APPENDIX IV

Opportunities for Local Carbon Offset Credits in the Natural and Working Lands Category

A Preliminary Review of Regulations and Protocols Related to Forest and Other Natural Lands, Urban Forest, Wetlands, Soil Carbon, and Cropland Biomass

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1 INTRODUCTION

Much of California's climate strategy focuses on reducing or avoiding future greenhouse gas (GHG) emissions through mitigation measures such as decarbonizing electricity, electrifying transportation, or reducing use of high global warming potential gases. Increasingly, California is focusing on the ability of Natural and Working Lands to store carbon and remove carbon dioxide (CO_2) that already exists in the atmosphere. In its estimate of carbon stocks in California, the California Air Resources Board (CARB) evaluated the ability of five broad categories to remove and sequester carbon: Forest and Other Natural Lands, Urban Forest, Wetlands, Soil Carbon, and Cropland Biomass.[1] According to CARB, in 2018 there was approximately 5,340 million metric tons (MMT) of carbon in the carbon stocks within these categories in California.[2] Most of this carbon, approximately 85%, is contained in forest and shrubland because they have the highest carbon density of any land cover type and they represent the majority of California's landscape.[3] These categories form the framework for this report, with the Forest and Other Natural Lands category broken into two separate categories.

This appendix will focus on opportunities to implement projects on Natural and Working Lands in the San Diego region to generate carbon offset credits (offset credit). Important to this analysis, is whether certain types of GHG reduction and/or removal activities are required by law, regulation, or other legally-binding mandate. While there are no direct requirements for activities included in the Natural and Working Lands category (e.g., afforestation, urban forestry, wetland restoration, etc.), many laws and regulations that implicate Natural and Working Lands focus on land use designations and restrictions on implementing certain activities on certain land types. As a result, many of the GHG emissions removal activities are not common practice, and all related offset credit protocols are considered additional or likely additional, as long as the related activities do not violate applicable land use restrictions. In some cases, GHG emissions removal activities could be required for environmental mitigation purposes when some form of development occurs. These activities and related GHG emissions impacts would be considered not additional. However, if the project went beyond the mitigation requirements, then those extra GHG reductions or removals could be considered additional. While this report makes preliminary additionality determinations for broad categories of activities, final determinations should be made on a project-by-project basis.

It is also important to note that carbon sequestration capacity changes with different types of land cover. For example, forest land sequesters more carbon than grassland. Additionally, carbon sequestration capacity can be dynamic and depend on the characteristics of the land cover, such as whether the land has been burned by fire and the age of the organism. This can make it difficult to estimate the GHG impacts of carbon sequestration.

As California continues to advance its climate policies and there is a realization that protecting existing stocks and removing carbon are important, there appears to be a trend towards regulating and requiring some of the GHG emission reduction and removal activities relevant to the Natural

[1] California Air Resources Board, An Inventory of Ecosystem Carbon in California's Natural & Working Lands, 2018, p. 5–6: https://ww3.arb.ca.gov/cc/inventory/pubs/nwl_inventory.pdf.
[2] Id. at 6.
[3] Id. at 6–7.

and Working Lands category.[4] The California Natural Resources Agency (CNRA), the California Environmental Protection Agency (CalEPA), and the California Department of Forestry and Fire Protection (CALFIRE) have developed the California Forest Carbon Plan to establish California's forests as a net carbon sink.[5] Executive Order N-82-20, signed by Governor Newsom in 2020, calls for California to conserve 30% of its land and coastal waters by 2030.[6] Given these developments, it would be necessary to monitor regulatory activity to determine whether the additionality determination presented here would change for certain activities in the Natural and Working Lands category.

1.1 Project Purpose and Methods

The goal of this project is to identify project opportunities to reduce or remove GHG emissions in the San Diego region that could be used to generate offset credits. To support this overall goal, the Energy Policy Initiatives Center (EPIC) identified categories of GHG emissions in the San Diego region; identified activities to reduce or remove emissions; identified related regulations that require such activities; identified related offset credit protocols; evaluated these protocols based on applicability to conditions in the San Diego region and the number of projects developed in the United States (U.S.), California, and the San Diego region; and, determined whether the offset credit protocols and related activities would be considered additional to what would have happened otherwise. The additionality determination is based on a two-part test. The Legal Requirement Test determines whether the activity is required by legislation or regulation or otherwise legally mandated. The Common Practice Test determines whether the project activity is considered a common practice and would have happened otherwise for financial or technological reasons. A more detailed discussion of the project approach is provided in Section 3 of the main project report.

This report summarizes the findings of this analysis for the Natural and Working Lands category, including Forest, Other Natural Lands (Grasslands), Urban Forest, Wetlands, Soil Carbon, and Cropland Biomass. Cropland Biomass is briefly discussed in Section 7, though a full analysis was not completed because EPIC did not identify any active protocols in the subcategory.

1.2 Key Findings

There are several key findings based on the analysis of the Natural and Working Lands category for the report.

- All Active and Applicable Protocols Related to the Natural and Working Lands Category are Considered Additional – The activities included in active and applicable protocols in the

[4] See California Air Resources Board, An Inventory of Ecosystem Carbon in California's Natural & Working Lands, 2018: https://ww3.arb.ca.gov/cc/inventory/pubs/nwl_inventory.pdf.
[5] California Department of Forestry and Fire Protection, California Environmental Protection Agency, California Natural Resources Agency, California Forest Carbon Plan Managing Our Forest Landscapes in a Changing Climate, 2018, p. 1: https://resources.ca.gov/CNRALegacyFiles/wp-content/uploads/2018/05/California-Forest-Carbon-Plan-Final-Draft-for-Public-Release-May-2018.pdf.
[6] Executive Order N-82-20, 2020: https://www.gov.ca.gov/wp-content/uploads/2020/10/10.07.2020-EO-N-82-20-.pdf.

Natural and Working Lands category would be considered additional or likely additional, but there are limited opportunities to implement these activities in the San Diego region due to the relatively small area of compatible land (e.g., forest land) compared to other regions in California (Table 1). Of the protocols considered additional, 11 have at least one project in the U.S. and 5 have at least one project in CA, including four in the Forest subcategory and one in the Wetlands subcategory.

Table 1 Results of Natural and Working Lands Screening Process

Protocol Category	All Protocols	Active, Applicable	And Additional	And at Least 1 Project in U.S	And at Least 1 Project in CA
Forestry	24	8	8	7	4
Grasslands	7	6	6	2	0
Soil Management	5	4	4	1	0
Urban Forest	5	5	5	0	0
Wetlands	10	5	5	1	1
Total	**51**	**28**	**28**	**11**	**5**

- There are a Limited Number of GHG Carbon Offset Credit Projects in California Using Protocols Related to the Natural and Working Lands Category – There are 86 total projects implemented in California using protocols considered additional in this category (Table 2 and Table 3). Nearly all of these projects fall under forest management, while one project falls under wetland creation/restoration. There are no projects in California related to the Other Natural Lands (Grasslands), Soil Carbon, or Urban Forest subcategories.
- The Only Carbon Offset Credit Project in the San Diego Region is Related to Forestry – There is one forestry project in the San Diego region—the only offset credit project in the region. The lack of projects may be due in part to the limited number of existing voluntary protocols that are applicable to the San Diego region, limitations in compatible land for offset credit projects (e.g., forests), and current offset credit prices. While the past lack of projects is not definitive, it suggests that past projects were not feasible.
- There Appears to be a Trend to Regulate Natural and Working Lands in California – California has begun to recognize the importance of Natural and Working Lands in fighting climate change[7], and if California moves forward to require GHG emission reduction and removal activities within the Natural and Working Lands category, the additionality determination for relevant protocols and activities may change if related activities become required by law or regulation.

[7] See California Air Resources Board, An Inventory of Ecosystem Carbon in California's Natural & Working Lands, 2018: https://ww3.arb.ca.gov/cc/inventory/pubs/nwl_inventory.pdf.

Table 2 Projects in Active and Applicable Protocols Related to Forests and Other Natural Lands

GHG Emission Subcategory/Protocol	US	CA	San Diego Region	Additionality Determination
Forestry	**228**	**85**	**1**	
CAR U.S. Forest Projects Compliance Offset Protocol (CARB)	90	49	0	Additional
CAR Forest	41	19	1	Additional
ACR U.S. Forest Projects Compliance Offset Protocol (CARB)	89	16	0	Additional
ACR Afforestation and Reforestation of Degraded Lands	1	1	0	Additional
CAR Mature Forest Management (Climate Forward)	2	0	0	Additional
CAR Reforestation (Climate Forward)	0	0	0	Additional
VCS AR-ACM0001: Afforestation and Reforestation of Degraded Land, Version 5.2.0	4	0	0	Additional
VCS U.S. Forest Projects Compliance Offset Protocol (CARB)	1	0	0	Additional
Grasslands	**14**	**0**	**0**	
CAR Grassland	13	0	0	Likely Additional
ACR Avoided Conversion of Grasslands and Shrublands to Crop Production	1	0	0	Additional
ACR Compost Additions to Grazed Grasslands	0	0	0	Additional
CAPCOA Optional Composting Facility Component-Grazed Grasslands Protocol (ACR-MCP)	0	0	0	Additional
VCS VM0026 Methodology for Sustainable Grassland Management (SGM)	0	0	0	Likely Additional
VCS VM0032 Methodology for the Adoption of Sustainable Grasslands through Adjustment of Fire and Grazing	0	0	0	Additional

Table 3 Projects in Protocols Related to Urban Forest, Wetlands, and Soil Carbon

GHG Emission Subcategory/Protocol	US	CA	San Diego Region	Additionality Determination
Urban Forest	**0**	**0**	**0**	
ACR Urban Forest Projects Compliance Offset Protocol (CARB)	0	0	0	Additional
CAR Urban Forest Management	0	0	0	Additional
CAR Urban Forest Projects Compliance Offset Protocol (CARB)	0	0	0	Additional
CAR Urban Tree Planting	0	0	0	Additional
VCS Urban Forest Projects Compliance Offset Protocol (CARB)	0	0	0	Additional
Wetlands	**1**	**1**	**0**	
ACR Restoration of California Deltaic and Coastal Wetlands	1	1	0	Additional
CAPCOA Restoration of California Deltaic and Coastal Wetlands (ACR)	0	0	0	Additional
CAPCOA VM0024 Methodology for Coastal Wetland Creation, v1.0 (Verra)	0	0	0	Additional
VCS VM0024 Methodology for Coastal Wetland Creation, v1.0	0	0	0	Additional
VCS VM0033 Methodology for Tidal Wetland and Seagrass Restoration, v1.0	0	0	0	Additional
Soil Carbon	**1**	**0**	**0**	
VCS VM0021 Soil Carbon Quantification Methodology, v1.0	1	0	0	Additional
CAPCOA Biochar Production Project Reporting & Addendum (Placer County APCD	0	0	0	Additional
CAR Soil Enrichment	0	0	0	Additional
VCS VM0017 Adoption of Sustainable Agricultural Land Management, v1.0	0	0	0	Likely Additional

2 FOREST

The Forest subcategory of the Natural and Working Lands inventory quantifies the biomass carbon stored in forests, shrublands and woodlands. It quantifies live biomass (which includes trunk, branches, and bark of trees), understory (shrubs and plants growing beneath the main canopy of a forest), and their roots. It also includes a preliminary estimate of dead biomass, which includes standing and fallen dead trees, roots, and litter (leaves, bark, needles, twigs that have fallen to the forest floor), which contains high uncertainty and will continually be refined in the future.[8] Forest/Shrubland includes land exhibiting greater than or equal to 10% canopy cover comprised of live trees and/or shrubs, including tree-dominated land and shrub-dominated land.[9] Note that the Urban Forest subcategory is covered in Section 4.

The San Diego region has relatively limited forested land compared to other regions of California. About 130,870 acres in the region are forest.[10] It has been estimated that these forest lands in the county have the potential to sequester 103,387 metric tons (MT) CO_2e per year, but rates of carbon sequestration vary "within tree species, soil types, and geographic areas, depending on age, temperature, humidity, and water and nutrient availability," making sequestration difficult to calculate and verify for an offset credit project that targets carbon sequestration in forests.[11] In addition, the region has significant shrublands with more than 630,000 acres of chaparral vegetation within the San Diego region.[12] The sequestration value and potential of chaparral vegetation is unknown,[13] which makes it difficult to calculate the impacts that could result from a project to sequester GHG emissions on chaparral shrublands. Due to the large quantities of chaparral shrublands in the San Diego region, there may be an opportunity to develop a protocol that focuses on chaparral vegetation once a quantification methodology to calculate carbon sequestration value is adopted.

2.1 Methods to Reduce Emissions

Examples of project activities that could be considered applicable to the San Diego region under forestry protocols include direct tree planting; site preparation actives that promote natural regeneration of tree seedlings; improved forest management; and avoided conversion of forest land.

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[8] California Air Resources Board, An Inventory of Ecosystem Carbon in California's Natural & Working Lands, 2018, p. 15: https://ww3.arb.ca.gov/cc/inventory/pubs/nwl_inventory.pdf.
[9] Id. at 24.
[10] Dudek, Evaluation of Greenhouse Gas Emissions Offset Availability within San Diego County, 2018, p. 9: https://www.ci.oceanside.ca.us/civicax/filebank/blobdload.aspx?BlobID=49641.
[11] Ibid.
[12] County of San Diego, Chaparral Vegetation Community: https://www.sandiegocounty.gov/content/dam/sdc/pds/mscp/docs/Biodiversity/handoutvegcomm3.pdf.
[13] The U.S. Forest Service, University of California, Davis, and San Diego State University are currently in the process of collaboratively working towards developing a sequestration value for chaparral vegetation within the San Diego region. It is important to note that the sequestration value is variable, depending on ecosystem type, the species of chaparral, and physical changes that occur during the life of the vegetation (i.e., whether the land has burned from fire or not).

2.2 Legislation and Regulation

There are no federal, state, or local laws, regulations, or legally binding mandates that require eligible forestry project activities to occur. Under CEQA, however, if some form of development occurs that significantly impacts forest resources, mitigation measures may be required that call for implementation of one of these activities.[14]

2.3 Protocols

EPIC identified 24 protocols from the three main offset credit programs—American Carbon Registry (ACR), Climate Action Reserve (CAR), and Verified Carbon Standard (VCS) —in the U.S. within the Forest subcategory. Of that total, eight are active and cover activities applicable to the San Diego region (Table 4). Each offset credit program administers a related CARB compliance protocol, and two protocols are associated with the CAR Climate Forward program, which is separate from its offset credits protocols and provides "forward mitigation units" on an *ex ante* basis.[15] These protocols listed in Table 4 cover project activities related to reforestation, afforestation, avoided conversion, and forest management. The following provides a summary of a sample of forestry protocols.

- CAR Forest Protocol, Version 5.0[16] – This protocol seeks to sequester carbon on forestland through management activities that maintain or increase carbon stocks on forested land. The protocol approves activities that fall under improved forest management and avoided conversion. Improved forest management includes such activities as increasing the overall age of the forest by increasing rotation ages, increasing the forest productivity by thinning diseased and suppressed trees, managing competing brush and short-lived forest species, increasing the stocking of trees on understocked areas, and maintaining stocks at a high level. Avoided conversion prevents the conversion of forestland to non-forest land use by dedicating the land to continuous forest cover at existing or increased stocking levels through conservation easement recordation or transfer to public ownership.
- CARB Compliance Offset Protocol U.S. Forest Projects[17] – This protocol seeks to achieve GHG reductions and removal enhancements associated with sequestration of carbon through reforestation, improved forest management, and avoided conversion.

There are 228 projects in the U.S. related to protocols in the Forest subcategory, including 85 in California and one in the San Diego region, which is the only offset credit protocol project in the region. The total number of projects in California use four protocols, and about three-quarters are associated with two CARB compliance protocols. Four protocols have no projects in California.

[14] See California Environmental Quality Act, California Public Resources Code (PRC) §§ 21000 et seq.
[15] See the Project Report for more details on offset credit programs, protocols, and registries.
[16] Climate Action Reserve, Forest Protocol, Version 5.0, 2019: https://www.climateactionreserve.org/how/protocols/forest/.
[17] California Air Resources Board, Compliance Offset Protocol U.S. Forest Projects, 2015: https://ww2.arb.ca.gov/our-work/programs/compliance-offset-program/compliance-offset-protocols/us-forest-projects/2015.

Table 4 Projects in Active and Applicable Protocols Related to Forestry[18]

Protocol	US	CA	San Diego Region
CAR U.S. Forest Projects Compliance Offset Protocol (CARB)	90	49	0
CAR Forest	41	19	1
ACR U.S. Forest Projects Compliance Offset Protocol (CARB)	89	16	0
ACR Afforestation and Reforestation of Degraded Lands	1	1	0
CAR Mature Forest Management (Climate Forward)	2	0	0
CAR Reforestation (Climate Forward)	0	0	0
VCS AR-ACM0001: Afforestation and Reforestation of Degraded Land, Version 5.2.0	4	0	0
VCS U.S. Forest Projects Compliance Offset Protocol (CARB)	1	0	0
Total	**228**	**85**	**1**

The limited number of projects in CA and the San Diego region could be due to a lack of related land uses (e.g., forests, wetlands, etc.) or other factors such as project cost effectiveness.

2.4 Additionality

This section evaluates whether the protocols listed above or similar activities would lead to GHG reductions that would not have occurred otherwise. In the context of offset credits, it is important to determine whether a project and associated GHG reductions or removals would have happened in the absence of any benefit derived from creating an offset credit; that is, whether the reduction or removal is in addition to what would have otherwise happened. Additionality is a key concept in evaluating offset credits and there are several different ways to determine, or test, whether a project is considered additional.

California regulation defines "additional" to mean "greenhouse gas emission reductions or removals that exceed any greenhouse gas reduction or removals otherwise required by law, regulation or legally binding mandate, and that exceed any greenhouse gas reductions or removals that would otherwise occur in a conservative business-as-usual scenario."[19] This definition creates a two-part test of additionality: a Legal Requirement Test and a Common Practice Test (sometimes called performance test).[20] Even though this two-part test is developed in the context of CARB's compliance offsets, it is similar to that used by offset credit programs, and thus can serve as a reasonable framework to evaluate whether offset credit protocols and resulting GHG emission reductions or removals would be considered additional.

[18] Note that Urban Forest is a separate category. See Section 4.
[19] 17 California Code of Regulations (CCR) § 95802(a).
[20] Ibid.

Additionality must be determined on a project-by-project basis. For our purposes here, we consider a preliminary screen of protocols and project types (e.g., reforestation or wetland restoration) to determine whether as a group they could be considered additional. The additionality determination provided here is intended as a preliminary determination and specific additionality screening would have to be applied to a specific project to determine whether the associated GHG reductions or removals are additional.

A more detailed discussion of additionality is provided in Section 2.3 of the main report.

Additionality Tests

There are several different tests to determine additionality. This report uses two common tests.

- Legal Requirement Test – This test determines whether there are any laws, regulations, policies, or legally-binding mandates that would have required the activity. If the activity does not exceed requirements, related emissions reductions would fail the legal requirement test and be considered not additional.
- Common Practice Test – This test determines whether in the absence of a requirement the activity would have happened anyway due to technological, financial, or other considerations. For example, if the activity is cost effective without the proceeds from carbon offset credits or represents a common practice, it could be considered not additional.

2.4.1 Legal Requirement Test

EPIC did not identify any laws or regulations mandating or requiring reforestation, afforestation, improved forest management, or avoided conversion. Therefore, protocols with activities related to reforestation, afforestation, avoided conversion, and forest management would be considered additional under the Legal Requirement Test. However, if any of these activities are required for environmental mitigation purposes, then they could not be used for offset credit projects because the activities would have been required by law and thus would fail the Legal Requirement Test. However, if the project goes above and beyond what is required for mitigation purposes, those subsequent GHG impacts would be considered additional.

2.4.2 Common Practice Test

The Common Practice Test, sometimes called the performance test, is an industry or sector specific analysis that requires the individual project to either achieve emission reductions in excess of what would have occurred otherwise based on whether there is widespread deployment of the particular project, technology, or practice or whether there is performance achievement that is greater than average within a relevant geographical area.[21] This determines what is a common practice in the

[21] See American Carbon Registry, THE AMERICAN CARBON REGISTRY STANDARD: REQUIREMENTS AND SPECIFICATIONS FOR THE QUANTIFICATION, MONITORING, REPORTING, VERIFICATION, AND REGISTRATION OF PROJECT-BASED GHG EMISSIONS REDUCTIONS AND REMOVALS, Version 7.0, 2020, at p. 27–28: https://americancarbonregistry.org/carbon-accounting/standards-methodologies/american-carbon-registry-standard/acr-standard-v7-0_final_dec2020.pdf.

geographical region. A project-by-project analysis of what is a common practice to determine whether the applicable project passed a business-as-usual test was beyond the scope of this document for the San Diego region. However, the GHG emissions reduction and removal activities within the Forest subcategory do not appear to be common practice within the San Diego region. Therefore, these activities likely would pass the Common Practice Test and be considered additional. Evaluation on a project basis would be necessary to determine whether a specific project would be considered common practice.

2.5 Other Considerations

There are several other factors a project proponent should consider that may pose barriers to implementation of a forestry offset credit project in the San Diego region. Permanence is an important factor when implementing an offset credit project in the Natural and Working Lands category. Activities on Natural and Working Lands to sequester carbon or avoid conversion "have the potential for GHG reductions and removals to be reversed upon exposure to risk factors."[22] A project proponent must be able to ensure that a offset credit project is in fact permanent for a required amount of time and will continue to reduce and/or remove GHG emissions from the atmosphere into the future. As an example, ACR requires that project proponents "must commit to maintain, monitor, and verify Project Activity for a Minimum Project Term of 40 years,"[23] while VCS requires a permanence analysis of up to 100 years.[24] "ACR requires that projects with a risk of reversals shall assess and mitigate risk, and monitor, report, and compensate for reversals."[25] This is difficult to accomplish but is required to be eligible to receive offset credits.

A second consideration is the dynamic and complex nature of the carbon sequestration process.[26] There are many factors that can impact how much carbon is sequestered by a given species within a unique ecosystem. Factors such as fire activity, age of the organism, what ecosystem is being targeted, water availability, and so on, all impact carbon sequestration potential. A project proponent would need to address this issue before implementing a carbon sequestration project.

2.6 Summary of GHG Reduction Opportunities

There are opportunities to implement offset credit projects in the San Diego region in the Forest subcategory. These activities, which include reforestation, afforestation, avoided conversion, and improved forest management, are considered additional and would pass the Legal Requirement

[22] Id. at 31.
[23] Ibid.
[24] See Verified Carbon Standard, AFOLU Non-Permanence Risk Tool, 2019, p. 2: https://verra.org/wp-content/uploads/2019/09/AFOLU_Non-Permanence_Risk-Tool_v4.0.pdf.
[25] American Carbon Registry, THE AMERICAN CARBON REGISTRY STANDARD: REQUIREMENTS AND SPECIFICATIONS FOR THE QUANTIFICATION, MONITORING, REPORTING, VERIFICATION, AND REGISTRATION OF PROJECT-BASED GHG EMISSIONS REDUCTIONS AND REMOVALS, Version 7.0, 2020, at p. 31: https://americancarbonregistry.org/carbon-accounting/standards-methodologies/american-carbon-registry-standard/acr-standard-v7-0_final_dec2020.pdf.
[26] Barta Ecological Strategies, Linking Climate-Friendly Farming Practices to San Diego County's Climate Action Plan: An Opportunity Analysis of Carbon Farming in the Unincorporated County, 2018, p. 21: https://static1.squarespace.com/static/5d51ab12fea20500010a114b/t/5e7556479ba3bf5a8db2aff1/1584748117967/Opportunity_of_Carbon_Farming_in_San_Diego_County.pdf.

and Common Practice Tests at the time of publication (Table 5). However, these opportunities may be limited due to the relatively small area of forest lands in the San Diego region.

Table 5 Summary of Additionality Determination for Forest Protocols

Protocol	Additionality Determination
CAR U.S. Forest Projects Compliance Offset Protocol (CARB)	Additional
CAR Forest	Additional
ACR U.S. Forest Projects Compliance Offset Protocol (CARB)	Additional
ACR Afforestation and Reforestation of Degraded Lands	Additional
CAR Mature Forest Management (Climate Forward)	Additional
CAR Reforestation (Climate Forward)	Additional
VCS AR-ACM0001: Afforestation and Reforestation of Degraded Land, Version 5.2.0	Additional
VCS U.S. Forest Projects Compliance Offset Protocol (CARB)	Additional

A potential related opportunity may exist to sequester carbon in chaparral vegetation, a major ecosystem within the San Diego region. Currently there is no formal method to quantify the carbon sequestration value in this ecosystem. Further analysis would be needed to develop a method to determine GHG emissions impacts from projects involving chaparral in the San Diego region, particularly estimating annual changes in GHG sequestration due to restoration and enhancement. More research is needed to determine whether it could be possible to develop a carbon offset credit for chapparal.

3 OTHER NATURAL LANDS (GRASSLANDS)

The Other Natural Lands subcategory includes grasslands, rangelands, and other natural lands (i.e., desert). This section focuses project opportunities on grasslands in the San Diego region. Grasslands include areas dominated by grasses or herbaceous vegetation, exhibiting tree or shrub canopy cover below 10%.[27] According to SanGIS, there are 208,641 acres of grassland and meadow vegetation in the San Diego region, and 20,889 acres of field/pasturelands.[28] Rangelands cover nearly 200,000 of these acres, but it is not known how much of this land is actively being grazed currently.[29] Much of this land is highly sloped making it likely infeasible to implement an offset credit project on rangelands in the San Diego region such as adding organic compost to these lands.[30] This compatible land is further reduced once additional criteria of each specific protocol is taken into account, making compatible land for related offset credit projects limited in the San Diego region. Also, no projects using these protocols have been implemented within the San Diego region.

3.1 Methods to Reduce Emissions

Activities to sequester carbon on grasslands that are applicable to the San Diego region include the following:[31]

- Adjusting the number/type of grazing animals;
- Adjusting the frequency and intensity of planned or unplanned fires;
- Introduction of herbaceous grassland species as potential forage for grazing animals;
- Restoration of degraded grassland soils;
- Improving the rotation of grazing animals between grassland areas;
- Limiting the number of grazing animals on degraded grassland;
- Restoring severely degraded grasslands by replanting with grasses;
- Ensuring appropriate management over the long-term into a grassland landscape;
- Adding organic compost to grasslands; and
- Preventing the conversion of grasslands to annual crop production.

3.2 Legislation and Regulation

There are currently no federal, state, or local laws, regulations, or legally binding mandates that require GHG emissions reduction and/or removal activities to occur on grasslands.

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[27] California Air Resources Board, An Inventory of Ecosystem Carbon in California's Natural and Working Lands, 2018, p. 15: https://ww3.arb.ca.gov/cc/inventory/pubs/nwl_inventory.pdf.
[28] SanGIS, SANGIS ECO_VEGETATION_CN Map Layer: https://www.sangis.org/index.html.
[29] Barta Ecological Strategies, Linking Climate-Friendly Farming Practices to San Diego County's Climate Action Plan: An Opportunity Analysis of Carbon Farming in the Unincorporated County, 2018, p. 12: https://static1.squarespace.com/static/5d51ab12fea20500010a114b/t/5e7556479ba3bf5a8db2aff1/1584748117967/Opportunity_of_Carbon_Farming_in_San_Diego_County.pdf.
[30] Id. at 21.
[31] See related protocols in Section 3.3.

While there are no requirements at the local level, there are multiple Climate Action Plan (CAP) measures related to this subcategory that are summarized below. These CAP measures target agricultural lands but can be relevant to the Other Natural Lands (Grasslands) subcategory because grassland could be zoned as agricultural land. Accordingly, there are approximately 84,852 acres of grassland/meadow vegetation and field/pasturelands that are classified as farmland in the San Diego region.[32]

- Oceanside Measure AF3: Agricultural Lands Conservation Program[33] – This CAP measure seeks to assist landowners in preparing agricultural easement grant applications for the Sustainable Agricultural Lands Conservations (SALC) Grant Program. Additionally, this CAP measure hopes to identify internal and external funding sources for minimum and matching funds for up to 250 acres of agricultural preservation easements between 2020 and 2024, along with another round identifying internal and external funding sources for minimum matching funds for up to 250 acres for agricultural preservation easements between 2025 and 2029.
- County of San Diego Measure T-1.2: Acquire Agricultural Easements[34]– This CAP measure seeks to acquire agricultural easements through an expanded Purchase of Agriculture Conservation Easement (PACE) Program. This includes acquiring 443 acres of agricultural easements by 2020 and an additional 4,430 acres between 2021 and 2030. The County of San Diego recently expanded the properties that are eligible to participate in the program for 2021[35] to approximately 628,000 acres in the county.[36]

3.3 Protocols

EPIC identified six active protocols from the three main offset credit programs in the U.S. within the Other Natural Lands (Grasslands) subcategory that are applicable to the San Diego region (Table 6). Note that the protocol listed under California Pollution Control Officers Association (CAPCOA)[37] is the same as the ACR protocol for Compost Additions to Grazed Grasslands. The following provides brief summaries of the protocols and the types of eligible projects.

[32] SanGIS, SANGIS ECO_VEGETATION_CN Map Layer: https://www.sangis.org/index.html; Farmland Mapping and Monitoring Program, 2018: https://www.conservation.ca.gov/dlrp/fmmp.
[33] City of Oceanside, Oceanside Climate Action Plan, 2019, p. 3-39: https://www.ci.oceanside.ca.us/civicax/filebank/blobdload.aspx?BlobID=50404.
[34] County of San Diego, County of San Diego Climate Action Plan, 2018, p. 3-12: https://www.sandiegocounty.gov/content/dam/sdc/pds/advance/cap/publicreviewdocuments/PostBOSDocs/San%20Diego%20County%20Final%20CAP.pdf.
[35] County of San Diego, Purchase of Agricultural Conservation Easement (PACE) Program, last visited March 9, 2021: https://www.sandiegocounty.gov/content/sdc/pds/advance/PACE.html.
[36] Debroah Sullivan Brennan, *County's updated conservation plan aims to save more San Diego farmland*, San Diego Union-Tribune, March 7, 2021: https://www.sandiegouniontribune.com/news/politics/story/2021-03-07/updated-conservation-plan-aims-to-save-more-san-diego-farmland?utm_id=24952&sfmc_id=1451165.
[37] CAPCOA developed a registry called GHG Rx with a range of carbon offset credit protocols. Many of the protocols are the same as those offered by the three main carbon offset credit programs.

- ACR Methodology for the Avoided Conversion of Grasslands and Shrublands to Crop Production, Version 2.0[38] – This protocol seeks to avoid GHG emissions by preventing the conversion of grasslands and shrublands to annual crop production through subjecting all participating fields to a qualified Land Conservation Agreement prohibiting the conversion of the grassland or shrubland for the duration of the minimum project term or longer. This land may remain in use for livestock grazing and/or haying and be subject to prescribed burning or wildfires during the project, so long as the provisions of the relevant qualified Land Conservation Agreement are met.
- ACR Methodology for Compost Additions to Grazed Grasslands, Version 1.0[39] – This protocol seeks to sequester carbon and avoid emissions related to anaerobic decomposition of organic waste material in landfills by adding organic compost to grasslands which in turn increases the sequestration potential of the grasslands. For purposes of this report, only the carbon sequestration portion is relevant.
- CAR Grassland Protocol Version 2.1[40] – This protocol seeks to reduce GHG emissions through avoiding the conversion of grassland to cropland. The project may also employ other activities such as seeding, organic fertilizer application, haying, forage harvesting, livestock grazing, and/or irrigation as part of the project activity, subject to conditions laid out in the protocol.
- VCS VM0026 Methodology for Sustainable Grassland Management, Version 1.0[41] – This protocol seeks to reduce and/or remove GHG emissions through the implementation of Agricultural Land Management activities that introduce sustainable grassland management activities. These practices include, but are not limited to, activities such as improving the rotation of grazing animals between grassland areas, limiting the number of grazing animals on degraded grassland, and restoring severely degraded grasslands by replanting with grasses and ensuring appropriate management over the long-term into a grassland landscape.
- VCS VM0032 Methodology for the Adoption of Sustainable Grasslands through Adjustment of Fire and Grazing, Version 1.0[42] – This protocol seeks to reduce and/or remove GHG emissions through activities that: adjust the number, type and husbandry of grazing animals; adjust the frequency and intensity of planned or unplanned fires; and/or introduce herbaceous grassland species as potential forage for grazing animals or to restore degraded soils.

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[38] American Carbon Registry, Methodology for the Avoided Conversion of Grasslands and Shrublands to Crop Production, Version 2.0, 2019: https://americancarbonregistry.org/carbon-accounting/standards-methodologies/methodology-for-avoided-conversion-of-grasslands-and-shrublands-to-crop-production.

[39] American Carbon Registry, Methodology for Compost Additions to Grazed Grasslands, Version 1.0, 2014: https://americancarbonregistry.org/carbon-accounting/standards-methodologies/methodology-for-greenhouse-gas-emission-reductions-from-compost-additions-to-grazed-grasslands.

[40] Climate Action Reserve, Grassland Protocol, Version 2.1, 2020: https://www.climateactionreserve.org/how/protocols/grassland/.

[41] Verra, Methodology for Sustainable Grassland Management, Approved VCS Methodology VM0026, Version 1.0, 2014: https://verra.org/methodology/vm0026-methodology-for-sustainable-grassland-management-sgm-v1-0/.

[42] Verra, Methodology for the Adoption of Sustainable Grasslands through Adjustment of Fire and Grazing, Approved VCS Methodology VM0032, Version 1.0, 2015: https://verra.org/methodology/vm0032-methodology-for-the-adoption-of-sustainable-grasslands-through-adjustment-of-fire-and-grazing-v1-0/.

ACR Methodology for the Avoided Conversion of Grasslands and Shrublands to Crop Production, Version 2.0 seeks to avoid the conversion of shrublands and implicates the chaparral considerations mentioned previously in Section 2. Given the vast quantity of chaparral vegetation in the San Diego region, there is potential to avoid the conversion of chaparral shrublands; however, no protocols apply to chaparral and, as noted above, no formal method to quantify the carbon sequestration value of chaparral exists.

There are relatively few projects in the U.S. using these protocols. There are a total of 14 projects nationwide and none in California. Nearly all of the projects use the CAR Grassland protocol.

Table 6 Protocols Related to Grasslands

Protocol	US	CA	San Diego Region
CAR Grassland	13	0	0
ACR Avoided Conversion of Grasslands and Shrublands to Crop Production	1	0	0
ACR Compost Additions to Grazed Grasslands	0	0	0
CAPCOA Optional Composting Facility Component-Grazed Grasslands Protocol (ACR-MCP)	0	0	0
VCS VM0026 Methodology for Sustainable Grassland Management (SGM)	0	0	0
VCS VM0032 Methodology for the Adoption of Sustainable Grasslands through Adjustment of Fire and Grazing	0	0	0
Total	**14**	**0**	**0**

3.4 Additionality

This section evaluates whether the protocols listed above or similar activities would lead to GHG reductions that would not have occurred otherwise. A brief discussion of additionality is provided in Section 2.4.

3.4.1 Legal Requirement Test

Projects in the San Diego region seeking to establish and maintain sustainable grasslands to receive offset credits would be considered additional because there are no laws, regulations, or legally binding mandates that require the emission reduction and/or removal activities to occur. There are no nationally regulated grasslands within the region, but the minimal area of grasslands limits the land that could be suitable for projects related to a grassland protocol.

3.4.2 Common Practice Test

The GHG emissions reduction activities within the Other Natural Lands (Grasslands) subcategory may be common practice within the San Diego region. Some of the activities to reduce and/or remove GHG emissions may be common practice in the San Diego region for sustainable ecosystem and rangeland management. For example, activities to manage the number of animals

grazing on a pasture and to rotate these animals to different pastures is being done in the San Diego region.[43] Anecdotally, it also appears that management of other non-federal public lands that allow grazing in the county are working towards more standardized practices such as these.[44] More analysis is needed to determine whether this is common practice in the San Diego region.

3.5 Other Considerations

A project proponent should be aware of the permanence issue, complexity of carbon sequestration estimates, and other project considerations discussed in Section 2.5 when implementing a project in the Other Natural Lands (Grasslands) subcategory.

3.6 Summary of GHG Opportunities

There are opportunities to implement offset credit projects in the Other Natural Lands (Grasslands) subcategory, though no project using protocols in this subcategory have been implemented in the San Diego region. The activities that fall within grassland management, restoration, and avoided conversion activities are currently considered additional or likely additional, though some grazing management practices may be common practice and a project proponent should analyze these to ensure additionality before implementing a related project (Table 7). Although project opportunities exist, they may be limited by the relatively small area of grasslands within the San Diego region. Subsequent analysis would need to be performed on a project-by-project basis to ensure the project is feasible and would pass both additionality tests.

Table 7 Summary of Additionality Determination for Grasslands Protocols

Protocol	Additionality Determination
CAR Grassland	Likely Additional
ACR Avoided Conversion of Grasslands and Shrublands to Crop Production	Additional
ACR Compost Additions to Grazed Grasslands	Additional
CAPCOA Optional Composting Facility Component-Grazed Grasslands Protocol (ACR-MCP)	Additional
VCS VM0026 Methodology for Sustainable Grassland Management (SGM)	Likely Additional
VCS VM0032 Methodology for the Adoption of Sustainable Grasslands through Adjustment of Fire and Grazing	Additional

[43] Debroah Sullivan Brennan, *"Carbon farming" offers new chance for cattle ranch*, San Diego Union-Tribune, May 12, 2017: https://www.sandiegouniontribune.com/communities/north-county/sd-no-carbon-farming-20170512-story.html; Kate Munden-Dixon and Leslie Roche, *Young Cal ranchers find new ways to thrive*, The Escondido Grapevine, February 9, 2020: https://www.escondidograpevine.com/2020/02/09/young-cal-ranchers-find-new-ways-to-thrive/.

[44] Personal Communication with Megan Jennings, San Diego State University, April 8, 2021.

4 URBAN FOREST

The Urban Forest portion of the Natural and Working Lands inventory quantifies the biomass carbon stored in urban trees and their roots. It does not include herbaceous plants like grasses and shrubs, which have a smaller carbon sequestration capacity than woody trees. Similar to the cropland biomass inventory, annual plants are not included because their growing cycle results in a negligible amount of net biomass carbon change on an annual basis.[45]

4.1 Methods to Reduce Emissions

Activities to increase carbon sequestration related to the Urban Forest subcategory include the following:

- Increasing urban forest carbon stocks;
- Conserving urban forest carbon stocks;
- Activities designed to increase removals of CO_2;
- Activities designed to reduce or prevent emissions of CO_2;
- Increasing urban forest productivity by removing diseased and suppressed trees;
- Reducing emissions by avoiding tree removals;
- Planting additional trees on available and appropriate sites;
- Monitoring, protecting, and treating trees to avoid premature mortality from stressors such as drought, pests, storm damage, and abiotic agents; and
- Reducing the vulnerability of trees to impacts of climate change by increasing resilience.

4.2 Legislation and Regulation

EPIC did not identify any relevant federal, state, or local laws, regulations or legally binding mandates that require urban forestry activities to reduce and/or remove GHG emissions to occur. Although there are many CAPs within the region that address urban forestry. Below is a non-exhaustive list of CAP measures that target urban forests. A project proponent that seeks to implement an urban forestry project should perform subsequent analysis of local measures and ordinances to understand how these may impact the additionality determination for the project the proponent seeks to implement.

In the San Diego region, CAP measures addressing urban forestry are common. The following are related CAP measures.

- City of San Diego Strategy 5: Climate Resiliency[46]– CAP measure with a target to achieve 15% urban tree canopy cover within the city by 2020 and 35% urban tree canopy cover by 2035.

[45] California Air Resources Board, An Inventory of Ecosystem Carbon in California's Natural & Working Lands, 2018, p. 15: https://ww3.arb.ca.gov/cc/inventory/pubs/nwl_inventory.pdf.
[46] City of San Diego, City of San Diego Climate Action Plan, 2015, p. 41: https://www.sandiego.gov/sites/default/files/final_july_2016_cap.pdf.

- County of San Diego A-2.1: Increase Residential Tree Planting[47]– CAP measure to increase the net number of trees in the county on private lands outside the publicly maintained rights-of-way by requiring trees be planted for every new residential dwelling unit constructed in the unincorporated county at a rate of 2 trees per new dwelling unit. This measure seeks to plant 35,146 trees through new residential development by 2030, with an additional 28,202 trees planted through new residential development between 2031 and 2050.
- Encinitas Goal 7.1: Increase Urban Tree Cover[48] – CAP measure to increase urban tree cover by, starting in 2018, developing and implementing an Urban Tree Planting Program, including standards to right-size trees and minimize pruning and irrigation needs, to promote increased carbon sequestration by trees within the city. Goals set by this measure include planting 150 net new trees by 2020 and 650 net new trees by 2030 to increase the tree canopy coverage from 22% to 22.16%.
- Imperial Beach S.1: Tree Planting[49] – CAP measure to have a net increase of trees within the city by planting 866 trees by 2030. Included in this number is to plant 300 trees within city rights-of-way by 2030 and change the city code to require tree planting in new and redeveloped residential and commercial developments.
- Oceanside Measure AF1: Urban Forestry Program[50] – CAP measure with a goal to plant 200 trees each year on public rights-of-way and to require development projects to incorporate an annual average of 200 additional trees per year.
- Solana Beach Measure U-1 Carbon Sequestration (Urban Tree Planting)[51] – CAP measure with a goal to cover 2,107 acres of developed areas with urban tree canopy by 2035. Program requires new development to plant trees to achieve an equivalent canopy cover and the city will plant trees at city-owned properties and public areas to achieve the same canopy coverage. Public areas include open space, streets, and parking lots.

[47] County of San Diego, County of San Diego Climate Action Plan, 2018, p. 3-78: https://www.sandiegocounty.gov/content/dam/sdc/pds/advance/cap/publicreviewdocuments/PostBOSDocs/San%20Diego%20County%20Final%20CAP.pdf (Note that this requirement has been adopted by the County of San Diego Board of Supervisors.)

[48] City of Encinitas, City of Encinitas Climate Action Plan, 2018, Interim Revision 2020, p. 3-15: https://encinitasca.gov/Portals/0/City%20Documents/Documents/City%20Manager/Climate%20Action/CAP_2_3_2021_final.pdf?ver=2021-02-03-151752-820.

[49] City of Imperial Beach, City of Imperial Beach Local Coastal Program Resilient Imperial Beach Climate Action Plan, 2019, p. 37: https://www.imperialbeachca.gov/vertical/sites/%7BF99967EB-BF87-4CB2-BCD5-42DA3F739CA1%7D/uploads/Approved_CAP_071719_MF_1234_Climate_Action_Plan_Reso_2019-8054.pdf.

[50] City of Oceanside, Oceanside Climate Action Plan, 2019, p. 3-35: https://www.ci.oceanside.ca.us/civicax/filebank/blobdload.aspx?blobid=48919.

[51] City of Solana Beach, City of Solana Beach Climate Action Plan, 2017, p. 3-15: https://www.ci.solana-beach.ca.us/vertical/sites/%7B840804C2-F869-4904-9AE3-720581350CE7%7D/uploads/City_of_Solana_Beach_Climate_Action_Plan(1)(2).pdf.

This is a subset of CAP measures that contemplate legal requirements.

- El Cajon Support Measure for Strategy 8[52] – Develop a tree preservation or replanting ordinance intended to preserve large canopy shade trees.
- Encinitas 7.1.e[53] – Present to Council for consideration an ordinance to require and/or incentivize additional tree planting on private property throughout the city.
- County of San Diego A-2.1.[54]– Amend Title 8 of the San Diego County Code of Regulatory Ordinances (Water Conservation and Landscaping Ordinance) to increase residential tree planting.
- Imperial Beach S.1.2[55] – Make changes to the City code to require tree planting in new and redeveloped residential and commercial developments.
- Oceanside AF1.2[56] – Adopt a Green Streets Ordinance that requires all new development projects to incorporate shade trees and establish criteria for the number of shade trees. Criteria may reasonably be linked to metrics such as the number of residences, building area, or impervious area.
- Solana Beach Action U-1.1[57] – Implement the Urban Tree Planting Program to achieve the City's goal to cover 2,107 acres of developed areas with urban tree canopy by 2035. The program would require new development to plant trees to achieve an equivalent canopy coverage. Furthermore, the City would plant trees at City-owned properties and public areas to achieve the same canopy coverage. Public areas include open space, streets, and parking lots.

Although there are many CAP measures in the San Diego region related to the Urban Forest subcategory, no analysis was completed to determine which CAP measures have been implemented. A project proponent should perform this analysis before undertaking an urban forestry related offset credit project because a CAP measure may impact the additionality determination, as discussed more below in Section 4.4.

[52] City of El Cajon, City of El Cajon Climate Action Plan, 2019, p. 3-14: https://www.cityofelcajon.us/home/showdocument?id=20009.
[53] City of Encinitas, City of Encinitas Climate Action Plan, 2018, Interim Revision 2020, p. 3-15: https://encinitasca.gov/Portals/0/City%20Documents/Documents/City%20Manager/Climate%20Action/CAP_2_3_2021_final.pdf?ver=2021-02-03-151752-820.
[54] County of San Diego, County of San Diego Climate Action Plan, 2018, p. 3-79: https://www.sandiegocounty.gov/content/dam/sdc/pds/advance/cap/publicreviewdocuments/PostBOSDocs/San%20Diego%20County%20Final%20CAP.pdf (Note that the County of San Diego Board of Supervisors adopted this amendment with an operative date of July 24, 2020.)
[55] City of Imperial Beach, City of Imperial Beach Local Coastal Program Resilient Imperial Beach Climate Action Plan, 2019, p. 37: https://www.imperialbeachca.gov/vertical/sites/%7BF99967EB-BF87-4CB2-BCD5-42DA3F739CA1%7D/uploads/Approved_CAP_071719_MF_1234_Climate_Action_Plan_Reso_2019-8054.pdf.
[56] City of Oceanside, Oceanside Climate Action Plan, 2019, p. 3-35: https://www.ci.oceanside.ca.us/civicax/filebank/blobdload.aspx?blobid=48919.
[57] City of Solana Beach, City of Solana Beach Climate Action Plan, 2017, p. 3-15: https://www.ci.solana-beach.ca.us/vertical/sites/%7B840804C2-F869-4904-9AE3-720581350CE7%7D/uploads/City_of_Solana_Beach_Climate_Action_Plan(1)(2).pdf.

4.3 Protocols

EPIC identified five active protocols from the three main offset credit programs in the U.S. related to the Urban Forest subcategory that are applicable to the San Diego region (Table 8). The CARB protocols from ACR, CAR, and VCS are all the same, while the remaining two CAR protocols below are separate protocols. No urban forestry projects have been implemented in the U.S. This could imply that Urban Forest projects are not feasible at this time.

- CAR Urban Forest Management Protocol, Version 1.1[58] – This protocol seeks to reduce GHG emissions through activities that sequester carbon in woody biomass within an urban environment.
- CAR Urban Tree Planting Protocol, Version 2.0[59] – This protocol seeks to sequester carbon in woody biomass in the urban environment through a planned set of activities designed to increase removals of CO_2 from the atmosphere or reduce or prevent emissions of CO_2 through increasing and/or conserving urban forest carbon stocks.
- CARB Urban Forest Projects Compliance Offset Protocol[60] – This protocol seeks to permanently increase carbon storage in urban trees through a planned set of tree planting and maintenance activities.

Table 8 Protocols Related to Urban Forest

Protocol	US	CA	San Diego Region
ACR Urban Forest Projects Compliance Offset Protocol (CARB)	0	0	0
CAR Urban Forest Management	0	0	0
CAR Urban Forest Projects Compliance Offset Protocol (CARB)	0	0	0
CAR Urban Tree Planting	0	0	0
VCS Urban Forest Projects Compliance Offset Protocol (CARB)	0	0	0

4.4 Additionality

This section evaluates whether the protocols listed above would lead to GHG reductions that would not have occurred otherwise. A brief discussion of additionality is provided in Section 2.4.

4.4.1 Legal Requirement Test

There are no federal or state laws, regulations or legally binding mandates that require urban forestry activities to occur, though there are many CAP measures within the region related to the Urban Forest subcategory that could impact the additionality determination. If a CAP measure

[58] Climate Action Reserve, Urban Forest Management Protocol, Version 1.1, 2019: https://www.climateactionreserve.org/how/protocols/urban-forest/.
[59] Climate Action Reserve, Urban Tree Planting, Version 2.0, 2014: https://www.climateactionreserve.org/how/protocols/urban-forest/.
[60] California Air Resource Board, Compliance Offset Protocol Urban Forest Projects, 2011: https://ww3.arb.ca.gov/regact/2010/capandtrade10/copurbanforestfin.pdf.

seeks to increase urban forest canopy cover, the activity may be seen as required and offset credits would be considered not additional. Even if a CAP includes a requirement to plant trees (e.g., ordinance), it likely would be considered additional if trees are planted beyond what the ordinance or requirement calls for. In this case, it would be necessary to track the number of trees planted and separate the GHG impacts of CAP measures from those of offset credit projects to ensure additionality. The Compliance Offsets Protocol Task Force convened by CARB similarly found that urban forest management projects "must achieve GHG reductions or removals above and beyond compliance with any federal, state, or local law, statute, rule, regulation, or ordinance, as well as any court order or other legally binding mandates."[61]

4.4.2 Common Practice Test

Project activities in the Urban Forest subcategory can have a high cost to implement and there is a generally declining trend in urban forest canopy cover nationwide.[62] In the absence of regulation, urban forestry project activities could be considered additional and beyond common practice, particularly if the offset credit project maintains carbon stocks above the baseline.[63] A specific analysis would be needed to determine whether the project would go beyond the expected level of activity under common practice, including levels of tree planting included in CAP measures.

4.5 Other Considerations

A project proponent should be aware of the permanence issue, complexity of carbon sequestration estimates, and other project considerations discussed in Section 2.5 when implementing a project in the Urban Forest subcategory.

4.6 Summary of GHG Reduction Opportunities

There are opportunities in the region to implement offset credit projects through urban forestry protocols. There are no federal or state laws, regulations, or legally binding mandates requiring urban forestry activities (Table 9). However, as discussed above, there may be additionality, double-counting, and credit tracking issues due to the many CAPs in the region that seek to maintain or increase the current carbon stocks of urban forests in the region. Nonetheless additional opportunities could exist as long as a project proponent can demonstrate that the trees planted are above what is required or would otherwise happen due to other City programs or projects. A project proponent would need to perform subsequent analysis to ensure that the GHG emission reduction activity is additional under the Legal Requirement Test and the Common Practice Test, and that no double-counting or credit tracking issues may arise due to the many CAPs in the region that have measures related to the Urban Forest subcategory.

[61] California Air Resources Board, Compliance Offsets Protocol Task Force Final Recommendations, 2021, p. 184: https://ww2.arb.ca.gov/sites/default/files/2021-03/offsets_task_force_final_report_030221.pdf.
[62] Ibid.
[63] Ibid.

Table 9 Additionality Determination for Urban Forest Protocols

Protocol	Additionality Determination
ACR Urban Forest Projects Compliance Offset Protocol (CARB)	Additional
CAR Urban Forest Management	Additional
CAR Urban Forest Projects Compliance Offset Protocol (CARB)	Additional
CAR Urban Tree Planting	Additional
VCS Urban Forest Projects Compliance Offset Protocol (CARB)	Additional

There are currently three discrete urban forestry protocols, but no related projects have been implemented in the U.S. or the San Diego region. The Compliance Offsets Protocol Task Force convened by CARB has recognized that there may be multiple "barriers to broader participation in urban forest carbon projects include[ing] cost, scale, timing of revenues from carbon credits, and issues of ownership and liability."[64] These considerations will be important for a project proponent to keep in mind when instituting an Urban Forest offset credit project.

[64] Id. at 182.

5 WETLANDS

The Wetlands portion of the Natural and Working Lands inventory includes three categories identified in the IPCC inventory guidelines: rewetted organic soils, coastal wetlands, and inland wetland mineral soils. CARB generated the wetland inventory for 2016 using a combination of IPCC default emission factors and wetland mapping data from the San Francisco Estuary Institute. Wetlands have the potential to remove and sequester carbon from the atmosphere, and freshwater mineral soil wetlands and tidal wetlands are net carbon sinks.[65] However, wetlands also emit small amounts of GHGs. CARB estimates that California's wetlands released less than an estimated one million MMT CO_2e in CO_2 and methane (CH_4) statewide in 2016.[66]

Wetlands may provide opportunities for GHG emissions reduction opportunities because of the many different applications of wetlands projects, including on coastal or agricultural lands.[67] But, according to one study there are only 786 acres of land near wetlands in the San Diego region that have been zoned to qualify for restoration, that are eligible for restoration, and that will not be impacted by rising sea levels.[68] This figure does not include wetland areas that are zoned as "Open Space" and could possibly be eligible for a restoration project.[69] This is a relatively limited amount of land to locate and implement offset credit projects.

5.1 Methods to Reduce Emissions

Projects applicable in the San Diego region under wetlands protocols are:

- Converting land to wetlands;
- Restoration of wetlands;
- Stopping or greatly reducing soil organic carbon oxidation on subsided and/or drained agricultural lands;
- Creation of tidal or estuarine wetlands through substrate establishment and/or vegetation establishment;
- Creating, restoring, and/or managing hydrological conditions;
- Altering sediment supply;
- Changing salinity characteristics;
- Improving water quality;
- (Re-)introducing native plant communities; and
- Improving management practices.

[65] Scot D. Bridgham, et al., *The Carbon Balance of North American Wetlands*, 26 *WETLANDS* 4, 2006, p. 894: https://link.springer.com/content/pdf/10.1672/0277-5212(2006)26%5b889:TCBONA%5d2.0.CO;2.pdf.
[66] California Air Resources Board, An Inventory of Ecosystem Carbon in California's Natural & Working Lands, 2018, p. 16: https://ww3.arb.ca.gov/cc/inventory/pubs/nwl_inventory.pdf.
[67] Sara Wanous, *Carbon Offsets in San Diego County An Analysis of Carbon Offset Policy Effectiveness, Best Practices, and Local Viability in the San Diego County Region*, University of California San Diego Scripps Institution of Oceanography, 2019, p. 16: https://escholarship.org/uc/item/2t48k6m7#main.
[68] Ibid.
[69] Ibid.

5.2 Legislation and Regulation

There are currently no federal, state, or local laws, regulations, or legally binding mandates that require wetland creation, restoration, or improved management to occur. However, there are federal and state mitigation requirements for the loss of wetlands that may require one or more of these methods to be implemented to compensate for the lost wetlands when some form of development occurs.[70] For example, there are mitigation requirements under CEQA for the loss of wetlands that may require one or more of these methods to be implemented to compensate for the lost wetlands when some form of development occurs that creates some form of environmental harm.

5.3 Protocols

EPIC identified five active protocols from the three main offset credit programs in the U.S. within the Wetlands subcategory that are applicable to the San Diego region (Table 10). Note that the protocols listed under CAPCOA[71] are the same as the ACR and VCS protocols. The following provides brief summaries of the protocols and the types of eligible projects.

- ACR Restoration of California Deltaic and Coastal Wetlands, Version 1.1[72] – This protocol seeks to reduce and/or remove GHG emissions through conversion of land to wetlands in the coastal areas of California. The methodology allows for GHG sink enhancements and GHG reductions by: (1) stopping or greatly reducing soil organic carbon oxidation on subsided and/or drained agricultural lands; and (2) increasing soil organic carbon storage by restoring tidal and non-tidal wetlands.
- VCS VM0024 Methodology for Coastal Wetland Creation, Version 1.0[73] – This protocol seeks to reduce and/or remove GHG emissions through the creation of tidal or estuarine wetlands through substrate establishment and/or vegetation establishment. Substrate establishment consists of adding sediment to an area devoid of sediment, or to add sediment in an open water system to raise the land elevation such that emergent plants can colonize. Vegetation establishment encompasses the process of seeding or transplanting vegetation to the soil or providing adequate conditions for natural plant colonization.
- VCS VM0033 Methodology for Tidal Wetland and Seagrass Restoration, Version 1.0[74] – This protocol seeks to reduce and/or remove GHG emissions through the restoration of tidal wetlands. The project activities are expected to generate GHG reductions and/or removals

[70] See Clean Water Act, 23 United States Code (U.S.C.) §§ 1251 et seq.; Endangered Species Act, 16 U.S.C. §§ 1531 et seq.; California Environmental Quality Act, California PRC §§ 21000 et seq.; California Endangered Species Act, California Fish & Game Code §§ 2050 et seq. among others.
[71] CAPCOA developed a registry called GHG Rx with a range of carbon offset credit protocols. Many of the protocols are the same as those offered by the three main carbon offset credit programs.
[72] American Carbon Registry, Restoration of California Deltaic and Coastal Wetlands, Version 1.1, 2017: https://americancarbonregistry.org/carbon-accounting/standards-methodologies/restoration-of-california-deltaic-and-coastal-wetlands.
[73] Verra, Methodology for Coastal Wetland Creation, Approved VCS Methodology VM0024, Version 1.0, 2014: https://verra.org/methodology/vm0024-methodology-for-coastal-wetland-creation-v1-0/.
[74] Verra, Methodology for Tidal Wetland and Seagrass Restoration, Approved VCS Methodology VM0033, Version 1.0, 2015: https://verra.org/methodology/vm0033-methodology-for-tidal-wetland-and-seagrass-restoration-v1-0/.

through: (1) increased biomass; (2) increased autochthonous soil organic carbon; (3) reduced CH_4 and/or N_2O emissions due to increased salinity or changing land use; and (4) reduced CO_2 emissions due to avoided soil carbon loss. Eligible activities will restore tidal wetlands by: (1) creating, restoring, and/or managing hydrological conditions; (2) altering sediment supply; (3) changing salinity characteristics; (4) improving water quality; (5) (re-)introducing native plant communities; and (6) improving management practice(s).

There is only one project using a Wetlands protocol located in California and none in the San Diego region.

Table 10 Projects Related to Wetland Protocols

Protocol	US	CA	San Diego Region
ACR Restoration of California Deltaic and Coastal Wetlands	1	1	0
CAPCOA Restoration of California Deltaic and Coastal Wetlands (ACR)	0	0	0
CAPCOA VM0024 Methodology for Coastal Wetland Creation, v1.0 (Verra)	0	0	0
VCS VM0024 Methodology for Coastal Wetland Creation, v1.0	0	0	0
VCS VM0033 Methodology for Tidal Wetland and Seagrass Restoration, v1.0	0	0	0
Total	**1**	**1**	**0**

5.4 Additionality

This section evaluates whether the protocols listed above or similar activities would lead to GHG reductions that would not have occurred otherwise. A brief discussion of additionality is provided in Section 2.4.

5.4.1 Legal Requirement Test

Overall, the general activities of creating, restoring, or managing wetlands is not required by law or regulation, thus these project activities can be considered additional under the Legal Requirement Test and eligible to receive offset credits. However, some projects may trigger mitigation requirements or some form of management at either the federal or state level,[75] at which time the same activities would no longer be considered additional because the activity would then be required by a legally binding mandate, as discussed above in Section 5.2.

[75] See Clean Water Act, 23 United States Code (U.S.C.) §§ 1251 et seq.; Endangered Species Act, 16 U.S.C. §§ 1531 et seq.; California Environmental Quality Act, California Public Resources Code §§ 21000 et seq.; California Endangered Species Act, California Fish & Game Code §§ 2050 et seq., among others.

5.4.2 Common Practice Test

The general activities of creating, restoring, or managing wetlands are not common practice, and it has been estimated that these activities occur less than 5% of the time.[76] Therefore, these GHG emissions reduction activities would pass the Common Practice Test and be considered additional.

It has also been noted that "[w]ithout revenue from the sale of offset credits, proponents indicate that the goal of voluntary land conversions to achieve GHG emissions, crop conversion and levee protection goals cannot be attained," [77] contributing to the conclusion that these emission reduction and removal activities would pass the Common Practice Test.

5.5 Other Considerations

A project proponent should be aware of the permanence issue, complexity of carbon sequestration estimates, and other project considerations discussed in Section 2.5 when implementing a project in the Wetlands subcategory.

Additionally, specifically to the San Diego region, wetland offset credit projects may be limited because the wetland areas in the region tend to be smaller in size and circumscribed by urban development. This creates a higher barrier of entry to establishing offset credit projects and may be the reasons why there are no wetlands offset projects in the San Diego region.

5.6 Summary of GHG Reduction Opportunities

There are opportunities to receive offset credits in the Wetlands subcategory in the San Diego region. There are wetland areas within the region with the potential to create, restore, and/or manage these wetlands, though these opportunities may be limited due to the minimal amount of wetlands in the region. These general activities are not required by law or regulation and do not appear to be common practice, so these activities can be considered additional under both the Legal Requirement Test and the Common Practice Test (Table 11). However, if the GHG emissions reduction activity is required as a form of mitigation at either the federal or state level, then the activity would not be considered additional because it would be required by law. A project proponent must be aware that mitigation requirements may change the additionality determination of a given GHG emissions reduction activity.

[76] California Air Resources Board, Compliance Offsets Protocol Task Force Final Recommendations, 2021, p. 42: https://ww2.arb.ca.gov/sites/default/files/2021-03/offsets_task_force_final_report_030221.pdf.
[77] Id. at 45.

Table 11 Additionality Determination for Wetlands Protocols

Protocol	Additionality Determination
ACR Restoration of California Deltaic and Coastal Wetlands	Additional
CAPCOA Restoration of California Deltaic and Coastal Wetlands (ACR)	Additional
CAPCOA VM0024 Methodology for Coastal Wetland Creation, v1.0 (Verra)	Additional
VCS VM0024 Methodology for Coastal Wetland Creation, v1.0	Additional
VCS VM0033 Methodology for Tidal Wetland and Seagrass Restoration, v1.0	Additional

6 SOIL CARBON

The Soil Carbon part of the Natural and Working Lands inventory quantifies the amount of soil organic carbon (includes fresh and decomposed remains of plants and animals; excludes mineral carbon in soils) on all land types: forest/shrublands, grasslands, other natural lands (e.g., desert), croplands, and urban lands. It does not include inorganic mineral carbon from weathering of rocks or soil minerals formed by reaction with atmospheric CO_2. The inventory estimates soil organic carbon stock change resulting from disturbance, land conversion, land degradation, and soil management activities.[78]

Soil carbon practices can be implemented in the San Diego region with opportunities to reduce GHG emissions through multiple practices that are applicable to the region. Collectively, many of these practices, also sometimes referred to as "carbon farming," provide multiple benefits including reducing GHGs, building soil health, and strengthening climate resilience.[79] These practices can result in avoided emissions, carbon sequestration in plants, and long-term storage of soil and plant-based carbon,[80] though this subcategory focuses on the carbon stored in soil.

6.1 Methods to Reduce Emissions

Activities to enhance carbon sequestration of soils include the following. There is some overlap in these methods with the Other Natural Lands (Grasslands) subcategory.

- Changes to agricultural practices;
- Grasslands and rangelands restorations;
- Activities that reduce erosion;
- Grassland protection projects; and
- Treatments designed to improve diversity and productivity of grassland and savanna plant communities.

6.2 Legislation and Regulation

EPIC did not identify any federal, state, or local laws, regulations, or legally binding mandates that require soil carbon activities to occur, but there is one CAP measure within the region related to the Soil Carbon subcategory.

- Oceanside Measure AF4: Carbon Farming Program[81] – CAP measure with a goal to establish up to 50 acres of demonstration carbon farms by 2025 utilizing alternative

[78] California Air Resources Board, An Inventory of Ecosystem Carbon in California's Natural & Working Lands, 2018, p. 15: https://ww3.arb.ca.gov/cc/inventory/pubs/nwl_inventory.pdf.
[79] Barta Ecological Strategies, Linking Climate-Friendly Farming Practices to San Diego County's Climate Action Plan: An Opportunity Analysis of Carbon Farming in the Unincorporated County, 2018, p. 8: https://static1.squarespace.com/static/5d51ab12fea20500010a114b/t/5e7556479ba3bf5a8db2aff1/1584748117967/Opportunity_of_Carbon_Farming_in_San_Diego_County.pdf.
[80] Id. at 14–15.
[81] City of Oceanside, Oceanside Climate Action Plan, 2019, p. 3-41: https://www.ci.oceanside.ca.us/civicax/filebank/blobdload.aspx?BlobID=50404.

management practices that result in increased carbon sequestration. Such practices include, but are not limited to, synthetic nitrogen fertilization reductions, compost application, anaerobic digestion of waste, silvopasture, reduced tillage, cover cropping, conservation crop rotation, range planting, and improved nutrient management.

6.3 Protocols

EPIC identified four protocols from the three main offset credit programs in the U.S. within the Soil Carbon subcategory that are applicable to the San Diego region (Table 12). The following provides brief summaries of the protocols and the types of eligible projects.

- CAR Soil Enrichment Protocol, Version 1.0[82] – This protocol seeks to reduce GHG emissions on cropland or grassland through projects that reduce emissions and enhance soil carbon sequestration on agricultural lands through adoption of sustainable agricultural land management activities. The project must adopt agricultural management practices that are intended to increase soil organic carbon storage and/or decreased net emissions of CO_2, CH_4, and N_2O from agricultural operations. Land management practices considered for soil enrichment projects include those which result in one or more changes to: (1) fertilizer (organic or inorganic) application; (2) the application of soil amendments (organic or inorganic); (3) water management/irrigation; (4) tillage and/or residue management; (5) crop planting and harvesting (e.g., crop rotations, cover crops); (6) fossil fuel usage; and (7) grazing practices and emissions.
- VCS VM0017 Adoption of Sustainable Agricultural Land Management, Version 1.0[83] – This protocol seeks to reduce GHG emissions in agriculture through adoption of sustainable land management practices in the agricultural landscape (i.e., cropland or grassland). Sustainable land management is any practice that increases the carbon stocks of the land.
- VCS VM0021 Soil Carbon Quantification Methodology, Version 1.0[84] – This protocol seeks to reduce GHG emissions through a range of project activities that improve soils. This includes: (1) changes to agricultural practices; (2) grassland and rangeland restorations; (3) soil carbon protection and accrual benefits from reductions in erosion; (4) grassland protection projects; and (5) treatments designed to improve diversity and productivity of grassland and savanna plant communities.
- CAPCOA Biochar Production Project Reporting and Addendum, Version 3.0[85] – This protocol seeks to reduce GHG emissions through the creation of Biochar where, under business-as-usual conditions, the eligible feedstock would be left to decay, be combusted

[82] Climate Action Reserve, Soil Enrichment Protocol, Version 1.0, 2020: https://www.climateactionreserve.org/how/protocols/soil-enrichment/.
[83] Verra, Adoption of Sustainable Agricultural Land Management, Approved VCS Methodology VM0017, Version 1.0, 2011: https://verra.org/methodology/vm0017-adoption-of-sustainable-agricultural-land-management-v1-0/.
[84] Verra, Soil Carbon Quantification Methodology, Approved VCS Methodology VM0021, Version 1.0, 2012: https://verra.org/methodology/vm0021-soil-carbon-quantification-methodology-v1-0/.
[85] California Pollution Control Officers Association, Biochar Production for Project Reporting Protocol, Version 3.0, 2014: https://www.placer.ca.gov/DocumentCenter/View/2085/Biochar-Production-for-Project-Reporting-Protocol-PDF.

via open pile burning, transported to a local landfill for aerobic decay, or used for bioenergy production which would lead to increased GHG emissions.

There is one project in the U.S. using a Soil Carbon protocol, but none in California.

Table 12 Projects Related to Soil Carbon Protocols

Protocol	US	CA	San Diego Region
VCS VM0021 Soil Carbon Quantification Methodology, v1.0	1	0	0
CAPCOA Biochar Production Project Reporting & Addendum (Placer County APCD)	0	0	0
CAR Soil Enrichment	0	0	0
VCS VM0017 Adoption of Sustainable Agricultural Land Management, v1.0	0	0	0
Total	**1**	**0**	**0**

6.4 Additionality

This section evaluates whether the protocols listed above or similar activities would lead to GHG reductions that would not have occurred otherwise. A brief discussion of additionality is provided in Section 2.4.

6.4.1 Legal Requirement Test

Determining whether soil carbon GHG emission reduction and/or removal activities would pass the Legal Requirement Test is very project dependent because there are multiple activities that can be implemented and qualify under relevant protocols. In general, these GHG emissions reduction and removal activities currently would be considered additional and are not required by any relevant laws, regulations, or legally binding mandates. Therefore, these activities likely would pass the Legal Requirement Test and be considered additional.

6.4.2 Common Practice Test

Soil carbon GHG emissions reduction and/or removal activities do not appear to be common practice in the San Diego region. However, some eligible grazing practices may be common practice in the San Diego region, which could alter the additionality determination. A project proponent would need to resolve this issue before initiating an offset credit project in the Soil Carbon subcategory in the San Diego region. Evaluation on a project basis would be necessary to determine whether a specific project would be considered common practice.

6.5 Other Considerations

A project proponent should be aware of the permanence and lack of offset credit project considerations discussed in Section 2.5 when implementing a project in the Soil Carbon subcategory.

Additionally, the Oceanside Carbon Farming Program CAP measure may impact the additionality determinations made here for soil offset credit projects in Oceanside's jurisdiction. This CAP measure is a program and not a requirement, so a project will pass the Legal Requirement Test. But it may make it more difficult for a project to pass the Common Practice Test and be considered additional. This is because Oceanside may already be accounting for these GHG emissions reductions in their CAP inventory. Therefore, a soil offset credit project may not be reducing GHG emissions beyond what Oceanside is already accounting for, which is required to be considered additional. A project proponent seeking to implement a soil carbon offset project in Oceanside would need to resolve this issue before being eligible to receive offset credits.

6.6 Summary of GHG Reduction Opportunities

There are opportunities to implement GHG emissions reduction and removal activities in the Soil Carbon subcategory. There is some overlap in the methods to reduce and/or remove GHG emissions in the Soil Carbon and Other Natural Lands (Grasslands) subcategories, though this does not alter the additionality determination. These GHG emissions reduction and/or removal activities are not required by law or regulation and do not appear to be activities that would occur as common practices. However, some grazing practices that are eligible may be common practice, as discussed above in the Other Natural Lands (Grasslands) section, of which a project proponent would need to resolve before implementing one of those practices. Overall, GHG emissions reduction activities relevant to the Soil Carbon subcategory would be considered additional or likely additional and eligible to receive offset credits at the moment (Table 13).

Table 13 Summary of Additionality Determination for the Soil Carbon Category

Protocol	Additionality Determination
VCS VM0021 Soil Carbon Quantification Methodology, v1.0	Additional
CAPCOA Biochar Production Project Reporting & Addendum (Placer County APCD)	Additional
CAR Soil Enrichment	Additional
VCS VM0017 Adoption of Sustainable Agricultural Land Management, v1.0	Likely Additional

7 CROPLAND BIOMASS

The Cropland Biomass part of the Natural and Working Lands inventory quantifies the biomass carbon stored in woody crops in orchards and vineyards, such as almonds, walnuts, pistachios, grapes, and oranges. Most of this carbon pool is found in trunks and branches of these trees.[86] Annual herbaceous crops are not included because they are planted and harvested within the same year; therefore, their crop growing cycle results in a negligible amount of net biomass carbon change on an annual basis.[87] GHG emissions associated with direct human activities on cropland, such as fertilizer use, liming, rice cultivation, and fuel combustion in agriculture equipment are quantified in the annual statewide GHG inventory[88] and not in the Natural and Working Lands Inventory.[89] EPIC did not identify any active protocols within the Cropland Biomass subcategory. Therefore, this subcategory is not addressed in this report.

[86] California Air Resources Board, An Inventory of Ecosystem Carbon in California's Natural & Working Lands, 2018, p. 15: https://ww3.arb.ca.gov/cc/inventory/pubs/nwl_inventory.pdf.
[87] Ibid.
[88] See California Air Resources Board, California Greenhouse Gas Emissions for 2000 to 2018: Trends of Emissions and Other Indicators, 2018: https://ww3.arb.ca.gov/cc/inventory/pubs/reports/2000_2018/ghg_inventory_trends_00-18.pdf.
[89] California Air Resources Board, An Inventory of Ecosystem Carbon in California's Natural & Working Lands, 2018, p. 15: https://ww3.arb.ca.gov/cc/inventory/pubs/nwl_inventory.pdf.

8 CONCLUSION

All eligible offset credit activities for the Natural and Working Lands category in the San Diego region can be considered additional or likely additional unless otherwise required for mitigation purposes or if the offset credit project violates applicable land use restrictions. There are no local, state, or federal laws or regulations that mandate or require the GHG emission reduction and/or removal activities listed in the Forest, Other Natural Lands (Grasslands), Urban Forest, Wetlands, and Soil Carbon protocols, nor do these activities appear to be common practice in the San Diego region, except some grazing practices. Nonetheless, CAP measures and related actions (e.g., ordinances) may impact the additionality determination. Additionally, the lack of projects in the San Diego region could imply that related projects are not feasible or valuable at this time due to how dynamic the carbon sequestration process is and the lack of a formal quantification methodology for carbon sequestration value of the major ecosystem in the region, chaparral shrubland, the lack of suitable land types, implementation costs, and/or other considerations such as permanence.