# Appendix B

Carbon Sequestration Measures Audit
and Quantification

# AMBAG Natural and Working Lands Climate Mitigation and Resiliency Study

## Existing Carbon Sequestration Strategy Audit

This table presents existing policy and planning documents applicable to the Monterey Bay Area that seek to reduce greenhouse emissions and enhance resiliency through carbon-sequestering activities. Measures are identified by land cover type, strategy name, strategy description, strategy type, and the source from which the strategy originates. Strategy types are categorized as activity, resources, or coordination.

| Land Cover Type(s) | Strategy Name | Strategy or Policy Description | Type of Strategy | Source |
|---|---|---|---|---|
| Urban | Increase green space | Preserve or restore an additional 5 acres of green space within City limits by 2030. The goal will, in part, be accomplished by implementing a 100-foot development buffer around all sloughs within City limits and implementing watershed improvements and habitat enhancements for sloughs, storm culverts, and open channels. | Activity | Watsonville Climate Action Plan (Measure NW1-A) |
| Urban | Increase green space | Incentivize tree planting on public and private property (sequester carbon, provide shade, restore habitat) | Resources | Watsonville Climate Action Plan (Supporting Effort NW1-S2) |
| Urban | Increase green space | Develop a tree ordinance to protect existing trees. | Activity | Watsonville Climate Action Plan (Supporting Effort NW1-S3) |
| Urban | Increase green space | Develop and implement a Green Infrastructure Plan, including a combination of stormwater features, habitat, trees, and other greenery. | Activity | Watsonville Climate Action Plan (Supporting Effort NW1-S5) |
| Urban | Increase green space | Identify strategies for grassroots implementation of green infrastructure and restoration by City residents. | Activity | Watsonville Climate Action Plan (Supporting Effort NW1-S6) |
| Urban | Increase green space | Work with existing landowners to replace missing landscaping to increase green space. | Coordination | Watsonville Climate Action Plan (Supporting Effort NW1-S9) |
| Urban | Increase green space | Coordinate meeting series with Indigenous people to discuss best practices on restoration strategies and actions. | Coordination | Watsonville Climate Action Plan (Supporting Effort NW1-S7) |
| Urban | Increase green space | Expand and maintain both urban tree canopy and green spaces to moderate urban heat islands, decrease energy use, and contribute to carbon sequestration. | Activity | Natural and Working Lands Climate Smart Strategy |
| Urban | Increase green space | Update and implement the Forest Management Plan to enhance carbon sequestration potential | Activity | Carmel-by-the-Sea Climate Action Plan (Action 2.1.2) |
| Urban | Increase green space | Identify and develop a green infrastructure pilot project that incorporates tree and shrub planting to increase carbon sequestration in the city. | Activity | Carmel-by-the-Sea Climate Action Plan (Action 3.1.2) |
| All | Develop carbon offset program | Develop a local carbon offset and sequestration program to meet the City's GHG reductions toward meeting the goal of net-negative emissions by 2030. The City will implement local carbon offset and sequestration projects, such as use of a local organic waste composting facility, use of local woody organic waste, or conversion of biosolids to biochar for energy generation, soil enrichment, and develop new projects in Watsonville by 2030. Current and future carbon offset and sequestration projects shall be tracked and verified by the City, be in Watsonville, and support adaptation strategies of grid vulnerability and energy resilience and agricultural vulnerability and food resilience. | Coordination/ Activity | Watsonville Climate Action Plan (Measure NW2-A) |
| All | Develop carbon offset program | Increase opportunities for private and philanthropic investments in nature-based climate solutions, utilizing existing voluntary and compliance carbon markets, existing state and local programs, and the California Carbon Sequestration and Climate Resiliency Project Registry established pursuant to SB 27. | Activity/ Collaboration | CARB 2022 Scoping Plan |

| All | Collaborate to implement Smart Climate Goals | Identify the City's role in promoting and supporting climate-smart agricultural practices in partnership with the Pajaro Valley Water Management Agency (PVWMA) and Resource Conservation District of Santa Cruz County. | Coordination | Watsonville Climate Action Plan (Supporting Effort NW2-S1) |
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| All | Collaborate to implement Smart Climate Goals | In partnership with communities, tribes, and the private sector, expand and develop new infrastructure for manufacturing and processing of climate smart agricultural and biomass products. | Collaboration | CARB 2022 Scoping Plan |
| All | Collaborate to implement Smart Climate Goals | In collaboration with state and local agencies, accelerate the deployment of long-term carbon storage from waste woody biomass residues resulting from climate smart management, including storage in durable wood products, underground reservoirs, soil amendments, and other mediums. | Collaboration/ Activity | CARB 2022 Scoping Plan |
| All | Collaborate to implement Smart Climate Goals | Expand permit streamlining in collaboration with state and local agencies to accelerate implementation of climate smart forest management while protecting natural resources. | Activity | CARB 2022 Scoping Plan |
| All | Collaborate to implement Smart Climate Goals | Work across state agencies to reduce regulatory and permitting barriers around some healthy soils practices (e.g., composting), where appropriate. | Collaboration | CARB 2022 Scoping Plan |
| All | Collaborate to implement Smart Climate Goals | In collaboration with state and local agencies, accelerate the deployment of alternatives to agricultural burning that increase long-term carbon storage from waste agricultural biomass, including storage in durable wood products, underground reservoirs, soil amendments, and other mediums. | Collaboration | CARB 2022 Scoping Plan |
| All | Collaborate to implement Smart Climate Goals | Conduct research on the intersection of pesticides, soil health, GHGs, and pest resiliency via a multi-agency effort with DPR, CDFA, and CARB. | Collaboration/ Activity | CARB 2022 Scoping Plan |
| All | Collaborate to implement Smart Climate Goals | Work with state and local agencies to expand technical assistance for and enforcement of the defensible space requirements of PRC 4291 to reduce wildfire risk to homes and structures. | Collaboration | CARB 2022 Scoping Plan |
| Cropland, Urban | Identify innovative carbon sequestration solutions | Explore a pilot project to promote regenerative agriculture on City farmland. | Activity | Watsonville Climate Action Plan (Supporting Effort NW2-S2) |
| Cropland, Urban | Identify innovative carbon sequestration solutions | Partner to conduct carbon sequestration and carbon capture and storage opportunities in the City and regionally. | Coordination | City of Santa Cruz Climate Action Plan (CS2.1) |
| Cropland, Urban | Identify innovative carbon sequestration solutions | Partner with local lumber companies to promote sustainable and locally harvested lumber for timber construction to reduce emissions from materials transportation and reduce the price premium of emerging timber construction. | Coordination | City of Santa Cruz Climate Action Plan (CS2.4) |
| Cropland, Urban | Identify innovative carbon sequestration solutions | Prioritize additional lands for acquisition that provide habitats that are underrepresented in currently conserved areas, enable expanded public access, sequester carbon, and buffer climate impacts. | Coordination, Resources | PATHWAYS TO 30X30 CALIFORNIA (Measure 2.3) |
| Cropland, Urban | Identify innovative carbon sequestration solutions | Enhance carbon sequestration strategies through conservation and restoration of natural habitats, sustainable farming practices, and carbon capture technologies. | Activity | Climate Action and Adaptation Plan (CAAP) County of Santa Cruz |

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| Wetland | Quantify carbon sequestration potential | Quantify the resources/tools sequestration provided by the slough system. | Activity | Watsonville Climate Action Plan (Supporting Effort NW2-S4) |
| All | Quantify carbon sequestration potential | Account for the benefits of carbon sequestration by ecosystems. This can occur either following a disturbance, such as tree mortality from a storm, or following the conversion of one land use into another land use. | Activity | Introduction to ecosystem-based Carbon Management Opportunities in Urban Landscapes |
| Urban | Increase urban forestry | Reforest or afforest areas of the City that are currently mowed in line with other City parks and open space plans. | Activity | City of Santa Cruz Climate Action Plan (CR3.5) |
| Urban | Increase urban forestry | Increase urban forestry investment annually by 200 percent, relative to business as usual. | Activity | CARB 2022 Scoping Plan |
| Urban | Increase urban forestry | Increase and enhance open space and urban forests and support community tree plantings.<br><br>Action items:<br><br>• Develop informational materials and conduct outreach to encourage tree planting and urban forestry.<br>• Amend Zoning or municipal code, as necessary, to remove barriers to planting new trees along streets or on private property | Activity | Capitola Climate Action Plan (OS-2) |
| Cropland, Vineyard/Orchard, Grassland | Increase carbon sequestration by applying compost throughout the community | Explore making compost available at no or low cost to community gardeners. Continue to operate the compost bin rebate program. | Activity | City of Santa Cruz Climate Action Plan (CR3.1) |
| Cropland, Vineyard/Orchard, Grassland | Increase carbon sequestration by applying compost throughout the community | Engage with community gardeners, agriculture industry, master gardeners and Homeless Garden Project to plan and set goals around compost development and application. | Coordination/ Activity | City of Santa Cruz Climate Action Plan (CR3.2) |
| Cropland, Vineyard/Orchard, Grassland | Increase carbon sequestration by applying compost throughout the community | Explore collaborating with UCSC to pilot opportunities for regenerative agriculture and permaculture. | Coordination | City of Santa Cruz Climate Action Plan (CR3.3) |
| Cropland, Vineyard/Orchard, Grassland | Increase carbon sequestration by applying compost throughout the community | Apply compost in ecologically appropriate contexts to grasslands to enhance carbon sequestration and storage. | Activity | Natural and Working Lands Climate Smart Strategy |
| Cropland, Vineyard/Orchard, Grassland | Increase carbon sequestration by applying compost throughout the community | Increase adoption of compost production on farms and application of compost in appropriate grassland settings for improved vegetation and carbon storage, and to deliver waste diversion goals through nature-based solutions. | Activity | CARB 2022 Scoping Plan |

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| Urban, Forest, Oak Woodland, Shrubland, Grassland | Identify policies and programs that support carbon sequestration | Adopt regenerative landscaping policies and promote training to support commercial and residential landowners to better maintain native and carbon sequestering landscapes. | Activity | City of Santa Cruz Climate Action Plan (CR3.4) |
| Urban, Forest, Oak Woodland, Shrubland, Grassland | Identify policies and programs that support carbon sequestration | Evaluate policies to strengthen current open space habitat preservation. | Activity | City of Santa Cruz Climate Action Plan (CR3.6) |
| Urban | Increase urban agricultural opportunities | Increase the number of community gardens through the following sub-measures:<br><br>• Identify and inventory potential community garden and urban farm sites on parks, public easements, PG&E easements, and rights-of-way, and develop a program to establish community gardens in appropriate locations<br>• Encourage significant new residential developments over 50 units to include space that can be used to grow food.<br>• Establish a process through which a neighborhood can propose and adopt a site as a community garden.<br>• Work with schools to develop opportunities for creating additional community gardens on their campuses.<br><br>Action Items:<br><br>• Develop informational materials and conduct outreach to promote farmers markets and locally produced food to residents, businesses, and event organizers.<br>• Amend Zoning Ordinance, as necessary, to remove barriers to community gardens and urban agriculture | Coordination/ Activity | Capitola Climate Action Plan (OS-1) |
| All | Restore degraded landscapes, waterways, and priority habitats | In coordination with implementation of the Natural and Working Lands Climate Smart Strategy and other relevant state climate change initiatives, identify areas where environmental restoration will achieve the most significant climate benefits, including protecting carbon stores, sequestering carbon, and buffering human and natural communities from the impacts of climate change. | Coordination | PATHWAYS TO 30X30 CALIFORNIA (Measure 6.2) |
| Wetlands | Restore degraded landscapes, waterways, and priority habitats | Reconnect wetlands to ocean tides by removing human-made barriers to deliver successful outcomes for biodiversity, blue carbon sequestration, and ecosystem health. | Activity | PATHWAYS TO 30X30 CALIFORNIA (Measure 6.15) |
| Cropland | Restore degraded landscapes, waterways, and priority habitats | Repurpose cropland retired or fallowed due to lack of water supply for environmental, cultural and societal benefits, such as sequestering carbon, capturing floodwater, recharging aquifers, reducing dust, and providing habitat. | Activity | Natural and Working Lands Climate Smart Strategy |
| Cropland, Vineyard/Orchard | Incorporate carbon farming practices | Promote comprehensive farm management plans, such as whole-farm conservation plans, carbon farm plans and organic system plans. | Activity | Natural and Working Lands Climate Smart Strategy |

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| Cropland, Vineyard/Orchard | Incorporate carbon farming practices | Planting for carbon sequestration and storage to improve crop land soil health by increasing plant diversity and minimizing soil disturbance. | Activity | Natural Resource Conservation Service (NRCS) (Measure E612B) |
| Cropland, Vineyard/Orchard | Incorporate carbon farming practices | Utilize innovative agriculture energy use and carbon monitoring and planning tools to reduce on-farm GHG emissions from energy and fertilizer application or to increase carbon storage, as well as to promote on-farm energy production opportunities. | Activity | CARB 2022 Scoping Plan |
| Cropland, Vineyard/Orchard | Incorporate carbon farming practices | Utilize the recommendations included in CDFA's Farmer and Rancher-Led Climate Change Solutions493 report to accelerate deployment of healthy soils practices, organic farming, and climate smart agriculture practices. | Activity | CARB 2022 Scoping Plan |
| Cropland, Vineyard/Orchard | Incorporate carbon farming practices | Enhance field borders to increase carbon storage along edges of fields. | Activity | Natural Resource Conservation Service (NRCS) (Measure E386A) |
| All | Proactive management of current natural and working lands | Protect against habitat loss and fragmentation and reconnect fragmented habitats in developed lands to help maintain carbon sequestration. | Activity | Natural and Working Lands Climate Smart Strategy |
| All | Proactive management of current natural and working lands | Establish and expand mechanisms that ensure forests, shrublands, and grasslands are protected from land conversion and that support ongoing, rather than one-time, management actions. | Activity | CARB 2022 Scoping Plan |
| All | Proactive management of current natural and working lands | Establish and expand mechanisms that ensure sparsely vegetated lands are protected from land conversion, prioritizing those areas most vulnerable to climate change and loss. | Activity | CARB 2022 Scoping Plan |
| All | Proactive management of current natural and working lands | Avoid conversion and advance durable protection measures, such as acquisition and voluntary easement and infill and compact development, as means of preserving carbon sequestration and storage value and building climate resilience. | Activity | Natural and Working Lands Climate Smart Strategy |
| All | Proactive management of current natural and working lands | Integrate complementary climate change benefits into publicly funded conservation easement programs where possible to enable expanded carbon sequestration and storage and to strengthen natural resilience to climate change impacts. | Coordination | PATHWAYS TO 30X30 CALIFORNIA (Measure 3.2) |
| All | Proactive management of current natural and working lands | Improve carbon sequestering ability of forests by reforesting with more drought-adapted trees able to thrive with expected current and future climate and weather patterns | Activity | Climate Action and Adaptation Plan (CAAP) County of Santa Cruz |
| All | Promote equitable engagement | Prioritize and practice equity, including through meaningful community engagement and prioritizing implementation of nature-based solutions that benefit the communities most vulnerable to climate change. | Collaboration | CARB 2022 Scoping Plan |
| All | Promote equitable engagement | Consult and partner with California Native American tribes to increase co-management and tribal management authority; restore, protect, and enhance natural cultural resources, traditional foods, and cultural landscapes; respect tribal sovereignty; and support tribes' implementation of tribal expertise and Traditional Ecological Knowledge and cultural easements. | Collaboration | CARB 2022 Scoping Plan |

| All | Promote equitable engagement | Leverage existing innovative financial and market mechanisms, and explore new ones, between the public, private, and philanthropic sectors to secure funding of climate smart land management. | Collaboration | CARB 2022 Scoping Plan |
|---|---|---|---|---|
| All | Promote equitable engagement | Conduct outreach and education to develop and facilitate the increased adoption of safer, more sustainable pest management practices and tools; reduce the use of harmful pesticides; promote healthy soils; improve water and air quality; and reduce public health impacts. | Collaboration | CARB 2022 Scoping Plan |
| All | Promote equitable engagement | Increase public awareness of urban forest benefits and, where appropriate, prioritizing irrigation of trees over lawns. | Collaboration | CARB 2022 Scoping Plan |
| All | Leverage technical skills and knowledge | Leverage and support technical assistance providers: such as the UC Cooperative Extension and California's 98 Resource Conservation Districts, that have track records of providing technical assistance to local landowners and implementing agriculture, forestry, natural resource management, and restoration projects across the state. | Collaboration | CARB 2022 Scoping Plan |
| All | Leverage technical skills and knowledge | Provide technical assistance and resources to disadvantaged communities to implement community urban greening projects to provide equitable access to the benefits of urban greening projects. | Collaboration | CARB 2022 Scoping Plan |
| Forest, Oak Woodland, Shrubland | Increase and expand forest management practices | Accelerate the pace and scale of climate smart forest management to at least 2.3 million acres annually by 2025, in line with the climate smart management strategies identified in this Scoping Plan, the NWL Climate Smart Strategy, and the Wildfire and Forest Resilience Action Plan. | Activity, Resources | CARB 2022 Scoping Plan |
| Forest, Oak Woodland, Shrubland | Increase and expand forest management practices | Reforestation following disturbance, using appropriate species, is an impactful practice that can help prevent conversion away from forestland and establish new trees to sequester carbon. The number of acres that may need reforestation following high severity wildfires is estimated to continue to increase into the future. | Activity, Resources | CARB 2022 Scoping Plan |
| Forest, Oak Woodland, Shrubland | Increase and expand forest management practices | Protect resilient forests and large trees and advance proactive vegetation management in more vulnerable stands, using forest thinning, which includes methods such as prescribed and cultural burns and managed natural wildfire, to reduce the risk of catastrophic wildfire, increase resilience to future drought, increase carbon sequestration rates, and stabilize carbon storage. | Activity | Natural and Working Lands Climate Smart Strategy |
| Forest, Oak Woodland | Efficient processing of biomass | Expand infrastructure to facilitate processing of biomass resulting from climate smart management. | Activity, Resources | CARB 2022 Scoping Plan |
| Grassland | Improve grassland management practices | Establish and expand mechanisms that ensure grasslands are protected from land conversion/parcelization and that support ongoing, rather than one-time, management actions that improve carbon sequestration. | Activity | CARB 2022 Scoping Plan |
| Grassland | Improve grassland management practices | Deploy grassland management strategies, like prescribed grazing, compost application, and other regenerative practices, to support soil carbon sequestration, biodiversity, and other ecological improvements. | Activity, Resources | CARB 2022 Scoping Plan |
| Cropland, Forest, Oak Woodland, Shrubland, Grassland | Explore solutions that provide multifunctional solutions | Support strategies that achieve co-benefits of safer, more sustainable pest management practices and the health and preservation of ecosystems, such as implementing the California Department of Pesticide Regulation's (DPR's) Sustainable Pest Management Work Group recommendations. | Activity | CARB 2022 Scoping Plan |

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|---|---|---|---|---|
| Cropland, Forest, Oak Woodland, Shrubland, Grassland | Explore solutions that provide multifunctional solutions | Ensure the overlapping nature of the conservation targets to create opportunities to achieve multiple habitat protection objectives when conducting land protection as well restoration and enhancement projects. | Activity | Santa Cruz County Regional Conservation Investment Strategy |
| Wetland | Explore solutions that provide multifunctional solutions | Identify and prioritize wetland restoration efforts around climate vulnerable communities. | Activity | CARB 2022 Scoping Plan |
| Wetland, Fresh Marsh | Explore solutions that provide multifunctional solutions | Construct living shorelines, which are protected, stabilized shorelines constructed with natural materials that can sequester carbon and maintain carbon stores of the wetlands they protect. | Activity | Natural and Working Lands Climate Smart Strategy |
| All | Explore solutions that provide multifunctional solutions | Continue to improve understanding of how environmental conservation achieves climate benefits, including improved precision of measuring carbon sequestration and storage on natural and working lands and specific resilience benefits of conservation or restoration projects. | Activity | PATHWAYS TO 30X30 CALIFORNIA (Measure 10.8) |
| Wetland, Fresh Marsh | Explore funding opportunities | Leverage other funding and institutions to support wetland restoration projects, including land trusts, local funding (e.g., San Francisco Measure AA), federal funding, and private and philanthropic funding to support wetlands restoration projects. | Resources | CARB 2022 Scoping Plan |
| Wetland, Fresh Marsh | Explore funding opportunities | A tax of $12 per parcel per year, for a period of 20 years. This special tax is levied on all parcels within the nine Bay Area counties. The parcel tax funds will be used to restore wetlands and do important work to preserve a healthy San Francisco Bay. | Resources | San Francisco Bay Restoration Authority (San Francisco Measure AA) |
| Cropland, Vineyards/Orchards | Explore funding opportunities | Establish or expand financial mechanisms that support ongoing deployment of healthy soils practices and organic agriculture. | Resources | CARB 2022 Scoping Plan |
| Forest, Oak Woodland | Explore funding opportunities | Pursue funding to expand forest management to promote carbon sequestration and reduce threat of intense fires. | Resources | City of Santa Cruz Climate Action Plan (CR1.3) |

# Methodologies for Estimating Carbon and Cost Quantification for Land Treatments

# Technical Appendix

This technical appendix provides an overview of the approach and methodologies used to quantify the potential scale, carbon sequestration benefits, and cost of land treatments presented in Chapter 4. An outline of the approach and methodologies is shown in steps 1-3 below, which are further discussed in detail in the following sections.

▶ **Step 1:** Determine list of land treatments and their associated statewide acreages.

▶ **Step 2:** Downscale the land treatments to the Monterey Bay Area (defined as Monterey, San Benito, and Santa Cruz counties), based on each land cover type's proportion of statewide acreage.

▶ **Step 3:** Assign quantitative carbon reduction and cost values to these downscaled land treatments.

These steps were used to calculate the results presented in Section 4.5 of the Climate Study.

# 1     LAND TREATMENTS AND STATEWIDE ACREAGES

A list of endorsed statewide land treatment types and their associated acreages was compiled based on three public documents described in Chapter 2: 1) the AB 1757 Expert Advisory Committee Recommendations (referred to hereafter as EAC Recommendations) (CNRA 2023), 2) the Recommendations for AB 1757 Targets and Pathways for Annual and Perennial Agriculture and the Recommendations for AB 1757 Targets and Pathways for California Rangelands comment letters (referred to hereafter as Ag Organizations Recommendations) (California Climate & Agriculture Network et al. 2023), and 3) the California Air Resources Board's (CARB's) *2022 Scoping Plan for Achieving Carbon Neutrality* and its associated Appendix I: Natural and Working Lands Technical Support Document (collectively referred to hereafter as the 2022 Scoping Plan) (CARB 2022a and CARB 2022b, respectively). These documents all recommend various levels and/or types of statewide land treatments for natural and working lands. There is substantial overlap amongst the three referenced resources in the types of land treatments proposed, but the land treatments do not align in their entirety across these documents (i.e., a land treatment type and/or level may be proposed in one document, but not the others).

To determine the targets to use for the Climate Study, a "loading order" approach was used for each land treatment, based on information in these documents. The EAC Recommendations document was used as the preferred source, as it was the most recent (at the time of analysis) and accounted for the other two documents' data and analysis. If data for an identified land treatment was not available in the EAC Recommendations, the Ag Organizations Recommendations were used, followed by the 2022 Scoping Plan. Table 1 below shows the statewide annual acreage land treatment targets from these documents. The targets used for the purposes of this Climate Study are indicated in bold text; the process for downscaling them to the Monterey Bay Area is described in Section 2.

**Table 1          Statewide Annual Acreage Land Treatment Targets, by Document**

| Land Cover Type | Land Treatment Type | 2022 Scoping Plan | Ag Organizations Recommendations | EAC Recommendations | Notes |
|---|---|---|---|---|---|
| Agricultural Lands: Croplands, Orchards, Vineyards, Grazed Grasslands, and Rangelands | Compost amendment | 40,142 | **487,333** | NA | [1] |
| | Transition to organic farming | 64,758 | **129,339** | NA | [2] |
| | Cover crops (legumes and non-legumes) | 19,234 | **140,000** | NA | [3] |
| | No-till or reduced-till agriculture | 19,213 | **70,000** | NA | [4] |
| | Hedgerows/windbreaks/shelterbelts | 214 | 25,333 | **25,400** | [5] |
| | Grazing management | NA | **272,667** | NA | [6] |
| | Silvopasture | NA | **40,667** | NA | [7] |
| | Conservation easements | 8,340 | **59,600** | NA | [8] |
| | Move farmland to equilibrium status | NA | NA | 380,000 | [9] |
| | Riparian restoration / Establishing riparian forest buffers | 56 | 3,160 | **2,000** | |
| Forests, Shrublands, and Non-grazed Grasslands | Prescribed burning | **507,457** | NA | See note [10] | [10] |
| | Mastication | **197,041** | NA | See note [10] | [10] |
| | Thinning | **535,155** | NA | See note [10] | [10] |
| | Other mechanical | **756,240** | NA | See note [10] | [10] |
| | Biological, chemical, and herbaceous treatments | **39,253** | NA | See note [10] | [10] |
| | Harvesting | **283,724** | NA | See note [10] | [10] |
| | Clearcut | **24,652** | NA | See note [10] | [10] |
| | Conserve privately-owned managed conifer forests | NA | NA | 222,222 | [11] |
| | Reduce annual conversion rate of grasslands | NA | NA | 75% reduction from current rate | [12] |
| Wildland-Urban Interface | Defensible space establishment | 31,645 | NA | 63,289 | [13] |
| Wetlands | Wetland restoration and management | 5,356 | NA | 5,356 | [14] |
| Desert Lands | Avoided conversion of desert lands | 15,000 acres above current level | NA | 15,000 acres above current level at minimum | |
| Urban Forests | Increased investment in urban forests | $4.2 billion over BAU | NA | $4.2 billion over BAU | [15] |
| Developed Lands | Reduce expansion of developed land | NA | NA | Less than 10,000 new acres of developed | |

| Land Cover Type | Land Treatment Type | 2022 Scoping Plan | Ag Organizations Recommendations | EAC Recommendations | Notes |
|---|---|---|---|---|---|
| | | | | land over the next 10 years | |

Notes: CARB = California Air Resources Board; BAU = business as usual; EAC = 1757 Expert Advisory Committee; NA = not applicable. Grazed grasslands are primarily used to feed livestock and are considered agricultural lands for the purposes of this Climate Study. Non-grazed grasslands are generally unmanaged and considered part of the forests, shrublands, and grasslands category.

Bold values indicate the acreages used from the three documents for the purpose of the Climate Study.

[1] The AB 1757 Expert Advisory Committee (EAC) does not endorse a specific acreage target for composting. There are unclear long-term carbon sequestration benefits of this practice (in the long run, soil may achieve an equilibrium carbon stock, and then decline due to climate impacts). However, the EAC is generally supportive of composting and other soil health practices because they have co-benefits such as improved soil health, nutrient use, water holding capacity, microbial activity, and food security (CNRA 2023: 11-19).

[2] The EAC recommends that organic acreage targets be at least 2 million, or 20 percent of current cropland acres. The state is already at this target (California Department of Food and Agriculture n.d.: 1). However, the opportunity for organic agriculture should be extended to 100 percent of producers. This has the benefit of transferring knowledge of organic production to all producers, as well as helping to form carbon markets (Horwath, pers. comm., 2024). The estimates in this row include cropland only; pastureland is not included.

[3] The EAC does not have specific acreage targets for cover cropping but does support the practice due to co-benefits—see item [1].

[4] The EAC does not have specific acreage targets for conservation tillage but does support the practice due to co-benefits—see item [1].

[5] The EAC advocates for "farm edge diversification" on 380,000 acres in California by 2040 but does not specify specific practices to implement. It is assumed that farm edge diversification encompasses hedgerows, windbreaks, and shelterbelts, all of which are usually planted at the edge of farms (CNRA 2023: 16).

[6] CARB and the EAC do not have specific acreage targets for grazing management. The EAC is generally supportive of the practice, as it prevents overgrazing and mitigates wildfires (CNRA 2023: 39).

[7] CARB and the EAC do not have specific acreage targets for silvopasture.

[8] CARB and the agriculture organizations discuss the use of conservation easements (CARB 2022a: 82 and California Climate & Agriculture Network et al. 2023: 5), which prevent development on agricultural land. See note [9] below for the EAC's recommendation on farmland conservation, which differs from the easement approach.

[9] "Equilibrium status" is defined by the EAC as follows: Fallow land must be rehabilitated to a climate change-resistant ecosystem category, and farmland that is lost due to development must be offset by an increase in agricultural or park uses in unused urban spaces (CNRA 2023: 14). This calculation was performed assuming 9.5 million statewide acres of agricultural land, per the 2022 Scoping Plan (CARB 2022a: 254), and a 25-year implementation timeframe.

[10] The EAC is generally supportive of the magnitude of CARB's overall fuel management goal (CNRA 2023: 35). However, it recommends the following changes: 1) Prioritize fuels management in mixed conifer forest and appropriate oak woodlands (up to 2 million acres annually [CNRA 2023: 35]). 2) In mixed conifer forests and oak woodlands, managed fire should be the preferred land treatment, and mechanical approaches should be reduced (CNRA 2023: 35). 3) For shrublands in wildland-urban interface (WUI) areas, fuel treatments such as thinning, mastication, and prescribed fire can promote non-native grass establishment in these lands. These fuel treatments can thus increase fire risk and should be avoided unless there is a specific cultural interest (CNRA 2023: 41).

[11] Assuming 2 million acres of privately-owned managed conifer forests have conservation easements by 2034. 2 million is the midpoint of the EAC's suggested range of 1-3 million (CNRA 2023: 33).

[12] No data was available on grassland conversion rates for the Monterey Bay Area, so this practice was not considered for this Climate Study.

[13] 2022 Scoping Plan values assume 50,000 parcels per year are treated, and each parcel has a defensible space area of approximately 0.63 acres. This land treatment rate results in 100 percent defensible space compliance in 20 years (Moreno, pers. comm., 2023). The EAC recommends full WUI compliance in 10 years (CNRA 2023: 26), so the EAC's proposed rate of defensible space establishment shown in the table is twice CARB's value in the 2022 Scoping Plan.

[14] In the Delta and Suisun Marsh areas, 32,500 acres of tidal habitats are restored and 50,000 acres of wetlands are managed or converted to rice cultivation by 2045. In the San Francisco Bay, 20,000 acres of tidal wetlands are restored by 2045. Additionally, 3,000 acres of eelgrass are restored in the San Francisco Bay by 2038 (CNRA 2023: 44). These conservation efforts are assumed to start in 2025.

[15] Urban forest acreage is not quantified because, per the Scoping Plan, the land treatments do not target a specific number of acres. Instead, urban forest treatments reflect an increase in investment in these lands, which comprises a combination of planting new trees, maintenance, removal, and disposal. The EAC is generally in agreement with CARB's urban forest targets in the 2022 Scoping Plan (Schwartz, pers. comm., 2024)

Source: Prepared by Ascent in 2024.

# 2 DOWNSCALING LAND TREATMENT ACREAGES TO MONTEREY BAY AREA

Land cover type acreages for the Monterey Bay Area and corresponding statewide values are shown in Tables 2 and 3 below, respectively. For all land cover types except rangelands, Monterey Bay Area acres were derived from the Carbon Stock Inventory Technical Memorandum (see Appendix A), and statewide acres were derived from the 2022 Scoping Plan (CARB 2022a). Rangelands comprise multiple land cover types where livestock graze, including grasslands, shrublands, woodlands, and wet meadows. Thus, rangeland acreages overlap with other land types, and cannot be added with other values in the table. They are shown in Tables 2 and 3 as separate line items. Rangeland acreage estimates for the Monterey Bay Area were obtained from the University of California, Davis (2024), and rangeland acreage estimates for the entire state of California were obtained from the Ag Organizations Recommendations (California Climate & Agriculture Network et al. 2023).

**Table 2          Monterey Bay Area Land Cover Type and Acreage**

| Land Cover Type | Acres |
|---|---|
| Forest | 322,437 |
| Fresh Marsh | 55,500 |
| Oak Woodland | 563,980 |
| Urban | 119,422 |
| Cropland | 265,179 |
| Orchards/Vineyards | 70,438 |
| Shrubland | 803,213 |
| Grassland | 1,039,070 |
| Wetland | 20,373 |
| Other | 201 |
| Barren | 19,031 |
| Water | 13,145 |
| **Total** | **3,291,989** |
| **Rangelands[1]** | **2,842,573** |

[1]   Rangelands include multiple land cover types including grasslands, shrublands, woodlands, and wet meadows and are not included in the total acres to avoid potential double counting.

Source: Prepared by Ascent in 2024.

**Table 3          Statewide Land Cover Type and Acreage**

| Land Cover Type | Acres |
|---|---|
| Forests | 29,000,000 |
| Shrublands | 33,000,000 |
| Grasslands and Pastures | 11,500,000 |
| Wetlands | 1,700,000 |
| Deserts | 10,200,000 |
| Croplands | 9,500,000 |
| Developed Lands | 6,800,000 |
| **Total** | **101,700,000** |
| **Rangelands[1]** | **57,000,000** |

1   Rangelands include multiple land cover types including grasslands, shrublands, woodlands, and wet meadows and are not included in the total
    acres to avoid potential double counting.

Source: Prepared by Ascent in 2024.

For most land cover types, downscaling endorsed statewide land treatment targets to the Monterey Bay Area was performed based on the ratio of Monterey Bay Area land cover in Table 2 to statewide land cover in Table 3. However, the following exceptions applied:

▶   **Forests, shrublands, and grasslands:** The 2022 Scoping Plan modeling divides these land cover types into "ecounits," or areas with similar ecology and vegetation cover. Those ecounits are depicted in Figure 1 below, with the Monterey Bay Area's approximate location indicated by a black circle. The forests, shrublands, and grasslands within the Monterey Bay Area contain three distinct ecounits: approximately 279,000 acres of Central Coast Evergreen Forest, approximately 1,930,000 acres of Central Coastal Wood, Shrub, and Grasslands, and approximately 470,000 acres of North-Central Coastal Forest, for a total of approximately 2,679,000 acres (based on data from CARB [2022c]). To determine the treatment level for the Monterey Bay Area, 2022 Scoping Plan treatments for only these three ecounits were considered and downscaled to the Monterey Bay Area.

**Figure 1          California and Monterey Bay Area Ecounits for Forests, Shrublands, and Grasslands**
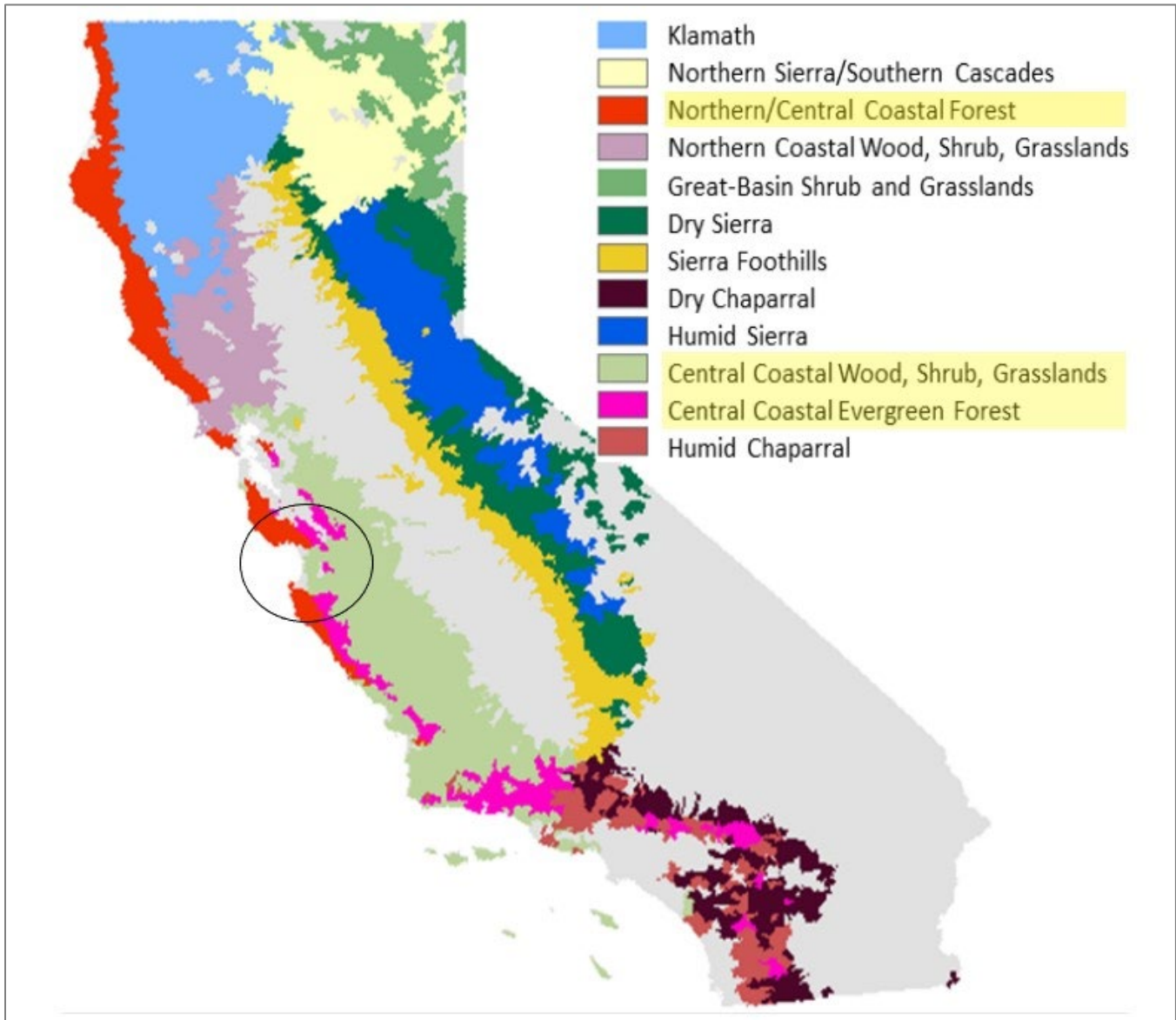


Source: Original image from CARB 2022b: 30. Annotations and highlighting added by Ascent in 2024.

▶  **Urban Forests:** No data from the sources used in this analysis were available on urban forest acreage in the
   Monterey Bay Area, so this was assumed to be equal to the urban area of 119,422 acres in Table 2. Additionally,
   the 2022 Scoping Plan did not estimate urban forest acreage. However, *California's 2017 Climate Change Scoping
   Plan* estimated a statewide urban forest area of 21,280 square kilometers, or 5,258,381 acres (CARB 2018: 66). This
   acreage was used to calculate a downscaling factor of 2.3 percent, which is the ratio of Monterey Bay Area urban
   forest acres to statewide urban forest acres.

▶  **Wildland-urban interface:** No data from the sources used in this analysis were available on wildland-urban
   interface acreage in the Monterey Bay Area. Thus, this value was prorated based on the Monterey Bay Area's
   share of statewide population (approximately 1.9 percent), not land area. Statewide treatments of 100,000 parcels
   per year were prorated based on this value and an assumption of 0.63 acres of defensible space per parcel (per
   CARB [2022b: 152], which states that the wildland-urban interface consists of 955,920 acres and 1,510,398 parcels).

The results of these downscaling calculations are shown in Table 4 below.

**Table 4        Statewide and Monterey Bay Area Acres Treated**

| Land Cover Type | Treatment Type | Statewide Acres Used for Climate Study | Monterey Bay Area Acres Treated | Percent of Statewide Acres Treated |
|---|---|---|---|---|
| Agricultural Lands: Croplands, Orchards, Vineyards, Grazed Grasslands, and Rangelands | Compost amendment | 487,333 | 18,763 | 3.9% |
| | Transition to organic farming | 129,339 | 4,569 | 3.5% |
| | Cover crops (legumes and non-legumes) | 140,000 | 4,946 | 3.5% |
| | No-till or reduced-till agriculture | 70,000 | 2,473 | 3.5% |
| | Hedgerows/windbreaks/shelterbelts | 25,400 | 897 | 3.5% |
| | Grazing management | 272,667 | 24,636 | 9.0% |
| | Silvopasture | 40,667 | 2,028 | 5.0% |
| | Conservation easements | 59,600 | 2,615 | 4.4% |
| | Move farmland to equilibrium status | 380,000 | 13,425 | 3.5% |
| | Riparian restoration / Establishing riparian forest buffers | 2,000 | 71 | 3.5% |
| Forests, Shrublands, and Non-grazed Grasslands | Prescribed burning | 507,457 | 16,447 | 3.2% |
| | Mastication | 197,041 | 14,658 | 7.4% |
| | Thinning | 535,155 | 8,486 | 1.6% |
| | Other mechanical | 756,240 | 3,847 | 0.5% |
| | Biological, chemical, and herbaceous treatments | 39,253 | 1,641 | 4.2% |
| | Harvesting | 283,724 | 1,402 | 0.5% |
| | Clearcut | 24,652 | 1,204 | 4.9% |
| | Conserve privately-owned managed conifer forests | 222,222 | 1,826 | 0.8% |
| | Reduce annual conversion rate of grasslands | 75 percent reduction from current rate | NA | NA |
| Wildland-Urban Interface | Defensible space establishment | 63,289 | 1,232 | 1.9% |
| Wetlands | Wetland restoration and management | 5,356 | 239 | 4.5% |
| Desert Lands | Avoided conversion of desert lands | 15,000 acres above current level at minimum | 28 | 0.2% |
| Urban Forests[1] | Increased investment in urban forests | $4.2 billion over BAU | $95,977,818 over BAU | 2.3% |
| Developed Lands | Reduce expansion of developed land | Less than 10,000 new acres of developed land over the next 10 years | 18 | 0.2% |

Notes: BAU = business as usual; NA = not applicable.

1   Urban forest acreage is not quantified because the treatments do not target a specific number of acres. Instead, urban forest treatments reflect
    an increase in investment in these lands, which comprises a combination of planting new trees, maintenance, removal, and disposal (CARB
    2022b: 178). No data were available on the rate of grassland conversion in Monterey Bay Area, so this was not included in the Climate Study,

Source: Prepared by Ascent in 2024.

# 3        ASSIGNING COST AND CARBON REDUCTION

This section describes the data sources that were used to assign costs and carbon sequestration values to the land treatments described in Sections 1 and 2.

## 3.1      COST

The 2022 Scoping Plan provided dollars per acre values for most land treatments (CARB 2022b: 173), except for grazing management and silvopasture. For these treatments, cost data was obtained from the Environmental Quality Incentives Program (EQIP) (EQIP 2022: 373 and 641). EQIP is the US Department of Agriculture's (USDA's) program that reimburses farmers and ranchers for the cost of integrating conservation practices into management of natural and working lands. All cost-per-acre values appear in Table 4.1 in Chapter 4.

## 3.2      CARBON SEQUESTRATION

For agricultural treatments, carbon sequestration values were derived from the USDA's COMET-Planner tool (United States Department of Agriculture, Colorado State University, California Air Resources Board, and California Department of Food and Agriculture 2024). The one exception was organic farming, which was not available in the COMET-Planner tool, and thus carbon sequestration values were obtained from the 2022 Scoping Plan (CARB 2022b: 124). For non-agricultural treatments, carbon sequestration values were obtained from the 2022 Scoping Plan (CARB 2022a: 156). Table 5 below shows the average MT C sequestered per acre treated per year.

**Table 5        Average MT C Sequestered per Acre Treated Per Year**

| Land Cover Type | Treatment Type | MT C sequestered from treatment, per acre per year |
|---|---|---|
| Agricultural Lands: Croplands, Orchards, Vineyards, Grazed Grasslands[1], and Rangelands[2] | Compost amendment (cropland, orchard, vineyard) | 0.567 |
| | Compost amendment (rangeland) | 1.208 |
| | Transition to organic farming | 0.740 |
| | Cover cropping (legumes) | 0.109 |
| | Cover cropping (non-legumes) | 0.019 |
| | No till | 0.060 |
| | Reduced till | 0.030 |
| | Hedgerows/windbreaks/shelterbelts | 2.822 |
| | Riparian forest buffers (cropland, orchard, vineyard) | 0.540 |
| | Grazing management | 0.030 |
| | Silvopasture | 0.180 |
| Forests, Shrublands, and Non-grazed[3] Grasslands | All Treatments | 0.016 |

| Land Cover Type | Treatment Type | MT C sequestered from treatment, per acre per year |
|---|---|---|
| Wetlands | Wetland restoration and management | 8.523 |
| Desert Lands | Avoided conversion of desert lands | 0.002 |
| Urban Forests | Tree planting, maintenance, removal, and disposal | $11,990 per MT C[4] |

Notes: C = carbon; MT = metric tons.

[1] Grazed grasslands are primarily used to feed livestock and are considered agricultural lands for the purposes of this Climate Study.

[2] Rangelands include grazed grasslands and other lands where livestock may graze, including shrublands, woodlands, and wet meadows.

[3] Non-grazed grasslands are generally unmanaged and considered part of the forests, shrublands, and grasslands category.

[4] Per the 2022 Scoping Plan, urban forest treatments do not target a specific number of acres. Instead, urban forest treatments reflect an increase in investment in these lands, which comprises a combination of planting new trees, maintenance, removal, and disposal (CARB 2022b: 178). The 2022 Scoping Plan calculates a cost of $3,270 per sequestered metric ton of carbon dioxide equivalent (CARB 2022a: 156). This implies a cost of $11,990 per sequestered metric ton of carbon (one molecule of carbon dioxide weighs 44/12, or approximately 3.67, times the weight of one atom of carbon).

Source: Prepared by Ascent in 2024.

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