SOAR BAKERSFIELD | Sustainable Opportunities Advancing Resilience

APPENDIX D

Kern County Carbon Stocks Analysis

SOAR Bakersfield Existing Carbon Stock Inventory Technical Report for the City of Bakersfield

Prepared for:

US EPA Region 9
75 Hawthorne Street
San Francisco, CA 94105

August 2025

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TABLE OF CONTENTS

Appendices

Figures

Tables

LIST OF ABBREVIATIONS

CAL FIRE	California Department of Forestry and Fire Protection
county	Kern County
DWR	California Department of Water Resources
FRAP	Fire and Resource Assessment Program
gSSURGO	Gridded Soil Survey Geographic
NRCS	USDA Natural Resources Conservation Service
NWI	National Wetlands Inventory
project	SOAR Bakersfield Project
USDA	US Department of Agriculture
USFWS	US Fish and Wildlife Service

1 SUMMARY

This technical report presents an estimate of the existing carbon stock in Kern County (county) to support the development of the Sustainable Opportunities Advancing Resilience (SOAR) Bakersfield Project (hereafter referred to as "the project"), along with the methodology used to conduct the analysis. The carbon stock analysis provides an inventory of carbon currently stored in vegetation and soils across natural (e.g., grasslands, forests) and working (i.e., agricultural) lands within the county. It includes a countywide summary of carbon stock values, as well as a breakdown by each incorporated city and the unincorporated county jurisdictional boundaries. Throughout this report, the inventory is referred to as a "baseline"; it is a snapshot of the existing carbon stock for the most recent available data that can be used to measure changes in carbon stock over time. Carbon stock values are presented in terms of metric tons of carbon (MT C).

This report includes the following sections:

- **Section 2: Overview of Carbon Stock** provides an overview of the term carbon stock and other concepts referenced in this report.
- **Section 3: Methods to Estimate Baseline Carbon Stock in the County** describes the data, sources, and methodology used to estimate existing carbon stock in the county.
- **Section 4: Summary of Estimated Baseline Carbon Stock in the County** presents the estimated carbon stock values in the county.
- **Section 5: Comparison to Other Studies** describes the results of this analysis in comparison to similar efforts conducted in other regions of California.

2 OVERVIEW OF CARBON STOCK

Natural and working lands hold a prominent place in California's path toward carbon neutrality. While quantification of carbon stock values is an evolving area, understanding the magnitude and nature of existing carbon stock and potential future sequestration opportunities from natural and working lands will be an important advancement in climate mitigation and resilience planning in the county.

Land use changes and management practices have direct impacts on the amount of carbon that is stored and sequestered within vegetation and soils in the county. New development that converts grasslands, forests, shrublands, or other natural land covers to urban land uses reduces the carbon sequestration potential of such lands. Reforesting or afforesting barren, unproductive lands to preserve them from development and enhance their quality will have the opposite effect, increasing the lands' carbon sequestration potential. This inextricable link between land use and carbon stock highlights the need for thoughtful land use planning that minimizes losses to current carbon stock and maximizes preservation/enhancements.

Natural and working lands in the county provide benefits to the region through arable lands that produce food, recreational amenities, tourism, and provide wildlife habitat. Historically, land has been converted from natural and working lands into developed land uses within the county. This report provides a baseline estimate for the carbon that is stored in the county's vast natural and working lands This baseline can be used to evaluate future changes in carbon stock and the carbon sequestration potential associated with land management practices that enhance soil and vegetative carbon uptake.

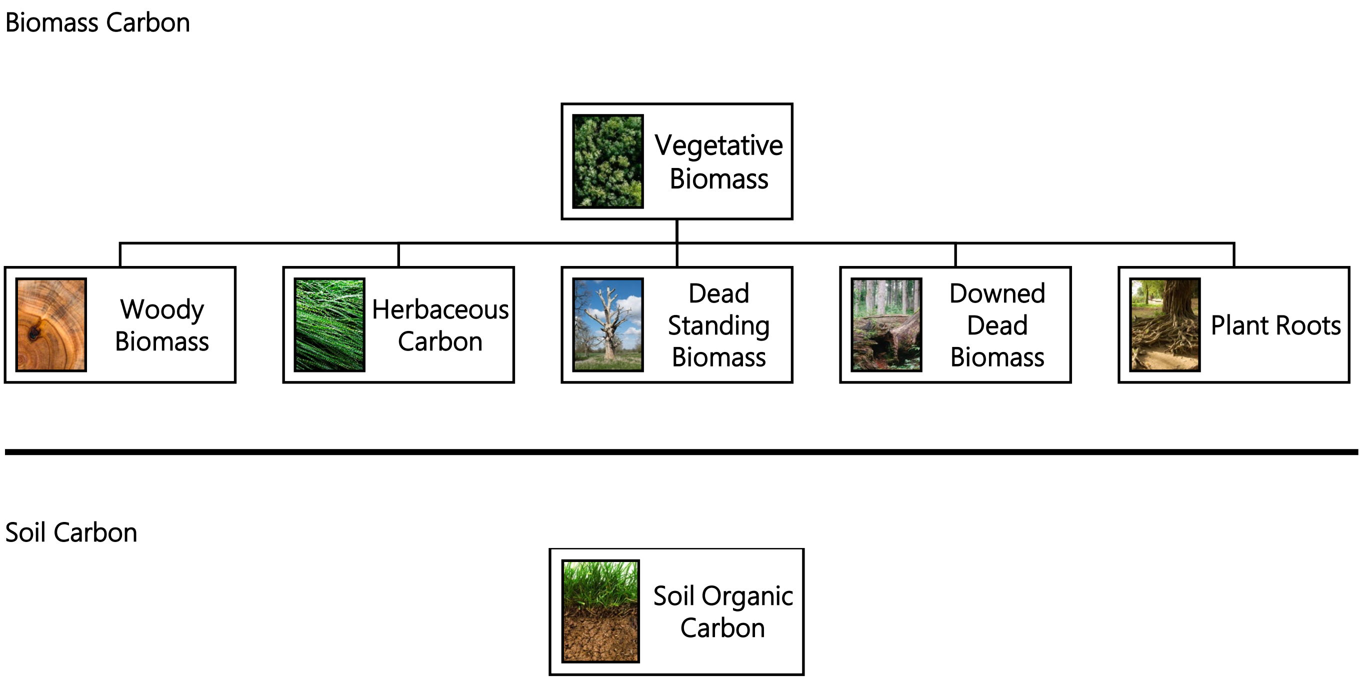
2.1 KEY TERMS

The following key terms are used throughout this report and are defined as such:

- **Carbon Pool:** A system that has the capacity to accumulate or release carbon, considered to be a reservoir. Examples include forest biomass, wood products, soils, and the atmosphere (IPCC 2006).
- **Carbon Sequestration:** The process of increasing the carbon content of a carbon pool other than the atmosphere (IPCC 2006).
- **Carbon Stock:** The absolute quantity of carbon held within a pool at a specified time (IPCC 2006).
- **Biomass Carbon:** The amount of carbon stored in all living plant tissues, both above and below ground, including trunks, stems, branches, foliage, and roots.
- **Soil Carbon:** The amount of inorganic and organic carbon in soils, which combined represent the largest global terrestrial carbon stock (Sharififar et al. 2023).
- **Soil Organic Carbon:** The amount of carbon within the decomposed organic matter of soil, which is the organic component of carbon in soils. Soil organic carbon accounts for approximately 58 percent of the total decomposed organic matter in soils (Lal 2004).
- **Natural Lands:** Lands consisting of forests, grasslands, deserts, freshwater and riparian systems, wetlands, coastal and estuarine areas, watersheds, wildlands, or wildlife habitats, or lands used for recreational purposes such as parks, urban and community forests, greenbelts, trails, and other similar open-space lands. For purposes of this paragraph, "parks" includes, but is not limited to, areas that provide public green spaces (California Public Resources Code 9001.5).
- **Working Lands:** Lands used for farming, grazing, or the production of forest products (California Public Resources Code 9001.5).

2.2 ANATOMY OF A CARBON STOCK INVENTORY

A carbon stock inventory represents the amount of carbon stored in natural lands (e.g., forests, wetlands, grasslands) and working lands (e.g., cropland) at a specified time. This analysis provides a baseline inventory of carbon stock in Kern county. To quantify the total carbon stock of an area, both biomass and soil carbon pools must be assessed. While inorganic carbon is an important component of soil carbon, this analysis focuses on soil organic carbon due to its strong link to biological processes and land management. The types and sources of carbon that were evaluated in the county are described below and depicted in Figure 1.



Source: Prepared by Ascent in 2025.

Figure 1 Types and Sources of Carbon included in a Carbon Stock Inventory

2.2.1 Biomass Carbon

Biomass carbon refers to the amount of carbon stored in all living plant tissues, both above and below ground. This includes trunks, stems, branches, foliage, and roots. Vegetation utilizes photosynthesis to take carbon dioxide out of the atmosphere and incorporate the carbon into biomass. Biomass carbon includes woody biomass in trunks, branches, and shoots as well as herbaceous carbon in leaves, flowers, fruiting bodies, and grasses. Additionally, biomass carbon includes the carbon in leaf litter, dead standing biomass, downed dead biomass, and roots. Approximately 45-50 percent of the dry biomass weight of the vegetation is equivalent to its carbon stock (McGroddy et al. 2004; Schlesinger 1991).

Carbon is stored in vegetative biomass for as long as the plant material remains intact, with woody tissues acting as longer-term carbon reservoirs due to their slower decomposition rates. However, biomass carbon is not permanently sequestered. It can be released back into the atmosphere through natural processes such as plant respiration, deterioration, and decomposition, or through disturbance events like wildfire, pest outbreaks, or land clearing. In managed landscapes, carbon loss can also occur through harvesting or the removal of vegetation.

An example of estimating carbon stock in forests is described in the California Forest and Rangeland Greenhouse Gas Inventory Development Final Report (hereafter referred to as the Forest and Rangeland Report) (Battles et al. 2013).

As discussed in the Forest and Rangeland Report, the U.S. Forest Service Forest Inventory and Analysis Program (FIA) calculated forest biomass using decadal data on tree height and diameter sampled by FIA. Forest biomass was estimated using volume-to-biomass models for individual tree species and was then converted to carbon stock using a 47 percent conversion rate (a median factor of the 45-50 percent range presented above). For other vegetation types included in a forest (aside from trees), scientific literature provided estimates of average biomass using similar sampling methods and was also converted to carbon stock using the 47 percent conversion rate (Battles et al. 2013).

2.2.2 Soil Carbon

Soil carbon refers to the amount of carbon stored in the soil, which includes both organic and inorganic carbon. Soil organic matter is a mixture of carbon compounds consisting of decomposing plant and animal tissue and carbon associated with soil minerals, and microbes. Within soil organic matter, approximately 58 percent is soil organic carbon, which represents the distinct carbon pool in the soil (Lal 2004). For most ecological assessments, the primary focus is on soil organic carbon due to its strong link to biological processes and land management. In this analysis, only soil organic carbon was assessed due to data limitations, and soil inorganic carbon was not included.

Soil organic carbon is stored in the soil through the incorporation of organic material such as plant litter, root exudates, and dead roots. Microbial organisms decompose this material, with some of the carbon retained in the soil and some released back into the atmosphere as carbon dioxide. The stability of soil carbon varies: some carbon can remain sequestered for millennia, while other portions may cycle back into the atmosphere within years or decades. Soil carbon dynamics are influenced by vegetation type, climate, soil texture and mineralogy, and land management practices. For instance, conservation practices such as reduced tillage, cover cropping, and crop rotation can help increase soil carbon stocks relative to conventional management (Ecological Society of America 2000).

Soil organic carbon is typically measured through direct soil sampling and laboratory analysis. Samples are collected by depth intervals and analyzed to determine soil organic carbon concentration, which is then combined with bulk density and sampling depth to estimate soil organic carbon stock per unit area. According to the IPCC Guidelines for National Greenhouse Gas Inventories, soil organic carbon stocks in a given area may reach a spatially averaged, stable value over time, influenced by soil characteristics, climate, land use, and management practices (IPCC 2006: Vol. 4, Ch. 2.2.3).

3 METHODS TO ESTIMATE BASELINE CARBON STOCK IN THE COUNTY

This report estimates total carbon stock across Kern county by combining geospatial land cover data with regionally appropriate carbon stock values. The analysis includes both biomass carbon and soil carbon (represented by soil organic carbon) and was carried out using a GIS-based approach supported by Python-based data processing and Excel-based aggregation.

Detailed land cover classifications, such as specific crop or vegetation types, were assigned per-unit biomass carbon stock values (in the unit of metric tons of carbon per acre) based on scientific literature and publicly available databases, prioritizing local or regional sources when available. When specific data were not available, proxy values from similar land cover types were used. Biomass carbon stock estimates were calculated by multiplying per-unit biomass carbon stock values by the acreage of each land cover classification. Soil organic carbon was then calculated within each of the detailed land cover classifications to obtain total combined carbon by land cover classification.

Detailed land cover classifications were then synthesized into broader general land cover categories (e.g., cropland, forest, shrubland) to simplify data aggregation. Next, the weighted average per-unit (combined) carbon stock values for each land cover category were obtained from the total carbon within a given land cover category and the land cover category's total acreage within Kern county. This approach enables a comprehensive and spatially explicit understanding of carbon storage across Kern county.

3.1 LAND COVER ANALYSIS

To assess the carbon stock in the county, a GIS-based analysis was performed using the best available data for both land cover (i.e., vegetation) and soil, which correspond to biomass and soil carbon stocks, as shown in Figure 1. As noted previously, due to data limitations, only soil organic carbon data were available for this analysis. The land cover classification process provides a spatial foundation for quantifying biomass carbon stock values across different land covers in the county. In addition, the process enables the assignment of soil organic carbon values by linking each land cover classification to corresponding soil carbon characteristics, including soil organic carbon stock values.

The California Department of Forestry and Fire Protection (CAL FIRE) Fire and Resource Assessment Program (FRAP) vegetation layer was used to assess land cover classifications, which is the most regionally specific dataset available for this analysis. The CAL FIRE FRAP vegetation layer includes the spatial distribution of habitat types within California, which was created in coordination with the California Department of Fish and Wildlife VegCamp Program and the U.S. Department of Agriculture's (USDA's) Forest Service Remote Sensing Laboratory data.

Next, the CAL FIRE FRAP vegetation layer was intersected with the U.S. Fish and Wildlife Service (USFWS) National Wetlands Inventory (NWI) layer. The NWI contains more than 35 million wetlands and deepwater features across the US. Wetlands that are identified using aerial imagery based on vegetation, visible hydrology, and geography. NWI provides information on the status, extent, characteristics, and functions of wetland, riparian and deepwater habitats.

Furthermore, the CAL FIRE FRAP and USFWS NWI layers were then intersected with the California Department of Water Resources (DWR) statewide crop mapping, which was used to identify the orchards and other croplands within the county. This statewide crop mapping layer superseded the CAL FIRE FRAP vegetation and NWI layers to provide more specific crop types within the county. In the areas where the crop mapping layer overlapped with the CAL FIRE FRAP or NWI layers, the CAL FIRE FRAP or NWI layers were removed.

Using these data layers, the land cover classifications in the county were identified. Note that these GIS layers provided detailed land cover classifications, which are often at the crop or vegetation community level (e.g., "cucumber," "Joshua tree," etc.). During the latter part of this analysis, which will be discussed below, these detailed land cover classifications were aggregated into broader and more general land cover categories (e.g., "cropland" for "cucumber", "desert" for "Joshua tree"). This enables the analysis of biomass carbon stock values at a broader land cover category level. Using broader and more general categories also facilitates interpretation at a more ecological and systemic level, helping to reveal countywide patterns in land-based carbon storage and identify key opportunities for conservation or restoration. Refer to Section 3.2 below for the detailed methodology on the land cover aggregation process, and further biomass carbon stock analysis.

Lastly, soil organic carbon data were assigned to each detailed land cover classification using the USDA's Natural Resources Conservation Service (NRCS) Gridded Soil Survey Geographic (gSSURGO) database, which provides soil organic carbon stock data throughout the state, inclusive of the county. Refer to Section 3.3 below for the detailed methodology on soil organic carbon stock data analysis.

Table 1 below shows the data layer sources and years published for the land cover and soil organic carbon analysis.

Table 1 Spatial Data Sources

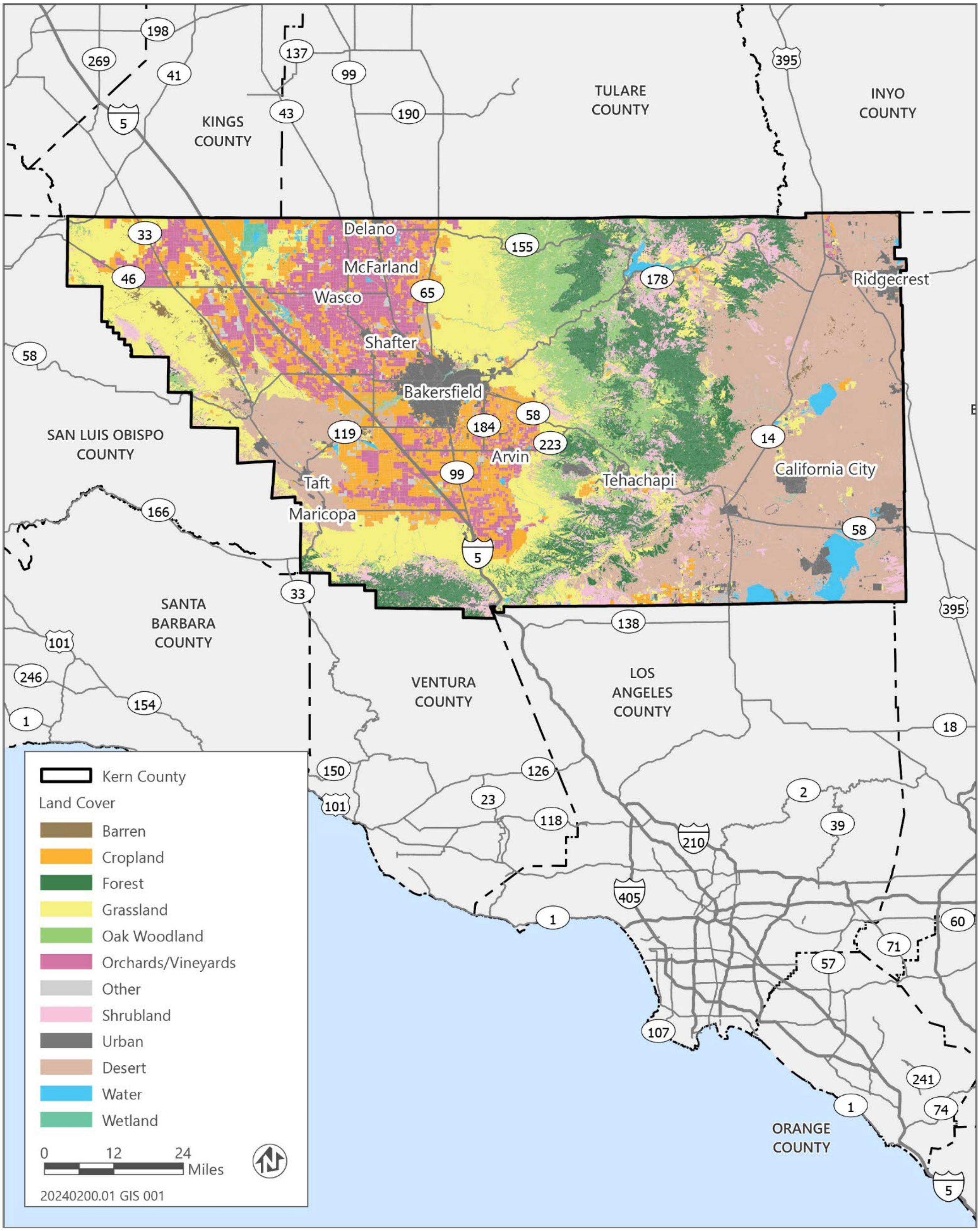
Source	Data Source Year
CAL FIRE FRAP	2022
NWI	2022
DWR	2021
gSSURGO	2024

Notes: CAL FIRE = California Department of Fire Protection and Forestry; DWR = Department of Water Resources; FRAP = Fire and Resource Assessment Program; gSSURGO = Gridded Soil Survey Geographic Database; NWI = National Wetlands Inventory.

Source: Compiled by Ascent in 2025.

Figure 2 displays the spatial distribution of general land cover categories within the county.

The attribute tables from the GIS land cover layers, which included detailed land cover classifications, general land cover categories, soil organic carbon stock values, and acreage values, were then exported to a comma-separated values file. A Python script was then used to process and summarize the data, generating a Microsoft Excel workbook that aggregated total acreages and soil organic carbon values by detailed land cover classification and general land cover categories. This workbook dataset served as the basis for subsequent biomass and total carbon stock quantification across Kern county. Note that at this stage, soil organic carbon stock values for each detailed and general land cover classification/category had already been assigned/calculated and were ready to be incorporated into the further total carbon stock analysis.



Source: Prepared by Ascent in 2025.

Figure 2 General Land Cover Categories in Kern County

3.2 BIOMASS CARBON QUANTIFICATION

To assess biomass carbon stock values, the resulting total acreages of each detailed land cover classification from the GIS, Microsoft Excel, and Python script analysis described above were linked to per-unit biomass carbon stock values found in scientific literature. These per-unit values (in metric tons of carbon per acre) were then multiplied by the corresponding acreage of each detailed land cover classification to estimate biomass carbon stocks. A full list of the sources used to obtain per-unit biomass carbon stock value is available in Appendix A.

When available, carbon stock values specific to Kern county or the broader region were prioritized. In cases where localized data were not available, statewide estimates were used. If a specific carbon stock value could not be found for a particular detailed land cover classification, the analysis relied on a proxy value from a more generalized land cover category that closely aligned with it. For example, the biomass carbon stock value was available for defruited avocado trees (representing the detailed land cover classification "avocado"), but not for other orchard crops such as cherries, olives, or apricots. In such cases, the carbon stock value for defruited avocado trees was applied to these similar orchard crop types as a reasonable proxy. This value was also treated as one of the representative ("universal") per-unit biomass carbon stock values under the broader "orchard/vineyard" general land cover category. Note that more than one representative per-unit biomass carbon stock values may exist for each of the general land cover categories.

Refer to Appendix A for a detailed explanation of the methodology used to assign per-unit biomass carbon stock values to detailed land cover classifications, as well as the use of representative proxy per-unit carbon stock values. Appendix A also includes the specific per-unit values assigned to each detailed land cover classification, along with other associated data and data sources.

Biomass carbon stock values for detailed land cover classifications were aggregated to estimate total biomass carbon stocks for broader general land cover categories. For example, detailed forest-associated classifications, such as eastside pine and Sierran mixed conifer, were each assigned per-unit biomass carbon stock values using the methodology described above. These values were then multiplied by the respective acreages of each detailed classification. The resulting values were summed to produce the total biomass carbon stock for the general "forest" land cover category.

A weighted average per-unit biomass carbon stock value was then calculated for the general "forest" category by dividing the total biomass carbon stock values for all forest-associated detailed land cover classifications by their combined acreage.

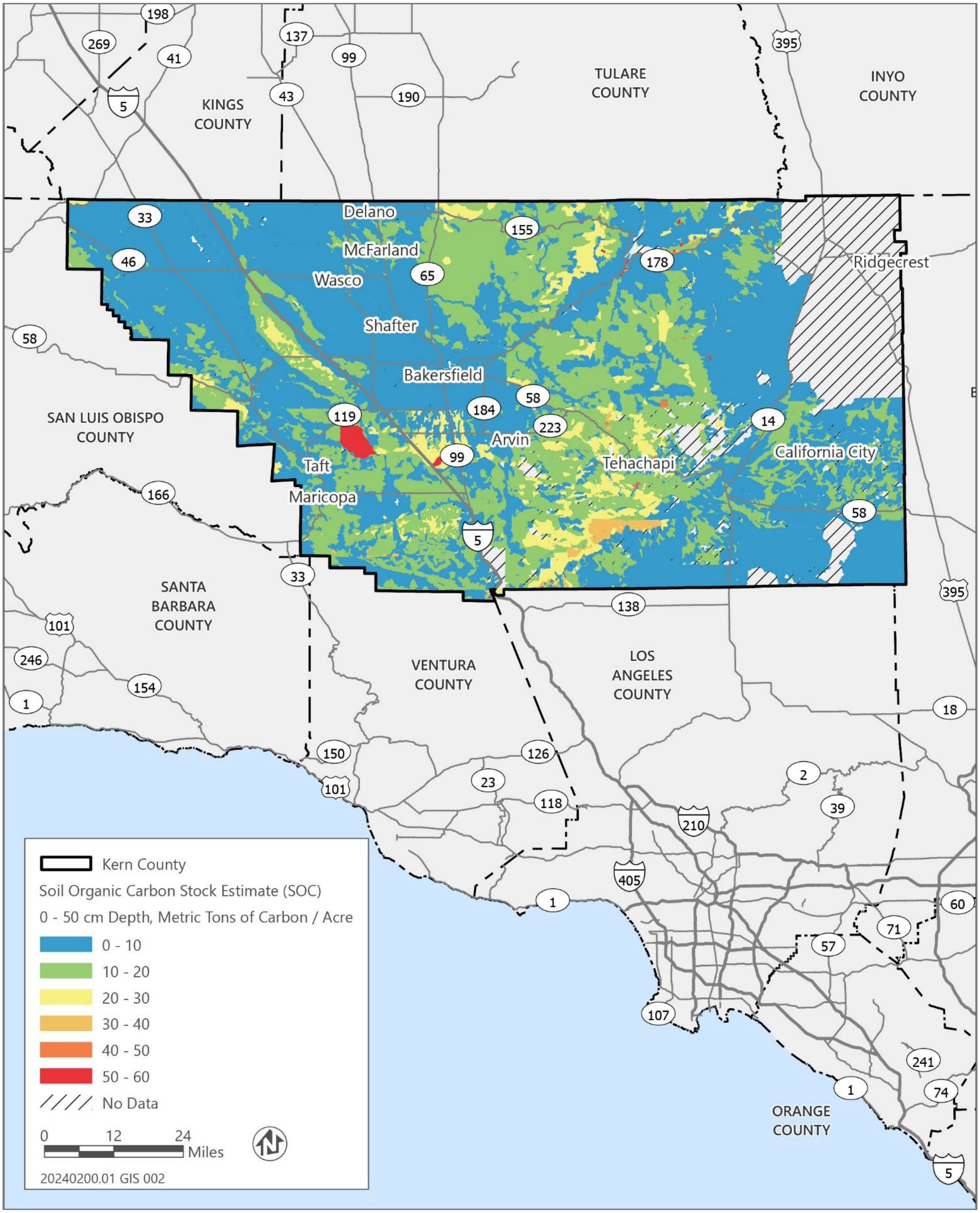
3.3 SOIL CARBON QUANTIFICATION

Soil organic carbon, as mentioned in Section 3.1 and shown in Figure 3 below, was estimated using the NRCS gSSURGO dataset, which provides soil type data throughout the state, inclusive of the county. gSSURGO provides data on the quantity of soil organic carbon at depths of 5, 20, 50, 100, and 150 centimeters (cm). Such data were collected from soil surveys performed throughout Kern county, and therefore are specific to the area of this analysis.

The following steps were performed for this analysis: First, gSSURGO data were uploaded into GIS for the county. Next, using the Soil Data Development Toolbox (a Python-scripted GIS toolbox used by the NRCS to create soil maps and reports), a soil map was created, and the attributes that represent soil organic carbon were extracted. These attributes were then joined to the land cover data layers, as outlined above in Section 3.1, to specify the soil organic carbon stored within each detailed land cover classification. Consistent with the methodology described in Section 3.2, total soil organic carbon stock values and weighted average per-unit soil organic carbon stock values were also calculated for each general land cover category.

Soil organic carbon was calculated to a depth of 50 cm, which included summing the soil organic carbon for the 0 to 5 cm, 5 to 20 cm, and 20 to 50 cm soil layers. This depth was chosen due to the 96 percent availability of soil carbon data from gSSURGO at this depth (deeper depths have lower data availability). For example, at the next depth of 100 cm, only 86 percent of the data was available. Note that the gSSURGO data used in this analysis was published in

2024, so it represents the most up-to-date soil carbon data collected. Figure 3 shows the soil organic carbon stock in the layer of soil between a depth of 0 and 50 cm, estimated in metric tons of carbon per acre for the county.



Source: Prepared by Ascent in 2025.

Figure 3 Soil Organic Carbon Stock between 0 and 50 centimeter depth within the County (Metric Tons of Carbon per Acre)

4 SUMMARY OF ESTIMATED BASELINE CARBON STOCK IN THE COUNTY

Using the carbon stock calculation methodology outlined in Section 3, and combining both biomass and soil carbon values, the total carbon stock in Kern county was estimated at approximately 74 million MT C. By overlaying each jurisdiction's city limits onto the land cover and carbon stock data, Table 2 presents the estimated biomass carbon, soil carbon, and total carbon stock for each jurisdiction within the county. The table also summarizes the countywide total carbon stock across all jurisdictions. Among all the incorporated jurisdictions, the City of California City has the highest total carbon stock (980,601 MT C). The City of Maricopa has the lowest carbon stock (6,542 MT C).

Additional carbon stock values are available for each jurisdiction by general land cover categories in Appendix B.

Table 2 Kern County Biomass, Soil and Total Carbon Stock Values by Jurisdiction

	Biomass Carbon (MT C)	Soil Carbon[1] (MT C)	Total Carbon (MT C)
Arvin	2,666	13,980	16,646
Bakersfield	151,893	535,009	686,902
California City	160,544	820,056	980,601
Delano	25,569	38,408	63,976
Maricopa	977	5,565	6,542
McFarland	11,295	40,254	51,549
Ridgecrest	6,830	—[2]	6,830
Shafter	132,587	85,073	217,660
Taft	11,009	80,353	91,362
Tehachapi	11,388	89,067	100,456
Wasco	20,980	20,673	41,653
Unincorporated County	33,003,480	38,714,004	71,717,484
Total Kern County	**34,338,715**	**40,442,441**	**73,981,661**

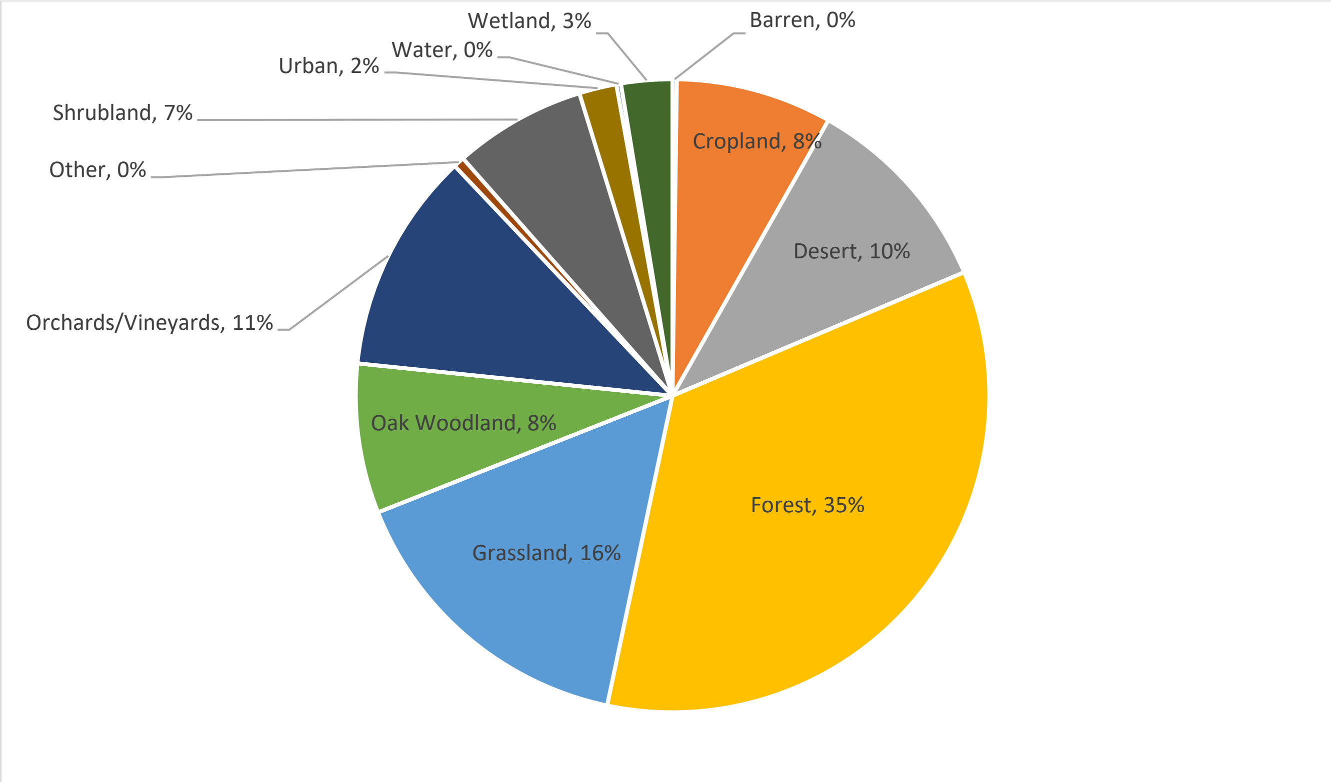
Notes: C = carbon; MT = metric tons.

[1] Soil (organic) carbon includes carbon held in soils, up to 50 centimeters deep. Note that 8.5 percent of the county's soil carbon data was either not available or not surveyed, as noted in the gSSURGO database.

[2] Soil carbon data for Ridgecrest is shown to be not available in the gSSURGO database.

Source: Prepared by Ascent in 2025.

Figure 4 below demonstrates the total carbon stock by general land cover categories in the county. As shown in Figure 4, 51 percent of the carbon is stored in grasslands and forests, with the rest being stored in orchards and vineyards, deserts, oak woodland, shrubland, cropland, and wetland.



Source: Prepared by Ascent in 2025.

Figure 4 Kern County Total Carbon Stock by General Land Cover Categories

The countywide per-unit biomass, soil and combined carbon stock values are shown by general land cover categories in Table 3 and Figure 5. The per-unit combined carbon stock values were calculated by summing the combined biomass and soil carbon stock values for each general land cover category and then dividing that total by the acreage of the corresponding general land cover category. As shown in Table 3, while some ecosystems, such as forest, hold more carbon in their biomass vegetation, other ecosystems, such as oak woodland, hold more in their soil. Forest and wetland have the highest per-unit combined carbon stock values.

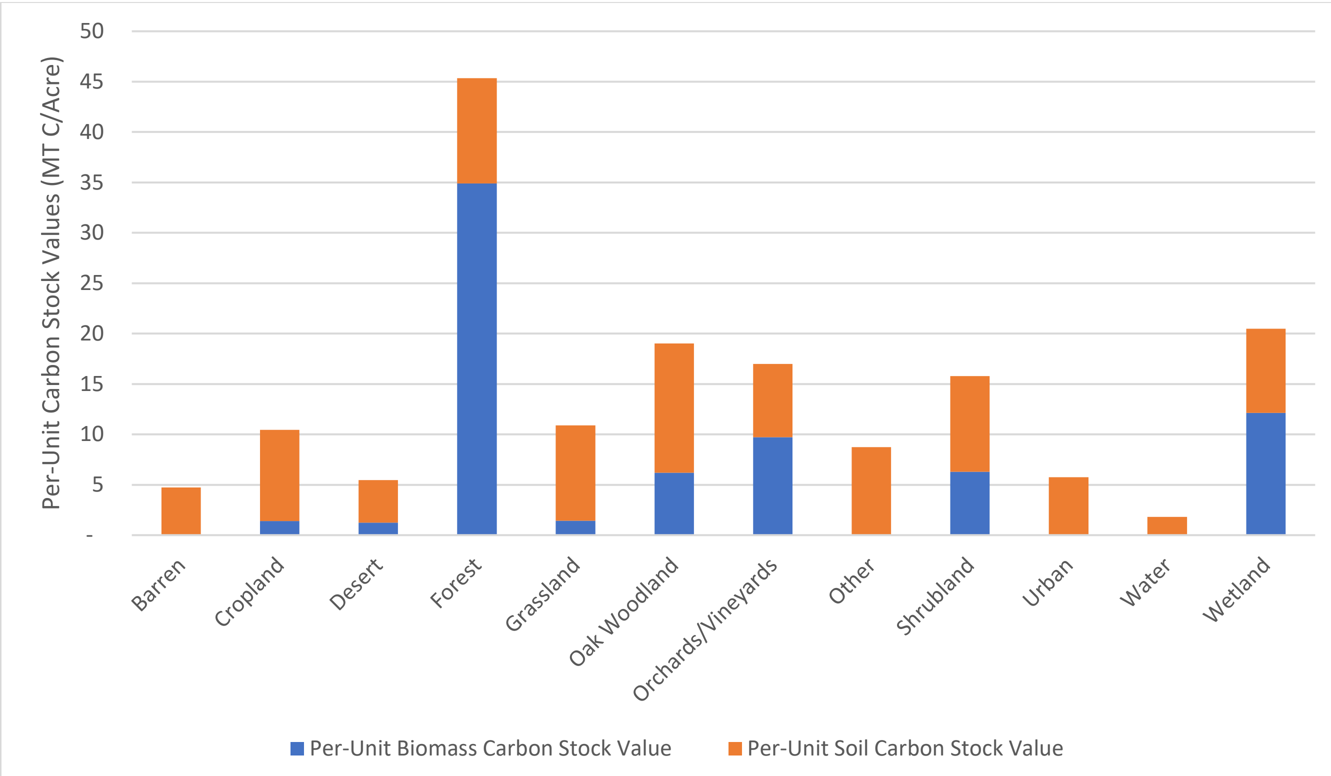
Table 3 Per-Unit and Total Carbon Stock Values by General Land Cover Categories

General Land Cover Category	Acres	Per-Unit Biomass Carbon Stock Values (MT C /acre)	Per-Unit Soil Carbon Stock Values (MT C /acre)	Per-Unit Combined Carbon Stock Values (MT C /acre)
Barren	34,153	—	5	5
Cropland	563,739	1	9	10
Desert	1,410,267	1	4	5
Forest	565,847	35	10	45
Grassland	1,064,411	1	9	11
Oak Woodland	296,873	6	13	19
Orchards/Vineyards	492,446	10	7	17
Other	47,694	—	9	9
Shrubland	316,957	6	9	16
Urban	245,841	—	6	6
Water	93,472	—	2	2

General Land Cover Category	Acres	Per-Unit Biomass Carbon Stock Values (MT C /acre)	Per-Unit Soil Carbon Stock Values (MT C /acre)	Per-Unit Combined Carbon Stock Values (MT C /acre)
Wetland	94,195	12	8	20

Notes: C = carbon; MT = metric tons.

Source: Prepared by Ascent in 2025.

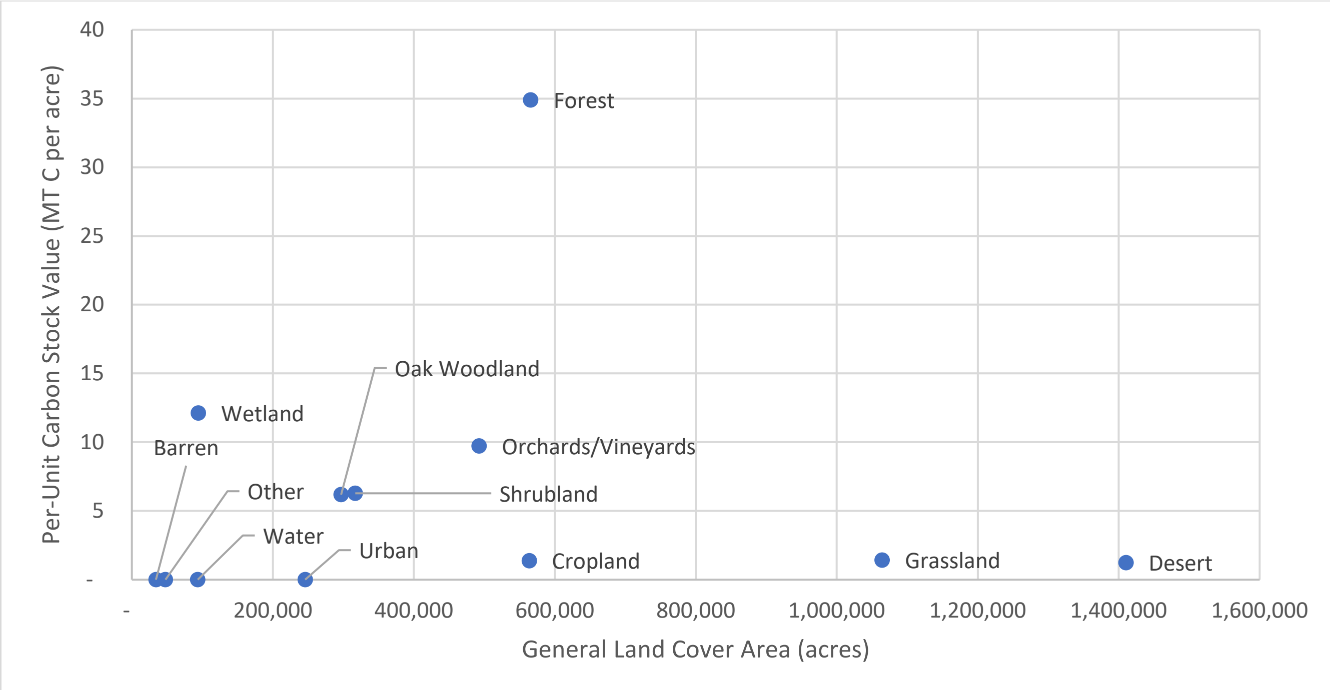


Notes: C = carbon; MT = metric tons.

Source: Prepared by Ascent in 2025.

Figure 5 Per-Unit Biomass and Soil Carbon Stock Values by General Land Cover Categories

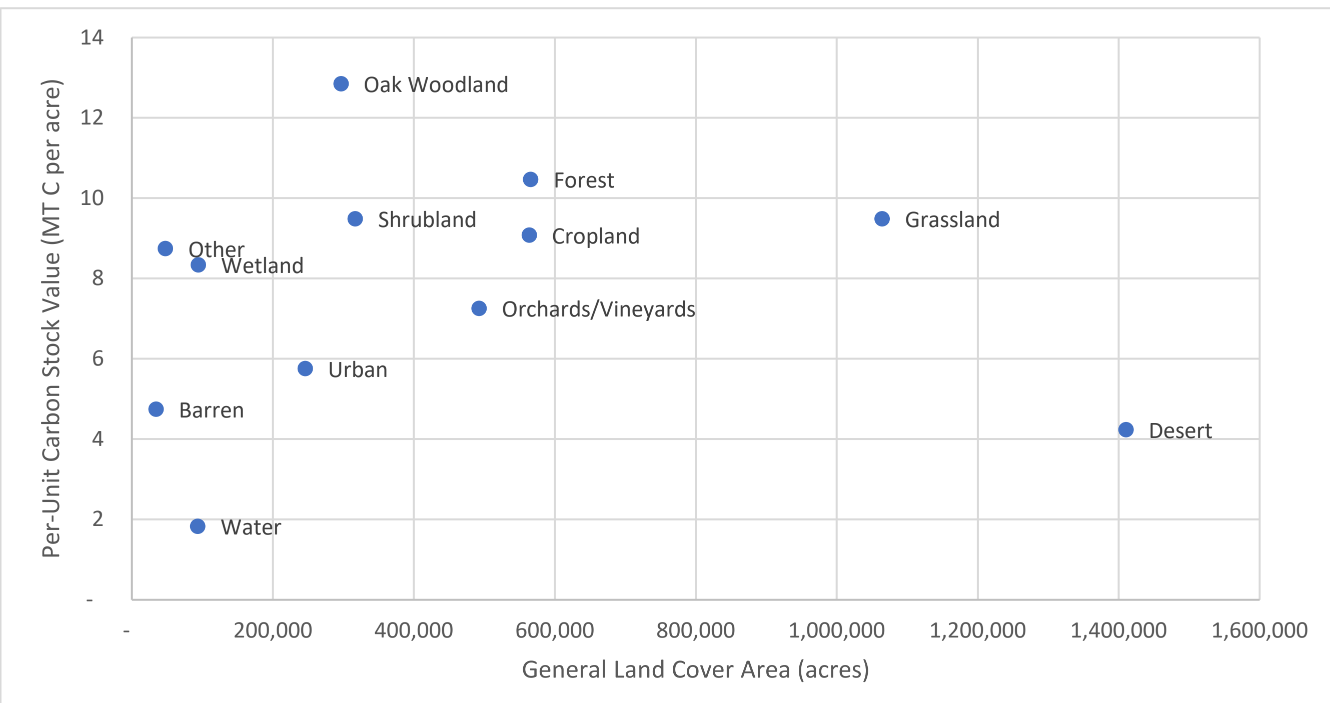
Furthermore, the total acreage and the per-unit biomass and soil carbon stock values for each general land cover category are shown in Figures 6 and 7, respectively. As shown in Figure 6, the forest land cover category has the highest per-unit biomass carbon stock value, substantially greater than all other land cover types, while lower-value land cover categories such as desert and grassland occupy more acreage in the county. In contrast, per-unit soil carbon stock values vary far less across land cover categories compared to biomass values.



Notes: C = carbon; MT = metric tons.

Source: Prepared by Ascent in 2025.

Figure 6 Per-Unit Biomass Carbon Stock Values by General Land Cover Categories



Notes: C = carbon; MT = metric tons.

Source: Prepared by Ascent in 2025

Figure 7 Per-Unit Soil Carbon Stock Values by General Land Cover Categories

5 COMPARISON TO OTHER STUDIES

Carbon stock inventories are a dynamic and rapidly changing field of study. In the last decade, cities and counties in California have taken on the challenge of quantifying the carbon stock within their jurisdictions with limited guidance, unlike anthropogenic greenhouse gas emissions quantification. The Association of Monterey Bay Area Governments (AMBAG) and counties such as Merced, Sonoma, Santa Barbara, San Diego, and Calaveras have all conducted geospatial analyses by identifying land cover types and connecting them to carbon values. Some of the variability in results can be attributed to the different GIS layers used in the land cover type classification, while other variability is in the carbon stock values per land cover type and the land cover makeup of the study areas. Table 4 shows the difference in the average per-unit combined carbon stock value (MT C/acre), as defined as total metric tons of carbon divided by total acres in a given region, between this report and studies that have been conducted across the state, as well as a comparison between CARB's two statewide carbon inventories.

Table 4 Carbon Stock Analyses Conducted Across California

Region	Analysis Year	Acres Evaluated	Per-unit Carbon Stock Value (MT C/Acre)	Total Carbon Stock (MMT C)
Kern County	2025	5,225,895	14	74
AMBAG	2023	3,291,989	35	117
Sonoma County	2016	1,016,781	62	63
Santa Barbara County	2020	1,632,162	31	51
Merced County	2019	1,265,303	11	14
San Diego County	2022	2,727,116	24	65
Calaveras County	2021	662,838	31	20
Statewide[1]	2018	105,000,000	51	5,340
Statewide[1]	2022	105,000,000	29	3,117

Notes: AMBAG = Association of Monterey Bay Area Governments; C = carbon; MT = metric tons; MMT = million metric tons.

[1] Both statewide analyses have been conducted by the California Air Resources Board and show vastly different results for the same acreage area of study, demonstrating the evolving nature of this type of analysis.

Source: Compiled by Ascent in 2025.

CARB has a longstanding history of quantifying both greenhouse gas emissions and carbon stock. In 2007, CARB first included an estimate of carbon sequestration in forests and rangelands in its statewide greenhouse gas inventory. In 2016, CARB published the Forestry & Other Natural Lands Inventory, followed by the publication of CARB's Ecosystem Carbon in California's Natural and Working Lands (NWL Inventory) in 2018. The NWL Inventory estimated the amount of carbon in natural and working lands but expressed uncertainty in the estimates, with a margin of error for soil carbon of 90 percent. In 2019, Merced County was the first local jurisdiction to release a carbon stock inventory based on spatial analysis, using the TerraCount method, funded by the California Department of Conservation. This method used LANDFIRE datasets (LANDFIRE n.d.) to assess the vegetation height, cover, and type to convert into carbon density values. In 2020, CARB refined the 2018 NWL Inventory and in 2022, CARB published a new NWL inventory and projections included in the 2022 Scoping Plan for Achieving Carbon Neutrality.

6 DATA GAPS

As carbon stock and sequestration research is rapidly evolving, this report highlights several data gaps in developing carbon stock analyses. As such, this analysis provides only an estimate of carbon stocks based on available data, and is intended to highlight the importance of carbon storage and sequestration while identifying key geographies and land cover types with potential for increases and losses of carbon stocks Generally, the accuracy of the carbon stock estimates is dependent on the data sources used, which contain several limitations.

First, the GIS layers used in this analysis were sourced from different years because they were produced by various federal and state agencies. The CAL FIRE FRAP vegetation layer and NWI layer were for the year 2022, while the Department of Water Resources' statewide cropping layer was for 2021. These data layers (used to calculate biomass carbon) and years were selected to represent a more uniform baseline year. However, the gSSURGO soil carbon data that was used was for 2024. Previous years' data are not publicly available. Therefore, the biomass and soil carbon stock value sources do not allow for a truly uniform baseline of carbon stock in the county. Nevertheless, the data layers used in this report are specific to the county.

Additionally, the per-unit biomass carbon stock values specific to each detailed land cover classification are limited due to the lack of studies evaluating carbon stock, particularly those specific to Kern county. For example, specific biomass per-unit carbon stock values for every crop produced in the county were not available. In cases like these, a per-unit carbon stock value for a more general land cover type (cropland, etc.) was used. In addition, some per-unit biomass carbon stock values do not include root carbon. Refer to Appendix A for more details.

The use of per-unit biomass carbon stock values also creates limits in identifying the density and height of vegetation, as compared to the methods used by the CARB NWL inventory. The Kern county carbon stocks is limited by the availability of carbon stock values for different land cover types, and does not allow for differentiation of the specific conditions of the land cover existing in the county. The per-unit biomass carbon stock values obtained for this analysis strived to be reference studies that generally represent the climate of Kern county; however, this was not possible in many cases.

Lastly, the gSSURGO organic soil carbon dataset had areas in Kern county with missing data. The City of Ridgecrest had no soil organic carbon data available; whereas the unincorporated Kern County has approximately 8 percent of data missing. With this missing data, comparisons of carbon stocks between jurisdictions is not recommended. Refer to Appendix B for more details.

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Appendix A

Per-Unit Biomass Carbon Stock Values by Land Cover Classification/Category and Associated Sources

The table below demonstrates the per-unit biomass carbon stock values selected for each detailed land cover classification, together with the GIS acreage for each classification, as well as the sources for the carbon stock values. Land cover classification-specific carbon stock values were used wherever the data were available. In other cases, proxy values from more generalized land cover categories were used.

1. Vineyard, Orchard and Crops

Non-vineyard and non-orchard crops' biomass per-unit carbon stock values were assigned the value for "cropland" in the US Geologic Survey's *Baseline and Projected Future Carbon Storage and Greenhouse-Gas Fluxes in Ecosystems of the Western United States* (hereafter referred to as "USGS Report") because more specific data was not available for these types (USGS 2012). Carbon stock values provided by this 2012 USGS report were also used as proxy values for multiple other detailed land cover classifications that fall under other general land cover types.

Vineyard carbon stock values were sourced from a UC Merced study (Williams 2020), while avocado and almond orchards were assigned specific values reported in the CARB-commissioned study by Saah et al. (2016). Although a carbon stock value was available for defruited avocado trees, equivalent values were not available for other orchard crops such as cherries, olives, and apricots. As a proxy, these crops were assigned the same per-unit value as defruited avocado trees, based on their similar structure and function. The use of defruited values is appropriate because the harvested fruit biomass is not retained in the vegetation or soil, and therefore should not contribute to long-term carbon storage.

Similarly, the biomass carbon stock value for almonds was used as a proxy for walnuts and pistachios, given their comparable growth forms and orchard management practices.

2. Wetland

For most wetland-associated classifications such as freshwater emergent wetland and riverine, proxy values were assigned based on the general category "wetland," due to a lack of more specific published data.

3. Forest

Per-unit biomass carbon stock values for a few detailed land cover classifications that fall within the "forest" general land cover category were provided by the *California Forest Carbon Plan* (Forest Climate Action Team 2018). Where more specific carbon values could not be found for some forest-associated land cover classifications, carbon stock values for general ecosystems in specific regions, including Mediterranean California, from the USGS report, were used as proxy values (USGS 2012).

4. Oak Woodland

Per-unit biomass carbon stock values for oak woodland-associated detailed land cover classifications were provided by *An Inventory of Carbon and California Oaks* (Gaman 2008).

5. Grassland

Grassland-associated carbon stock values were published and provided in a final report prepared for the California Energy Commission (Brown 2004).

6. Shrubland and Desert

Carbon values for California's chaparral and coastal scrub were from a scientific report produced by UC Davis staff (Bohlman et al. 2018). These detailed land cover classifications mostly fall under "shrubland" as the general land cover category. Moreover, carbon values for various desert-associated (alkali desert scrub, desert riparian, etc.) and shrubland-associated (Joshua tree, sagebrush, etc.) detailed land cover classifications were sourced from another scientific paper (Fucso et al. 2019).

Land Cover Classification, Category, Per-Unit Biomass Carbon Stock Values, Acreage and Data Sources

Detailed Land Cover Classification	General Land Cover Category	Per-Unit Biomass Carbon (MT C/acre)	Total Acres	Per Unit Biomass Carbon Data Source & Assumption	Spatial Data Source
Alfalfa and Alfalfa Mixtures	Cropland	2.1	37,660	USGS 2012 (Table 5.3)	DWR
Alkali Desert Scrub	Desert	1.24	366,916	Fusco et al. 2019[1]: Figure 1 & Table 2	CAL FIRE FRAP
Almonds	Orchards/Vineyards	11.83	213,911	Saah 2016 (Table 7)	DWR
Annual Grassland	Grassland	1.42	1,055,294	Brown et al. 2004 (page 17)	CAL FIRE FRAP
Apples	Orchards/Vineyards	6.18	468	Saah 2016 (Table 7) - assuming defruited avocado values	DWR
Apricots	Orchards/Vineyards	6.18	3	Saah 2016 (Table 7) - assuming defruited avocado values	DWR
Avocados	Orchards/Vineyards	6.18	1	Saah 2016 (Table 7) - assuming defruited avocado values	DWR
Barren	Barren	—	34,153	assumed to be zero	CAL FIRE FRAP
Beans (Dry)	Cropland	2.1	513	USGS 2012 (Table 5.3)	DWR
Bitterbrush	Shrubland	1.24	851	Fusco et al. 2019[1]: Figure 1 & Table 2; using sage brush value as they are the most similar	CAL FIRE FRAP
Blue Oak Woodland	Oak Woodland	6.07	288,623	Gaman 2008 (Table 4)	CAL FIRE FRAP
Blue Oak-Foothill Pine	Forest	13.86	12,666	Gaman 2008 (Table 4); blue oaks averaged for other regions	CAL FIRE FRAP
Bushberries	Cropland	2.1	1,120	USGS 2012 (Table 5.3)	DWR
Carrots	Cropland	—	14,116	Assumed to be zero because herbaceous material is removed	DWR
Chamise-Redshank Chaparral	Shrubland	4.28	1,323	Bolhman et al. 2018	CAL FIRE FRAP
Cherries	Orchards/Vineyards	6.18	4,271	Saah 2016 (Table 7) - assuming defruited avocado values	DWR
Citrus and Subtropical - No Subclass	Cropland	2.1	58,099	USGS 2012 (Table 5.3)	DWR
Closed-Cone Pine-Cypress	Forest	50.96	474	USGS 2012 (Table 5.3)	CAL FIRE FRAP
Coastal Oak Woodland	Oak Woodland	12.55	19	Gaman 2008 (Table 4)	CAL FIRE FRAP
Coastal Scrub	Shrubland	3.2	17,960	Bolhman et al. 2018	CAL FIRE FRAP
Cole Crops	Cropland	—	2,197	*Assumed to be zero because herbaceous material is removed	DWR
Corn, Sorghum and Sudan	Cropland	2.1	17,960	USGS 2012 (Table 5.3)	DWR
Cotton	Cropland	2.1	8,565	USGS 2012 (Table 5.3)	DWR
Cropland	Cropland	2.1	20,637	USGS 2012 (Table 5.3)	CAL FIRE FRAP
Dates	Orchards/Vineyards	6.18	38	Saah 2016 (Table 7) - assuming defruited avocado values	DWR
Deciduous - Misc.	Orchards/Vineyards	6.18	661	Saah 2016 (Table 7) - assuming defruited avocado values	DWR

Detailed Land Cover Classification	General Land Cover Category	Per-Unit Biomass Carbon (MT C/acre)	Total Acres	Per Unit Biomass Carbon Data Source & Assumption	Spatial Data Source
Deciduous Orchard	Orchards/Vineyards	6.18	32,097	Saah 2016 (Table 7) - assuming defruited avocado values	CAL FIRE FRAP
Desert Riparian	Desert	1.24	2,919	Fusco et al. 2019[1]. Figure 1 & Table 2; using salt desert scrub data for all desert land types	CAL FIRE FRAP
Desert Scrub	Desert	1.24	1,023,714	Fusco et al. 2019[1]. Figure 1 & Table 2; using salt desert scrub data for all desert land types	CAL FIRE FRAP
Desert Wash	Desert	1.24	16,719	Fusco et al. 2019[1]. Figure 1 & Table 2; using salt desert scrub data for all desert land types	CAL FIRE FRAP
Dryland Grain Crops	Cropland	2.1	3,373	USGS 2012 (Table 5.3)	CAL FIRE FRAP
Eastside Pine	Forest	50.96	5,314	USGS 2012 (Table 5.3)	CAL FIRE FRAP
Eucalyptus	Forest	50.96	40	USGS 2012 (Table 5.3)	CAL FIRE FRAP & DWR
Evergreen Orchard	Orchards/Vineyards	6.18	4,508	Saah 2016 (Table 7) - assuming defruited avocado values	CAL FIRE FRAP
Field Misc.	Cropland	—	164	Assumed to be zero because herbaceous material is removed	DWR
Flowers, Nursery and Christmas Tree Farms	Cropland	2.1	1,899	USGS 2012 (Table 5.3)	DWR
Fresh Emergent Wetland	Wetland	7.34	85,307	USGS 2012 (Table 5.3)	CAL FIRE FRAP & NWI
Freshwater Emergent Wetland	Wetland	7.34	24,899	USGS 2012 (Table 5.3)	CAL FIRE FRAP & NWI
Freshwater Forested/Shrub Wetland	Wetland	7.34	9,089	USGS 2012 (Table 5.3)	NWI
Freshwater Pond	Water	—	12,038	Assumed to be zero	NWI
Grain and Hay - Misc.	Cropland	2.1	17,547	USGS 2012 (Table 5.3)	DWR
Greenhouse	Cropland	2.1	204	USGS 2012 (Table 5.3)	DWR
Idle - Land not cropped in current or prior year, but within last 3 yrs.	Cropland	—	60,567	Assumed to be zero	DWR
Idle - Long Term - land consistently idle for four or more years	Cropland	—	75,266	Assumed to be zero	DWR
Irrigated Grain Crops	Cropland	2.1	2,954	USGS 2012 (Table 5.3)	CAL FIRE FRAP
Irrigated Hayfield	Cropland	2.1	6,995	USGS 2012 (Table 5.3)	CAL FIRE FRAP
Irrigated Row and Field Crops	Cropland	2.1	133,399	USGS 2012 (Table 5.3)	CAL FIRE FRAP
Jeffrey Pine	Forest	57.4	14,592	Forest Climate Action Team 2018[1]; assumed mixed conifer	CAL FIRE FRAP
Joshua Tree	Shrubland	1.24	32,560	Fusco et al. 2019[1]. Figure 1 & Table 2; using desert land cover type as	CAL FIRE FRAP

Detailed Land Cover Classification	General Land Cover Category	Per-Unit Biomass Carbon (MT C/acre)	Total Acres	Per Unit Biomass Carbon Data Source & Assumption	Spatial Data Source
				Joshua trees grow on deserts and would mostly resemble desert land cover.	
Juniper	Forest	50.96	85,307	USGS 2012 (Table 5.3)	CAL FIRE FRAP
Lacustrine	Water	—	4,502	Assumed to be zero	CAL FIRE FRAP
Lake	Water	—	76,932	Assumed to be zero	NWI
Lettuce/Leafy Greens	Cropland	—	3,280	Assumed to be zero because herbaceous material is removed	DWR
Melons, Squash and Cucumbers	Cropland	—	1,303	Assumed to be zero	DWR
Mixed Chaparral	Shrubland	9.69	154,655	Bolhman et al. 2018	CAL FIRE FRAP
Montane Chaparral	Shrubland	9.69	29,834	Bolhman et al. 2018: assumed to be mixed chaparral	CAL FIRE FRAP
Montane Hardwood	Forest	29.95	182,868	Gaman 2008	CAL FIRE FRAP
Montane Hardwood-Conifer	Forest	120.21	21,203	Forest Climate Action Team 2018[1], Gaman 2008; calculated the average of canyon oaks and mixed conifers	CAL FIRE FRAP
Montane Riparian	Forest	45.72	1,330	Dybala et al. 2018 (Table 3)	CAL FIRE FRAP
Not cropped, or unclassified at the time of remote-sensing analysis. Idle status not determined	Other	—	47,694	assumed to be zero	DWR
Olives	Orchards/Vineyards	6.18	1,658	Saah 2016 (Table 7) - assuming defruited avocado values	DWR
Onions and Garlic	Cropland	—	6,384	Assumed to be zero because herbaceous material is removed	DWR
Pasture	Cropland	2.1	1	USGS 2012 (Table 5.3)	CAL FIRE FRAP
Pasture - Miscellaneous Grasses	Grassland	1.42	319	Brown et al. 2004 (Page 17)	DWR
Pasture - Mixed	Grassland	1.42	3,480	Brown et al. 2004 (Page 17)	DWR
Pasture - Turf Farms	Grassland	1.42	459	Brown et al. 2004 (Page 17)	DWR
Peaches and Nectarines	Orchards/Vineyards	6.18	842	Saah 2016 (Table 7) - assuming defruited avocado values	DWR
Pecans	Orchards/Vineyards	11.83	570	Saah 2016 (Table 7)	DWR
Peppers (Chili, Bell, etc.)	Cropland	—	1,372	Assumed to be zero because herbaceous material is removed	DWR
Perennial Grassland	Grassland	1.42	4,860	Brown et al. 2004 (Page 17)	CAL FIRE FRAP
Pinyon-Juniper	Forest	4.8	137,286	Fusco et al. 2019[1]: Figure 1 & Table 2	CAL FIRE FRAP
Pistachios	Orchards/Vineyards	11.83	146,557	Saah 2016 (Table 7)	DWR
Plums	Orchards/Vineyards	6.18	12	Saah 2016 (Table 7) - assuming defruited avocado values	DWR

Detailed Land Cover Classification	General Land Cover Category	Per-Unit Biomass Carbon (MT C/acre)	Total Acres	Per Unit Biomass Carbon Data Source & Assumption	Spatial Data Source
Pomegranates	Cropland	2.1	8,703	USGS 2012 (Table 5.3)	DWR
Ponderosa Pine	Forest	50.96	40,265	USGS 2012 (Table 5.3)	CAL FIRE FRAP
Potatoes	Cropland	—	17,501	Assumed to be zero because herbaceous material is removed	DWR
Riverine	Wetland	7.34	46,449	USGS 2012 (Table 5.3)	CAL FIRE FRAP & NWI
Safflower	Cropland	—	256	Assumed to be zero because herbaceous material is removed	DWR
Sagebrush	Shrubland	1.24	79,774	Fusco et al. 2019[1]: Figure 1 & Table 2	CAL FIRE FRAP
Saline Emergent Wetland	Wetland	7.34	941	USGS 2012 (Table 5.3)	CAL FIRE FRAP
Sierran Mixed Conifer	Forest	50.96	61,847	USGS 2012 (Table 5.3)	CAL FIRE FRAP
Strawberries	Cropland	—	11	Assumed to be zero because herbaceous material is removed	DWR
Subalpine Conifer	Forest	50.96	34	USGS 2012 (Table 5.3)	CAL FIRE FRAP
Subtropical Fruits Misc.	Cropland	2.1	34	USGS 2012 (Table 5.3)	DWR
Sweet Potatoes	Cropland	—	1,201	Assumed to be zero because herbaceous material is removed	DWR
Tomatoes	Cropland	—	8,379	Assumed to be zero because herbaceous material is removed	DWR
Truck Crops - Misc.	Cropland	2.1	4,790	USGS 2012 (Table 5.3)	DWR
Urban	Urban	—	77,079	N/A	CAL FIRE FRAP
Urban - Unspecified Residential, Commercial, Industrial	Urban	—	167,314	N/A	DWR
Urban Landscape - Golf Course Irrigated	Urban	—	1,448	N/A	DWR
Valley Foothill Riparian	Wetland	45.72	11,764	Dybala et al. 2018 (Table 3)	CAL FIRE FRAP
Valley Oak Woodland	Oak Woodland	10.12	8,231	Gaman 2008 (Table 4)	CAL FIRE FRAP
Vineyard	Orchards/Vineyards	2.63	5,865	Williams et al. 2020	CAL FIRE FRAP
Vineyards - No Subclass	Orchards/Vineyards	2.63	79,682	Williams et al. 2020	DWR
Walnuts	Orchards/Vineyards	11.83	1,301	Saah 2016 (Table 7) - assuming defruited avocado values	DWR
Wet Meadow	Wetland	7.34	1,052	USGS 2012 (Table 5.3)	CAL FIRE FRAP
Wheat	Cropland	2.1	6,332	USGS 2012 (Table 5.3)	DWR
White Fir	Forest	50.96	2,621	USGS 2012 (Table 5.3)	CAL FIRE FRAP
Young Perennials	Cropland	2.1	14,963	USGS 2012 (Table 5.3)	DWR

Notes: [1]Note that the per-unit biomass values from these sources do not account for root carbon. C = carbon; CAL FIRE = California Department of Fire Protection and Forestry; DWR = Department of Water Resources; FRAP = Fire and Resource Assessment Program; gSSURGO = Gridded Soil Survey Geographic Database; MT = metric tons; NWI = National Wetlands Inventory; USGS = US Geological Survey.

Source: Prepared by Ascent in 2025.

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Appendix B

Baseline Carbon Stock
Estimates by Jurisdiction and General
Land Cover Categories

Arvin

Table B-1 Arvin Baseline Biomass and Soil Carbon

Land Cover Type	Biomass Carbon (MT C)	Soil Carbon[1] (MT C)	Total Carbon (MT C)
Cropland	1,319	7,325	8,644
Orchards/Vineyards	585	621	1,206
Other	—	246	246
Urban	—	5,524	5,524
Water	—	51	51
Wetland	762	212	974
Arvin Total	**2,666**	**13,980**	**16,646**

Notes: C = carbon; MT = metric tons.

[1] Soil carbon (soil organic carbon) includes carbon held up to 50 centimeters deep.

Source: Analysis completed by Ascent in 2025.

Bakersfield

Table B-2 Bakersfield Baseline Biomass and Soil Carbon

Land Cover Type	Biomass Carbon (MT C)	Soil Carbon[1] (MT C)	Total Carbon (MT C)
Barren	—	1,367	1,367
Cropland	24,968	129,898	154,866
Desert	2,321	14,227	16,547
Grassland	17,485	70,633	88,117
Orchards/Vineyards	63,921	30,501	94,422
Other	—	5,925	5,925
Shrubland	54	24	78
Urban	—	263,277	263,277
Water	—	4,890	4,890
Wetland	43,145	14,267	57,412
Bakersfield Total	**151,893**	**535,009**	**686,902**

Notes: C = carbon; MT = metric tons.

[1] Soil carbon (soil organic carbon) includes carbon held up to 50 centimeters deep.

Source: Analysis completed by Ascent in 2025.

California City

Table B-3 California City Baseline Biomass and Soil Carbon

Land Cover Type	Biomass Carbon (MT C)	Soil Carbon[1] (MT C)	Total Carbon (MT C)
Barren	—	10	10
Desert	143,896	718,247	862,143
Grassland	2,253	13,400	15,653
Shrubland	158	877	1,035
Urban	—	72,207	72,207
Water	—	601	601
Wetland	14,237	14,714	28,952
California City Total	**160,544**	**820,056**	**980,601**

Notes: C = carbon; MT = metric tons.

[1] Soil carbon (soil organic carbon) includes carbon held up to 50 centimeters deep. Note that 0.02 percent of California City's soil carbon data was either not available or not surveyed, as noted in the gSSURGO database.

Source: Analysis completed by Ascent in 2025.

Delano

Table B-4 Delano Baseline Biomass and Soil Carbon

Land Cover Type	Biomass Carbon (MT C)	Soil Carbon[1] (MT C)	Total Carbon (MT C)
Cropland	4,496	10,300	14,796
Grassland	1,271	2,126	3,397
Orchards/Vineyards	17,556	8,584	26,140
Other	—	196	196
Urban	—	16,322	16,322
Water	—	91	91
Wetland	2,245	789	3,034
Delano Total	**25,569**	**38,408**	**63,976**

Notes: C = carbon; MT = metric tons.

[1] Soil carbon (soil organic carbon) includes carbon held up to 50 centimeters deep.

Source: Analysis completed by Ascent in 2025.

Maricopa

Table B-5 Maricopa Baseline Biomass and Soil Carbon

Land Cover Type	Biomass Carbon (MT C)	Soil Carbon[1] (MT C)	Total Carbon (MT C)
Cropland	68	177	246
Desert	783	3,543	4,326
Urban	—	1,741	1,741
Wetland	125	104	229
Maricopa Total	**977**	**5,565**	**6,542**

Notes: C = carbon; MT = metric tons.

[1] Soil carbon (soil organic carbon) includes carbon held up to 50 centimeters deep.

Source: Analysis completed by Ascent in 2025.

McFarland

Table B-6 McFarland Baseline Biomass and Soil Carbon

Land Cover Type	Biomass Carbon (MT C)	Soil Carbon[1] (MT C)	Total Carbon (MT C)
Barren	—	65	65
Cropland	1,362	8,401	9,763
Orchards/Vineyards	9,925	16,876	26,802
Other	—	1,815	1,815
Urban	—	12,956	12,956
Water	—	129	129
Wetland	8	12	20
McFarland Total	**11,149**	**40,254**	**51,403**

Notes: C = carbon; MT = metric tons.

[1] Soil carbon (soil organic carbon) includes carbon held up to 50 centimeters deep.

Source: Analysis completed by Ascent in 2025.

Ridgecrest

Table B-7 Ridgecrest Baseline Biomass and Soil Carbon

Land Cover Type	Biomass Carbon (MT C)	Soil Carbon[1] (MT C)	Total Carbon (MT C)
Barren	—	—	—
Cropland	67	—	67
Desert	5,718	—	5,718
Grassland	43	—	43
Other	—	—	—
Urban	—	—	—
Water	—	—	—
Wetland	1,003	—	1,003
Ridgecrest Total	**6,830**	**—**	**6,830**

Notes: C = carbon; MT = metric tons.

[1] Soil carbon (soil organic carbon) includes carbon held up to 50 centimeters deep. Soil carbon data for Ridgecrest is shown to be not available in the gSSURGO database.

Source: Analysis completed by Ascent in 2025.

Shafter

Table B-8 Shafter Baseline Biomass and Soil Carbon

Land Cover Type	Biomass Carbon (MT C)	Soil Carbon[1] (MT C)	Total Carbon (MT C)
Cropland	5,750	23,834	29,584
Desert	3	3	6
Grassland	1	—	1
Orchards/Vineyards	124,824	43,360	168,184
Other	—	1,983	1,983
Urban	—	14,906	14,906
Water	—	213	213
Wetland	2,008	774	2,783
Shafter Total	**132,587**	**85,073**	**217,660**

Notes: C = carbon; MT = metric tons.

[1] Soil carbon (soil organic carbon) includes carbon held up to 50 centimeters deep.

Source: Analysis completed by Ascent in 2025.

Taft

Table B-9 Taft Baseline Biomass and Soil Carbon

Land Cover Type	Biomass Carbon (MT C)	Soil Carbon[1] (MT C)	Total Carbon (MT C)
Cropland	599	2,156	2,756
Desert	8,717	62,089	70,805
Grassland	455	2,557	3,012
Other	—	72	72
Urban	—	11,246	11,246
Water	—	838	838
Wetland	1,238	1,395	2,633
Taft Total	**11,009**	**80,353**	**91,362**

Notes: C = carbon; MT = metric tons.

[1] Soil carbon (soil organic carbon) includes carbon held up to 50 centimeters deep.

Source: Analysis completed by Ascent in 2025.

Tehachapi

Table B-10 Tehachapi Baseline Biomass and Soil Carbon

Land Cover Type	Biomass Carbon (MT C)	Soil Carbon[1] (MT C)	Total Carbon (MT C)
Barren	—	106	106
Cropland	366	6,758	7,125
Forest	3,724	263	3,987
Grassland	3,558	32,607	36,165
Oak Woodland	1,495	2,939	4,435
Orchards/Vineyards	14	20	34
Other	—	139	139
Shrubland	802	7,693	8,496
Urban	—	36,525	36,525
Water	—	781	781
Wetland	1,428	1,235	2,663
Tehachapi Total	**11,388**	**89,067**	**100,456**

Notes: C = carbon; MT = metric tons.

[1] Soil carbon (soil organic carbon) includes carbon held up to 50 centimeters deep.

Source: Analysis completed by Ascent in 2025.

Wasco

Table B-11 Wasco Baseline Biomass and Soil Carbon

Land Cover Type	Biomass Carbon (MT C)	Soil Carbon[1] (MT C)	Total Carbon (MT C)
Cropland	2,607	4,955	7,562
Grassland	8	39	47
Orchards/Vineyards	18,088	7,478	25,566
Other	—	812	812
Urban	—	7,126	7,126
Water	—	227	227
Wetland	277	36	313
Wasco Total	**20,980**	**20,673**	**41,653**

Notes: C = carbon; MT = metric tons.

[1] Soil carbon (soil organic carbon) includes carbon held up to 50 centimeters deep.

Source: Analysis completed by Ascent in 2025.

Unincorporated Kern County

Table B-12 Unincorporated Kern County Baseline Biomass and Soil Carbon

Land Cover Type	Biomass Carbon (MT C)	Soil Carbon[1] (MT C)	Total Carbon (MT C)
Barren	—	160,506	160,506
Cropland	739,057	4,923,182	5,662,239
Desert	1,587,294	5,169,672	6,756,966
Forest	19,738,044	5,921,250	25,659,294
Grassland	1,486,391	9,973,033	11,459,424
Oak Woodland	1,833,984	3,811,397	5,645,382
Orchards/Vineyards	4,552,081	3,464,124	8,016,205
Other	—	405,709	405,709
Shrubland	1,990,221	2,998,050	4,988,271
Urban	—	972,794	972,794
Water	—	162,790	162,790
Wetland	1,076,408	751,496	1,827,905
Unincorporated Kern County Total	33,003,480	38,714,004	71,717,484

Notes: C = carbon; MT = metric tons.

[1] Soil carbon (soil organic carbon) includes carbon held up to 50 centimeters deep. Note that 8.7 percent of the unincorporated county's soil carbon data was either not available or not surveyed, as noted in the gSSURGO database.

Source: Analysis completed by Ascent in 2025.