Appendix 1 – Methodology

California's Nature-Based Solutions (NBS) Climate Targets

4/22/2024

Background

This document is a technical appendix to California's Nature-Based Solutions (NBS) climate targets required under AB 1757 (2022, C. Garcia and R. Rivas). This appendix is intended to assist readers in understanding how the targets were calculated. If numbers or narratives are not included in this appendix, either the NBS was not identified or the NBS was identified, however, sufficient data were not found that could be used to derive a scientifically informed target or State of California (State) staff have determined that targets were not appropriate.

For every NBS identified, the target is provided along with a description of the NBS and the method that was used to arrive at the target.

These targets were calculated using multiple models, best-available data and information, and expert guidance. Targets for each land type were developed through considering:

- How lands are currently managed and associated carbon implications.
- Most effective NBS at the scale required by science that build resilience, and durable, sustainable carbon stocks.
- Technical and practical feasibility of NBS actions.
- The State's ability to measure and track progress over time.

The following list includes notes to the reader on California's first-ever comprehensive NBS climate targets. These targets:

1. Are designed to be achieved each year from 2030 to 2045, with the exception of the outcome-based percentage targets. Annual targets recognize that effective land management is a consistent, ongoing activity.
2. Require high levels of collective action and investment from many partners, including but not limited to federal, tribal, State, and local governments, private landowners and managers, community groups, philanthropy, educators, development companies, scientists, investors, and more.
3. Are not mutually exclusive; a given acre of land could contribute to multiple targets.
4. Are activity-based and outcome-based, considering and/or building on existing targets in California's NBS sector (ex. 1 million acres annually of forest treatment by 2025; conserving 30% of the state's lands and coastal waters by 2030; etc.).
5. Are flexible and aspatial, meaning they do not prescribe specific implementation methods or locations implementation should take place. NBS are successful when implemented in a tribally, regionally, and locally appropriate manner.

6. Were calculated based on activities that could be quantified *and* include activities that deliver climate benefits but cannot yet be quantified which count toward meeting the targets.

7. Include conservation targets. In addition to protection, "conservation" encompasses active stewardship and management to ensure healthy, resilient lands and is more broadly defined than conserved land under The Pathways to 30x30 strategy.

8. Reflect quantified baselines of current levels of action wherever possible.

9. Will guide State investments and policy.

10. Can be measured and tracked over time.

11. Can be updated over time to align with best-available science and increased ambition as necessary.

12. Underscore the need to improve understanding of the nature-based solutions being implemented across all land types in California.

Table of Contents

Background 2
Wildfire Risk Reduction Targets 5
Beneficial fire 7
Other fuel reduction activities 8
Forests 10
Afforestation 11
Conservation 12
Restoration 12
Working forest conservation 13
Illegal conversion and forest degradation 14
Wildfire risk reduction 15
Shrublands and Chaparral 16
Conservation 16
Restoration 17
Grasslands 18
Conservation 18
Restoration 19
Croplands 20
Healthy soils practices 21
Conservation 21
Organic agriculture 22
Developed Lands 24
Afforestation (adding trees) between communities and croplands 25
Conservation 26
Urban and community greening and forestry 26
Reducing community wildfire risk 29
Wildfire ignition rate from vehicles 29
Priority roadside treatment 30
Urban and community greening and forestry - urban tree planting 30
Wetlands and Seagrasses 32
Conservation 33

Restoration....33
Sea level rise protection of ecosystems....36
Sparsely Vegetated Lands....37
Conservation....37
Restoration....38

Wildfire Risk Reduction Targets

Forests, shrublands and chaparral, and grasslands are grouped here because wildfire risk reduction actions span these three land types. Additionally, wildfire itself spreads across these three landscapes, and thus should be considered holistically when devising wildfire risk reduction strategies.

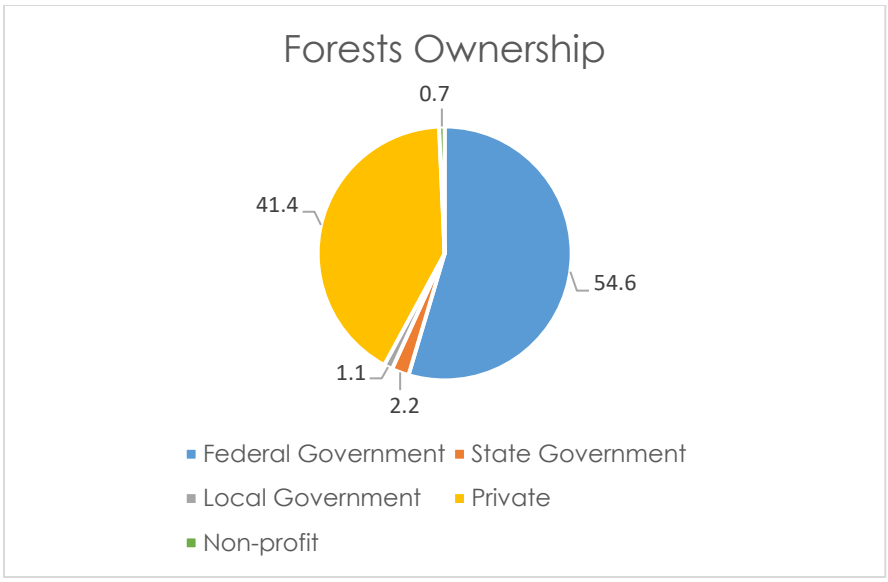
Acreage Targets

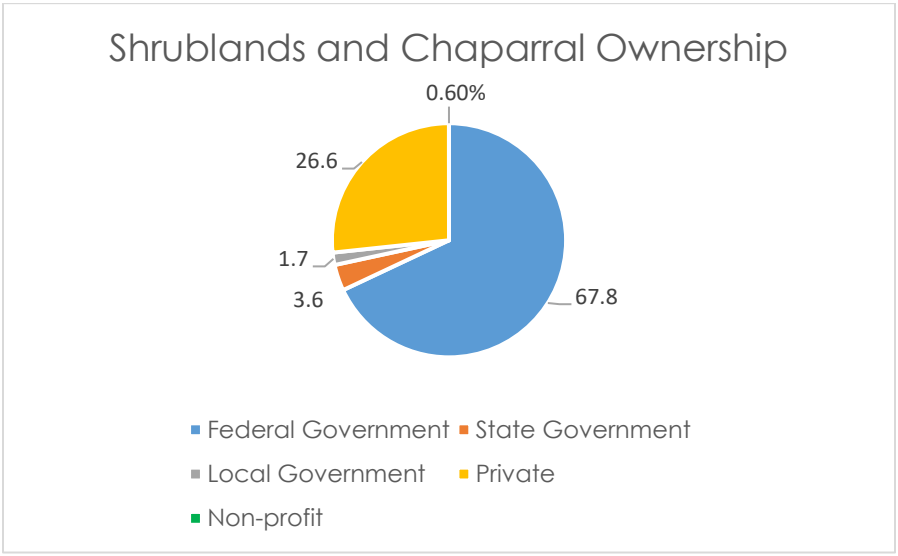
Nature-Based Solution (activity acres[1]/year)	2030	2038	2045
Beneficial Fire • Prescribed broadcast burning, cultural burning, planned managed fire, planned treatment burned in wildfire[2]	800K	1.2M	1.5M
Other Fuel Reduction Activities • Thinning, invasive species removal, prescribed herbivory (grazing), mechanical treatments (first entry and retreatments), and uneven-aged timber harvest	700K	800K	1M
TOTAL activity acres/year	**1.5M**	**2M**	**2.5M**

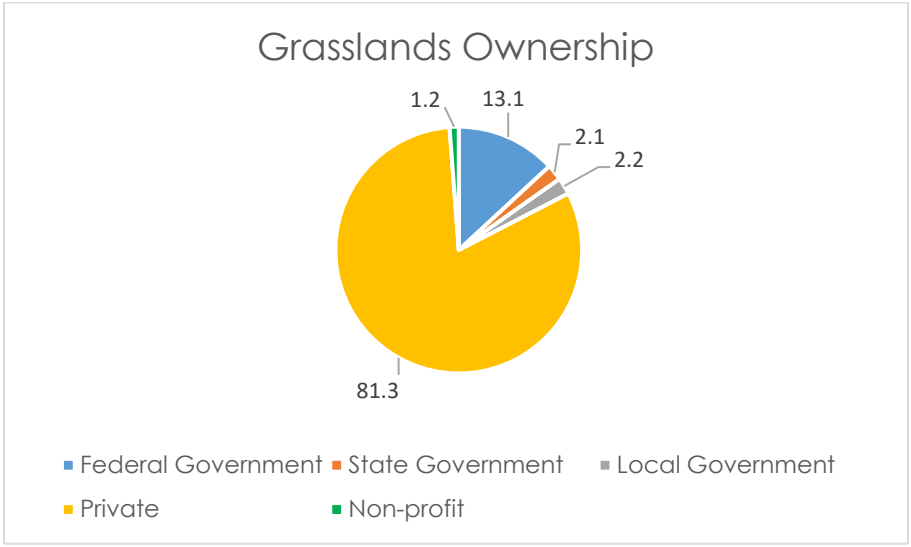
These are also complemented by related targets on California's developed lands related to reducing community wildfire risk, decreasing wildfire ignition rates caused by vehicles, and treating roadside vegetation that can be found below.

Ownership Breakdown of Forests, Shrublands and Chaparral, and Grasslands[3]

[1] Activity acres track every treatment action, including those that occurred in sequence on the same acre over time. For example, a thinning project may have been conducted on an acre prior to a prescribed burn.
[2] Includes first entry and maintenance burning, does not include any acres from wildfires where suppression is the primary objective.
[3] LANDFIRE Download Mosaic Data Products; CAL FIRE GIS Mapping and Data Analytics


Forests Ownership
0.7
41.4
54.6
1.1
2.2
Federal Government
State Government
Local Government
Private
Non-profit


Shrublands and Chaparral Ownership
0.60%
26.6
1.7
3.6
67.8
Federal Government
State Government
Local Government
Private
Non-profit


Grasslands Ownership
1.2
13.1
2.1
2.2
81.3
Federal Government
State Government
Local Government
Private
Non-profit

Beneficial fire

2030	2038	2045	Units
800000	1200000	1500000	activity acres/year

Description:

Beneficial fire is a term used to collectively refer to prescribed fire, cultural burning, fire managed for resource benefit, and planned treatment burned in wildfire.[4]

- Prescribed Fire: The intentional application of fire to land to achieve wildland management goals, including the prevention of high intensity wildland fires, watershed management, range improvement, vegetation management, forest improvement, wildlife habitat improvement, ecological integrity and resilience, community wildfire protection, carbon resilience, enhancement of culturally important resources, and maintenance of air quality. Prescribed fires undertaken for any of these reasons are considered "public purpose" burns pursuant to State law (Public Resources Code § 4491(a)). Prescribed fires are typically conducted in compliance with a written prescribed fire plan that outlines the conditions necessary for the burn to be "within prescription."
- Cultural Burning: The intentional application of fire to land by California Native American tribes, tribal organizations, or cultural fire practitioners to achieve cultural goals or objectives, including for subsistence, ceremonial activities, biodiversity, or other benefits. Cultural burning can differ from prescribed fire in terms of size, seasonality, timing, preparation/planning, and post-fire treatment.
- Planned Managed Fire/Fire Managed for Resource Benefit: The strategic choice to manage unplanned ignitions to achieve management objectives, such as ecosystem restoration or hazard reduction. Fire managed for resource benefit is typically deployed in wilderness areas, national parks, and other areas of public ownership under specific conditions or circumstances. This is also referred to as "managed fire."
- Planned Treatment Burned in Wildfire: Planned prescribed fire activities that are completed due to a natural ignition wildfire occurring, and acres burned are determined as meeting land management planning objectives in the post-assessment.

The acres in this target do not include any acres from wildfires that are not managed for resource benefit or were a part of a planned treatment. Low-to-moderately burned acres within fire footprints from fires that are not classified as one of the above would not count towards meeting this target. The objective of this target is to reintroduce fire to the landscape in a controlled and healthy manner. Targets are set to encourage action to address the climate crisis and its impacts.

Method:

[4] California's Strategic Plan for Expanding the Use of Beneficial Fire (wildfiretaskforce.org)

California's Wildfire and Forest Resilience Task Force set a target of 400,000 acres annually of beneficial fire by 2025. This target was developed within an overall goal of one million acres of fuel reduction treatments by 2025. The 2022 Scoping Plan's natural and working lands modeling determined that California would likely need approximately 2.5 million acres of fuel reduction treatments annually to meet the State's carbon targets. The scientific and technical underpinning for this need can be found in detail on pages 16-23, 29-117, 172-184, and 198-258 of Appendix I – Natural and Working Lands Technical Support Document of the 2022 Scoping Plan.[5] The wildfire risk reduction targets assume one million acres annually by 2025 and ramp up to 2.5 million acres annually by 2045. The ultimate objective is to reintroduce fire to California's landscapes to perform its natural ecological function on statewide scales. In the near-term, other types of fuel reduction work are prioritized to lay the groundwork for more beneficial fire acres, such that the ratio of beneficial fire to other treatment types is assumed to be 2 to 3. However, it is the objective of the overall wildfire risk reduction target that beneficial fire make up a larger percentage of this work over time, such that by 2030, beneficial fire accounts for more than half of the overall fuel reduction work, and by 2045 the ratio of beneficial fire to other fuel reduction activities is 3 to 2.

Previous studies and analyses estimate that pre-westward expansion, California (approximately years 1450-1849) would have seen 4.5 to 12 million acres of fire annually.[6] Given this estimate, 1.5 million acres of beneficial fire is most likely insufficient to fulfill the actual fire need of California's landscapes. However, unintentional wildfire will always occur at some level and will contribute to additional burned acres outside of this target. It will take Californians time to adjust to a landscape with this amount of annual fire, and for this reason, these targets set a gradual ramp up to allow for adjustments and impacts to public perception, public health, recreation, environmental regulations, and workforce that will come with this level of fire on the landscape.

Other fuel reduction activities

2030	2038	2045	Units
700000	800000	1000000	acres/year

Description:

This includes fuel reduction activities that fall within the general categories of thinning, invasive species removal, prescribed herbivory, mechanical treatments, and uneven-aged timber harvest. Treatments included in this target include both first entry and retreatments. Targets including post high severity fire reforestation and restoration can be found in the Forests section below.

[5] Appendix I - Natural and Working Lands Technical Support Document

[6] California's Historical Fire Activity before Modern Fire Suppression

- Thinning: A tree removal practice that reduces tree density and competition between trees in a stand. Thinning concentrates growth on fewer, high-quality trees, provides periodic income, and generally enhances tree vigor.[7]
- Invasive species removal: The targeted removal of invasive species for the purposes of facilitating the introduction or enhancement of native or other preferred vegetation.
- Prescribed herbivory: The use of domestic livestock to accomplish specific and measurable vegetation management objectives. Those would include things like removing biomass (fine fuel loads), reducing populations of specific plant species, slowing the re-establishment of shrubs on burned or mechanically thinned sites, and improving plant community structure for wildlife habitat values.
- Mechanical treatments: Mechanized thinning, mastication, and other mechanical forms of vegetation removal for various objectives, such as fuel breaks, fuel reduction, and site preparation.
- Uneven-aged timber harvest: Alternative prescription, commercial thin, group selection harvest, oak woodland management, rehabilitation of understocked areas, sanitation harvest, single tree selection, special products removal, transition harvest, and variable retention harvest.

Method:

As the wildfire risk reduction targets assume one million acres annually by 2025, with 400,000 of those acres coming from beneficial fire, the remaining 600,000 annual acres are assumed to come from these other forms of fuel reduction described above. This is a recognition that, in the near term, this type of fuel reduction will be prevalent as to lay the foundation for more beneficial fire going forward. These other fuel reduction activities will also need to be ramped up through time as the need for such activities are not likely to diminish and are necessary to achieve public health and safety goals and mitigate climate change.[8] However, these other fuel reduction activities are not set to ramp up as much as beneficial fire for a number of reasons including cost, benefit to ecosystems, work force constraints, and speed of implementation, among others.

[7] LANDFIRE Public Events – Raw and Model Ready Events Data Dictionary
[8] Appendix I - Natural and Working Lands Technical Support Document

Forests

Acreage Targets

Nature-Based Solution (acres/year)	2030	2038	2045
Afforestation (adding trees) • Oak woodland re-establishment in areas where they historically were found	52.9K	52.9K	52.9K
Conservation • Conserve old growth forests to preserve the oldest trees • Conserve conifer, riparian, and oak woodland forests	55.1K	55.1K	55.1K
Restoration • Post high severity fire reforestation and restoration • Restore health of degraded oak woodlands by enhancing riparian zones	322.1K	462.1K	322.1K
Working Forest Conservation • Extend harvest rotation lengths • Shift intensity of harvests • Restore and/or conserve wildlife habitat	165.2K	165.2K	165.2K
TOTAL acres/year	**595.3K**	**735.3K**	**595.3K**

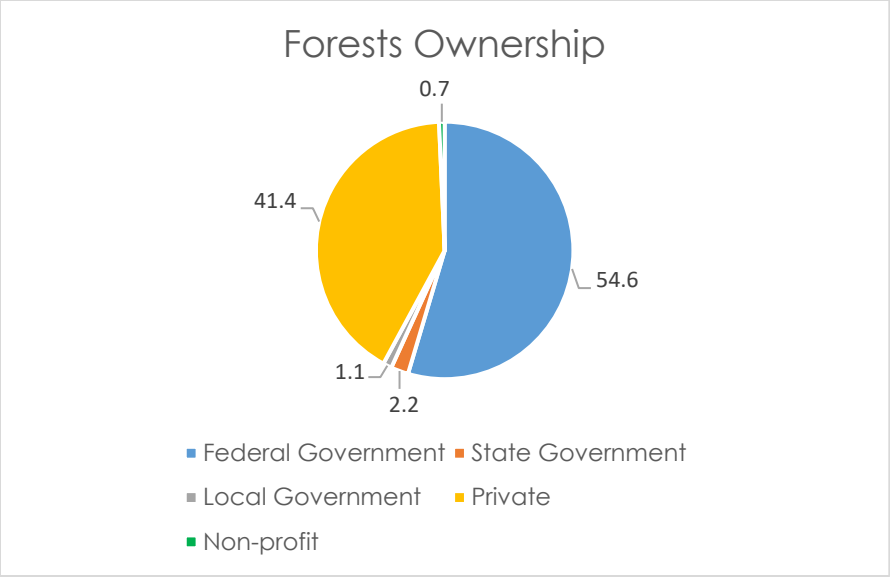
Percentage Targets

1. Decrease the rate of illegal conversion and forest degradation by 20% by 2030; 50% by 2038; and 90% by 2045.

2. Through beneficial fire and other fuel reduction activities, shift the proportion of statewide high severity wildfire to low or moderate severity wildfire such that the total percentage of low to moderate severity wildfire is 75% by 2030; 83% by 2038 and 90% by 2045.

Ownership Breakdown of Forests[9]

[9] LANDFIRE Download Mosaic Data Products; CAL FIRE GIS Mapping and Data Analytics



Afforestation

Oak woodland establishment

2030	2038	2045	Units
52857	52857	52857	acres/year

Description:

Re-establish oak woodlands where they naturally would have been found. This would primarily be on rangelands or other land use types.

Method:

It is estimated that at least 800,000 acres of oak woodlands in the Sierra Nevada Foothills have been lost.[10] If 30 percent of those woodlands can be reclaimed and restored that would amount to 240,000 acres. However, considering that 1) 800,000 acres is an older estimate, 2) it only accounts for the Sierra Foothills region, 3) there are currently at least 8.5 million acres of oak woodlands in California (but could be as much as 11 million acres),[11] and 4) it is estimated that 12.75 million acres of oak woodlands used to exist,[12] we can assume that the conversion back to oak woodlands could amount to 960,000 acres. That is to say, a sufficient amount of land exists in California that may allow for the successful establishment of 960,000 acres of oak woodland statewide. Between 2025-2029, the assumed level of afforestation is 22,857 acres annually to allow for a ramp up to the 2030 target of 52,857 acres.

[10] Oak Woodland Vegetation Dynamics: A State and Transition Approach
[11] UCANR Forest Advisor Michael Jones, PhD on July 25, 2023, at the Board of Forestry and Fire Protection's Management Committee.
[12] California Native Plant Society – Sacramento Valley Chapter: Oak Woodland

Conservation

Conserve old growth forests

2030	2038	2045	Units
55060	55060	55060	acres/year

Description:

This includes the intentional, legal protection of old growth forests within California to prevent harvest or conversion. Old growth is defined variably by region and forest type. No standard legal definition exists.

Method:

Although numbers are sparse, it is estimated that approximately 2.4 million acres of old growth, and 12.1 million acres of mature forest may exist in California.[13,14,15] To conserve 30 percent of these 2.4 million acres would require 720,000 acres of conservation. Given these trees' high levels of carbon storage, they should be conserved at higher rates. Conserving 1 million acres more than what is currently conserved by 2045 would require 55,060 additional acres annually from 2030-2045. This assumes a ramp up of conservation between 2025-2029 of 23,810 acres annually before targets are set for 2030-2045.

Restoration

Post high severity fire planting and restoration

2030	2038	2045	Units
280000	420000	280000	acres/year

Description:

Actively replant and/or restore forested areas burned by high severity fire.

Method:

Two post fire restoration planting targets currently exist. The U.S. Department of Agriculture has a target of 2.3 million acres by 2030 on public lands in Oregon and California.[16] California's Wildfire and Forest Resilience Task Force's draft reforestation strategy has a target of 1.4 million acres of reforestation from fires that occurred between 2019-2022. It is also important to consider the historical backlog of needed planting, alongside future projections of high severity fire. Modern large fires typically

[13] Mature and Old-Growth Forests: Definition, Identification, and Inventory
[14] 2002 Estimates of Old Growth Forests on the 18 National Forests of the Pacific Southwest Region
[15] Area of Old-growth Forests in California, Oregon, and Washington
[16] Reforestation Goals and Assessments, and a Climate-Informed Plan to Increase Federal Seed and Nursery Capacity

have a high severity burn proportion of 33 percent.[17,18] Over 19.3 million acres burned from 2000-2022, 33 percent of which is 6.4 million acres.[19] It is projected that without fuels reduction, high severity fire area could increase by 70 percent,[20] equating to approximately 500,000 acres per year of high severity fire by 2050. Thus, from 2025 to 2045, we could see a total of 10 million acres of high severity fire. From 2000 to 2045, California may have a total of 16.4 million acres of high severity burned area. Assuming that we only need to actively reforest 40 percent of those acres to account for clumping methods and edge regeneration,[21] we will need to reforest 6.5 million acres from 2025 to 2045. To allow for a ramp up from 2025, we start with an assumption of 140,000 annual acres from 2025-2029 and increase that linearly to a target of 420,000 annual acres in 2038. We then assume that beneficial fire and fuel reduction treatments take effect, and ramp this back down to a target of 280,000 acres in 2045. These acres, with linear extrapolations in between, equal 6.5 million acres, or the projected need plus the estimated backlog.

Oak woodland restoration

2030	2038	2045	Units
42121	42121	42121	acres/year

Description:

Improve the health of degraded oak woodlands, including enhancing or re-introducing riparian zones to these lands.

Method:

It is estimated that there are approximately 8.5 million acres of oak woodlands[22] and that approximately 30 percent of these acres need restoration.[23] Restoring 30 percent of those lands would require 765,000 acres of restoration. Some estimate as much as 11 million acres[24] of oak woodlands, and thus, this may constitute a conservative need. 765,000 acres of restoration amounts to 42,121 acres per year between 2030-2045. This assumes annual restoration of 18,214 acres between 2025-2029, allowing for a ramp up to 2030.

Working forest conservation

2030	2038	2045	Units

[17] Trends in Wildfire Severity: 1984 to 2010 in the Sierra Nevada, Modoc Plateau, and Southern Cascades, California, USA
[18] The 2020 California fire season: A year like no other, a return to the past or a harbinger of the future?
[19] These numbers include shrublands and chaparral and grasslands.
[20] Wildfire Simulations for California's Fourth Climate Change Assessment: Projecting Changes in Extreme Wildfire Events with a Warming Climate.
[21] Tamm Review: Reforestation for resilience in dry western U.S. forests
[22] California Native Plant Society – Sacramento Valley Chapter: Oak Woodland
[23] Conifer encroachment study will inform efforts to preserve and restore North Coast oak woodlands
[24] UCANR Forest Advisor Michael Jones, PhD on July 25, 2023, at the Board of Forestry and Fire Protection's Management Committee.

165179	165179	165179	acres/year

Description:

Working forest conservation refers to altering business as usual forest management to meet climate and biodiversity goals, while maintaining a sustainable forest resource utilization operation. Multiple actions may be included in working forest conservation such as extending the average age of intensively managed forests, shifting salvage intensity, promoting larger, older, more well-spaced stands with a natural diversity of species, and protecting wildlife habitat within project boundaries that are not otherwise protected. All ownerships are included in this target.

Method:

Seventeen million acres of California timberland exist.[25] The identified targets would result in 3 million acres of working forest conservation by 2045. The targets assume 71,423 annual acres of working forest conservation between 2025-2029, allowing for a ramp up to 2030. This can include all ownership types such as existing industrial and non-industrial timber operations. Although the priority is to enhance working forest conservation on timberlands that are currently intensively managed, these targets also aim to include timberlands that are currently unmanaged.

Illegal conversion and forest degradation

2030	2038	2045	Units
20	50	90	percent decrease from baseline rate

Description:

Conversion is the direct human-induced conversion of forested land to non-forested land. Forest degradation is the human-caused, long-term reduction of the overall supply of benefits from forests, which include wood, carbon storage, biodiversity, and other products or services.[26] This target only includes illegal and/or unpermitted activities within California.

Method:

Currently no baseline for the amount of illegal and/or unpermitted conversion and/or degradation exists, however, it is known that these activities do occur within California.[27] As the state scales overall forest management activities, it is even more essential that laws and regulations are followed. Once a baseline rate of conversion and degradation is determined, it is the objective of these targets to approach

[25] AB 1492 Development of Ecological Performance Measures for California's Nonfederal Timberlands
[26] Definitional issues related to reducing emissions from deforestation in developing countries
[27] How we mapped illegal cannabis farms in California

elimination of illegal and/or unpermitted conversion and degradation by 2045. A one percent decrease is assumed by 2025.

Wildfire risk reduction

Low to moderate severity wildfire

2030	2038	2045	Units
75	83	90	percent of total wildfire acres

Description:

Within the fire area burned during a single year, the percentage of low and moderate severity fire should be at least the identified percentage.

Method:

Historical proportions of high severity wildfire were below 10 percent.[28] Today, these proportions tend towards 30 to 35 percent.[29] These targets are results-oriented targets that track the effectiveness of our beneficial fire and other fuel reduction treatments on decreasing fire severity within forests. These targets are designed to leave time for treatments to ramp up and take effect while eventually reaching historical levels. The targets assume 70 percent of total wildfire acres burn at low or moderate severity by 2025.

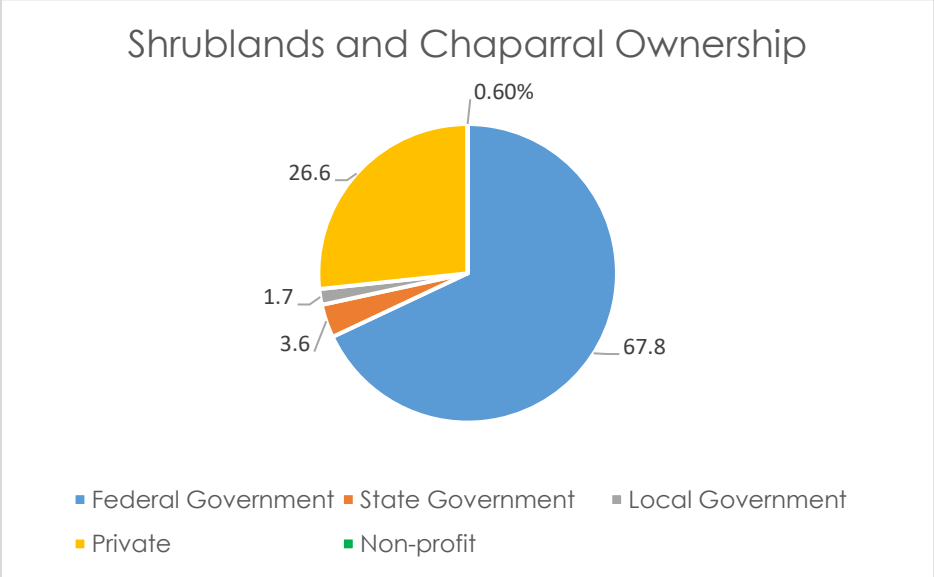
[28] The fire frequency-severity relationship and the legacy of fire suppression in California forests
[29] Wildfire burn severity and emissions inventory: an example implementation over California

Shrublands and Chaparral

Acreage Targets

Nature-Based Solution (acres/year)	2030	2038	2045
Conservation • Conserve chaparral and shrublands, with a focus on old growth and undeveloped areas	104.6K	104.6K	104.6K
Restoration • Restore chaparral and shrublands, with a focus on addressing threats from invasive species and fire; post-disturbance restoration; transitional zones; enhancing native vegetation; and re-establishing wildlife connectivity	37K	40K	45K
TOTAL acres/year	**141.6K**	**144.6K**	**149.6K**

Ownership Breakdown of Shrublands and Chaparral[30]



Conservation

Conserve old growth shrublands and chaparral

2030	2038	2045	Units
104613	104613	104613	acres/year

Description:

[30] LANDFIRE Download Mosaic Data Products; CAL FIRE GIS Mapping and Data Analytics

Conservation of shrublands and chaparral over 100 years old to protect them from human induced conversion or disturbance. Long lived shrublands and chaparral are extremely drought tolerant and sequester carbon in ecosystems such as deserts, even when all other life has gone dormant. As these lands are not easily established, it is imperative to maintain California's stock of these old growth shrubs which can live for thousands of years.

Method:

As shrublands and chaparral are not inventoried in the same way forests are, nor aged as easily as trees, different methods are used to estimate the area of old growth shrublands and chaparral. Using the historical wildfire polygons that exist over the last 100 years[31] on top of shrubland/chaparral extent,[32] we can identify those lands that have been disturbed within the last 100 years. When this is paired with shrublands/chaparral extent information, there are approximately 8.5 million acres of old growth shrublands and chaparral (>100 years old), though this is most likely an overestimate because of other disturbance factors for which we do not have records. If 30 percent of these were conserved, that would amount to nearly 2.6 million acres. As this is most likely an overestimate, this number can be reduced by 25 percent to 1.9 million acres. Today this land type often burns or is disturbed too frequently as compared to its historical disturbance regimes. For this reason, the area of focus for this conservation should be those shrublands and chaparral, primarily in southern California, that are currently experiencing frequent disturbance. These targets assume 45,238 acres of conservation annually between 2025-2029 to allow for a ramp up to 2030.

Restoration

2030	2038	2045	Units
37000	40000	45000	acres/year

Description:

Restore shrublands and chaparral such that natural vegetation is enhanced, wildlife habitat connectivity is reestablished, and sustainable fire regimes exist.

Method:

Using the same method described for shrubland and chaparral conservation, we can identify current shrublands and chaparral that have been disturbed within the last 10 years. As fires in these systems tend to be stand replacing, we can assume that any burned area will require some form of restoration to accelerate reestablishment or recovery. This analysis results in approximately 2.5 million acres in need of restoration. If 30 percent of these acres are restored, that would be almost 800,000 acres. To allow for a ramp up towards this acreage, we begin with an assumption of 35,000 acres per year

[31] CAL FIRE GIS Mapping and Data Analytics
[32] FRAP Vegetation, California

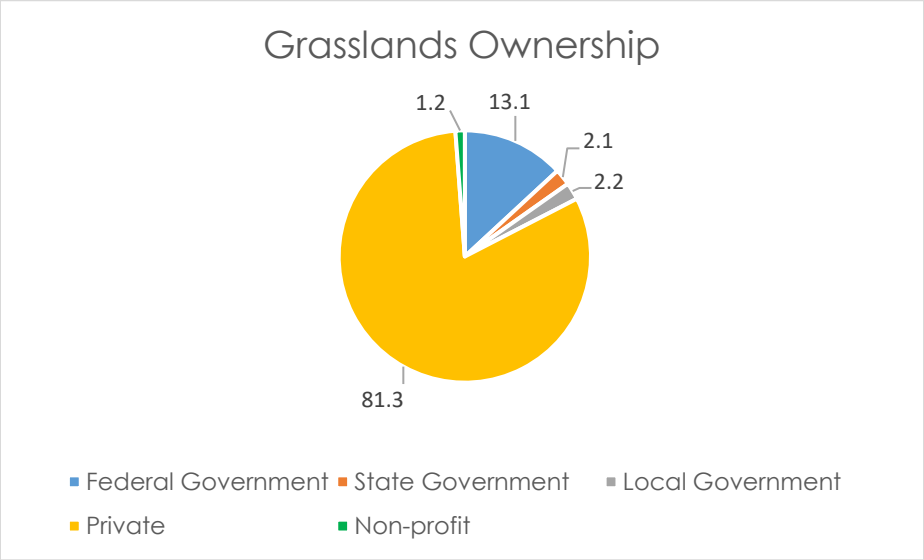
in 2025 and linearly increase to targets of 37,000 acres annually in 2030, 40,000 acres annually by 2038, and 45,000 acres per year by 2045.

Grasslands

Acreage Targets

Nature-Based Solution (acres/year)	2030	2038	2045
Conservation • Protect grasslands with a focus on remaining native grasslands, oak trees, and foothill pines	33K	33K	33K
Restoration • Restore degraded grasslands to native vegetation communities and diverse, perennial, deep-rooted grasses; soil amendments and prescribed grazing in line with the NWL Climate Smart Strategy; re-establishing a sustainable fire regime; riparian restoration	55.1K	55.1K	55.1K
TOTAL acres/year	**88.1K**	**88.1K**	**88.1K**

Ownership Breakdown of Grasslands[33]



Conservation

2030	2038	2045	Units
33036	33036	33036	acres/year

Description:

Conservation of intact grasslands.

[33] LANDFIRE Download Mosaic Data Products; CAL FIRE GIS Mapping and Data Analytics

Method:

It is estimated there are approximately 2 million acres of intact grasslands in California's central valley.[34] Thirty percent of this is 600,000 acres. These targets assume 14,286 annual acres of grassland conservation from 2025-2029 to allow for a ramp up to the 2030-2045 targets of 33,036 annual acres of grassland conservation.

Restoration

Restore to native grasslands

2030	2038	2045	Units
55060	55060	55060	acres/year

Description:

Convert degraded grasslands, or those grasslands that have been overtaken by invasive species, back to native grasslands.

Method:

Approximately 9.7 million acres of grasslands exist in California[35] and only 1 percent, or approximately 100,000 acres, of those lands are currently native grasslands.[36] Various constraints exist to grassland restoration,[37] however, opportunities exist to increase these acres, such as shifts in agricultural lands to idle lands used for ecosystem restoration, new development projects encouraging native grasslands establishment, and the current need for sage grouse habitat restoration. If we set a target of increasing native grasslands from 1 percent to 10 percent, that would require 1 million acres of grassland restoration. The targets are set to achieve this and assume 23,810 annual acres of grassland restoration between 2025-2029 to allow for a ramp up to the 2030 target.

[34] The last continuous grasslands on Earth: Identification and conservation importance
[35] California's Natural and Working Lands Climate Smart Strategy
[36] California Native Grasslands: A Historical Perspective A Guide for Developing Realistic Restoration Objectives
[37] California Grassland Restoration

Croplands

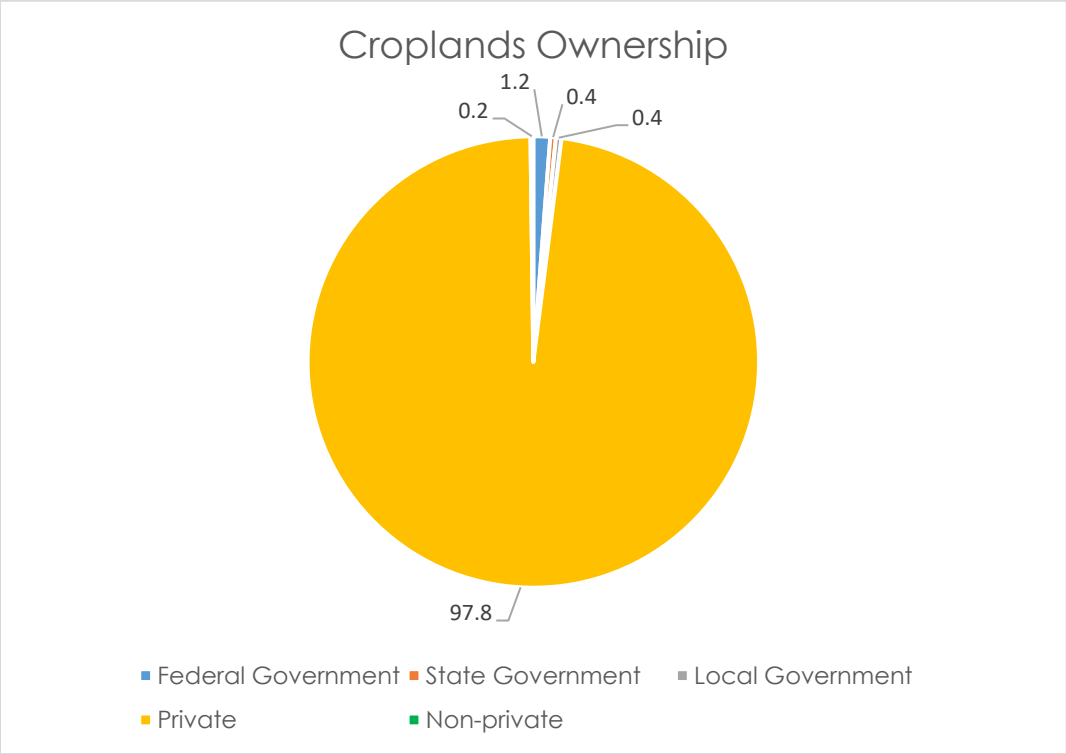
Acreage Targets

Nature-Based Solution (acres/year)	2030	2038	2045
Healthy Soils Practices • Implement healthy soils practices on annual and perennial croplands, such as compost application, cover cropping, hedgerows/windbreaks, no and reduced till, riparian buffers, whole orchard recycling, etc.	140K	190K	190K
Conservation • Conserve annual and perennial croplands	12K	16K	19.5K
TOTAL acres/year	152K	206K	209.5K

Percentage Targets

Convert conventional to organic systems in annual and perennial croplands -10% by 2030, 15% by 2038, and 20% by 2045.

Ownership Breakdown of Croplands[38]



[38] LANDFIRE Download Mosaic Data Products; CAL FIRE GIS Mapping and Data Analytics

Healthy soils practices

2030	2038	2045	Units
140000	190000	190000	acres/year

Description:

Healthy soils practices, also called conservation management practices, are practices that improve soil health, sequester carbon, and reduce greenhouse gas (GHG) emissions. Examples include using cover crops, applying compost, reducing or eliminating tillage, or planting hedgerows or other vegetation that sequesters carbon, supports soil biodiversity, retains topsoil, and builds soil organic matter.

Method:

There are currently about 9.5 million acres of land in California classified as cropland. The most ambitious implementation of healthy soils practices in the Scoping Plan required 100,000 new acres of healthy soils practices implemented per year.[39] If we use this as an assumed annual acreage from 2025-2029, and ramp up implementation to factor in expected action from local governments, possibly through Climate Action Plans, and other state agencies, such as Air Pollution Control Districts, as well as private sector actions like crediting farmer efforts through carbon markets, we set acreage targets of 140,000 per year in 2030 and 190,000 per year in 2038 and 2045. Assuming 100,000 annual acres of healthy soils practices between 2025-2029, these targets would result in an additional 1.6 million acres by 2038, and 3.1 million acres in 2045. In 2022, about 1 million acres were reported under no-till, reduced-till, or conservation tillage regimes and 388,000 acres had cover crop planted in California.[40] While it is difficult to know if these practices are co-occurring on the same field, a conservative baseline estimate is that healthy soils practices are currently being used on 1 million acres in California. From the baseline of 1 million acres, this target means at least 40 percent of croplands would be managed using healthy soils practices in 2045.

Conservation

2030	2038	2045	Units
12000	16000	19500	acres/year

Description:

Protection of agricultural lands to prevent conversion to more developed landscapes.

Method:

Between 2014 to 2021, the California Department of Conservation administered nearly 145,000 acres of agricultural easements, most of which were located on grazing lands.

[39] 2022 Scoping Plan Appendix I – Natural and Woking Land Technical Support Document
[40] NASS 2022 Data on Cover Crop and Tillage

The average acres per year of mixed and irrigated lands was 9,000. If these acres were doubled this would amount to approximately 18,000 acres per year. Allowing for a linear ramp up would equate to approximately 500 additional acres per year every year until 2045, resulting in 19,500 conserved annually by 2045. 9,500 acres are assumed to be conserved per year from 2025-2029. This would result in a total of 275,000 acres conserved by the end of 2045.

Organic agriculture

2030	2038	2045	Units
10	15	20	Percentage of total agricultural lands

Description:

Organically grown food is grown and processed using no synthetic fertilizers or pesticides. Organic farming uses ecologically-based pest controls and biological fertilizers derived largely from animal and plant wastes and nitrogen-fixing cover crops. Pesticides derived from natural sources (such as biological pesticides) may be used in producing organically grown food. Conversion to organic management of croplands is desired by many because of the market premium gained for organic products, and to achieve improvements in local and consumer health, local species diversity, and soil health. At the same time, organic management is typically more costly and risky than conventional approaches, and barriers of education and investment can hold back aspiring organic farmers.

Method:

There are about 9.6 million acres of cropland in California, and 9 million acres of classified irrigable cropland, although not all of them are regularly irrigated. For 2017, when California was beginning to recover from a historic drought, U.S. Department of Agriculture Economic Research Service estimated that 7.8 million acres were irrigated. In 2019, 8.7 million agricultural acres were irrigated in California, and these dropped well below 8 million during 2022, a drought year.[41] With implementation of the Sustainable Groundwater Management Act, projections of lowered snowpack in the Sierra Nevada, and considering that the above numbers include some irrigated pasture, regularly irrigated cropland acreage may average around 7.5 million acres in 2045, while total cropland including dryland crops may occupy around 8 million acres. Recently 411,000 acres of cropland in the state were certified organic,[42] amounting to roughly 5 percent of the acreage available. Public actions will likely be necessary to cause this number to rise to 20 percent (or 1.6 million acres), since the sector has not been expanding in recent years.[43] Twenty percent organic acreage represents the upward limit as the state's organic sector relies heavily upon in-state municipal and

[41] Economic Impacts of the 2020–22 Drought on California Agriculture; 2019 Land Use Data Publicly Available
[42] 2019 Organic Survey
[43] California Agriculture Organics Report, California State Organic Program - Reports

dairy manure compost sources to replace synthetic fertilizers, especially for nitrogen, and the supplies of these will be limited.[44] Significant portions of the available compost should also be reserved for non-organic systems and for certain non-agricultural uses, such as for roadside application by Caltrans or others. At the same time, a larger portion of the state's rangeland and its cattle and ruminant herds could be managed organically by 2045, since the state has seen considerable increase in the organic beef sector. However, this transition is not covered in current targeting.

[44] SB 1383 Infrastructure and Market Analysis; Manure Recycling and Innovative Products Task Force Final Report

Developed Lands

Within Developed Lands, there are three related targets that can have overlap, but are distinctly different. These targets are the Conservation, Urban and community greening and forestry, and Urban and community greening and forestry – trees planted/year targets.

Conservation is the act of legally protecting a plot of land, but not necessarily performing any additional actions on that land.

Urban and community greening and forestry includes increasing tree and other green cover whether that be the expansion of existing tree canopy cover and green spaces, or through the planting of distinctly new trees in new places. For example, an existing park that planted new trees in 2020 will expand that existing tree canopy cover through 2045. In another example, new trees may be planted every year through 2045 in place of an asphalt schoolyard with no trees. Both of these examples would count towards this target. Further, it should be noted that this target includes more than trees.

Urban and Community Greening and Forestry (trees planted/year) is specifically addressing the need to expand tree canopy cover by planting new trees in new places. This target counts the number of trees planted, and not the amount of tree canopy cover increased. In the above examples, this particular target would include the trees planted at the schoolyard, but not the park with existing trees that are increasing in size through time. The intent of this target is to ensure that we are planting new trees and not only relying on the expansion of existing tree canopies.

Acreage Targets

Nature-Based Solution (acres/year)	**2030**	**2038**	**2045**
Afforestation (adding trees) between communities and croplands • Establish tree line buffers between croplands and communities to reduce chemical exposure and enhance access to green space	133	185	230
Conservation • Protect existing urban tree cover	17.3K	17.3K	17.3K
Urban and Community Greening and Forestry • Increase tree canopy cover in cities, communities, and schoolyards • Establish drought-tolerant vegetation, remove grass yards • Increase green space, such as parks, gardens, schoolyards, greenways/greenbelts, street trees, green roofs, rain gardens, etc.	34.7K	34.7K	34.7K
Reducing Community Wildfire Risks • Defensible space establishment on properties in the wildland urban interface area	11K	11K	11K
TOTAL acres/year	**63.1K**	**63.2K**	**63.2K**

Percentage Targets

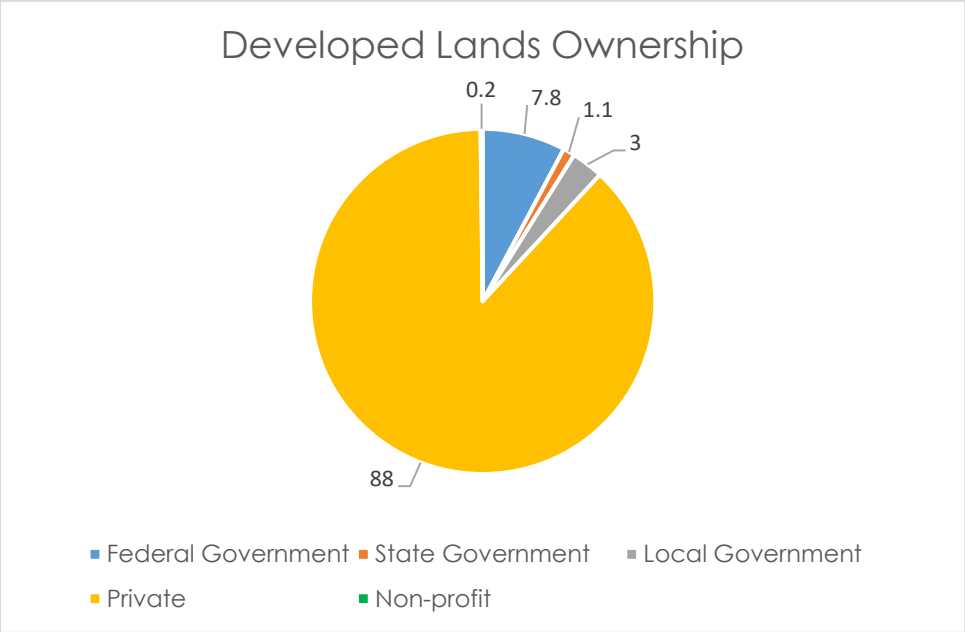
Decrease wildfire ignition incidents caused by vehicles - 10% by 2030, 20% by 2038, and 30% by 2045.

Treat priority roads that function as primary evacuation routes - 50% by 2030, 70% by 2038, and 100% by 2045.

Additional Targets

Nature-Based Solution	2030	2038	2045
Urban and Community Greening and Forestry (trees planted/year) • Increase large canopied, drought-tolerant trees meaningful to the community; prioritize communities with low tree canopy	200K	200K	200K

Ownership Breakdown of Developed Lands[45]



Afforestation (adding trees) between communities and croplands

2030	2038	2045	Units
133	185	230	acres/year

Description:

Establishment of agroforestry systems between commercial croplands and communities to decrease chemical exposure, increase carbon in crop systems, and enhance access

[45] LANDFIRE Download Mosaic Data Products; CAL FIRE GIS Mapping and Data Analytics

to treed green space for wildlife and communities. This is similar to the healthy soils practice of tree establishment, but with the explicit function of protecting communities.

Method:

The current acres of tree/shrub establishments and windbreak/shelterbelt establishment through the adoption of healthy soils practices is on the order of tens of acres per year. This is an order of magnitude increase from current levels. This is slightly different than the healthy soils practices acreages above as this is specifically targeted to create a physical barrier between croplands and communities which should provide multiple benefits. As such buffers are linear, small acreages can produce large buffers. This target assumes 100 acres per year from 2025-2029 as a ramp up to the 2030 target.

Conservation

2030	2038	2045	Units
17344	17344	17344	acres/year

Description:

Place tree cover within developed lands into legal protection against harvest, removal, or conversion.

Method:

Developed lands make up 7 million acres in California,[46] 15 percent of which are under tree canopy cover,[47] which equals 1.05 million acres of tree canopy cover. Conserving 30 percent of this acreage amounts to 315,000 acres. To achieve this, annual conservation targets of 17,344 acres per year are set between 2030-2045. These targets assume 7,500 acres per year of developed lands conservation between 2025-2029 to allow for a ramp up to 2030.

Urban and community greening and forestry

Tree canopy cover

2030	2038	2045	Units
10500	10500	10500	acres/year

Description:

Increase tree canopy cover within cities, communities, and schoolyards. This target is related to the below urban and community greening and forestry target measured in trees planted. Projects may simultaneously contribute to both of these targets, which were separated to reinforce the importance of not only growing existing canopies and

[46] California's Natural and Working Lands Climate Smart Strategy
[47] Biomass, Carbon Sequestration, and Avoided Emissions: Assessing the Role of Urban Trees in California

improving overall urban forest policy and management, but planting distinctly new trees.

Method:

Developed lands make up 7 million acres in California,[48] 15 percent of which are under tree canopy cover,[49] which equals 1.05 million acres of tree canopy cover. AB 2251 (2022, Calderon) mandates a 10 percent increase in tree canopy cover in urban areas by 2035.[50] This would equate to increasing urban tree canopy cover by a total of 105,000 acres, which requires 10,500 acres per year to 2035. This is then continued to 2045.

Drought-tolerant vegetation and grass removal

2030	2038	2045	Units
17426	17426	17426	acres/year

Description:

Conversion of grassy lawns to native drought tolerant vegetation.

Method:

It is estimated that approximately 633,000 acres of California are covered by irrigated lawns.[51] If half of this land were converted that would equal 316,500 acres. To convert this amount of land, 17,426 annual acres of drought-tolerant vegetation and lawn removal are needed between 2030-2045. This assumes 7,536 acres of drought-tolerant vegetation and lawn removal per year from 2025-2029 to allow for a ramp up to 2030.

Green space

2030	2038	2045	Units
1817	1817	1817	acres/year

Description:

Ensure every person in California has access to quality greenspace, typically defined as a park, urban forest, public garden, or tree lined square.[52] Access to greenspace is defined by walkability which is commonly expressed as approximately 0.5 miles.[53,54] Quality of greenspace can be quantified using various metrics that "affect the willingness of use and interaction of users with that space, including but not limited to

[48] California's Natural and Working Lands Climate Smart Strategy
[49] Biomass, Carbon Sequestration, and Avoided Emissions: Assessing the Role of Urban Trees in California
[50] AB-2251 Urban forestry: statewide strategic plan.
[51] Lawns and Water Demand in California
[52] Assessing Equity in the Accessibility to Urban Green Spaces According to Different Functional Levels
[53] Assessing Equity in the Accessibility to Urban Green Spaces According to Different Functional Levels
[54] Assessing Equitable Access to Urban Green Space: The Role of Engineered Water Infrastructure

intrinsic characteristics (size or patterns), features (vegetation, facilities or amenities), conditions (maintenance or safety) or user perception of its usefulness or quality."[55]

Method:

There are approximately 11,000 square miles of urban area in California. To ensure that every square mile of California's urban area has access to a quality green space would require one quality green space for every square mile. The average size of a quality green space is 10 acres.[56] This means California should have equitably spaced green spaces covering at least 110,000 acres. Assuming that quality greenspaces already exist in some locations, we aim for a 30 percent increase of quality greenspace by 2045 which equals an increase of 33,000 acres. To achieve this, 1,817 acres of green space are needed per year from 2030-2045. This assumes 786 acres of green space per year from 2025-2029 to allow for a ramp up to 2030.

Street tree cover

2030	2038	2045	Units
3304	3304	3304	acres/year

Description:

This is specific to street trees within communities. These acres may expand outside of populated or urban areas and into roads that are in need of tree cover to deliver carbon and other benefits.

Method:

There are 31,000 miles of medium and large roads within census urban areas. Adding a 10-meter buffer on either side of these roads amounts to 123,000 acres. This is an underestimate of the actual area, as these numbers are only within census urban areas, and this could extend outside the boundaries of these areas. If we increase tree cover on half of this area by 2045, that would equal approximately 60,000 acres. Expanding street tree cover on 60,000 acres would require 3,304 acres per year from 2030-2045. This assumes 1,429 acres per year from 2025-2029 to allow for a ramp up to 2030.

Schoolyard greening

2030	2038	2045	Units
1652	1652	1652	acres/year

Description:

The planting of trees, removal of pavement, installment of natural features for learning and recess, pocket forests, rain gardens, botanical gardens, natural playgrounds,

[55] Green Space Quality and Health: A Systematic Review

[56] Neighborhood poverty, park use, and park-based physical activity in a Southern California city

outdoor classrooms, and food producing gardens and landscapes on public school grounds.

Method:

There are 10,010 public schools in California. If we green an additional 30 percent of schoolyards, this would equal 3,003 schoolyards.[57] These schoolyards comprise 130,000 acres, of which 30 percent is approximately 40,000 acres. If we assume that existing tree canopy cover in schoolyards can already achieve 25 percent of this goal (i.e., 25 percent of 30 percent or 7.5 percent of the total area), then 30,000 acres would need additional tree canopy cover by 2045. This would equate to 1,625 acres annually between 2030-2045. This assumes 714 acres per year of greening schoolyards between 2025-2029 to allow for a ramp up to 2030.

Reducing community wildfire risk

Defensible space (property scale)

2030	2038	2045	Units
11012	11012	11012	acres/year

Description:

Establish defensible space around all structures in California's wildland urban interface (WUI) area in accordance with existing law.[58]

Method:

The 2022 Scoping Plan update estimated there are almost 200,000 acres where defensible space should be established and do not currently meet compliance.[59] Achieving this equates to 11,012 acres per year of defensible space between 2030-2045. These targets assume 4,762 acres of defensible space annually between 2025-2029 to allow for a ramp up to 2030.

Wildfire ignition rate from vehicles

2030	2038	2045	Units
10	20	30	percent reduction from previous average

Description:

This is a percentage reduction in the wildfire ignitions that are attributed to vehicles.

Method:

[57] California Schoolyard Forest System
[58] AB-3074 Fire prevention: wildfire risk: defensible space: ember-resistant zones.
[59] 2022 Scoping Plan Appendix I – Natural and Woking Land Technical Support Document

This target was established to account for the fuel reduction work that is occurring throughout the state around and along roadways, as well as other actions that reduce vehicle caused fires. This target takes into account the target for treatment along priority evacuation routes, as well as current State efforts to treat vegetation along roadways (currently over 100,000 acres per year).[60] Given the ambitious wildfire risk reduction and priority roadside treatment targets, and the current rate of treating roadside vegetation, it would be expected that a decrease in wildfire ignitions along roadways would follow. Additionally, agencies are now putting into place shutdowns[61] that restrict access to certain areas of the state during especially severe fire danger periods with an expressed purpose of reducing human caused ignitions. With the identified targets to treat roadside vegetation and efforts to reduce the chance of sparks from vehicles already underway, ambitious results-oriented targets to decrease wildfire ignition incidents caused by vehicles were set - 10 percent by 2030, 20 percent by 2038, and 30 percent by 2045. These targets assume a 5 percent reduction by 2025.

Priority roadside treatment

2030	2038	2045	Units
50	70	100	percent of priority roads that function as primary evacuation routes treated at least once

Description:

This target would ensure that every acre along priority roads that function as evacuation routes are treated at least once by 2045 with the appropriate treatment. These include private, local, State, and federal roads, to be identified, that are in need of vegetation management to enhance safety.

Method:

It is estimated that 14,993 center line miles in California are vulnerable to wildfire[62] of which 2,600 are a priority for treatment.[63] This, however, does not include private, local, and federal roads. Further, even if a road is vulnerable does not mean that it is a priority evacuation route. Defining, identifying, and quantifying these priority roads will occur throughout the coming years led by the State and in partnership with the appropriate private, local, and federal organizations. These targets assume 20 percent of priority roads treated by 2025.

Urban and community greening and forestry - urban tree planting

2030	2038	2045	Units
200000	200000	200000	trees planted/year

[60] Beta Interagency Treatment Dashboard
[61] USDA Forest Service Temporarily Closing All California National Forests for Public Safety
[62] Caltrans, State Push Fire-Resilient Roadways Strategy
[63] 2020 Critical Update to Caltrans Wildfire Vulnerability Analysis

Description:

Increase trees planted in cities and communities, specifically large canopied, drought-tolerant trees meaningful to the community. Communities with low tree canopy should be prioritized. These targets are related to the above urban and community greening and forestry targets measured in acres. Projects may simultaneously contribute to both of these targets, which were separated to reinforce the importance of not only growing existing canopies and improving overall urban forest policy and management, but planting distinctly new trees.

Method:

Developed lands make up 7 million acres in California,[64] 15 percent of which is under tree canopy cover,[65] which equals 1.05 million acres of tree canopy cover. AB 2251 (2022, Calderon) mandates a 10 percent increase in tree canopy cover in urban areas by 2035.[66] This would equate to increasing urban tree canopy cover by a total of 105,000 acres, which requires 10,500 acres per year to 2035. This is then continued to 2045. If 50 percent of this increase comes from newly planted areas, this would require 5,250 acres of tree planting per year. Tree densities in California average 32.7 trees per acre and thus, equates to planting approximately 200,000 trees per year. This is new planting and does not account for maintenance planting in existing treed areas, which makes up the vast majority of planting.

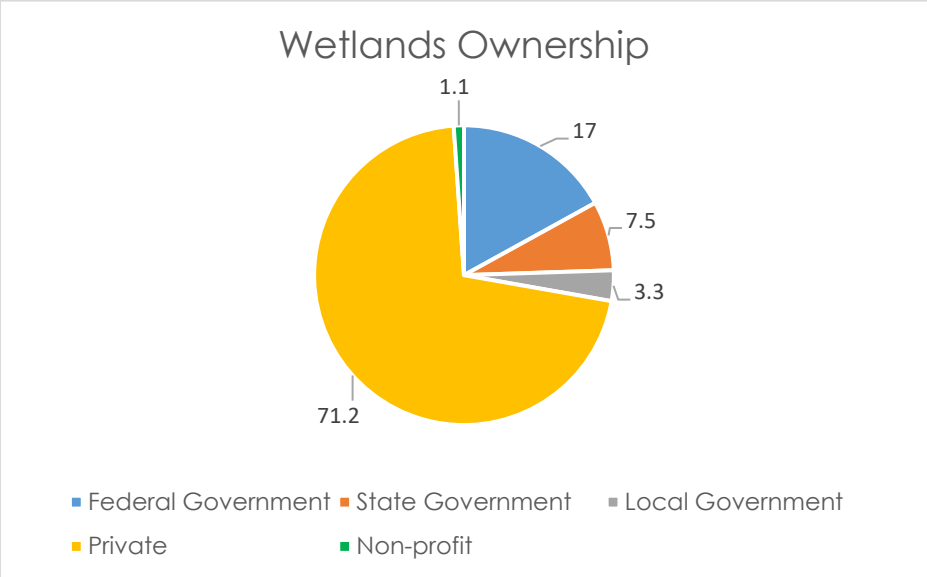
[64] California's Natural and Working Lands Climate Smart Strategy
[65] Biomass, Carbon Sequestration, and Avoided Emissions: Assessing the Role of Urban Trees in California
[66] AB-2251 Urban forestry: statewide strategic plan.

Wetlands and Seagrasses

Acreage Targets

Nature-Based Solution (Acres/year)	2030	2038	2045
Conservation • Conserve coastal wetlands, seagrass beds, Delta wetlands, and mountain meadow wetlands	1.3K	1.3K	1.3K
Restoration • Restore and/or re-establish coastal wetlands, including through beneficial reuse of sediment • Restore and/or re-establish seagrass beds, with a focus on eelgrass meadows • Restore Delta wetlands, including through re-establishing brackish and freshwater tidal wetlands on previously drained or seasonal wetlands, and rewetting deeply subsided areas through the creation of non-tidal managed wetlands or rice cultivation • Restore and/or rewet previously drained San Francisco Bay wetlands • Restore mountain meadow wetlands through restoring proper hydrologic flow, removing conifer encroachment, and/or beaver reintroduction	9.2K	9.2K	9.2K
Sea level rise protection of ecosystems • Restore coastal wetlands in a manner that enables them to keep pace with sea level rise, including conserving upland space needed for wetland migration	1.7K	1.7K	1.7K
TOTAL acres/year	**12.2K**	**12.2K**	**12.2K**

Ownership Breakdown of Wetlands[67]



[67] LANDFIRE Download Mosaic Data Products; CAL FIRE GIS Mapping and Data Analytics

Note: ownership percentages of water, including seagrasses and seaweeds, are complex and not readily available. This also includes unique ownership types not included in other land types, such as public trust lands managed by the California State Lands Commission and Waters of the U.S., which are defined in the regulations of federal agencies to establish the scope of federal jurisdiction.

Conservation

Coastal wetland conservation

2030	2038	2045	Units
1253	1253	1253	acres/year

Description:

Place coastal wetlands under legal protection from conversion.

Method:

It is estimated that there are 96,000 acres of coastal wetlands in California, outside of the San Francisco Bay.[68] Thirty percent of those acres is nearly 29,000 acres. Additionally, the California Ocean Protection Council's Strategic Plan to Protect California's Coast and Ocean 2020-2025[69] calls for protecting 10,000 acres of wetlands by 2025. Assuming the 2025 goal is met, this is continued to 2030, and then ramped down until an additional 30 percent of coastal wetlands are conserved by 2045.

Restoration

Coastal wetland restoration

2030	2038	2045	Units
330	330	330	acres/year

Description:

Restore and/or re-establish coastal wetlands.

Method:

The California Ocean Protection Council's Strategic Plan to Protect California's Coast and Ocean 2020-2025 identifies additional coastal wetland restoration in conjunction with the conservation targets.[70] To account for this additional restoration, 6,000 additional total acres, or 330 acres annually, of restoration between 2030-2045 are included. This assumes annual coastal wetland restoration of 143 acres per year from 2025-2029 to allow for a ramp up to 2030.

[68] EcoAtlas: Statewide - Map
[69] Strategic Plan to Protect California's Coast and Ocean 2020–2025
[70] Strategic Plan to Protect California's Coast and Ocean 2020–2025

Seagrass restoration

2030	2038	2045	Units
330	330	330	acres/year

Description:

Restore and/or re-establish seagrass beds, with a focus on eelgrass meadows.

Method:

It is estimated that 6,000 additional acres of eelgrass can be established within the San Francisco Bay,[71] which would require 330 acres per year between 2030-2045. This assumes annual seagrass restoration of 143 acres per year from 2025-2029 to allow for a ramp up to 2030. This is an underestimate of the total need statewide, however current mapping and modeling prevent more precise estimates statewide.

Brackish and freshwater tidal wetland restoration in the Sacramento-San Joaquin Delta and Suisun Marsh

2030	2038	2045	Units
1789	1789	1789	acres/year

Description:

Re-establish brackish and freshwater tidal wetlands within the Delta and Suisun Marsh on previously drained or seasonal wetlands.

Method:

The Delta Plan, Chapter 4, Protect, Restore, and Enhance the Delta Ecosystem, articulates a goal of adding 32,500 acres of tidal wetlands by 2050 to restore functionally connected habitats, support biodiversity, and improve ecological function for the Bay-Delta system.[72,73] Increased ambition has led to meeting this need by 2045. This amounts to 1,789 acres per year between 2030-2045, assuming 774 acres of brackish and freshwater tidal restoration annually from 2025-2029 to allow for a ramp up to 2030.

Managed wetlands restoration or rice cultivation on subsided lands in the Sacramento-San Joaquin Delta and Suisun Marsh

2030	2038	2045	Units
2753	2753	2753	acres/year

[71] Levering Wetlands for a Better Climate Future: Incorporating Blue Carbon into California's Climate Planning
[72] Delta Plan Chapter 4 Protect, Restore, and Enhance the Delta Ecosystem
[73] Delta Plan Appendix E: Performance Measures for the Delta Plan

Description:

Re-wet highly organic peat soils in the deeply subsided areas of the Delta to stop carbon emissions and resulting subsidence. Re-wetted lands can be managed as non-tidal wetlands or used for rice cultivation.

Method:

There are currently over 150,000 acres of deeply subsided highly organic peat soils in the Delta that continue to subside and emit approximately 1.4 million tons of carbon dioxide per year. Re-wetting the organic soils stops the microbial oxidation that results in carbon dioxide emissions. Of the 150,000 acres, approximately 100,000 acres are in private ownership and 50,000 acres are in public or publicly funded ownership. Private landowners have expressed interest in converting to rice cultivation to increase farm revenue and decrease subsidence related costs. Public landowners are converting subsided lands to managed wetland and rice cultivation. Based on the interest of landowners to address subsidence concerns and available incentives, a need of 50,000 acres was established. This amounts to 2,753 acres per year between 2030-2045. This assumes 1,190 acres of managed wetland restoration or rice cultivation per year between 2025-2029 to allow for a ramp up to 2030.

Wetland restoration in the San Francisco Bay-Delta

2030	2038	2045	Units
1652	1652	1652	acres/year

Description:

Rewet and/or otherwise restore previously drained wetlands in the San Francisco Bay-Delta.

Method:

It is estimated that approximately 30,000 acres of tidal marsh in the San Francisco Bay-Delta could be restored. This amounts to 1,652 acres of restoration annually between 2030-2045 with an assumption of 714 acres of restoration annually from 2025 to 2029. See Appendix C of the "Leveraging Wetlands for a Better Climate Future: Incorporating Blue Carbon into California's Climate Planning" report for more information.[74]

Mountain meadow restoration

2030	2038	2045	Units
2300	2300	2300	acres/year

Description:

[74] Leveraging Wetlands for a Better Climate Future: Incorporating Blue Carbon into California's Climate Planning

Management and restoration activities that restore riparian and meadow areas, such as removing conifer encroachment, restoring proper hydrologic flow, and beaver reintroduction.

Method:

The Sierra Meadows Partnership estimates that approximately 50 percent of the 280,000 acres of mountain meadows within the Sierra Nevada are known or expected to be degraded.[75] In November 2016, the Partnership set a goal to restore and/or protect 30,000 of the 140,000 acres of degraded meadows in the greater Sierra Nevada, including the Cascade and Warner Mountains, by 2030.[76] The California Forest Carbon Plan set a State target to restore 10,000 acres of mountain meadows by 2030 and a federal contribution of 10,000 acres of meadow restoration by 2030.[77] The meadow restoration targets in the Forest Carbon Plan were meant to be a "starting point for the achievement" of the Partnership goal of 30,000 acres by 2030. The Partnership's goal of 30,000 acres of meadow restoration/protection between 2017 and 2030 amounts to approximately 2,300 acres annually. This annual acreage is extended to 2045.

Sea level rise protection of ecosystems

2030	2038	2045	Units
1652	1652	1652	acres/year

Description:

Wetland migration to ensure that these ecosystems can persist in the face of sea level rise.

Method:

It is estimated that 30,000 acres of coastal wetlands need sea level rise resilience interventions[78] to prevent the drowning of these wetlands. This amounts to 1,652 acres of interventions per year between 2030-2045. This assumes 714 acres of interventions per year between 2025-2029 to allow for a ramp up to 2030. Other estimates say there are 57,000 acres of coastal wetlands that can potentially migrate.[79] Given this,1,652 is a conservative estimate of the need.

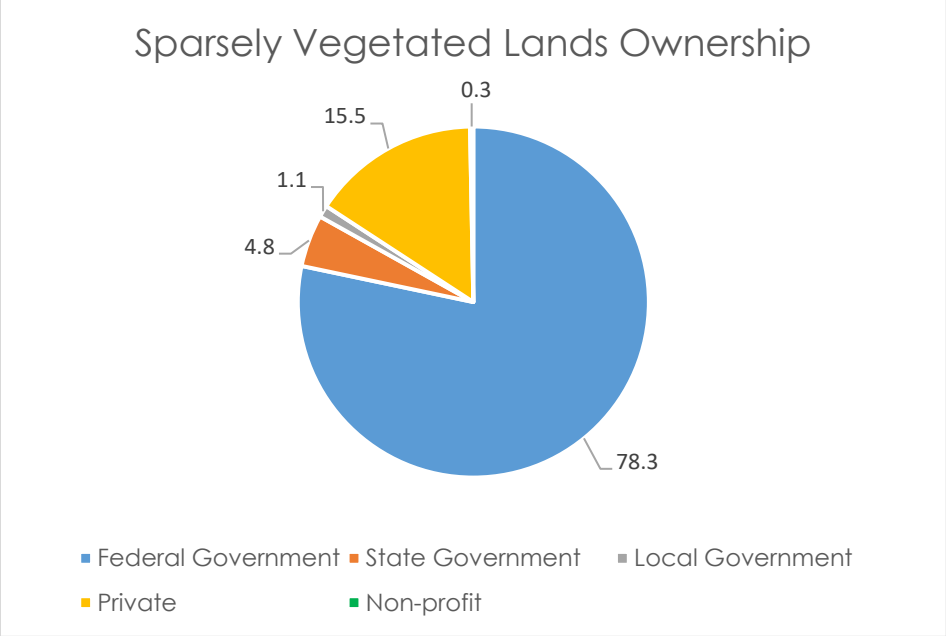
[75] Why Meadows?
[76] Sierra Meadows Strategy
[77] California Forest Carbon Plan
[78] Leveraging Wetlands for a Better Climate Future: Incorporating Blue Carbon into California's Climate Planning
[79] California Coastal Commission Statewide Sea Level Rise Vulnerability Synthesis

Sparsely Vegetated Lands

Acreage Targets

Nature-Based Solution (acres/year)	2030	2038	2045
Conservation • Conserve lands to prevent conversion and/or disturbance	20K	30K	40K
Restoration • Restore native vegetation on previously disturbed areas (or on those otherwise dominated by invasive species) including through invasive species removal and restoration of riparian zones	55.1K	55.1K	55.1K
TOTAL acres/year	**75.1K**	**85.1K**	**95.1K**

Ownership Breakdown of Sparsely Vegetated Lands[80]



Conservation

2030	2038	2045	Units
20000	30000	40000	acres/year

Description:

Placing these lands under legal protection against disturbance and conversion with a focus on areas with wildlife habitat under threat of conversion. Plant species in dry

[80] LANDFIRE Download Mosaic Data Products; CAL FIRE GIS Mapping and Data Analytics

sparsely vegetated lands can live thousands of years, and disturbance of the soils in these systems negatively impact public health and other ecosystem benefits. Returning to pre-disturbance levels of biomass and soils is a slow process and can take 50-300 years. In some cases, complete ecosystem recovery may require thousands of years.[81]

Method:

Sparsely vegetated lands cover at least 10 million acres in California.[82] Conserving 30 percent of this land equals 3 million acres. Because much of this land is already conserved and not every acre is suitable for development, a target beginning with 20,000 acres per year in 2030 is set. This number is then ramped up steadily through time. These targets assume 18,000 acres of restoration per year from 2025-2029 to allow for a ramp up to 2030. This would result in approximately half a million acres conserved by 2045.

Restoration

2030	2038	2045	Units
55060	55060	55060	acres/year

Description:

Restore native vegetation on previously disturbed sparsely vegetated lands and those sparsely vegetated lands dominated by invasive species for other reasons.

Method:

As with native grasslands, it can be assumed that only 1 percent of these lands are currently dominated by native vegetation.[83] Sparsely vegetated lands cover at least 10 million acres in California.[84] If we were to increase this by 10 percent that would require approximately 1 million acres of restoration. To achieve this, targets of 55,060 acres of restoration per year are set between 2030-2045. This assumes 23,810 acres of restoration per year between 2025-2029 to allow for a ramp up to the 2030 targets.

[81] Anthropogenic Degradation of the Southern California Desert Ecosystem and Prospects for Natural Recovery and Restoration
[82] California's Natural and Working Lands Climate Smart Strategy
[83] California Native Grasslands: A Historical Perspective A Guide for Developing Realistic Restoration Objectives
[84] California's Natural and Working Lands Climate Smart Strategy