Please adjust your screen reader settings to recognize underline and strikethrough text.

## Greenhouse Gas Emissions

This section presents a summary of regulations and policies applicable to greenhouse gas (GHG) emissions; a review of climate change science and GHG sources in California; quantification of GHG emissions associated with treatment activities implemented under the CalVTP; and a discussion about the CalVTP’s contribution to global climate change. In addition, mitigation measures are included to reduce the CalVTP’s contribution to climate change.

Comments on the Notice of Preparation related to GHG emissions included concerns about GHG emissions from prescribed burning, consistency with statewide GHG reduction goals specified in AB 32 (Statutes of 2006), accounting for loss of below-ground carbon sequestration in chaparral communities, and a request for discussion of the net impacts of treatment activities on long-term GHG emissions (see Appendix A). These are addressed in Section 3.4.3, “Environmental Impacts and Mitigation Measures.”

### Regulatory Setting

GHG emissions in California, including within the treatable landscape, are regulated by federal, state, regional, and local government agencies. These agencies aim to reduce GHG emissions to lessen the impact of global climate change through legislation, planning, policy-making, education, and a variety of programs. The regulations and the agencies responsible for improving regulating GHGs within the treatable landscape are discussed below.

#### Federal

In *Massachusetts et al. v. Environmental Protection Agency et al.*, [549](https://en.wikipedia.org/wiki/List_of_United_States_Supreme_Court_cases,_volume_549) [U.S.](https://en.wikipedia.org/wiki/United_States_Reports) 497 (2007), the Supreme Court of the United States ruled that carbon dioxide (CO2) fit within the definition of “air pollutant” under the federal Clean Air Act and that the U.S. Environmental Protection Agency (EPA) has the statutory authority to regulate GHG emissions. Treatment activities under the CalVTP have the potential to generate GHG emissions through use of off-road equipment, machine-powered hand tools, helicopters, vehicles for worker commute, trucks for materials delivery and hauling, and prescribed burning.

In October 2012, EPA and the National Highway Traffic Safety Administration, issued final rules to further reduce GHG emissions and improve corporate average fuel economy (CAFE) standards for light-duty vehicles for model years 2017 and beyond (77 Federal Register [FR] 62624). These rules would increase fuel economy to the equivalent of 54.5 miles per gallon, limiting vehicle emissions to 163 grams of CO2 per mile for the fleet of cars and light-duty trucks by model year 2025 (77 FR 62630). However, on April 2, 2018, the EPA administrator announced a final determination that the current standards are not appropriate and should be revised. On August 2, 2018, the U.S. Department of Transportation and EPA proposed the Safer Affordable Fuel-Efficient Vehicles Rule, which would amend existing CAFE and tailpipe CO2 emissions standards for passenger cars and light trucks and establish new standards covering model years 2021 through 2026. The proposal would retain the model year 2020 standards for both programs through model year 2026 (NHTSA 2018). Vehicles used for worker commute and hauling equipment for treatments implemented under the CalVTP would be subject to CAFE standards.

#### State

##### Statewide GHG Emission Targets and the Climate Change Scoping Plan

Reducing GHG emissions in California has been the focus of state government policy for approximately two decades (State of California 2018). GHG emission targets established by the state legislature include reducing statewide GHG emissions to 1990 levels by 2020 (Assembly Bill [AB] 32, Statutes of 2006) and to 40 percent below 1990 levels by 2030 (Senate Bill [SB] 32, Statutes of 2016). Executive Order S-3-05 calls for statewide GHG emissions to be reduced to 80 percent below 1990 levels by 2050. Executive Order B-55-18 calls for California to achieve carbon neutrality by 2045 and achieve and maintain net negative GHG emissions thereafter. These targets are in line with the scientifically established levels needed in the U.S. to limit the rise in global temperature to no more than 2 degrees Celsius, the warming threshold at which major climate disruptions, such as super droughts and rising sea levels, are projected. These targets also are consistent with efforts to further limit the temperature increase to 1.5 degrees Celsius (United Nations 2015:3).

*California’s 2017 Climate Change Scoping Plan* (2017 Scoping Plan), prepared by the California Air Resources Board (CARB), outlines the main strategies California will implement to achieve the legislated GHG emission target for 2030 and “substantially advance toward our 2050 climate goals” (CARB 2017a:1, 3, 5, 20, 25–26). It identifies the reductions needed by each GHG emission sector (e.g., transportation, industry, electricity generation, agriculture, commercial and residential, pollutants with high global warming potential, and recycling and waste). Statewide GHG emission reduction targets and the 2017 Scoping Plan are applicable to the CalVTP because GHG emissions would be generated by treatment activity implemented under the CalVTP. Furthermore, an objective of the CalVTP is to contribute to meeting California’s GHG emission goals by managing forests and other natural and working lands as a net carbon sink, consistent with the 2017 Scoping Plan.

The 2017 Scoping Plan identifies a 15–20 million metric tons of carbon dioxide equivalent (MMTCO2e) reduction from business-as-usual emissions from the natural and working lands sector to meet the state’s 2030 target. This section includes lands used for agriculture, grazing, and forestry. This reduction would be achieved through carbon sequestration in trees, other vegetation, soils, and aquatic sediment (CARB 2017a:14). Recent trends indicate that from 2001 to 2010, approximately 120 million metric tons of carbon was lost through wildland fire. California’s climate objective for natural and working lands is to maintain them as a carbon sink (i.e., net zero or negative GHG emissions) and, where appropriate, minimize the net GHG and black carbon emissions associated with management, biomass utilization, and wildfire events. To achieve this objective, the *2017 Scoping Plan* focuses on continued research and development to advance the state of science on carbon dynamics, develop a natural and working lands inventory, and directs the California Natural Resources Agency (CNRA) and other state agencies to complete a Natural and Working Lands Climate Change Implementation Plan consistent with the carbon neutrality goal of Executive Order B-55-18. Specifically, the *2017 Scoping Plan* acknowledges the role of fuel reduction treatments and prescribed burns in managing natural and working lands to reduce GHG emissions (CARB 2017a:87). Development of the Natural and Working Lands Climate Change Implementation Plan is discussed in greater detail below.

##### Draft 2030 Natural and Working Lands Implementation Plan

In a joint, interagency effort, the California Environmental Protection Agency (CalEPA), California Department of Food and Agriculture (CDFA), CNRA, CARB, and California Strategic Growth Council (SGC) released the *Draft California 2030 Natural and Working Lands Climate Change Implementation Plan* in January 2019. The draft plan is specific to the natural and working lands sector, which includes farmland, rangeland, forests, grasslands, wetlands, riparian areas, seagrass, and urban green space. The draft plan addresses the carbon flux from this sector, including the ever-dynamic changes in both GHG emissions and carbon sequestration associated with the management of these lands. It is estimated that California’s natural and working lands lost approximately 170 MMT of carbon between 2001 and 2014. Most of these losses were due to wildfire. This loss of carbon is equivalent to cumulative emissions of 630 MMTCO2e of previously sequestered carbon removed from the land over the same period (applying the atomic weight ratio of 3.67 for carbon to CO2). However, not all the carbon lost was emitted to the atmosphere as CO2. Some carbon leaves the land but persists in durable wood products. Other carbon losses are part of normal ecosystem function (CalEPA et al. 2019:9). The draft plan serves as a multi-disciplinary approach to conserve and maintain a resilient natural and working lands sector that will gradually shift the natural and working lands sector from being a net carbon emitter to being a net carbon sink, while also improving air quality, water quality, wildlife habitat, recreation, and providing other benefits. The draft plan sets goals for, at a minimum, increasing the rate of state-funded soil conservation practices fivefold, doubling the rate of state-funded forest management and restoration efforts, tripling the rate of state-funded oak woodland and riparian reforestation, and doubling the rate of state-funded wetland and seagrass restoration (CalEPA et al. 2019:13). The measures included in the draft plan are projected to result in cumulative emissions of 21.6 to 56.8 MMTCO2e by 2030 and cumulative emissions reduction of -36.6 to -11.7 MMTCO2e by 2045 (CalEPA et al. 2019:13-14).

The draft plan indicates that these GHG reductions will be met through a variety of practices under four broad pathways: conservation, forestry, restoration, and agriculture. One suite of practices is called, “Forestry – Improved forest health and reduced wildfire severity.” This suite of practices includes prescribed fire, mechanical thinning, and understory treatment. It aims to “restore health and resilience to overstocked forests and prevent carbon losses from severe wildfire, disease, and pests.”

The implementation goals for this practice includes 23,800–73,300 acres of prescribed fire per year, 59,000–73,000 acres of thinning per year, and 23,500–25,300 acres of understory treatment per year (CalEPA et al. 2019:18). CAL FIRE is identified as one of the implementing agencies of this practice. The draft plan notes that, although fuel reduction treatments involve near-term carbon costs, they result in long-term net carbon benefits in California. Fuel reduction activities, such as mechanical thinning and prescribed fire, reduce stand densities and fuel loads, restore the structure and composition of forest ecosystems, and lower the potential for damaging, high-severity fire, which is currently the primary cause of GHG emissions and carbon loss from the land sector. In the long-term, these activities are expected to result in climate benefits and healthier, more stable, and more resilient forests (CalEPA et al. 2019:14) An objective of the CalVTP is to contribute to meeting California’s GHG emission goals by managing forests and other natural and working lands as a net carbon sink, which would be consistent with the *Draft California 2030 Natural and Working Lands Climate Change Implementation Plan*.

##### California Forest Carbon Plan

In January 2017, CAL FIRE, in coordination with CNRA and CalEPA, released the *California Forest Carbon Plan*. The plan serves to implement policies to meet the forest carbon goals embodied in the *2017 Scoping Plan* and is relevant to the CalVTP because some treatment activities would be implemented in forests and because an objective of the CalVTP is to contribute to meeting California’s GHG emission goals by managing forests and other natural and working lands as a net carbon sink, consistent with the *California Forest Carbon Plan*. Currently, much of California’s forests are unhealthy, supporting unnatural density that lack resilience to drought, disease, insect and parasite infestation, and large, severe wildfire. The plan describes forest conditions across California; provides a projection of future conditions in consideration of climate change; and describes goals and related specific actions that may be taken to improve forest health, including resilient carbon sequestration; and provides principles and policies to guide and support these actions (CAL FIRE, CNRA, and CalEPA 2017). Specifically, the plan identifies the following targets for forest restoration and treatment activities on non-federal forest lands:

* by 2020, double the current rate of forest restoration and fuels reduction treatments, including prescribed fire, through the CAL FIRE Vegetation Treatment Program from the recent average of 17,500 acres per year to 35,000 acres per year;
* by 2030, increase forest restoration and fuels treatments, including mechanical thinning and prescribed burning, from the current rate of approximately 17,500 acres per year to 60,000 acres per year. This target is based on CAL FIRE’s determination of an operationally feasible increase in activity through its Vegetation Treatment Program;
* through CAL FIRE’s Forest Practice Program and the Timber Regulation and Forest Restoration Program, ensure that timber operations conducted under the Forest Practice Act and Rules contribute to the achievement of healthy and resilient forests that are net sinks of carbon, with due consideration given to all forest carbon pools;
* promote increasing the acreage of forest carbon projects and remove barriers to their implementation; and
* to address forest health and resiliency needs identified statewide on nonfederal lands, CAL FIRE has estimated that the rate of treatment of all types would need to be increased to approximately 500,000 acres per year to make an ecologically meaningful difference at a landscape scale. This estimate is based on consideration of ecological need and predictions of capacity to implement treatments. It should be considered an aspirational target to work toward. This goal is achievable with increased resources and expanded markets for woody materials. These treatments include those that generate revenue from harvest materials, such as commercial thinning and regeneration harvests.

##### Forest Management Task Force

[California’s](file:///\\sierra\shares\Projects\2018\18010126.01%20-%20CAL%20FIRE%20-%20Veg%20Treatment%20Program%20PEIR\4_Deliverables%20in%20progress\2-Admin%20Draft%20PEIR\01_Prepared%20by%20Authors\California's) Forest Management Task Force is an entity organized to protect the environmental quality, public health, and economic benefits provided by healthy forests. Its goals include, but are not limited to, implementing Executive Order B-52-18, improve and enhance forest health and resiliency, minimize regulatory barriers for prescribed fire and fuels reduction projects, and improve public education regarding the benefits of a healthy forest (Forest Management Task Force 2019). The Forest Management Task Force is relevant to the CalVTP because objectives of the CalVTP include increasing the use of prescribed burning as a vegetation treatment tool and improving ecosystem health in fire-adapted habitats.

##### Assembly Bill 1504 Forest Carbon Inventory

AB 1504 (Statutes of 2010) emphasizes the critical role California’s forests play in carbon sequestration and formalizes the Board of Forestry and Fire Protection’s (Board) responsibility in meeting or exceeding the statewide GHG emission reduction targets for the forest sector. AB 1504 requires the Board to ensure that its rules and regulations that govern the harvesting of commercial forest tree species consider the capacity of forest resources to sequester carbon sufficient to meet or exceed the state’s GHG reduction requirements for the forestry sector by 2020. The initial AB 32 Scoping Plan adopted by CARB in 2008 set a goal of maintaining the forest carbon sink with a net annual sequestration rate of 5 MMTCO2e/year (CARB 2008:64), a rate that was reiterated in the *2017 Scoping Plan* (CARB 2017:3).

CAL FIRE’s Fire and Resource Assessment Program (FRAP) develops an annual Forest Ecosystem and Harvested Wood Product Carbon Inventory (Forest Carbon Inventory) in collaboration with the U.S. Forest Service’s (USFS) Forest Inventory and Analysis Program (FIA), USFS Pacific Northwest Research Station (PNW), and the University of Montana Bureau of Business and Economic Research (BBER). This annual Forest Carbon Inventory report assists the Board in assessing whether the goal of sequestering 5 MMTCO2e/year of forest carbon is being met. This report also informs the goals identified in the *California Forest Carbon Plan*, discussed above. The annual Forest Carbon Inventory has been produced for 2015, 2016, and 2017.

Forest ecosystem carbon estimates for California are based on plot re-measurement of the same trees over time. This method captures and quantifies growth, tree removal, and tree mortality. Harvested wood product carbon estimates are based on a model created by BBER and the USFS, which follows annual harvest volumes through their timber product class allocation (e.g., softwood sawlogs, softwood pulpwood) and primary product allocation (e.g., softwood lumber, softwood plywood). Among other things, the model estimates how much carbon remains stored in durable wood products in use and at solid waste disposal sites. According to the most recent Forest Carbon Inventory (Christensen et al. 2018), California’s forests are sequestering 27.9 MMTCO2e/year, which exceeds the net annual sequestration target of 5 MMTCO2e.

##### Transportation-Related Standards and Regulations

The state has also passed legislation addressing GHG emissions associated with industrial sources, transportation, electricity generation, and energy consumption, as summarized below. Treatment activities under the CalVTP would involve fuel consumption and the use of on-road and off-road vehicles, which are subject to transportation-related standards and regulations.

As part of its Advanced Clean Cars program, CARB established more stringent GHG emission standards and fuel efficiency standards for fossil fuel–powered on-road vehicles. In addition, the program’s zero-emission vehicle (ZEV) regulation requires battery, fuel cell, and plug-in hybrid electric vehicles to account for up to 15 percent of California’s new vehicle sales by 2025 (CARB 2016a:15). By 2025, when the rules will be fully implemented, GHG emissions from the statewide fleet of new cars and light-duty trucks will be reduced by 34 percent and cars will emit 75 percent less smog-forming pollution than the statewide fleet in 2016 (CARB 2016b:1).

Executive Order B-48-18, signed into law in January 2018, requires all state entities to work with the private sector to have at least 5 million ZEVs on the road by 2030, as well as 200 hydrogen fueling stations and 250,000 electric vehicle–charging stations installed by 2025. It specifies that 10,000 of these charging stations must be direct-current fast chargers.

CARB adopted the Low Carbon Fuel Standard (LCFS) in 2007 to reduce the carbon intensity of California’s transportation fuels. The LCFS applies to fuels used by on-road motor vehicles and by off-road vehicles, including construction equipment (Wade, pers. comm., 2017). In September 2018, CARB approved amendments to the LCFS to require a 20 percent reduction in carbon intensity by 2030 to further the state towards the 2030 GHG reduction target. The staff report that accompanied the amendments estimated that from January to March 2018, biomass-based diesel averaged 14 percent of every gallon of diesel sold in the state and renewable natural gas (e.g., biogas) was 68 percent of all fuel used in natural gas vehicles (CARB 2018a:EX-1).

##### California’s Climate Adaptation Strategy

California’s overall plan for climate adaptation is expressed in *Safeguarding California Plan: 2018 Update* (CNRA 2018). The plan provides policy guidance for state decision-makers and is part of continuing efforts to reduce impacts and prepare for climate risks. The plan includes 76 policy recommendations across 11 policy sectors. One of the key sectors is forestry, which includes: restoring and protecting forest ecosystem function by reintroducing fire and improving management, protecting California’s forest base, and enhancing watershed health; supporting community resilience by rebuilding California’s forest management workforce, expanding the extent and health of California’s urban tree canopy, and advancing fire preparedness; and fostering creative solutions to sustainably use biomass from fuels reduction activities and to better understand climate trends in forests via research and monitoring. Goal F-1 of the plan is to restore fire as a core ecological process, complemented by fuels reduction, working forests, and thinning to enhance forest health, resilience, and long-term carbon stability (CNRA 2018:4, 116–117, 127). The plan is relevant to the CalVTP because objectives of the CalVTP include increasing the use of prescribed burning as a vegetation treatment tool, improving ecosystem health in fire-adapted habitats, and contributing to meeting California’s GHG emission goals by managing forests and other natural and working lands as a net carbon sink.

#### Local

When state agencies, including CAL FIRE, are conducting governmental activities under the authority of state law or the State Constitution, in this case, treatments implemented under the proposed CalVTP, they are exempt from local government plans, policies, and ordinances (unless a constitutional provision or statute directs otherwise). Nonetheless, CAL FIRE voluntarily seeks to operate consistently with local governance to the extent the project is subject to them. This is reflected in SPR AD-3.

Given its statewide extent and the possible number of local and regional responsible agencies, this Program EIR does not identify potentially applicable local government plans, policies, and ordinances. Types of local regulations relevant to GHGs may include climate action plans. Climate action plans (CAPs) are comprehensive roadmaps that outline the specific activities that a city, county, or agency will undertake to reduce its GHG emissions. CAPs build upon the information gathered by GHG inventories and focus on those activities that can achieve the greatest emissions reductions in the most cost-effective manner. CAPs in California are designed to align with the statewide targets mandated by AB 32 and SB 32 (discussed above). CAL FIRE has not prepared a CAP that addresses the GHG emissions associated with its operations. This Program EIR assumes that any vegetation treatments proposed by local or regional agencies under the CalVTP would be consistent with local plans, policies, and ordinances, as required by SPR AD-3.

### Environmental Setting

#### Physical Scientific Basis of Greenhouse Gas and Climate Change

Certain gases in the earth’s atmosphere, classified as GHGs, play a critical role in determining the earth’s surface temperature. Solar radiation enters the atmosphere from space. A portion of the radiation is absorbed by the earth’s surface, and a smaller portion of this radiation is reflected toward space. The absorbed radiation is then emitted from the earth as low-frequency infrared radiation. The frequencies at which bodies emit radiation are proportional to temperature. The earth has a much lower temperature than the sun; therefore, the earth emits lower frequency radiation. Most solar radiation passes through GHGs; however, infrared radiation is absorbed by these gases. As a result, radiation that otherwise would have escaped back into space is instead “trapped,” resulting in a warming of the atmosphere. This phenomenon, known as the greenhouse effect, is responsible for maintaining a habitable climate on earth.

Prominent GHGs contributing to the greenhouse effect are CO2, methane, nitrous oxide, hydrofluorocarbons, perfluorocarbons, and sulfur hexafluoride. Human-generated emissions of these GHGs in excess of natural ambient concentrations are found to be responsible for intensifying the greenhouse effect and leading to a trend of unnatural warming of the earth’s climate, known as global climate change or global warming. It is “extremely likely” that more than half of the observed increase in global average surface temperature from 1951 to 2010 was caused by the anthropomorphic increase in GHG concentrations and other anthropomorphic forcing (IPCC 2014:5). This warming is observable considering the 20 hottest years ever recorded occurred within the past thirty years (McKibben 2018).

Climate change is a global problem. GHGs are global pollutants, unlike criteria air pollutants and toxic air contaminants, which are pollutants of regional and local concern. Whereas most pollutants with localized air quality effects have relatively short atmospheric lifetimes (approximately 1 day), GHGs have long atmospheric lifetimes (1 year to several thousand years). GHGs persist in the atmosphere long enough to be dispersed around the globe. Although the lifetime of any GHG molecule depends on multiple variables and cannot be determined with perfect certainty, it is understood that more CO2 is emitted into the atmosphere than is sequestered by ocean uptake, vegetation, and other forms of sequestration. Of the total annual human-caused CO2 emissions, approximately 55 percent are estimated to be sequestered through ocean and land uptake every year, averaged over the last 50 years, whereas the remaining 45 percent of human-caused CO2 emissions remain stored in the atmosphere (IPCC 2013:467).

The quantity of GHGs in the atmosphere responsible for climate change is not precisely known, but it is enormous. No single project alone would measurably contribute to an incremental change in the global average temperature or to global or local climates or microclimates. From the standpoint of CEQA, GHG impacts relative to global climate change are inherently cumulative.

#### Greenhouse Gas Emission Sources and Sinks

As discussed previously, GHG emissions are attributable in large part to human activities. Emissions of CO2 are byproducts of fossil fuel combustion. Methane, a highly potent GHG, primarily results from off-gassing (the release of chemicals from nonmetallic substances under ambient or greater pressure conditions) and is largely associated with agricultural practices, organic material decomposition in landfills, and the burning of forest fires (Black et al. 2017). Nitrous oxide emissions are largely attributable to agricultural practices and soil management. CO2 sinks, or reservoirs, include vegetation and the ocean, which absorb CO2 through sequestration and dissolution (CO2 dissolving into the water), respectively, two of the most common processes for removing CO2 from the atmosphere.

Because the treatable landscape under the CalVTP spans across the state, the state’s GHG inventory is provided for context. The total GHG inventory for California in 2016 was 429 MMTCO2e (CARB 2018b). This is less than the 2020 target of 431 MMTCO2e equal to the inventory for 1990 (CARB 2018c:1). Table 3.8-1 summarizes the statewide GHG inventory for California.

Table 3.8-1 Statewide GHG Emissions by Economic Sector1

| Sector | Percent |
| --- | --- |
| Transportation | 41 |
| Industrial | 23 |
| Electricity generation (in state) | 10 |
| Electricity generation (imports) | 6 |
| Agriculture | 8 |
| Residential | 7 |
| Commercial | 5 |
| Not specified | <1 |

Source: CARB 2018b

1 The inventory provides estimates of anthropogenic GHG emissions within California, as well as emissions associated with imported electricity; natural sources are not included in the inventory.

##### Existing Levels of Emissions Generated by Wildfires

As shown in Table 3.8-1, transportation, industry, and electricity generation are the largest sectors of anthropogenic GHG emissions. These estimates do not account for GHGs emitted from wildfire or any other sources of GHGs on natural and working lands (besides those generated by agricultural activities). Wildfire has been a pervasive, natural, environmental factor throughout most of the state since before Euro-American settlement of California. It is estimated that approximately 1.8 million hectares (4.4 million acres) burned annually, pre-historically, resulting in high levels of wildfire emissions (Stephens et al. 2007). Table 3.8-2 summarizes CARB’s estimation of GHG emissions associated with wildfire between 2007 and 2017 (CARB 2019a).

Table 3.8-2 Annual GHG Emission Estimates from Wildfire, 2007–20171

| Year | MMTCO2e2 | Aces Burned (million) |
| --- | --- | --- |
| 2007 | 22.8 | 1.04 |
| 2008 | 45.7 | 1.35 |
| 2009 | 9.6 | 0.43 |
| 2010 | 1.4 | 0.09 |
| 2011 | 3.5 | 0.20 |
| 2012 | 15.9 | 0.75 |
| 2013 | 19.2 | 0.56 |
| 2014 | 21.2 | 0.53 |
| 2015 | 22.9 | 0.79 |
| 2016 | 14.4 | 0.55 |
| 2017 | 36.7 | 1.34 |

Notes: MMTCO2e = million metric tons carbon dioxide equivalent

1 There are large uncertainties associated with mapped vegetation types, fuel loading, fuel moisture, burned area, modeled fuel consumption in flaming and smoldering phases, and emission factors. The emission estimates may have an uncertainty of between a factor of 2 to 3 (CARB 2019b:1). The latest estimates from CARB are for 2017.

2 Emissions estimates only account for the emissions of carbon dioxide and do not include emissions of nitrous oxide or methane. Emissions estimates also do not include those GHG emissions associated with firefighting activity (e.g., combustion of fossil fuels by equipment, trucks, and aircraft).

Source: CARB 2019a

As shown in Table 3.8-2, the level of GHGs emitted by wildfires across the state varies from year to year with a statewide average of 19.39 MMTCO2e per year during the 2007–2017 period. Data are not yet available for the state’s 2018 wildfires, which were the largest and most damaging on record. Though CARB has not yet finalized the emissions estimate for 2018, the 2018 wildfires will likely be comparable to other peak years, like 2008. The potential continues for future wildfires of similar or greater intensity and destruction.

##### Existing Levels of Emissions Generated by Vegetation Treatments

As described in Chapter 1, “Introduction” and Section 2.3.1, “Past and Current Treatments,” vegetation treatment currently occurs around the state under several other wildfire risk reduction programs implemented by various federal, state, and local agencies. In 2017–2018, CAL FIRE treated approximately 33,000 acres in California using the same treatment activities as proposed under the CalVTP.

GHG emissions are generated by existing treatment activities. Emissions are generated by mechanical equipment, hand tools, worker commute and haul trips, and from prescribed burning.

#### Effects of Climate Change on wildfire risk

According to the Intergovernmental Panel on Climate Change (IPCC), which was established in 1988 by the World Meteorological Organization and the United Nations Environment Programme, global average temperature will increase by 1.5 degrees Celsius (°C) (2.7 degrees Fahrenheit [°F]) by 2040. This 1.5 °C warming represents a global average indicating that some portions of the earth will experience more dramatic warming than others, and thus the extent of climate change effects on individual regions will vary. Long-term effects of climate change include rising temperatures; changes in precipitation patterns; increased severe weather events such as droughts, heath waves, and hurricanes; and sea-level rise. These effects have the potential to threaten transportation and energy infrastructure, crop production, forests and rangelands, and public health (CNRA 2018:64, 116–117, 127; OPR, CEC, and CNRA 2018:7–14). The effects of climate change will also have an indirect adverse impact on the economy as more severe natural disasters such as frequent and catastrophic wildfires cause expensive, physical damage to communities.

According to California’s Fourth Climate Change Assessment, if global GHGs are reduced at a moderate rate, California will experience average daily high temperatures that are warmer than the historic average by 2.5 °F from 2006 to 2039, by 4.4 °F from 2040 to 2069, and by 5.6 °F from 2070 to 2100. If GHG emissions continue at current rates, then California will experience average daily high temperatures that are warmer than the historic average by 2.7 °F from 2006 to 2039, by 5.8 °F from 2040 to 2069, and by 8.8 °F from 2070 to 2100 (OPR, CEC, and CNRA 2018:5). The potential effects of this warming in California are well documented. Since its previous climate change assessment in 2012, California has experienced several of the most extreme natural events in its recorded history: a severe drought from 2012-2016, an almost non-existent Sierra Nevada winter snowpack in 2014-2015, back-to-back years of the warmest average temperatures, and increasingly large and severe wildfires (OPR, CEC, and CNRA 2018:3).

As discussed in Section 3.17, “Wildfire,” climate change has led to the exacerbation of wildfire conditions in two major ways: earlier spring snowmelt and reduced winter precipitation has resulted in a longer wildfire season, and cycles of heavy precipitation followed by drought conditions increase fuel loading in wet years and reduce moisture-content during droughts. One study estimates that the western U.S. has experienced a doubling of area burned by wildfire due to anthropogenic climate change (Abatzoglou and Williams 2016). These conditions have resulted in the largest, most destructive, and deadliest wildfires on record in California history. Nine of the state’s 10 deadliest wildfires have occurred since 2003 and are listed in Table 3.17-1, “Top 10 California Wildfires.” According to California’s Fourth Climate Change Assessment, *Statewide Summary Report* (2018), if GHG emissions continue to rise, the frequency of extreme wildfires burning over 25,000 acres could increase by 50 percent by 2100 and the average area burned statewide could increase by 77 percent by the end of the century (OPR, CEC, and CNRA 2018). The CalVTP would substantially increase the pace and scale of vegetation treatments in response to increased wildfire risk.

### Impact Analysis and Mitigation Measures

#### Analysis Methodology

State CEQA Guidelines Section 15064 and Appendix G direct a lead agency to consider the following factors when assessing the significance of GHG emissions:

* The extent to which the project may increase or reduce GHG emissions as compared to the existing environmental setting;
* Whether the project emissions exceed a threshold of significance that the lead agency determines applies to the project; and
* The extent to which the project complies with regulations or requirements adopted to implement a statewide, regional, or local plan for the reduction or mitigation of GHG emissions.

This analysis estimates annual GHG emissions directly generated by treatment activities implemented under the CalVTP. Emissions generated by off-road equipment were estimated using emission factors derived from CARB’s web-based OFFROAD2017 model (CARB 2017b). Emissions generated by on-road vehicle trips were estimated using emission factors from the Emission Factor 2014 model (EMFAC2017, Version 1.0.2) (CARB 2017b). Emissions from prescribed burns were estimated using emission factors from published research (Urbanski 2014) and fuel loading consumption rates from NWCG’s *National Wildfire Coordinating Group Smoke Management Guide for Prescribed Fire* (NWCG 2018). Emissions from livestock used in prescribed herbivory treatments were estimated using emission rates for enteric fermentation published in the *2006 IPCC Guidelines for National Greenhouse Gas Inventories* (IPCC 2006). All detailed calculations and assumptions are provided in Appendix AQ-1. The emissions intensity of treatment activities can vary widely according to multiple factors including, but not limited to, the amount of vegetation removed or treated per acre, the maturity of the vegetation, the number of workers and equipment needed for each treatment project, and the types of equipment available. For these reasons, all assumptions involved in the emissions calculations are included in Appendix AQ-1 and all emissions estimates are approximations. In addition to short-term treatment-related emissions, the analysis also acknowledges that treatment activities under the CalVTP are intended to decrease the severity of wildfires over the long-term, resulting in the potential for reduced GHG emissions and increased levels of sequestered carbon; however, the state of the science makes it infeasible to include reliable quantified estimates of potential long-term changes in GHG emissions or carbon sequestration that may indirectly result from these treatments over time.

Although several air districts have established thresholds of significance for GHG emissions, these thresholds are meant for evaluating GHGs associated with land use development projects, including residential, commercial, industrial, and public land uses and facilities. Thus, they are not applicable to evaluation of treatment activities under the proposed CalVTP, which would generate short-term GHG emissions but are expected to result in long-term benefits. No thresholds of significance have been established by an air district, CAL FIRE, or any other government agencies that is aligned with the 2030 statewide GHG target mandated by SB 32 of 2016 and is suitable for the types of GHG-emitting treatment activities proposed under the CalVTP. Thus, this analysis qualitatively evaluates whether the annual GHG emissions generated by treatment activities implemented under the CalVTP would be substantial.

Additionally, this analysis assesses the CalVTP’s consistency with State regulatory programs designed to reduce GHG emissions, especially in regard to the statewide GHG goals mandated by AB 32 of 2006 and SB 32 of 2016. This approach is consistent with one of the pathways to compliance presented in the California Supreme Court ruling, *Center for Biological Diversity v. California Department of Fish and Wildlife (2015)* *62 Cal.4th 204, 229-231.* The CalVTP is evaluated for its consistency with adopted regulations, plans, and policies aimed at reducing GHG emissions, including the *2017 Scoping Plan* (CARB 2017a)*, Draft California 2030 Natural and Working Lands Climate Change Implementation Plan* (CalEPA et al. 2019), and the *California Forest Carbon Plan* (CAL FIRE, CNRA, and CalEPA 2017).

Significance determinations account for the influence of relevant SPRs, which are incorporated into treatment design and listed below.

* **SPR AD-3 Consistency with Local Plans, Policies, and Ordinances**: The project proponent will design and implement the treatment in a manner that is consistent with applicable local plans (e.g., general plans, Community Wildfire Protection Plans, CAL FIRE Unit Fire Plans), policies, and ordinances to the extent the project is subject to them. This SPR applies to all treatment activities and treatment types, including treatment maintenance.
* **SPR AQ-3 Create Burn Plan**: The project proponent will create a burn plan using the CAL FIRE burn plan template for all prescribed burns. The burn plan will include a fire behavior model output of First Order Fire Effects Model and BEHAVE or other fire behavior modeling simulation and that is performed by a qualified fire behavior technical specialist that predicts fire behavior, calculates consumption of fuels, tree mortality, predicted emissions, greenhouse gas emissions, and soil heating. The project proponent will minimize soil burn severity from broadcast burning to reduce the potential for runoff and soil erosion. The burn plan will be created with input from a qualified technician or certified State burn boss. This SPR applies only to prescribed burning treatment activities and all treatment types, including treatment maintenance.
* **SPR GHG-1 Contribute to the AB 1504 Carbon Inventory Process**: The project proponent of treatment projects subject to the AB 1504 process will provide all necessary data about the treatment that is needed by the U.S. Forest Service and FRAP to fulfill requirements of the AB 1504 carbon inventory, and to aid in the ongoing research about the long-term net change in carbon sequestration resulting from treatment activity, including treatment maintenance.

#### thresholds of significance

Global climate change is inherently a cumulative issue. GHG emissions occurring in any location can contribute to global concentrations in the atmosphere in combination with cumulative emissions. Any individual project alone would not substantially change global GHG concentrations. Thresholds of significance are based on Appendix G and Section 15064 of the State CEQA Guidelines, professional judgment, and CEQA case law.

Implementation of the proposed CalVTP would result in a cumulatively considerable contribution to climate change if it would:

* conflict with any applicable plan, policy, or regulation of an agency adopted for the purpose of reducing the emissions of GHGs; or
* generate GHG emissions, either directly or indirectly, that may have a significant impact on the environment.

#### Issues Not Evaluated Further

All issues identified in State CEQA Guidelines Appendix G and listed above under Thresholds of Significance are evaluated below.

#### Impact Analysis

Impact GHG-1: Conflict with Applicable Plan, Policy, or Regulation of an Agency Adopted for the Purpose of Reducing the Emissions of GHGs

The CalVTP would be consistent with applicable plans, policies, and regulations aimed at reducing GHG emissions, including *California’s 2017 Climate Change Scoping Plan*, the *California Forest Carbon Plan*, and *Draft California 2030 Natural and Working Lands Climate Change Implementation Plan*. The purpose of the CalVTP is to reduce wildfire risk, which could reduce GHG emissions and increase carbon sequestration over the long term. This impact would be **less than significant**.

Regulations, plans, and policies aimed at reducing GHG emissions from the natural lands in the treatable landscape of the CalVTP include the *2017 Scoping Plan, Draft California 2030 Natural and Working Lands Climate Change Implementation Plan,* and the *California Forest Carbon Plan*.

As described in Section 3.8.1, “Regulatory Setting,” the *2017 Scoping Plan* lays out the framework for achieving compliance with statewide GHG targets mandated by SB 32 of 2016 (i.e., 40 percent below 1990 levels by 2030). To help meet the statewide target for 2030 the *2017 Scoping Plan* prescribed a 15–20 MMTCO2e reduction from business-as-usual emissions from the natural and working lands sector and determined that this reduction should be achieved through increased carbon sequestration and the reduction of wildfire emissions. The treatment activities implemented under the CalVTP would be consistent with the types of treatments called for in the *2017 Scoping Plan*, acknowledging the important role of fuel reduction treatments and prescribed burns in managing natural and working lands to reduce GHG emissions. For the tree-dominated landscape, SPR GHG-1 requires CAL FIRE to provide annual information to support continued understanding of the role of forests in carbon sequestration.

The *Draft California 2030 Natural and Working Lands Climate Change Implementation Plan* has set a goal for, at a minimum, doubling the rate of state-funded forest management and restoration efforts, which include prescribed burns, mechanical treatments, and understory treatments. Implementation goals are 23,800–73,300 acres of prescribed burns per year, 59,000–73,000 acres of thinning per year, and 23,500–25,300 acres of understory treatment per year. The plan identifies CAL FIRE as one of the implementing agencies of these treatments. The CalVTP aims to substantially increase the pace and scale of vegetation treatments and has set a target of 250,000 acres per year, a pace that it aims to reach by 2024. As stated in Section 2.5.3, “Distribution of Treatment Activities,” the relative distribution of treatment activities is reasonably expected to be 50 percent prescribed burning, 10 percent manual treatments, 20 percent mechanical treatments, 10 percent herbicide treatments, and 10 percent prescribed herbivory, which meets and exceeds the targets set forth in the *Draft California 2030 Natural and Working Lands Climate Change Implementation Plan.* Similarly, the CalVTP would meet the acreage targets for forest restoration and treatment activity levels for nonfederal forest lands set forth in the *California Forest Carbon Plan*.

While the CALAND model is informed by a growing body of literature on the effects of fuels treatment activities on carbon sequestration, the technical documentation supporting the CALAND model acknowledges uncertainty in net carbon effects of vegetation treatments in various landscapes. The model’s technical documentation suggests that more detailed research about wildfire and regeneration of vegetation in tree-, shrub-, and grass-dominated lands is needed to adequately characterize the conditions for reforestation and non-regeneration in the model (Di Vittorio and Simmonds 2018:24).

As stated in Section 2.2, “Objectives of the CalVTP,” one of the objectives of the CalVTP is to be consistent with the *California Forest Carbon Plan*, the *2017 Scoping Plan*, and *Draft California 2030 Natural and Working Lands Climate Change Implementation Plan*. Given that the CalVTP is aligned with the specific goals and strategies called out in these plans, as discussed above, the CalVTP would be consistent with state plans and policies for carbon management in natural and working landscapes. This impact would be **less than significant**.

##### Mitigation Measures

No mitigation is required for this impact.

Impact GHG-2: Generate GHG Emissions through Treatment Activities

Direct GHG emissions from the proposed increase in annual treatment activities conducted under the CalVTP would be substantial, recognizing planned levels of treatment would increase from 33,000 acres to 250,000 acres per year. At the full target rate of 250,000 acres per year, GHG emissions from treatments would amount to an estimated 4.~~,~~051 MMTCO2e annually. Consistent with the goals of the proposed fuel treatments to decrease the occurrence of high-severity wildfires and increase the potential rates of carbon sequestration, implementation of the CalVTP could result in a cumulative net carbon benefit over the long term~~, which is the most relevant timeframe and global context of GHG-caused, climate change–related environmental effects~~. However, there is uncertainty in predicting future wildfire occurrence, emissions, and carbon sequestration rates, which are highly variable depending on many factors. Future wildfire intensities and carbon sequestration in treated areas are the subjects of continued scientific research and debate. To meet CEQA’s mandate of good faith disclosure and acknowledge potential future impacts in light of uncertainties, this GHG impact is classified as **potentially significant**, recognizing the reliability of estimates for direct GHG emissions and the uncertainty of the intended net carbon benefits of reduced wildfire intensity and increased carbon sequestration in treated areas.

Treatment activities implemented under the CalVTP would result in GHG emissions directly generated by off-road equipment, on-road vehicles, machine-powered hand tools, and helicopters; and from the combustion of vegetation. Worker commute trips and hauling of equipment and materials associated with all treatment activities would also directly generate GHG emissions.

Mechanical treatments would be performed with heavy-duty off-road equipment such as wheeled tractors, crawler-type tractors, excavators, feller/bunchers, skidders, chippers, masticators or other specially designed tractors with attached implements designed to selectively cut, uproot, crush/compact, or chop target vegetation.

Manual treatments would typically be conducted by one or two hand crews (i.e., 20–40 crew members) using four to eight chainsaws. Masticators and chippers may also be used at some manual treatment sites to assist with biomass disposition during manual treatments.

The vegetative debris produced by mechanical or manual treatments may be processed into several products: electricity, soil additives and amendments, engineered/composite wood, firewood, paper, densified wood, biochar, and potentially syngas and biofuels. This could result in additional haul truck trips to processing facilities, which would generate additional GHG emissions. Indirect emissions would also be generated through energy use at the facilities that process the raw vegetative debris.

Prescribed herbivory may require intermittent use of an all-terrain vehicle or utility vehicle for herding livestock or transporting temporary fencing. On-road trucks would be used to haul livestock to and from sites where prescribed herbivory would be conducted.

Herbicide application may require all-terrain vehicles or tractors with sprayers. However, few pieces of GHG emission-generating equipment would be required, because herbicides would most frequently be applied by hand.

Prior to implementing a prescribed burn, heavy-duty off-road equipment such as bulldozers, bulldozer transports, and masticators or track chippers may be used to create a fire containment (fuel break) perimeter. Fire engines and water trucks would be stationed on-site as a precautionary measure. Hand tools to ignite the prescribed burn could include drip torches and Terra torches, which run on a blend of diesel fuel and gasoline. A helicopter with a helitorch may be used when a large area needs to be burned or in an area with terrain that has limited accessibility. Combustion of vegetation from prescribed burning would directly produce substantial GHG emissions immediately during treatment. The combustion of vegetation produces smoke, which is composed of a complex mixture of compounds, including CO2 and methane.

As discussed in Chapter 2, “Program Description,” treatment activities would be selected based on several parameters including site-specific characteristics (e.g., types and maturity of vegetation, soil characteristics, terrain, proximity to sensitive areas, topography, accessibility), weather conditions, treatment objectives, cost and available funding, and input from communities. Furthermore, the treatable landscape encompasses many different vegetation types, which can be grouped into three broad categories: grass, shrub, and tree. Given this wide variability over an expansive geographic area, there is no set of “typical” treatment characteristics that can be used to represent each type of treatment activity under the CalVTP. For instance, mechanical treatments conducted in a grass fuel type environment may use mowers, whereas mechanical treatments conducted in a tree fuel type environment may use feller/bunchers. Even the same treatment activity in the same fuel type could also vary. For instance, a mechanical treatment for a WUI fuel reduction treatment in a tree fuel type environment where biomass may be masticated and left in place may use chippers and masticators, whereas a mechanical treatment to establish a fuel break in a tree fuel type environment may use feller/bunchers, skidders, or cut-to-length systems to fell and remove trees.

To provide a general sense of the scale of emissions that may be associated with treatment activities, the rates of GHG emissions associated with each treatment activity (i.e., mechanical treatment, manual treatment, prescribed herbivory, herbicide application, and prescribed burning) in each fuel type (i.e., grass, shrub, tree) are estimated on a per-acre basis using assumptions about the types and number of equipment that would be used by a treatment crew, as well as the number of workers per treatment crew. Treatment activities are subdivided by type because the types of equipment that would be used within each fuel type are distinct. These GHG emission rates are summarized in Table 3.8-3. See Appendix AQ-1 for detailed input parameters and assumptions. Exact GHG emissions for treatment activities conducted under the CalVTP may differ from the hypothetical rates presented in Table 3.8-3 because equipment, crew size, and total acreage for each type of treatment activity could vary widely. However, these rates provide a reasonable approximation of the emissions such activities would generate.

The emission rates presented in Table 3.8-3 do not include emissions generated by trucks hauling equipment or livestock to and from treatment sites at the beginning and end of each treatment because the emissions associated with the transport of equipment and livestock would vary considerably depending on the size of a treatment site and the number of crews working at each site. The emission rates presented in Table 3.8-3 also do not include emissions associated with any hauling or processing of biomass, which may occur as part of some manual and mechanical treatment activities as conditions warrant. As discussed in Section 2.5.2, “Description of Treatment Activities,” the percentage of vegetation hauled to biomass facilities for energy generation is expected to increase over time. These emissions are not quantified due to the high level of uncertainty about what types of processing-related activities would occur and the distances feedstock would be hauled. Additionally, new biomass processing facilities that would require a discretionary decision made by a lead agency would be subject to its own CEQA review.

Table 3.8-3 Greenhouse Gas Emissions Directly Associated with Treatment Activity

|  | Direct GHG Emissions per Acre Treated (MTCO2e/acre) |
| --- | --- |
| Prescribed Burning |  |
| Tree Fuel Type | 63.15 |
| Shrub Fuel Type | 16.15 |
| Grass Fuel Type | 7.90 |
| Mechanical Treatment |  |
| Tree Fuel Type | 0.92 |
| Shrub Fuel Type | 0.29 |
| Grass Fuel Type | 0.07 |
| Manual Treatment |  |
| Tree Fuel Type | 0.69 |
| Shrub Fuel Type | 0.40 |
| Grass Fuel Type | <0.01 |
| Prescribed Herbivory |  |
| Tree Fuel Type | 0.08 |
| Shrub Fuel Type | 0.55 |
| Grass Fuel Type | 0.55 |
| Herbicide Application |  |
| Tree Fuel Type | 0.02 |
| Shrub Fuel Type | 0.01 |
| Grass Fuel Type | <0.01 |

Notes: MTCO2e/acre = metric tons of carbon dioxide-equivalent per acre

1. Emissions estimates do not include emissions generated by trucks hauling equipment and livestock to and from treatment sites at the beginning and end of each treatment.

2 More than one type of treatment may be performed on the same land in the same year. For example, manual treatment or herbicide application may be conducted prior to a prescribed burn.

3. These emission estimates do not account for any emissions associated with the removal of vegetative biomass from treatments sites and any processing activity that may occur thereafter, including potential use as feed stock for a biomass power facility, composting, or chipping and mulching applications.

Source: See Appendix AQ-1 for detailed calculations and assumptions.

As shown in Table 3.8-3, prescribed burning, whether broadcast burning or pile burning, would be the most GHG-intensive treatment activity on a per-ace basis. This is because most of the carbon contained in fuels subject to prescribed burns is directly emitted into the air as either CO2 or particulate matter, rather than staying in a sequestered state for an extended period after it is piled, chipped, masticated, killed with herbicide, digested by livestock, spread across the ground, and/or hauled offsite to be used as mulch, a soil amendment, or fuel at a biomass energy facility. The values in Table 3.8-3, however, do not reflect any re-treatment or maintenance to achieve the objectives of the CalVTP. The values also don’t reflect secondary emissions that may result from treatments other than prescribed burning; secondary emissions may result from haul treated vegetation offsite and potential use as feed stock for a biomass facility, composting, chipping and mulching, or other disposition methods.

An estimate of the annual level of direct GHG emissions for 250,000 acres per year would be approximately 4~~,~~.051 MMTCO2e, based on the expected relative distribution of treatment activities (i.e., 50 percent prescribed burning, 10 percent manual treatments, 20 percent mechanical treatments, 10 percent herbicide treatments, and 10 percent prescribed herbivory) and the assumption that the distribution of treated fuel types would be proportional to their presence in the treatable landscape (as displayed in Figure 2-2, “Fuel Types in the Treatable Landscape”). Applying these parameters and assumptions, the level of GHG emissions generated by each treatment activity is summarized in Table 3.8-4. See Appendix AQ-1 for detailed input parameters and assumptions. The annual emissions from fuel treatments would increase substantially with the CalVTP, because of the expansion in the volume of treatment planned in the state.

Table 3.8-4 Annual Greenhouse Gas Emissions Generated by Treatment Activity

|  | Direct GHG Emissions (MTCO2e/year) |
| --- | --- |
| Prescribed Burning | 4,020,672 |
| Mechanical Treatment | 11,603 |
| Manual Treatment | 9,245 |
| Prescribed Herbivory | 8,989 |
| Herbicide Application | 546 |
| Total | **4,051,054** |

Notes: MTCO2e/year = metric tons of carbon dioxide-equivalent per year

Source: See Appendix AQ-1 for detailed calculations and assumptions.

As shown in Table 3.8-4, the level of GHG emissions generated by treatment activities under the CalVTP would total approximately 4,051,054 MTCO2e per year (or 4.~~,~~051 MMTCO2e/year). This amount is equivalent to 0.9 percent of the statewide target for 2020 of 431 MMTCO2e/year and 1.6 percent of the statewide target for 2030 of 258.6 MMTCO2e/year. In the context of legislated statewide GHG targets, the level of treatment-related GHG emissions would be considerable.

The effect of vegetation treatment on the carbon content of the landscape over the long term—by reducing occurrences of high-severity wildfires and/or by increasing the carbon sequestration potential of vegetated landscapes—continues to be the focus of scientific research and model development, particularly in tree-dominated landscapes. The current body of research presents various and inconsistent findings regarding the effects of treatments on the long-term carbon emission or sequestration of vegetated lands. A review of the scientific literature in the *Draft California 2030 Natural and Working Lands Climate Change Implementation Plan* indicates that, in a broader context, treatment activities reduce vegetation densities and fuel loads, restore the structure and composition of ecosystems, and may lower the potential for damaging, high-severity fire, which is currently the primary source of GHG emissions and carbon loss from the natural and working lands sector (Stephens et al. 2009; Campbell et al. 2007; Hurteau et al. 2008; Hurteau and North 2009; and North et al. 2009—all cited in CalEPA et al. 2019:14). Additionally, it finds that future vegetative growth on treated acres would result in carbon sequestration over time. The *Draft California 2030 Natural and Working Lands Climate Change Implementation Plan*, which includes treatment activities, relied on the California Natural and Working Lands Carbon and Greenhouse Gas Model (CALAND model) to evaluate the long-term effects of the draft plan.

The CALAND model is an empirically based landscape-scale carbon accounting model that assesses the projected GHG benefits of certain conservation, restoration, and management activities on California’s natural and working lands. CALAND is designed to quantify the level of GHG emissions associated with treatments of different types of vegetation as well as the net change in carbon sequestration in vegetation and soils resulting from different types of treatments (Di Vittorio and Simmonds 2018:3). The technical documentation that supports the CALAND model suggests that strategies to enhance resilience to pest and disease and reduce stand density in degraded forests, including prescribed burning and thinning, are likely to benefit regional forest health and help prevent large losses of carbon (Di Vittorio and Simmonds 2018:52), although more research is warranted to be able to definitively estimate carbon sequestration. It also suggests that, while fuel reduction treatment activities require direct carbon emissions, they could also result in long-term carbon sequestration benefits and can affect vegetation carbon accumulation rates for a 20-year post-management period (Di Vittorio and Simmonds 2018). However, some key assumptions of CALAND about the carbon dynamics associated with the utilization of harvested and collected biomass carbon for wood products and energy would not apply to CalVTP. Notably, CALAND assumes some treatments of forested lands would include the harvest of merchantable timber for the manufacture of wood products that continue to hold sequestered carbon over their useful life and then the eventual CO2 and methane emissions associated with the decay of discarded wood products. This assumption would not be applicable to CalVTP treatments in tree fuel types, because the CalVTP does not include harvest of merchantable timber. CALAND also assumes removal of 20 percent of live and dead standing trees for wood products and bioenergy resulting from “clearing of ladder fuels and debris through thinning” in forests (Di Vittorio and Simmonds 2018:12, 14, 20). Disposition of biomass created by the CalVTP treatments would likely differ from the CALAND assumptions (see Section 2.5.2 in Chapter 2, “Program Description”.

Other studies address the reduction of GHG emissions from wildfire in treated areas, based on the expectation that fires would be less intense in those locations. Wildfires are especially emission-intensive because they are uncontrolled, can burn for a long duration (weeks or months), and can result in crown fires that burn entire trees. Wildfires on untreated lands are more difficult to control and suppress than wildfires on lands that have undergone vegetation treatments. One study determined that, in some forest classes that historically had relatively frequent fire intervals, wide-scale prescribed burn application can reduce GHG emissions from wildfires by 18−25 percent in the western U.S., and by as much as 60 percent in specific forest systems as compared to a wildfire on untreated lands (Wiedinmyer and Hurteau 2010). The classes of forests in which this relationship was found include mixed conifer, Douglas-fir/ponderosa pine, and ponderosa/Jeffrey pine. As discussed in Section 3.16, “Wildfire,” there is a scientific consensus that there is a correlation between certain types of forest fuel treatments and reduced wildfire severity. Other studies suggest that reducing fuels through mechanical treatments and prescribed burning is effective at reducing fire severity and annual area burned when applied at the landscape scale over an extended period (Kim et al. 2013, Prichard and Kennedy 2014). Another study found that when moderate- and high-severity wildfires encountered a previously treated area, fire severity was substantially reduced in the treated area relative to the adjacent untreated area (Lydersen et al. 2017). The findings of these studies indicate that vegetation treatments may result in a net carbon benefit in the long term, particularly in the context of avoided GHG emissions from wildfire, the severity and extent of which would be less in treated areas, and/or the potential for treated areas to sequester more carbon.

Other published studies indicate that the carbon sequestration potential for an area is highly dependent on many variables, and in some cases may not result in a net carbon benefit over the long term. For instance, a study by Campbell et al. (2011), which focused on forests in southern Oregon and northern California, did not find evidence that thinning trees and other fuel-reduction practices aimed at reducing the probability of high-severity forest fire have the added benefit of increasing terrestrial carbon stocks. This study found that reductions in carbon sequestration resulting from vegetation treatment (i.e., removal of fuels) generally exceed the level of emissions avoided should the treated area be burned in a wildfire; and that only when treatments change the equilibrium between growth and mortality can they alter the level of carbon sequestration over the long term. In addition, a modeling study by Hurteau and North (2009) suggests that the potential for treatments of a forest to result in a long-term increase in carbon sequestration is most affected by the stand structure, which generally refers to the distribution of trees by species and size, resulting from the fuel treatments (Hurteau and North 2009). Another modeling study, by Reinhardt and Holsinger (2010), determined that vegetation treatments in forests in the northern Rocky Mountains decreased fire severity and crown fire occurrence and reduced subsequent wildfire emissions, but did not increase post-wildfire carbon stored on-site. It also found, conversely, that untreated stands had greater wildfire emissions but stored more carbon. There is limited research regarding the effects of fuel treatments on carbon emission and sequestration within shrub- and grass-dominated lands.

In summary, there is uncertainty in predicting future wildfire occurrence, severity, emissions, and carbon sequestration rates that will continue to be evaluated in ongoing research and factored into future state-level planning for management of natural and working lands and in future iterations of the CALAND model and other models. As stated in the *2017 Scoping Plan*, continued research and development to advance the state of science on carbon dynamics is needed (CARB 2017a:82–83). The current scientific understanding of the carbon-related effects of vegetative treatments is limited, in part, because the long timescale in which these carbon cycles need to be considered. For forests especially, an appropriate timescale is on the order of 20, 50, or 100 years, or longer. This is acknowledged in the *2017 Climate Change Scoping Plan* *2017 Scoping Plan*, the *California Forest Carbon Plan*, and *California 2030 Natural and Working Lands Climate Change Implementation Plan,* and is also acknowledged in the AB 1504 Carbon Inventory Process.

The potential exists for long-term, cumulative net carbon benefits and there is research that indicates that in some cases, immediate GHG emissions from treatment activities and the loss of carbon from removal of vegetation are greater than the positive carbon effects of reduced wildfire severity and size. To meet CEQA’s mandate of good faith disclosure (*California Native Plant Society v. City of Santa Cruz, supra,* 177 Cal.App.4th at p. 979) by acknowledging potential future impacts in light of the uncertainties, this PEIR classifies this GHG impact as **potentially significant**, recognizing the reliability of estimates of direct GHG emissions and the uncertainty of the intended net carbon benefits of reduced wildfire intensity and increased carbon sequestration in treated areas. Even though the predicted long-term outcome may be beneficial, the “potentially significant” determination is intentional as an expression of the Board’s commitment to continued support of ongoing research and adjustment of carbon management approaches as the science evolves.

Mitigation Measure GHG-2. Implement GHG Emission Reduction Techniques During Prescribed Burns

When planning for and conducting a prescribed burn, project proponents implementing a prescribed burn will incorporate feasible methods for reducing GHG emissions, including the following, which are identified in the *National Wildfire Coordinating Group Smoke Management Guide for Prescribed Fire* (NWCG 2018):

* reduce the total area burned by isolating and leaving large fuels (e.g., large logs, snags) unburned;
* reduce the total area burned through mosaic burning;
* burn when fuels have a higher fuel moisture content;
* reduce fuel loading by removing fuels before ignition. Methods to remove fuels include mechanical treatments, manual treatments, prescribed herbivory, and biomass utilization; and
* schedule burns before new fuels appear.

As the science evolves, other feasible methods or technologies to sequester carbon could be incorporated, such as conservation burning, a technique for burning woody material that reduces the production of smoke particulates and carbon released into the atmosphere and generates more biochar. Biochar is produced from the material left over after the burn and spread with compost to increase soil organic matter and soil carbon sequestration. Technologies to reduce greenhouse gas emissions may also include portable units that perform gasification to produce electricity or pyrolysis that produces biooil that can be used as liquid fuel and/or syngas that can be used to generate electricity.

The project proponent will document in the Burn Plan required pursuant to SPR AQ-3 which methods for reducing GHG emissions can feasibly be integrated into the treatment design.

###### Significance after Mitigation

Implementation of Mitigation Measure GHG-2 would require project proponents conducting prescribed burns to implement GHG emission reduction techniques, as feasible. Given the potential infeasibility of implementing specific emission reduction techniques and the uncertainties associated with all the parameters and objectives of prescribed burning, it is not feasible to precisely quantify the GHG reductions that would be achieved by implementation of Mitigation Measure GHG-2 in this programmatic evaluation. For instance, these measures may not always be feasible when the objective of a prescribed burn is to consume coarse woody debris in areas of high tree mortality. Also, the feasibility of conducting mosaic burning can depend on the size of a burn, and mosaic burning may not meet the objectives of CAL FIRE or the landowner. Moreover, burning fuels with a higher fuel moisture content can generate more smoke and result in less consumption, potentially reducing the longevity or effectiveness of a prescribed burn treatment. Thus, acknowledging the need for a balance between achieving treatment rate objectives and minimizing immediate GHG or smoke impacts, the levels of GHGs emitted by prescribed burns could still be considerable. Implementation of Mitigation Measure GHG-2 would support the development and implementation of refined treatment strategies in compliance with the *California 2030 Natural and Working Lands Climate Change Implementation Plan* to heighten the GHG benefit of this plan. With the continued evolution of the body of scientific knowledge about the long-term carbon sequestration effects of vegetation treatments and application of research-backed guidance to treatment implementation, the likelihood of net GHG benefits would be reasonably expected to grow over time. Other measures could include the purchase and retirement of carbon credits to offset the one-time GHG emissions directly associated with treatment activity; however, this approach would consume financial resources needed to achieve the wildfire risk reduction objectives of the proposed CalVTP, so offset purchase could detract from and would not contribute to feasibly meeting the key objective of increasing the pace and scale of treated acreage.

Similar to the reasons for the pre-mitigation significance determination, to meet CEQA’s mandate of good faith disclosure and acknowledge potential future impacts in light of uncertainties, this PEIR classifies this GHG impact as **potentially significant and unavoidable** after implementation of mitigation. Even though the long-term outcome may yet become beneficial, the “potentially significant and unavoidable” determination alerts the public to the potential that net positive emissions may persist over time.

This page intentionally left blank.