate Action Team Tree Group. Staff from Thurston County, Lacey, Olympia, and Tumwater reviewed early drafts and provided significant feedback on the report structure and content. At Thurston Regional Planning Council, Michael Ambrogi contributed data analysis of land cover, and Jennifer Bass conducted interviews and research while serving as an intern for TRPC in 2021.

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Table of Contents

Appendices

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1. Overview

The Thurston Climate Mitigation Plan (TCMP) includes carbon sequestration among the strategies and actions identified to meet the region's goal of reducing locally generated greenhouse gas emissions 85 percent from 2015 levels by 2050. This report outlines existing information and resources for policymakers and staff to inform next steps for increasing carbon sequestration in the Thurston region.

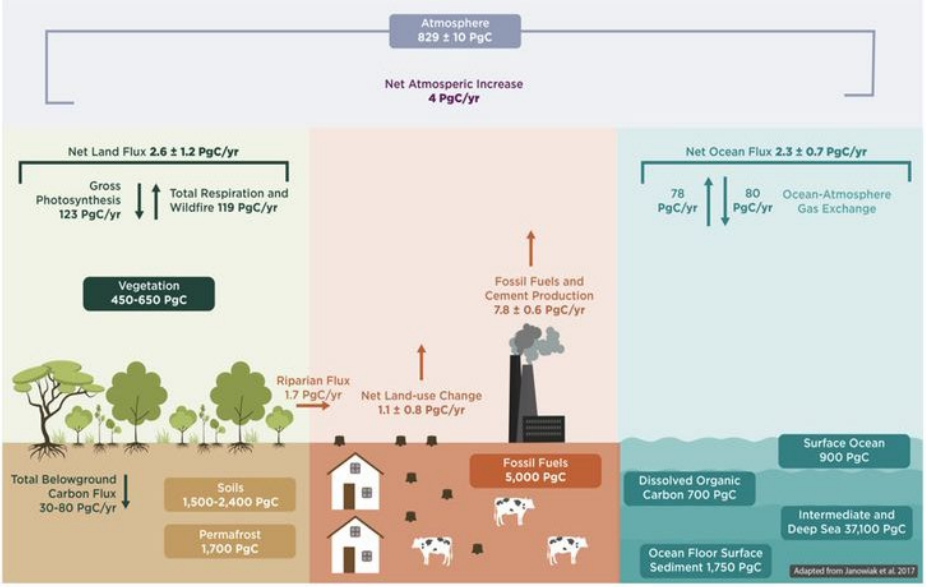
Findings from this report include:

- **Existing forests and trees in Thurston County sequester approximately 927,000 $MTCO_2e$/year.** This estimate provides a preliminary baseline that TCMP partners can use to monitor progress toward the carbon sequestration targets listed in the plan. Additional information is needed to estimate baseline sequestration provided by other land types, including agriculture and prairies.
- **The sequestration target set in the TCMP is highly ambitious, and likely infeasible with actions currently included in the plan.** Sequestration actions, including expanding regenerative agriculture, reforestation, prairie preservation, extended timber harvest, and tidal wetland restoration have the potential to increase sequestration by 122,411-314,290 $MTCO_2e$/year. This falls below the TCMP sequestration target of an additional 380,000 $MTCO_2e$/year over the baseline rate by 2050. This target may be harder to achieve as forested areas are developed and converted to other land uses—avoiding forest conversion does not increase sequestration potential, but can help maintain the existing sequestration provided by these areas.
- **TCMP partners can choose from a range of policies and programs to increase sequestration in the region.** Potential areas for initial focus include actions that preserve and increase sequestration in rural forests, align existing programs with sequestration goals, fill priority data gaps, and build relationships among community partners.

2. What is Carbon Sequestration?

Carbon sequestration is a process that removes carbon dioxide from the atmosphere and stores it in natural or artificial sinks, such as soil, vegetation, and the ocean. Other terms used to describe this process include carbon dioxide removal (CDR) and negative emissions technologies (NETs).

Figure 1. The global carbon cycle. Source: Michigan State University Forest Carbon and Climate Program.



"The carbon cycle is nature's way of reusing carbon atoms, which travel from the atmosphere into organisms in the Earth and then back into the atmosphere over and over again. Most carbon is stored in rocks and sediments, while the rest is stored in the ocean, atmosphere, and living organisms."

- NOAA

Carbon sequestration is both a naturally occurring process and a potential strategy for mitigating climate change. In theory, actions taken to increase rates of carbon sequestration can offset greenhouse gas emissions from other sources. All pathways modeled by the IPCC that limit global warming to 1.5°C require carbon dioxide removal, and this modeling indicates that the longer it takes for countries to reduce emissions towards zero, the more sequestration will be needed to meet that target (IPCC, 2018).

Carbon sequestration is sometimes criticized as "band-aid" for the climate crisis that enables emitters to avoid making changes that reduce sources of emissions. Some opponents argue that a focus on carbon sequestration distracts and diverts limited resources that would be better invested in proven technologies that need to be rapidly scaled up to meet climate targets, such as renewable energy infrastructure and energy efficiency improvements (Palmgren et al., 2004, Garcia Freites and Jones, 2020). While carbon sequestration is a natural process, it can be challenging to determine the true effectiveness of actions intended to increase sequestration, and separate their benefit from what might have occurred without intervention (Badgley, et al, 2021).

3. Sequestration Strategies and Targets

The analysis completed for the Thurston Climate Mitigation Plan (TCMP) found that local actions identified to reduce emissions from sources like energy use and transportation will likely be sufficient to meet the region's 2030 goal, but fall short of the region's target for 2050 (Hammerschlag, 2020). The TCMP proposed using carbon sequestration to offset the gap with a target that the Thurston region sequester an additional 380,000 $MTCO_2e$/year by 2050 to offset continued emissions from other sectors and meet its emission reduction goal.

While carbon sequestration can take many forms,[1] the TCMP focuses on the role of terrestrial sequestration—processes by which trees and other types of plants capture carbon dioxide from the atmosphere through photosynthesis and store it in vegetation and soil. The TCMP focused on three strategies to reach its targets: regenerative agriculture, afforestation and reforestation, and conservation and restoration of native prairies.

Regenerative Agriculture is an approach to food production that employs a variety of practices with a holistic aim to improve soil and ecosystem health, increase biodiversity, and store carbon.[2] Practices like double cropping, using cover crops, planting perennials, or adding organic matter to the soil can increase carbon input, while practices that limit the amount and intensity of tillage, burning, and erosion can reduce the amount of carbon lost from the soil (Giller et al., 2021).

TCMP Sequestration Actions & Targets: Agriculture

Strategy & Actions

Strategy A2. Support agricultural practices that sequester carbon.

- ***Action A2.1 – regenerative agriculture.*** Expand regenerative agricultural practices among farmers that aim for a "whole farm" approach. Provide education on how to increase organic matter content and water retention in soils within urban and agricultural settings.

Target

Manage 6,600 acres of agricultural land to store carbon through regenerative agriculture practices by 2050. This was estimated to increase carbon sequestration by 3,300 $MTCO_2e$/year.

Afforestation and Reforestation. Trees sequester carbon by capturing carbon dioxide from the atmosphere during photosynthesis and transforming it into biomass or storing it in deadwood and the soil. ***Afforestation*** is defined as planting trees in areas that have not historically been covered by forests and may involve land use transformation. ***Reforestation*** is defined as replacing trees in areas that have

[1] Other forms of carbon sequestration, including storing carbon through oceanic (blue carbon) and geologic processes were not included in the list of actions assessed to reach the TCMP's goals, but could be part of an overall carbon sequestration strategy.

[2] Despite widespread interest in regenerative agriculture, no legal or regulatory definition of the term "regenerative agriculture" exists nor has a widely accepted definition emerged in common usage. A survey of the term's use in journal articles and by practitioners found definitions often include a combination of process and outcomes (Newton et al., 2020). The authors recommend users of the term define it for their own purpose and context.

historically been covered by forests. The sequestration potential of trees can vary widely based on species, location, and age. The carbon density of coastal forests in the Pacific Northwest is up to twice that calculated for forests in the Midwest. Large individual trees can store significantly more carbon than small trees, so older, larger trees are important carbon stocks, though younger stands of smaller trees accumulate more carbon by area on an annual basis (carbon flux) (Case et al., 2021; Nowak & Crane, 2002; Gray et al., 2016).

TCMP Sequestration Actions & Targets: Forests

Strategy & Actions

Strategy A5: Manage forests to sequester carbon.

- ***Action A5.1 – reforestation & afforestation program.*** Develop a coordinated reforestation/afforestation program. Begin by identifying priority areas where reforestation and afforestation may have carbon reduction benefits.

Strategy A6: Reduce emissions from the urban landscape.

- ***Action A6.5*** – ***municipal canopy.*** Maximize tree canopy on jurisdiction owned or managed land, where appropriate, in balance with other jurisdictional goals.
- ***Action 6.9 – tree canopy preservation.*** Develop a tree canopy ordinance that establishes a baseline for current urban canopy and sets goals for future canopy to increase resilience. Combine direct cooling value (urban heat island mitigation) with carbon sequestration value when evaluating urban tree management.

Target

Manage sufficient forestland and prairies to sequester 375,000 tons of CO_2 annually by 2050.

Prairie Preservation and Restoration. Prairies have perennial grasses with deep fibrous root systems that can make up 60-80 percent of biomass in surrounding soil. Prairies in Thurston County and the South Puget Sound have native bunch grasses with roots that extend up to two feet deep, and some of the native forbs, including lupine and balsamroot, can have taproots that extend up to ten feet deep (Hamman 2020, pers comm.). This subterranean biomass creates sequestration potential, with some estimates that prairies hold approximately 20 percent of the world's soil carbon stock (Janowiak et al., 2017). Quantifying soil carbon sequestration is highly complex and varies based on climate, soil, and vegetation, though soil carbon stocks in prairies and grasslands tend to be the greatest in regions with

TCMP Sequestration Actions & Targets: Prairies

Strategy & Actions

Strategy A7: Increase carbon sequestration in marine and prairie ecosystems.

- ***Action A7.3 – prairie preservation.*** Support aggressive implementation of habitat conservation plans that provide for preservation and restoration of prairie habitat for endangered and threatened prairie species.

Target

Included in forests target.

the greatest rainfall, like Thurston County, and decrease with increasing annual temperature (Case et al, 2021).

The targets developed for the plan provide a rough calculation of how much TCMP partners would need to increase sequestration to meet the region's overall emissions reduction targets. The plan's analysis did not consider whether those targets are reasonable or feasible for local jurisdictions to achieve given practical constraints—such an assessment went beyond the scope and timeframe of the TCMP's development. The analysis also lacked data for several other strategies discussed in the plan that could contribute to a more complete estimate of sequestration potential:

- Baseline sequestration provided by existing land cover and land practices
- Change in emissions from anticipated development and changes to land uses between 2015 and 2050 (future baseline), and the sequestration potential of land conservation actions
- Sequestration rate of alternative forest, tree canopy, and agriculture management practices, including in urban areas
- Sequestration rate of restored prairie areas

These data gaps mean that while the TCMP recognizes the climate mitigation potential of conserving existing trees, forested areas, and prairies, these benefits were not quantified to set targets for the plan. Similarly, the potential benefits of restoring prairies and marine areas are discussed in the plan, but were not included in the sequestration target. Many other potential ways to increase carbon sequestration (such as climate-smart aquaculture practices like kelp farming) were not considered in developing the TCMP. For all these reasons, the quantitative targets developed for the plan should be viewed as a starting place to help frame regional discussions about the role of sequestration in climate mitigation. This report is a first step toward filling some of those data gaps.

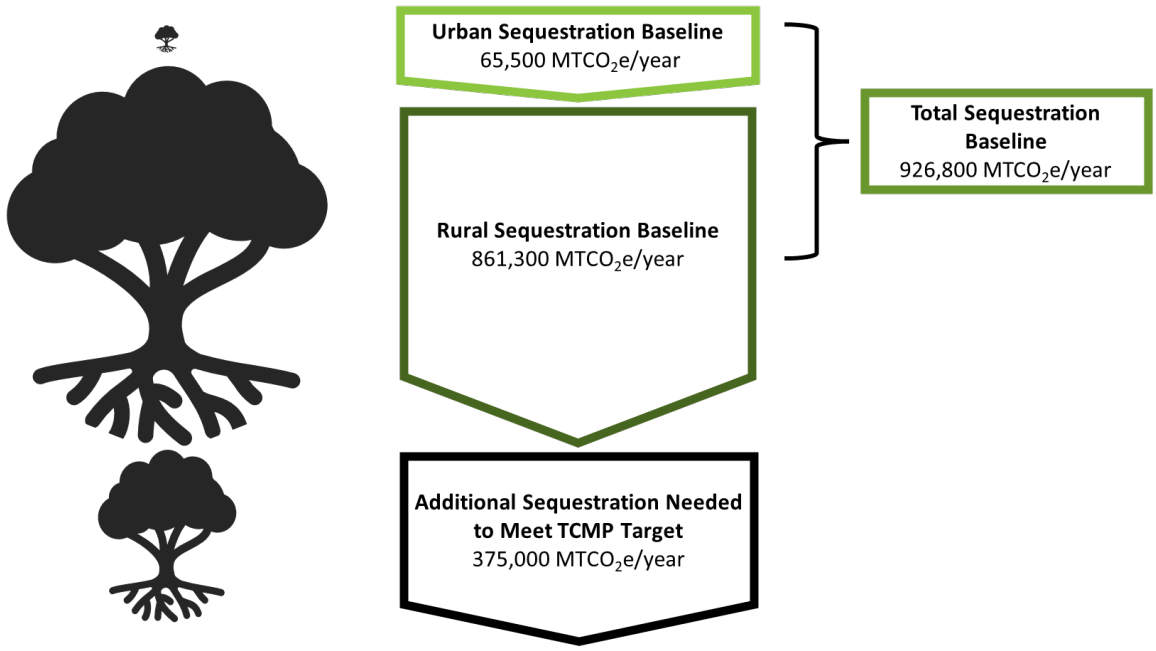
4. Baseline Sequestration

How much carbon does land in Thurston County sequester each year?[3]

The Intergovernmental Panel on Climate Change (IPCC) recommends that greenhouse gases from land uses be reported in six categories: Forest Land, Cropland, Grassland, Wetlands, Settlements, and Other Land. To aid in this assessment, ICLEI[4] developed the Land Emissions and Removals Navigator (LEARN) tool. As of 2022, the tool estimates local greenhouse gas impacts of forests and trees, but does not estimate emissions and sinks from other types of land uses, such as croplands and grasslands.

From 2006-2016, the LEARN tool estimates forests and trees in Thurston County sequestered 926,800 $MTCO_2e$/year.[5] The bulk of that sequestration (93 percent) takes place in rural portions of the county; trees in urban areas contribute a relatively small proportion of sequestration countywide (7 percent).

Figure 2. Baseline carbon sequestration from forests and trees in Thurston County and sequestration targets. Source: ICLEI LEARN tool, 2006-2016. Note this figure does not include estimated sequestration from agriculture.



This estimate provides a preliminary baseline that TCMP partners can use to monitor progress toward the carbon sequestration targets listed in the plan. To meet those targets, sequestration from forests and trees will need to increase to 1.3 million $MTCO_2e$/year, equivalent to the baseline figure plus an additional 375,000 $MTCO_2e$/year. Future analyses could improve on this data by developing baseline estimates for emissions from other land use categories, including agricultural lands and prairies.

[3] See Appendix B for more in-depth review of existing, available methodologies and data sources to inform baseline and potential carbon sequestration in Thurston County.
[4] ICLEI - United States chapter of the International Council for Local Environmental Initiatives
[5] ICLEI LEARN tool estimates were re-run December 7, 2022, using current jurisdictional boundaries, and reflect updates made to the tool through that date. For more information, see Appendix B.

5. Carbon Sequestration Potential

How much more carbon could certain land covers (forest, agriculture lands, prairies) potentially sequester in the future under different climate mitigation strategies?

TRPC reviewed a variety of methodologies, data sources, and tools to estimate the carbon sequestration potential of different actions. This review suggests the sequestration target set in the TCMP is highly ambitious, and likely infeasible with actions currently included in the plan. Approaching the target will require a substantial investment of resources into sequestration actions and significant changes to development patterns and land use practices. In addition, TCMP partners should consider how future land cover changes could reduce sequestration capacity from the baseline discussed above, potentially pushing emissions targets farther out of reach. Alternatively, the TCMP partners could consider adjusting the sequestration target to a more attainable amount and increasing targets for reducing emissions from other sectors to close the gap. Findings from this review are summarized below; for additional detail, see Appendix A.

Table 1. Estimated sequestration potential of climate mitigation actions.

	Estimated Sequestration Potential ($MTCO_2e$/year)	
Sequestration Strategies	**Low**	**High**
Sequestration actions included in the TCMP		
Regenerative agriculture (A2.1)	340*	6,990‡
Reforestation/afforestation (A5.1)	170*	118,820†
Prairie preservation (A7.3)	1*	4,760§
Other sequestration actions		
Extended timber harvest	117,600*	171,180*
Tidal wetland restoration	4,300*	12,540*
SUBTOTAL	**122,411**	**314,290**
Actions that maintain sequestration capacity		
Avoided conversion of forests°	11,310*	56,490*

Sources – see Appendix A for additional detail:
** Robertson et al. (2021). Note that this analysis does not distinguish between activities occurring in urban versus rural areas. Most forested areas (93%) are in rural portions of Thurston County.*
† Reforestation Hub
‡ NRCS COMET-PLANNER, Washington Climate Smart Estimator
§ CARB Land Restoration Benefit Calculator Tool
° Avoiding forest conversion will not increase total sequestration in the region. It will only reduce future net emissions.

Sequestration Potential of Actions Included in the TCMP

Regenerative Agriculture – TCMP Action A2.1

The TCMP set a target that 30 percent of cropland would be managed with regenerative agriculture practices by 2050 (6,600 acres). Data more recently developed for the Washington State Department of Agriculture and Conservation Commission suggests that the plan's analysis underestimates sequestration potential from this sector—land management practices are likely to have higher rates of sequestration than that used in the plan's analysis, and these practices could be applied on more land area, resulting in potential sequestration of nearly 7,000 $MTCO_2e$/year.

Reforestation/Afforestation – TCMP Action A5.1

Reforestation Hub, a project of Nature Conservancy and American Forests, identified just under 54,000 acres of land in Thurston County with reforestation potential, which, if restored at an average rate of 2,000 acres per year over 30 years, could sequester an estimated 119,000 $MTCO_2e$/year (Cook-Patton et al., 2020). This estimate is likely a high mark of how much reforestation is possible in Thurston County, but still falls short of the sequestration target for afforestation and reforestation in the TCMP (375,000 $MTCO_2e$/year).[6] It assumes an approach that includes planting trees on large areas of urban open space and agricultural lands, which may be incompatible with other climate mitigation strategies and community goals. A more moderate approach that focuses on reforesting sensitive riparian areas at a rate of approximately 40 acres per year could result in additional sequestration of around 2,000 $MTCO_2e$/year by 2050 (Robertson et al., 2021).

Prairie Preservation – TCMP Action A7.3

Under Thurston County's approved Habitat Conservation Plan, nearly 3,500 acres of prairie land will need to be managed to mitigate for projected impacts from future development on listed species over the next 30 years (Thurston County 2022). These activities include enhancing existing reserve areas, establishing new reserves, and securing working land easements in areas that overlap with agricultural activities. Conservation and restoration also will be included in the Bush Prairie Habitat Conservation Plan under development for land within the Tumwater Urban Growth Area. Completing the conservation activities identified in Thurston County's approved Habitat Conservation Plan could increase sequestration by nearly 5,000 $MTCO_2e$/year, and additional efforts in the region could add to this potential.

Sequestration Potential of Additional Actions

Extended Timber Harvest

Most timberlands in Washington State are harvested after 30 or 40 years of growth—deferring harvests until 70 or 80 years allows substantial additional carbon to be stored in trees. One study estimates that extending harvest times on a greater proportion of private, state, and federal timber lands across the county could result in additional sequestration of up to 171,200 $MTCO_2e$/year in Thurston County (Robertson et. al, 2021). Extending timber harvests could affect the amount of timber excise taxes collected and distributed to counties and the state General Fund.

[6] Though the study identifies a greater amount of potential land than needed in the plan, it uses a much more conservative sequestration rate.

Several actions on the long list considered for the TCMP focused on extending the length of timber harvest rotations, but none were ranked as a priority in the TCMP. With a better understanding of their sequestration potential, it may be worthwhile to revisit these actions and add them to the priority list.

Tidal Wetland Restoration

According to one analysis, restoration of tidal areas in Thurston County could sequester between 4,000 and 13,000 $MTCO_2e$/year. Two actions on the long list for the TCMP focused on increasing carbon sequestration in marine ecosystems, and these actions were a priority of the Squaxin Island Tribe, although they did not rank highly enough to be included in the plan. Revisiting these actions could help close any gap created by reducing expectations for other strategies.

Avoided Conversion of Forests

Forest conversion both creates a direct source of carbon emissions (by releasing a portion of the carbon stored in trees and roots into the atmosphere as carbon dioxide[7]) and reduces capacity for future forest carbon sequestration. Reducing the loss of forested areas to new development will not increase carbon sequestration, but could have substantial benefits by maintaining the region's existing baseline of carbon storage capacity. If future land use change is considered, the region will need to reduce emissions further to overcome the impacts of forest conversion and meet the TCMP targets. Avoiding forest conversion will minimize this additional gap.

The scenario analysis for the TCMP did not include an estimated rate of future forest conversion. One analysis estimates that if forest conversion continues at the rate seen in past decades, the region would lose 3,800 acres over next 30 years (Robertson et al., 2021). In contrast, TRPC estimates that by implementing existing local zoning and development codes that comply with the Growth Management Act—concentrating growth in urban areas and preserving rural character—local partners are already on a track to limit forest loss to nearly half that amount (2,100 acres). Concentrating a greater proportion of new development in urban areas and reducing development pressure on rural areas (as called for by the Sustainable Thurston land use targets adopted in the plan and actions listed under strategy T1) would further shrink that loss to around 1,300 acres of forest cover.[8] This outcome could maintain an estimated 56,490 $MTCO_2e$/year of sequestration from forested areas that may otherwise be converted to developed land uses.

Several actions listed in the TCMP focus on tree cover in urban areas (A6.5, A6.9)—these actions are likely to have limited impact, given the relatively small contribution that urban areas make to the baseline sequestration estimate. Partners may wish to consider actions that focus on reducing forest conversion in rural areas, which have the bulk of forested land. The long list of actions considered for the TCMP included a strategy focused on land preservation (Strategy A4)—actions under this strategy did not rank as a high priority in the TCMP, since the greenhouse gas inventory at that time did not include an estimate of emissions from land conversion. With a better understanding of their sequestration potential, it may be worthwhile to revisit these actions and add them to the priority list.

[7] Net emissions from forest conversion depend on how the timber cleared is used – some carbon continues to be stored for the long term as wood products.

[8] Estimates of future forest cover used TRPC's land capacity model and population and employment forecast. See Appendix B and TRPC 2021.

6. Community Perspectives and Opportunities

TRPC staff interviewed local stakeholders[9] to gain a better understanding about opportunities and concerns around the carbon sequestration targets and actions in the TCMP. Common themes from those interviews are listed in Table 2. For additional detail, see Appendix B.

Table 2. Summary of stakeholder perspectives on a regional carbon sequestration program

Vision	• Regional in scale • Includes wide range of practices: trees, agriculture, prairie preservation • Accessible to all types of land owners (urban, rural, small and large) • Supports other community goals related to habitat protection, open space protection, cooling • Focuses on voluntary and incentive-based tools, including education and technical support, with some regulatory support • Coordinated with state efforts
Opportunities	• Develop a baseline estimate of carbon sequestered through existing land uses (agriculture, forests, prairies) to account for impact of land conversion • Develop outreach materials and provide technical assistance for various practices: regenerative agriculture, forest management (including extended rotations), urban tree preservation and landscaping • Connect to existing programs, like Transfer of Development Rights (TDR), Voluntary Stewardship Program (VSP), existing city tree programs • Develop more consistent/complementary tree protection policies and standards across partner jurisdictions • Regulatory reform to remove barriers to regenerative agriculture practices
Concerns	• Appropriate balance among different sequestration forms: ex., where reforestation potential overlaps with existing agricultural lands or prairie areas • Appropriate balance between tree protection in urban areas, need for dense urban development (another TCMP strategy), and residential development • Financial cost of programs and staff time • Lack of interest among landowners/land managers • Ongoing maintenance requirements of lands used to account for sequestration • How to keep all stakeholders involved in the process • Voluntary, flexible tools are preferred, but may not meet the need • More land use needs than available land • Focus on carbon sequestration will reduce action on carbon reduction, allowing continued emissions from polluting entities • Accounting, so carbon sequestration benefit is not counted more than once

These interviews suggest there is considerable interest among potential community partners in activities that increase carbon sequestration, but that any future steps should carefully consider how those actions support other regional goals. Existing federal, state, and local resources may help support the development of carbon sequestration actions. These resources are summarized in Appendix C.

[9] Interviews were held with representatives from Thurston Conservation District, Capitol Land Trust, South of the Sound Community Farmland Trust, WSU Extension (Forestry), Thurston Climate Action Team, City of Lacey, and City of Olympia

7. Carbon Sequestration in Practice: Case Studies

Other cities, counties, and organizations have existing programs that incorporate elements of carbon sequestration, though few have done so as part of broader climate mitigation strategies. TRPC staff interviewed representatives from several different types of programs to better understand how sequestration could be addressed in the Thurston region.[10] Complete information on the case studies is included in Appendix D.

The carbon sequestration initiatives profiled take three forms: carbon credit programs, community forests, and urban forestry programs. The profiled programs offer the following insights into the potential for a carbon sequestration program in the Thurston region.

Partnerships help leverage expertise and make efficient use of resources. Rather than developing programs entirely in-house, all the profiled programs depend on some level of partnership between local government, private entities, nonprofits, and the community. For example, the Tucson Million Trees Initiative is operated by the nonprofit Tucson Clean and Beautiful and the mayor's office. The nonprofit is responsible for primary operations while the directive and goal came from the mayor's office. Similarly, King County's carbon credit program operates through county partnerships with City Forest Credits, Verified Carbon Standard, Microsoft, and other local businesses. This allows the County to outsource the time-consuming process of determining credit value to an outside third-party, rather than taking on the expense and accountability for developing that expertise within its own staff. Partners can also help fund and staff programs. The staffing demands for each program differ but are supported and distributed through local partnerships.

Urban tree canopy programs can serve multiple community goals, are the most established type of program, and potentially are the easiest place to start, but they have a limited climate mitigation benefit and tracking for sequestration adds significant complexity. Representatives from Pierce Conservation District, Tucson Million Trees Initiative, Tacoma Urban Forestry Management Plan, and King County recommended using urban tree programs to meet carbon sequestration targets in combination with other community goals. Generally, these programs require less overhead management than programs that cover a wider range of habitat types, and tree maintenance falls on individual renters or property owners. Most existing urban tree planting initiatives identify equity, public health, and a cooling effect as their primary goals rather than sequestration. These examples are in line with broader studies of urban tree planting and tree management programs that conclude such programs have broad benefits for climate *adaptation*—including through cooling, stormwater absorption, and health benefits—but limited potential to appreciably mitigate greenhouse gas emissions (Pataki et. al, 2021). Accurately measuring the additional carbon sequestration provided by urban forestry programs can pose a challenge; for tracking the program's benefits relative to a specific climate mitigation goal like that in the TCMP, practitioners recommend using an established certification organization.

Communicating with the community and gaining support or approval prior to program implementation is essential. Community engagement is critical for urban forestry programs to

[10] TRPC conducted interviews with representatives of the following profiled programs: King County Forest Carbon Program, Pierce Conservation District Partnership with City Forest Credits, Nisqually Community Forest, Tucson Million Trees, Tacoma Urban Forestry Management Plan

understand resident needs, ensure that individuals have tools to care for trees, and place trees in appropriate spaces. Community support is also essential for rural reforestation, preservation, and afforestation efforts to understand land use needs and develop maintenance plans. Carbon credit programs rely on community and local interest in purchasing the credits. Determining interest and support before initiating the program can increase participation and overall success.

Seed funding from grants, utilities, or taxes are key to initiating programs, but partners should consider developing a sustainable funding source for long-term program needs. Most programs received grant funding to initiate a small-scale pilot program before expanding efforts. Each program requires funding for initiation and ongoing maintenance and oversight. Funding from carbon credit sales were identified as essential in continuing preservation and maintenance work. Many tree planting efforts are transitioning to use funding from stormwater management to increase the availability and security of funding.

Carbon sequestration programs should highlight options to benefit marginalized or historically disadvantaged communities. The programs reviewed incorporate equity considerations to varying degrees. Carbon sequestration can raise equity and environmental justice concerns, including that sequestration projects may be located at a distance from the emissions they are intended to offset, and that their co-benefits (such as improved air and water quality) do not accrue to the people whose health and communities may be most directly impacted by sources of emissions and climate impacts. For example, programs intended to increase tree cover may disproportionately benefit white and affluent communities. Particularly in urban areas, such programs can have the unintended effect of increasing property values and housing costs, leading to gentrification and the displacement of low-income residents, people of color, and other vulnerable and marginalized communities (Wolch et al., 2014). Representatives from urban tree planting programs suggest designing regional programs to distribute trees to historically underserved communities. Similarly, preserving open spaces can occur in areas that increase accessibility to green spaces for marginalized communities. Many tree planting program representatives recommended working with American Forests to designate priority regions.

8. Policy Options

Regional partners have many options to move toward meeting the 2050 carbon sequestration targets outlined in the TCMP. TRPC staff developed a list of potential policy options based on conversations with stakeholders, case studies, and sequestration potential in the Thurston region; details of each action are included in Appendix E.

Cost Estimates

- $ = less than $100,000
- $$ = $100,000-$1,000,000
- $$$ = $1,000,000

More detailed cost estimates are included with the description of each action in Appendix E.

Staff Estimates

- Low = less than 1 FTE for limited duration, across all partners
- Medium = 1 FTE for longer duration, across all partners
- High = More than 1 FTE, for indefinite duration, across all partners

Carbon Sequestration Potential

		Low/High Baseline Sequestration Category	Low/High Sequestration Potential	Confidence/Probability of Impact
Overall Carbon Sequestration Potential	Low	**Low/Unknown** (Urban Trees, Agriculture, Prairies)	**Low/Medium** (regenerative agriculture, prairie preservation, avoided conversion of urban areas, tidal wetland restoration)	**Low** (voluntary education/outreach, limited ability to scale)
	Med	**Low** (Urban Trees, Agriculture, Prairies)	**Low/Medium** (regenerative agriculture, prairie preservation, avoided conversion of urban areas, tidal wetland restoration)	**Medium/High** (monetary incentives, regulation, or capital project; potential for widespread application)
		High (Rural Forest)	**High** (avoided conversion of rural forest areas, extended timber harvest)	**Low** (voluntary education/outreach, limited ability to scale)
	High	**High** (Rural Forest)	**High** (avoided conversion of rural forest areas, extended timber harvest)	**Medium/High** (monetary incentives, regulation, or capital project; potential for widespread application)
	Enabling	**No direct sequestration benefit, but enables other actions.**		

Table 3. Policy Options to Support Carbon Sequestration in the Thurston region. For details on each action, see Appendix E.

Action	Initial Cost	Ongoing Costs	Staff Requirements	Carbon Sequestration Potential	Potential Lead
Forests and Trees					
Rural/Forest Landowner Outreach and Technical Support Program	$$	$$	Medium	Medium	TCD, WSU Extension
Urban Tree Outreach and Technical Support	$$	$$	Medium	Low	Lacey, Olympia, Tumwater
Regional Urban Tree Canopy Assessment	$	$	Low	Enabling	TRPC, Thurston County, Lacey, Olympia, Tumwater
Tree Canopy Targets	$	$	Low	Enabling	TRPC, Thurston County, Lacey, Olympia, Tumwater
Urban Tree Management Plans and Code Review	$$	$	Medium	Medium	Thurston County, Lacey, Olympia, Tumwater
Forest Conversion Ordinance and Rural Tree Standards Update	$$	$	Medium	High	Thurston County
Comprehensive Plan Review and Update	$$	-	Medium	High	Thurston County, Lacey, Olympia, Tumwater
State Forest Lands Management Advocacy	$	$	Low	High	Thurston County, CASC
Working Forest Conservation Easements	$$$	$$$	High	High	Thurston County
Community Forests	$$$	$$$	High	High	Thurston County, Land Trusts
Regional Tree Fund	$$	$	Medium	Enabling	Thurston County
Urban Forest Carbon Credit Program	$	$	Low	Low	Thurston County, Lacey, Olympia, Tumwater, TCD
Rural Forest Carbon Credit Program	$$	$$	Medium	High	Thurston County, TCD
Transfer of Development Rights Program Update	$	$	Medium	Medium	Thurston County
Land Conservation and Restoration Capacity	$	$	Medium	Enabling	Thurston County, Lacey, Olympia, Tumwater, Land Trusts

Action	Initial Cost	Ongoing Costs	Staff Requirements	Carbon Sequestration Potential	Potential Lead
Reforestation/Afforestation Projects[11]	$$	$$$	High	High	Thurston County, TCD, Land Trusts
Agriculture					
Regenerative Agriculture Practice Tracking	$	$	Low	Enabling	TCD, WSU Extension
Regenerative Agriculture Outreach and Technical Assistance	$$	$$	Medium	Low	Thurston County, TCD
Agriculture Zoning and Development Code Review	$	$	Low	Medium	Thurston County
Conservation Programs Update	$	$	Low	Medium	Thurston County
Regional Agriculture Fund	$	$	Low	Enabling	Thurston County
Agriculture Carbon Credit Program	$	$$	Medium	Medium	Thurston County, Lacey, Olympia, Tumwater, TCD
Prairies					
Prairie Soil Analysis	$	$	Low	Enabling	WSU Extension
HCP Implementation	$$$	$$$	High	Medium	Thurston County, Tumwater, Port of Olympia
Prairie Conservation and Enhancement Carbon Credit Program	$	$$	Medium	Medium	Thurston County, CNLM
Supporting/Other Actions					
Land Use Change Emissions Inventory	$	$	Low	Enabling	TRPC
TCMP Action Update	$	$	Low	Enabling	TRPC
TCMP Target Update	$	$	Low	Enabling	TRPC
Sequestration Working Group	$	$	Medium	Enabling	TRPC
Blue carbon/Tidal restoration	$$$	$$$	Medium	Medium	Squaxin Island Tribe, cities, county

[11] A reforestation program focused on planting in rural areas would have the most potential for contributing to TCMP sequestration targets; planting projects incorporated into urban forest management programs would have limited sequestration potential.

9. Conclusion and Next Steps

This report outlines existing information and resources for policymakers and staff to consider in creating a regionally coordinated carbon sequestration program, though gaps remain that would help partners understand the long-term impacts of carbon sequestration. The carbon sequestration targets identified in the TCMP were based on what the region required to meet climate goals, but looking ahead, TCMP partners will need to balance the role of sequestration with other climate mitigation strategies and available resources.

As a first phase of addressing this sector, partners may opt to focus resources on the following areas:

- **Initiate actions with low to medium staff requirements that address areas with the greatest carbon sequestration potential—rural forests.**
    - Forest Conversion Ordinance and Rural Tree Standards Update
    - State Forest Lands Management Advocacy
- **Lay the groundwork for more intensive actions that address sequestration in rural forests, including looking at feasibility of:**
    - Working Forest Conservation Easements
    - Community Forests
    - Rural/Forest Landowner Outreach and Technical Support Program
    - Regional Tree Fund
    - Carbon Credit Programs
    - Reforestation/Afforestation Projects
- **Ensure the role of carbon sequestration is recognized and aligned in existing programs.**
    - Comprehensive Plan Updates
    - Transfer of Development Rights Program Update
    - Conservation Program Amendments
    - Habitat Conservation Plan Implementation
    - TCMP Action and Target Update
- **Fill priority data gaps to better enable and inform future work and sequestration estimates.**
    - Land Use Change Emissions Inventory
    - Regional Urban Tree Canopy Assessment
    - Prairie Soil Analysis
    - Regenerative Agriculture Practice Tracking
- **Help build relationships and capacity among regional partners**
    - Land Conservation and Restoration Capacity
    - Sequestration Working Group

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