



Area Source Methodology Technical Documentation

Section 7.18

Managed Burning And Disposal,

Non-Agricultural Open Burning

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Area Source Improvement & Community Inventory Development Section

Air Quality Planning and Science Division

Emission Inventory Source Category

Miscellaneous Processes / Managed Burning and Disposal

Emission Inventory Codes (CES Codes) and Description

EIC Codes (CES Codes)	Description
670-670-0200-0000 (47290)	Non-Agricultural Open Burning

Federal Sources Classification Codes and Description

SCC Codes	Description
2610000100	Waste Disposal - Open Burning - Yard Waste - Leaf Species Unspecified
2610000300	Waste Disposal - Open Burning - Yard Waste - Weed Species Unspecified (incl Grass)
2610000400	2610000400 Waste Disposal - Open Burning - Yard Waste - Brush Species Unspecified

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Source Category Description

The Non-Agricultural Open Burning category includes emissions from intentional burning for waste disposal purposes of leaf and brush in outdoor areas. This methodology estimates emissions of fine particulate matter (PM), particulate matter with a diameter of 10 microns or less (PM₁₀), particulate matter with a diameter of 2.5 microns or less (PM_{2.5}), oxides of nitrogen (NO_x), carbon monoxide (CO), and ammonia (NH₃) resulting from these emissions.

At the time of this methodology's development, several other non-agricultural open burning methodologies were in use or under development by other agencies, which are listed below. These served as useful references for the development of this methodology.

- Sacramento Metropolitan Air Quality Management District, 2000. Area Source Summary – Sacramento County, Non-Agricultural Waste Burning. https://ww3.arb.ca.gov/ei/areasrc/districtmeth/sac/as_opburn00_670.pdf
- San Joaquin Valley Air Pollution Control District, 2009. 2006 Area Source Emissions Inventory Methodology: 670 – Non-Agricultural Open Burning. <https://ww2.valleyair.org/media/102foasm/nonagopenburning2006.pdf>
- United States Environmental Protection Agency, 2020. 2020 National Emissions Inventory Technical Support Document: Waste Disposal – Open Burning – Yard Waste. https://www.epa.gov/system/files/documents/2023-04/NEI2020_TSD_Section36_WD_OpenBurning_YardWaste.pdf

I. District Submittals

Following CARB approval, district-specific emission estimates submitted by the Bay Area Air Quality Management District (BAAQMD) will replace the statewide emission estimates presented in this document. The Bay Area Air Quality Management District estimates county-specific residential non-agricultural burns to remove vegetation for wildfire risk reduction under Regulation 5: Open Burns. The Air District collects direct activity data for these types of burns from submitted Open Burn Notifications which are aggregated by county. Reported burn volumes are converted to tons using CARB's default conversion factor for brush. Emissions are then estimated, consistent with CARB's methodology, by applying U.S. EPA National Emissions Inventory Wagon Wheel emission factors for hazardous materials burning, which assume a 50/50 mixture of leaves and brush representative of yard waste and defensible space vegetation.

Changes in This Update

Not applicable. This is a new methodology.

Emissions Estimation Inputs

The calculations for estimating the emissions from the burning of yard waste involve first estimating the amount of leaf and brush waste generated per capita. The amount of yard waste burned is estimated by multiplying the per capita amount of leaf and brush waste by the number of people likely to burn waste in each county. The number of people likely to burn waste is based on the rural population in each county and the percent of that population likely to burn. The total amount of yard waste burned is scaled by the percentage of forested acreage in each county. The total amount of yard waste burned is multiplied by emissions factors for each criteria air pollutants to estimate emissions of these pollutants from yard waste burning.

II. Activity Data

Activity data for this source category are based on the amount of leaf and brush generated per person and the population likely to burn. Staff calculated the leaf and brush generation based on forested acreage in the location of interest multiplied by the estimated leaf and brush generation per acre. The population likely to burn is based on the rural population of location of interest multiplied by the percentage estimated to burn annually. A summary of the activity data used for residential backyard burning is shown in Table 1. More information on the calculations can be found in the Emissions Estimation Methodology section. A summary of COABDIS level activity data can be found in Appendix A.

Table 1: Activity data for residential backyard open burning.

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Activity	Value	Sources
Population (P_{COABIS}) 2023	39,123,861 State level; Per County-Air Basin-District (COABDIS)	California Department of Finance P-2a, 2023
Urban/Rural Population Percentages	6% State level; Per County-Air Basin-District (COABDIS)	County-level Urban and Rural information for the 2020 Census
Leaf and Brush Generation Per Person (YW_P)	0.64 tons per person	See section for calculation details.
Leaf and Brush Generation Per Forested Acre	1.40 tons leaf and brush generation per acre	Bray and Gorham, 1964.
California Forested Acreage	~17,500,000 acres total statewide. 17.4% of total acreage.	USGS 2018. Using the following forest categories from the National Land Coverage Database: Deciduous Forest, Evergreen Forest, Mixed Forest, Woody Wet.

III. Emissions Factors

Staff utilized the EPA's 2020 Wagon Wheel Emissions Factor compendium for emissions factors for brush and leafy material. Those factors are reproduced in Table 2.

Table 2: Emissions factors for residential backyard open burning.

Material Type	Pollutant	Emissions Factor (lbs/ton of material burned)
Brush	Ammonia	14.52
Brush	Carbon Monoxide	140
Brush	Nitrogen Oxides	5
Brush	PM2.5	13.1
Brush	Sulfur Dioxide	1.66
Brush	Volatile Organic Compounds	19
Leaf	Ammonia	18.01
Leaf	Carbon Monoxide	112
Leaf	Nitrogen Oxides	6.2
Leaf	PM2.5	29.3
Leaf	Sulfur Dioxide	0.76
Leaf	Volatile Organic Compounds	28

Emissions Estimation Methodology

To estimate emissions from this source category, staff calculate the yard waste generation per capita at the state level by using the following calculation.

$$YW_P = FD_G \times F_a \div P_S$$

Where:

YW_P = Yard waste per person.

FD_G = Forest debris generation per acre. Staff calculated this value by taking the average forest litter production for forests in California resulting in a value of 1.40 short tons per acre (Bray and Gorham, 1964).

F_a = Statewide forested acreage. Staff calculated the statewide forested acreage using the National Land Coverage Database and included the following land types: Deciduous Forest, Evergreen Forest, Mixed Forest, Woody Wet.

P_S = Statewide population.

Staff calculated the population likely to burn using a similar methodology to the National Emissions Inventory (NEI) (EPA 2022). It is assumed that populations in urban areas do not burn yard waste as it is either prohibited or the availability of yard waste pickup makes burning unnecessary. Thus, staff used rural population estimates from the 2020 US Census to determine the percentage of rural population per COABDIS. Staff also used the same NEI assumption that 24% of rural population burns yard waste (Environics Research Group 2001).

$$P_{\text{Burn}} = P_{\text{COABDIS}} \times R_P \times L_B$$

Where:

P_{Burn} = Population likely to burn yard waste.

P_{COABDIS} = Population for each CoAbDis region.

R_P = Percentage of population is considered rural according to 2020 US Census.

L_B = 24% of rural population expect to burn.

The amount of material burned per COABDIS is calculated by multiplying the per capita yard waste by the population likely to burn and scaled by the percent of the region that is forested. Staff utilized the National Land Coverage Database (NLCD) to calculate each region's coverage. Staff used the following land cover types to determine forested acreage: deciduous forest, evergreen forest, mixed forest, and woody wetlands. Staff assumes that half of the material is leafy and half is brush.

$$M_{B,\text{Leaf}} = YW_P \times F_F \times P_{\text{Burn}} \times 50\%$$

$$M_{B,\text{Brush}} = YW_P \times F_F \times P_{\text{Burn}} \times 50\%$$

Where:

$M_{B,\text{Leaf}}$ = Leafy material burned per COABDIS

$M_{B,\text{Brush}}$ = Brush material burned per COABDIS

F_F = Percent of COABDIS region that is forested.

To calculate the emissions per COABDIS by pollution type, staff multiplies the material burned by each of the emissions factors.

$$E_{\text{Pollutant}} = M_{\text{Type}} \times EF_{\text{Pollutant}}$$

Where:

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$E_{\text{Pollutant}}$ = Emissions from each pollutant.

M_{Type} = Material burned by type (leafy material, brush).

$EF_{\text{Pollutant}}$ = Emissions factor from each pollutant based on the material type.

Results of these calculations for each COABDIS are shown in Appendix B.

Sample Calculations

This section provides sample calculations for Mendocino county which is part of the Mendocino County Air Quality Management District in the North Coast Air Basin. The data year used is 2023. Note that staff did not express all significant digits in calculations and rounding may result in slight discrepancies.

Mendocino has the following activity data in Table 3.

Table 3: Activity data for Mendocino county.

Activity	Value
Population (P_{COABIS}) 2023	89,556
Urban/Rural Population Percentages	48.46% rural
Leaf and Brush Generation Per Person (YW_P)	0.64 tons per person
Forested Acreage	54.79% of county is considered forested.

The population likely to burn is calculated as follows.

$$P_{\text{Burn}} = P_{\text{COABDIS}} \times R_P \times L_B$$

$$P_{\text{Burn}} = 89,556 \times 48.46\% \times 24\%$$

$$P_{\text{Burn}} = 10,416.7$$

The amount of material burned is calculated as follows.

$$M_{\text{B,Leaf}} = YW_P \times F_F \times P_{\text{Burn}} \times 50\%$$

$$M_{\text{B,Leaf}} = 0.64 \times 54.79\% \times 10,416.7 \times 50\%$$

$$M_{\text{B,Leaf}} = 1,826.4$$

$$M_{B,Brush} = YW_P \times F_F \times P_{Burn} \times 50\%$$

$$M_{B,Brush} = 1,826.4$$

To calculate the emissions, in this case PM_{2.5}, the calculation is as follows.

$$E_{Pollutant} = M_{Type} \times EF_{Pollutant}$$

$$E_{PM2.5} = M_{B,Leaf} \times EF_{PM2.5,Leaf} + M_{B,Brush} \times EF_{PM2.5,Brush}$$

$$E_{PM2.5} = 1,826.4 \times 29.3 + 1,826.4 \times 13.1$$

$$E_{PM2.5} = 53,513.2 + 23,925.7$$

$$E_{PM2.5} = 77,438.9 \text{ PM}_{2.5} \text{ per year 2023}$$

$$E_{PM2.5} = 38.72 \text{ ton PM}_{2.5} \text{ per year}$$

Emissions Estimates

Using this methodology, staff calculated the total statewide emissions for 2023 to be 612.11 tons of PM_{2.5} per year which averages to 1.68 tons of PM_{2.5} per day.

The emissions for all pollutants at the COABDIS level are shown in Appendix B.

Speciation

CARB has developed organic gas profiles to facilitate the calculation of reactive organic gases (ROG), VOC, or total organic gases (TOG), given any one of these values. For each speciation profile, the fraction of TOG that is ROG and VOC is specified. These organic gas profile codes can also be used to identify associated toxic compounds. CARB's organic gas speciation profile for non-agricultural open burning is presented in Table 4.

CARB has also developed similar profiles for particulate matter that facility the calculation of total PM (TPM), PM_{2.5}, and PM₁₀. The speciation profile for non-agricultural open burning is presented in Table 4.

Table 4: Speciation profile for non-agricultural open burning.

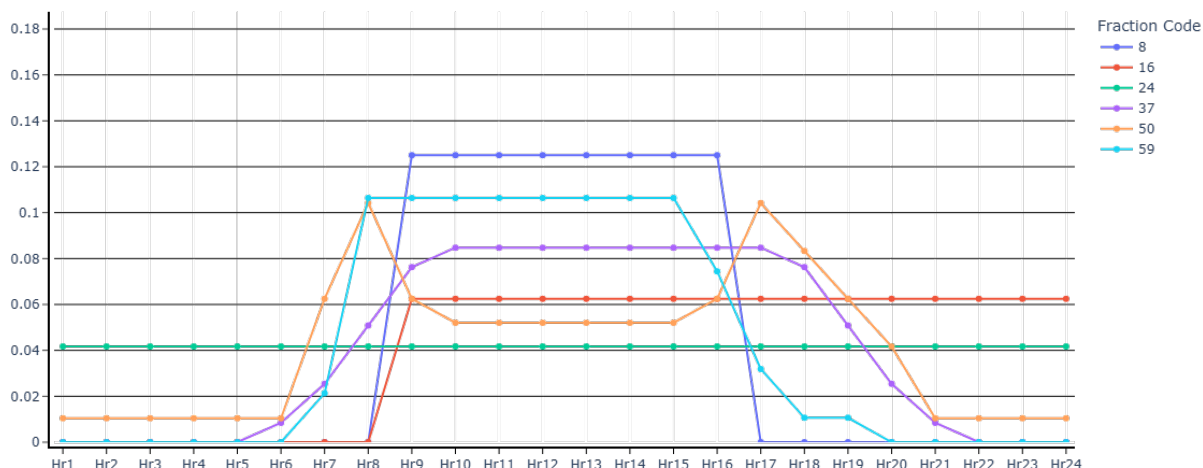
EIC	PM Profile No.	PM _{2.5} /TPM	PM ₁₀ /TPM	OG Profile No.	ROG/TOG	VOC/TOG
670-670-0200-0000	461	0.9316	0.9825	523	0.44	0.44

Temporal Activity

To accurately represent the temporal variation of emissions from non-agricultural open burning, this methodology utilizes the historical temporal profiles based on Air District. The following temporal allocations are applied:

- Hourly Variation:**

Hourly Fractions RF3108 EIC: 67067002000000



The following table identifies which Air District are linked to which fractional code.

Fraction Code	County	Air District
8	San Diego County	San Diego County Apcd
8	Santa Cruz	Monterey Bay Air Resources District
8	Monterey	Monterey Bay Air Resources District
8	San Benito	Monterey Bay Air Resources District
8	San Luis Obispo	San Luis Obispo County Apcd
16	Santa Barbara	Santa Barbara County Apcd
24	Alpine	Great Basin Unified Apcd
24	Inyo	Great Basin Unified Apcd
24	Mono	Great Basin Unified Apcd
24	Lassen	Lassen County Apcd
24	Modoc	Modoc County Apcd
24	Siskiyou	Siskiyou County Apcd
24	Alameda	Bay Area Aqmd
24	Contra Costa	Bay Area Aqmd
24	Marin	Bay Area Aqmd
24	Napa	Bay Area Aqmd
24	San Francisco	Bay Area Aqmd
24	San Mateo	Bay Area Aqmd
24	Santa Clara	Bay Area Aqmd

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Fraction Code	County	Air District
24	Solano	Bay Area Aqmd
24	Sonoma	Bay Area Aqmd
24	Fresno	San Joaquin Valley Apcd
24	Kern	San Joaquin Valley Apcd
24	Kings	San Joaquin Valley Apcd
24	Madera	San Joaquin Valley Apcd
24	Merced	San Joaquin Valley Apcd
24	San Joaquin	San Joaquin Valley Apcd
24	Stanislaus	San Joaquin Valley Apcd
24	Tulare	San Joaquin Valley Apcd
24	Ventura	Ventura County Apcd
24	San Bernardino	Mojave Desert Aqmd
37	Lake	Lake County Aqmd
37	El Dorado	El Dorado County Aqmd
37	Placer	Placer County Apcd
37	Amador	Amador County Apcd
37	Calaveras	Calaveras County Apcd
37	El Dorado	El Dorado County Aqmd
37	Mariposa	Mariposa County Apcd
37	Nevada	Northern Sierra Aqmd
37	Placer	Placer County Apcd
37	Plumas	Northern Sierra Aqmd
37	Sierra	Northern Sierra Aqmd
37	Tuolumne	Tuolumne County Apcd
37	Del Norte	North Coast Unified Aqmd
37	Humboldt	North Coast Unified Aqmd
37	Mendocino	Mendocino County Aqmd
37	Sonoma	Northern Sonoma County Apcd
37	Trinity	North Coast Unified Aqmd
37	Butte	Butte County Aqmd
37	Colusa	Colusa County Apcd
37	Placer	Placer County Apcd
37	Sacramento	Sacramento Metropolitan Aqmd
37	Shasta	Shasta County Aqmd
37	Solano	Yolo-Solano Aqmd
37	Tehama	Tehama County Apcd
37	Yolo	Yolo-Solano Aqmd
37	Imperial	Imperial County Apcd
50	Glenn	Glenn County Apcd
50	Los Angeles	South Coast Aqmd
50	Orange	South Coast Aqmd

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Fraction Code	County	Air District
50	Riverside	South Coast Aqmd
50	San Bernardino	South Coast Aqmd
50	Riverside	South Coast Aqmd
50	Riverside	Mojave Desert Aqmd
50	Riverside	South Coast Aqmd
50	Los Angeles	Antelope Valley Aqmd
59	Kern	Eastern Kern Apcd
59	Sutter	Feather River Aqmd
59	Yuba	Feather River Aqmd

- Weekly Variation:**

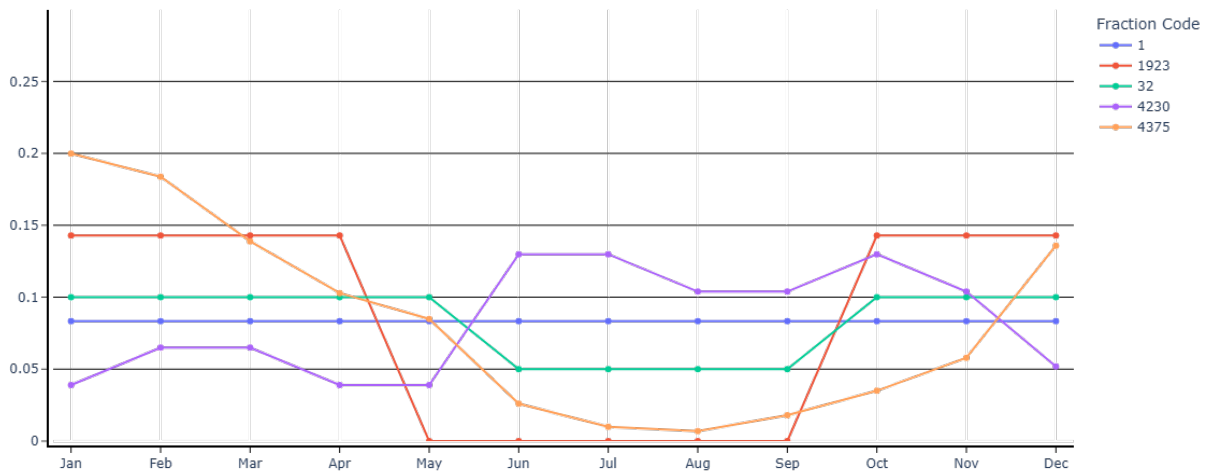
The weekly variation is evenly distributed for all regions.

Weekly Fractions RF3108 EIC: 67067002000000



- Monthly Variation:**

Monthly Fractions RF3108 EIC: 67067002000000



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Fraction Code	County	Air District
1	Alpine	Great Basin Unified Apcd
1	Inyo	Great Basin Unified Apcd
1	Mono	Great Basin Unified Apcd
1	Lake	Lake County Aqmd
1	El Dorado	El Dorado County Aqmd
1	Placer	Placer County Apcd
1	Amador	Amador County Apcd
1	Calaveras	Calaveras County Apcd
1	El Dorado	El Dorado County Aqmd
1	Mariposa	Mariposa County Apcd
1	Nevada	Northern Sierra Aqmd
1	Placer	Placer County Apcd
1	Plumas	Northern Sierra Aqmd
1	Sierra	Northern Sierra Aqmd
1	Tuolumne	Tuolumne County Apcd
1	Monterey	Monterey Bay Air Resources District
1	San Benito	Monterey Bay Air Resources District
1	Santa Cruz	Monterey Bay Air Resources District
1	Del Norte	North Coast Unified Aqmd
1	Humboldt	North Coast Unified Aqmd
1	Mendocino	Mendocino County Aqmd
1	Sonoma	Northern Sonoma County Apcd
1	Trinity	North Coast Unified Aqmd
1	Lassen	Lassen County Apcd
1	Modoc	Modoc County Apcd
1	Siskiyou	Siskiyou County Apcd
1	Butte	Butte County Aqmd
1	Colusa	Colusa County Apcd
1	Glenn	Glenn County Apcd
1	Placer	Placer County Apcd
1	Sacramento	Sacramento Metropolitan Aqmd
1	Shasta	Shasta County Aqmd
1	Solano	Yolo-Solano Aqmd
1	Sutter	Feather River Aqmd
1	Tehama	Tehama County Apcd
1	Yolo	Yolo-Solano Aqmd
1	Yuba	Feather River Aqmd
1	Alameda	Bay Area Aqmd
1	Contra Costa	Bay Area Aqmd
1	Marin	Bay Area Aqmd
1	Napa	Bay Area Aqmd

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Fraction Code	County	Air District
1	San Francisco	Bay Area Aqmd
1	San Mateo	Bay Area Aqmd
1	Santa Clara	Bay Area Aqmd
1	Solano	Bay Area Aqmd
1	Sonoma	Bay Area Aqmd
1	Merced	San Joaquin Valley Apcd
1	San Joaquin	San Joaquin Valley Apcd
1	Ventura	Ventura County Apcd
1	Imperial	Imperial County Apcd
1	San Bernardino	Mojave Desert Aqmd
1923	San Luis Obispo	San Luis Obispo County Apcd
1923	Los Angeles	South Coast Aqmd
1923	Orange	South Coast Aqmd
1923	Riverside	South Coast Aqmd
1923	San Bernardino	South Coast Aqmd
1923	Riverside	South Coast Aqmd
1923	Riverside	Mojave Desert Aqmd
1923	Riverside	South Coast Aqmd
1923	Los Angeles	Antelope Valley Aqmd
32	San Diego	San Diego County Apcd
4230	Santa Barbara	Santa Barbara County Apcd
4375	Fresno	San Joaquin Valley Apcd
4375	Kern	Eastern Kern Apcd
4375	Kern	San Joaquin Valley Apcd
4375	Kings	San Joaquin Valley Apcd
4375	Madera	San Joaquin Valley Apcd
4375	Stanislaus	San Joaquin Valley Apcd
4375	Tulare	San Joaquin Valley Apcd

Growth Forecasting

Growth factors are used to estimate emissions in future years. Staff will incorporate existing growth models for this activity which is based on population projections (California Department of Finance, 2023). This growth model only assumes growth, which is projected at the rate of population increase, when the rural population is greater than 20%. If the rural population is not greater than 20%, no growth is assumed in the region. Staff will use the County-Level Urban and Rural Information for the 2020 Census (United States Census Bureau, 2023). A summary of growth parameters is listed in Appendix C.

Assumptions and Limitations

Emissions factors for this category are described with a “D” level certainty from AP-42 meaning a lower level of confidence in the accuracy of the data. The emissions from burning yard waste vary based on the type of pile, the moisture content of fuel, and various other factors.

Comments and Recommendations

The activity data is based on best available estimates on the population likely to burn. Future survey data or more information on burn permits could increase the certainty of estimates.

References

1. Bray and Gorham, 1964. Litter Production in Forests of the World, Advances in Ecological Research.
2. California Department of Finance, 2023. P-2a: County Population Projections.
3. Environics Research Group, 2001. Household Garbage Disposal and Burning: Ontario Survey.
4. Sacramento Metropolitan Air Quality Management District, 2000. Area Source Summary – Sacramento County, Non-Agricultural Waste Burning.
5. San Joaquin Valley Air Pollution Control District, 2009. 2006 Area Source Emissions Inventory Methodology: 670 – Non-Agricultural Open Burning.
6. United States Environmental Protection Agency, 2020. 2020 National Emissions Inventory Technical Support Document: Waste Disposal – Open Burning – Yard Waste.
7. United States Geological Survey, 2024. Annual National Land Cover Database (NLCD) Collection 1.1.
8. United States Census Bureau, 2023. County-Level Urban and Rural Information for the 2020 Census.

Appendix A: Activity Data

County	Air Basin	Air District	Population ¹	Percent Populati on Rural ²	Total Forested Acreage ³
Alameda	San Francisco Bay Area	Bay Area Aqmd	1,644,199.00	0%	9%
Alpine	Great Basin Valleys	Great Basin Unified Apcd	1,166.00	100%	43%
Amador	Mountain Counties	Amador County Apcd	40,028.00	69%	43%
Butte	Sacramen to Valley	Butte County Aqmd	205,741.00	21%	21%
Calaveras	Mountain Counties	Calaveras County Apcd	44,616.00	82%	40%
Colusa	Sacramen to Valley	Colusa County Apcd	21,981.00	43%	1%
Contra Costa	San Francisco Bay Area	Bay Area Aqmd	1,148,745.00	1%	8%
Del Norte	North Coast	North Coast Unified Aqmd	26,320.00	44%	56%
El Dorado	Lake Tahoe	El Dorado County Aqmd	30,078.52	37%	41%
El Dorado	Mountain Counties	El Dorado County Aqmd	159,276.48	37%	49%

¹ California Department of Finance, 2023. P-2a County Population Projections.

² United States Census Bureau, 2023. County-Level Urban and Rural Information for the 2020 Census.

³ United States Geological Survey, 2024. Annual National Land Cover Database (NLCD) Collection 1.1.

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County	Air Basin	Air District	Population¹	Percent Populati on Rural²	Total Forested Acreage³
Fresno	San Joaquin Valley	San Joaquin Valley Apcd	1,017,152.00	11%	15%
Glenn	Sacramen to Valley	Glenn County Apcd	28,596.00	41%	3%
Humboldt	North Coast	North Coast Unified Aqmd	133,968.00	32%	67%
Imperial	Salton Sea	Imperial County Apcd	182,090.00	18%	1%
Inyo	Great Basin Valleys	Great Basin Unified Apcd	18,740.00	42%	4%
Kern	San Joaquin Valley	San Joaquin Valley Apcd	775,280.86	13%	4%
Kern	Mojave Desert	Eastern Kern Apcd	133,016.14	13%	6%
Kings	San Joaquin Valley	San Joaquin Valley Apcd	152,548.00	11%	0%
Lake	Lake County	Lake County Aqmd	66,875.00	41%	13%
Lassen	Northeast Plateau	Lassen County Apcd	28,137.00	73%	24%
Los Angeles	South Coast	South Coast Aqmd	9,407,214.01	1%	4%
Los Angeles	Mojave Desert	Antelope Valley Aqmd	404,248.99	1%	4%

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County	Air Basin	Air District	Population¹	Percent Populati on Rural²	Total Forested Acreage³
Madera	San Joaquin Valley	San Joaquin Valley Apcd	159,892.00	39%	19%
Marin	San Francisco Bay Area	Bay Area Aqmd	254,301.00	6%	20%
Mariposa	Mountain Counties	Mariposa County Apcd	16,862.00	100%	31%
Mendocino	North Coast	Mendocino County Aqmd	89,556.00	48.46%	54.79%
Merced	San Joaquin Valley	San Joaquin Valley Apcd	288,589.00	17%	0%
Modoc	Northeast Plateau	Modoc County Apcd	8,540.00	100%	22%
Mono	Great Basin Valleys	Great Basin Unified Apcd	13,008.00	47%	22%
Monterey	North Central Coast	Monterey Bay Air Resources District	437,174.00	14%	12%
Napa	San Francisco Bay Area	Bay Area Aqmd	135,107.00	15%	12%
Nevada	Mountain Counties	Northern Sierra Aqmd	100,711.00	48%	69%
Orange	South Coast	South Coast Aqmd	3,148,555.00	0%	4%
Placer	Lake Tahoe	Placer County Apcd	10,312.15	15%	39%

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County	Air Basin	Air District	Population¹	Percent Populati on Rural²	Total Forested Acreage³
Placer	Mountain Counties	Placer County Apcd	26,351.46	15%	64%
Placer	Sacramen to Valley	Placer County Apcd	376,954.39	15%	15%
Plumas	Mountain Counties	Northern Sierra Aqmd	19,078.00	100%	30%
Riverside	South Coast	South Coast Aqmd	1,978,305.86	5%	5%
Riverside	Salton Sea	South Coast Aqmd	451,260.87	5%	2%
Riverside	Mojave Desert	Mojave Desert Aqmd	21,346.61	5%	0%
Riverside	Mojave Desert	South Coast Aqmd	272.08	5%	0%
Sacramento	Sacramen to Valley	Sacrament o Metropolitan Aqmd	1,578,904.00	2%	1%
San Benito	North Central Coast	Monterey Bay Air Resources District	65,783.00	23%	9%
San Bernardino	South Coast	South Coast Aqmd	1,629,110.22	5%	21%
San Bernardino	Mojave Desert	Mojave Desert Aqmd	553,258.78	5%	0%
San Diego	San Diego County	San Diego County Apcd	3,289,885.00	4%	5%

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County	Air Basin	Air District	Population¹	Percent Populati on Rural²	Total Forested Acreage³
San Francisco	San Francisco Bay Area	Bay Area Aqmd	838,251.00	0%	0%
San Joaquin	San Joaquin Valley	San Joaquin Valley Apcd	792,088.00	8%	1%
San Luis Obispo	South Central Coast	San Luis Obispo County Apcd	278,976.00	19%	11%
San Mateo	San Francisco Bay Area	Bay Area Aqmd	740,929.00	2%	23%
Santa Barbara	South Central Coast	Santa Barbara County Apcd	442,152.00	6%	8%
Santa Clara	San Francisco Bay Area	Bay Area Aqmd	1,900,834.00	1%	20%
Santa Cruz	North Central Coast	Monterey Bay Air Resources District	263,775.00	13%	37%
Shasta	Sacramen to Valley	Shasta County Aqmd	179,348.00	34%	46%
Sierra	Mountain Counties	Northern Sierra Aqmd	3,162.00	99%	71%
Siskiyou	Northeast Plateau	Siskiyou County Apcd	43,099.00	71%	44%
Solano	Sacramen to Valley	Yolo-Solano Aqmd	141,073.99	4%	0%
Solano	San Francisco Bay Area	Bay Area Aqmd	305,689.01	4%	1%

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County	Air Basin	Air District	Population¹	Percent Populati on Rural²	Total Forested Acreage³
Sonoma	North Coast	Northern Sonoma County Apcd	49,837.44	14%	41%
Sonoma	San Francisco Bay Area	Bay Area Aqmd	429,454.56	14%	10%
Stanislaus	San Joaquin Valley	San Joaquin Valley Apcd	548,838.00	8%	1%
Sutter	Sacramen to Valley	Feather River Aqmd	99,824.00	15%	2%
Tehama	Sacramen to Valley	Tehama County Apcd	64,786.00	57%	16%
Trinity	North Coast	North Coast Unified Aqmd	15,871.00	100%	45%
Tulare	San Joaquin Valley	San Joaquin Valley Apcd	478,192.00	20%	21%
Tuolumne	Mountain Counties	Tuolumne County Apcd	53,195.00	48%	43%
Ventura	South Central Coast	Ventura County Apcd	826,745.00	3%	8%
Yolo	Sacramen to Valley	Yolo-Solano Aqmd	221,202.00	8%	0%
Yuba	Sacramen to Valley	Feather River Aqmd	83,405.00	30%	36%

Appendix B: Emissions Results for 2023

The table below includes draft estimates of emissions in tons per year for each COABDIS. Since district submittals can overwrite state methodology, the estimates below do not account for data provided from districts to CARB.

The data presented include districts prohibitions: South Coast AQMD requested zeros for all emissions since backyard burning is prohibited, Monterey Bay Air Resources District requested zeros for all leaf emissions since burning leaves is prohibited.

County	Air Basin	Air District	CO	NH ₃	NO _x	SO ₂	VOC and ROG	TOG	PM2.5	PM10	TPM
Alameda	San Francisco Bay Area	Bay Area Aqmd	7.16	0.92	0.32	0.07	1.34	3.04	1.20	1.27	1.29
Alpine	Great Basin Valleys	Great Basin Unified Apcd	4.90	0.63	0.22	0.05	0.91	2.08	0.82	0.87	0.89
Amador	Mountain Counties	Amador County Apcd	116.53	15.04	5.18	1.12	21.73	49.39	19.61	20.68	21.05
Butte	Sacramento Valley	Butte County Aqmd	89.67	11.58	3.99	0.86	16.72	38.01	15.09	15.91	16.20
Calaveras	Mountain Counties	Calaveras County Apcd	142.95	18.46	6.35	1.37	26.66	60.60	24.05	25.37	25.82
Colusa	Sacramento Valley	Colusa County Apcd	1.18	0.15	0.05	0.01	0.22	0.50	0.20	0.21	0.21
Contra Costa	San Francisco Bay Area	Bay Area Aqmd	8.61	1.11	0.38	0.08	1.61	3.65	1.45	1.53	1.56

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County	Air Basin	Air District	CO	NH₃	NO_x	SO₂	VOC and ROG	TOG	PM2.5	PM10	TPM
Del Norte	North Coast	North Coast Unified Aqmd	62.27	8.04	2.77	0.60	11.61	26.39	10.48	11.05	11.25
El Dorado	Lake Tahoe	El Dorado County Aqmd	43.47	5.61	1.93	0.42	8.11	18.43	7.31	7.71	7.85
El Dorado	Mountain Counties	El Dorado County Aqmd	275.90	35.62	12.26	2.65	51.46	116.95	46.42	48.96	49.83
Fresno	San Joaquin Valley	San Joaquin Valley Apcd	170.70	22.04	7.59	1.64	31.84	72.35	28.72	30.29	30.83
Glenn	Sacramento Valley	Glenn County Apcd	3.22	0.42	0.14	0.03	0.60	1.37	0.54	0.57	0.58
Humboldt	North Coast	North Coast Unified Aqmd	272.18	35.14	12.10	2.61	50.76	115.37	45.80	48.30	49.16
Imperial	Salton Sea	Imperial County Apcd	2.52	0.33	0.11	0.02	0.47	1.07	0.42	0.45	0.46
Inyo	Great Basin Valleys	Great Basin Unified Apcd	2.88	0.37	0.13	0.03	0.54	1.22	0.48	0.51	0.52
Kern	San Joaquin Valley	San Joaquin Valley Apcd	39.53	5.10	1.76	0.38	7.37	16.76	6.65	7.01	7.14

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County	Air Basin	Air District	CO	NH₃	NO_x	SO₂	VOC and ROG	TOG	PM2.5	PM10	TPM
Kern	Mojave Desert	Eastern Kern Apcd	10.79	1.39	0.48	0.10	2.01	4.57	1.82	1.92	1.95
Kings	San Joaquin Valley	San Joaquin Valley Apcd	0.05	0.01	0.00	0.00	0.01	0.02	0.01	0.01	0.01
Lake	Lake County	Lake County Aqmd	33.04	4.27	1.47	0.32	6.16	14.01	5.56	5.86	5.97
Lassen	Northeast Plateau	Lassen County Apcd	47.58	6.14	2.11	0.46	8.87	20.17	8.00	8.44	8.59
Los Angeles	South Coast	South Coast Aqmd	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Los Angeles	Mojave Desert	Antelope Valley Aqmd	1.31	0.17	0.06	0.01	0.24	0.55	0.22	0.23	0.24
Madera	San Joaquin Valley	San Joaquin Valley Apcd	113.44	14.65	5.04	1.09	21.16	48.08	19.09	20.13	20.49
Marin	San Francisco Bay Area	Bay Area Aqmd	29.08	3.75	1.29	0.28	5.42	12.33	4.89	5.16	5.25
Mariposa	Mountain Counties	Mariposa County Apcd	50.40	6.51	2.24	0.48	9.40	21.36	8.48	8.94	9.10
Mendocino	North Coast	Mendocino County Aqmd	230.13	29.71	10.23	2.21	42.92	97.55	38.72	40.83	41.56

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County	Air Basin	Air District	CO	NH₃	NO_x	SO₂	VOC and ROG	TOG	PM2.5	PM10	TPM
Merced	San Joaquin Valley	San Joaquin Valley Apcd	2.34	0.30	0.10	0.02	0.44	0.99	0.39	0.41	0.42
Modoc	Northeast Plateau	Modoc County Apcd	18.48	2.39	0.82	0.18	3.45	7.83	3.11	3.28	3.34
Mono	Great Basin Valleys	Great Basin Unified Apcd	13.07	1.69	0.58	0.13	2.44	5.54	2.20	2.32	2.36
Monterey	North Central Coast	Monterey Bay Air Resources District	38.56	4.00	1.38	0.46	5.23	11.89	3.61	3.81	3.87
Napa	San Francisco Bay Area	Bay Area Aqmd	22.52	2.91	1.00	0.22	4.20	9.54	3.79	4.00	4.07
Nevada	Mountain Counties	Northern Sierra Aqmd	322.45	41.63	14.33	3.10	60.14	136.68	54.25	57.22	58.24
Orange	South Coast	South Coast Aqmd	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Placer	Lake Tahoe	Placer County Apcd	5.66	0.73	0.25	0.05	1.06	2.40	0.95	1.00	1.02
Placer	Mountain Counties	Placer County Apcd	23.63	3.05	1.05	0.23	4.41	10.02	3.98	4.19	4.27

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County	Air Basin	Air District	CO	NH₃	NO_x	SO₂	VOC and ROG	TOG	PM2.5	PM10	TPM
Placer	Sacramento Valley	Placer County Apcd	77.27	9.98	3.43	0.74	14.41	32.76	13.00	13.71	13.96
Plumas	Mountain Counties	Northern Sierra Aqmd	56.06	7.24	2.49	0.54	10.46	23.76	9.43	9.95	10.13
Riverside	South Coast	South Coast Aqmd	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Riverside	Salton Sea	South Coast Aqmd	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Riverside	Mojave Desert	Mojave Desert Aqmd	0.06	0.01	0.00	0.00	0.01	0.02	0.01	0.01	0.01
Riverside	Mojave Desert	South Coast Aqmd	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Sacramento	Sacramento Valley	Sacramento Metropolitan Aqmd	3.62	0.47	0.16	0.03	0.68	1.54	0.61	0.64	0.65
San Benito	North Central Coast	Monterey Bay Air Resources District	7.15	0.74	0.26	0.08	0.97	2.20	0.67	0.71	0.72
San Bernardino	South Coast	South Coast Aqmd	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
San Bernardino	Mojave Desert	Mojave Desert Aqmd	1.17	0.15	0.05	0.01	0.22	0.50	0.20	0.21	0.21

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County	Air Basin	Air District	CO	NH₃	NO_x	SO₂	VOC and ROG	TOG	PM2.5	PM10	TPM
San Diego	San Diego County	San Diego County Apcd	69.97	9.03	3.11	0.67	13.05	29.66	11.77	12.42	12.64
San Francisco	San Francisco Bay Area	Bay Area Aqmd	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
San Joaquin	San Joaquin Valley	San Joaquin Valley Apcd	4.23	0.55	0.19	0.04	0.79	1.80	0.71	0.75	0.76
San Luis Obispo	South Central Coast	San Luis Obispo County Apcd	55.00	7.10	2.44	0.53	10.26	23.31	9.25	9.76	9.93
San Mateo	San Francisco Bay Area	Bay Area Aqmd	28.27	3.65	1.26	0.27	5.27	11.98	4.76	5.02	5.11
Santa Barbara	South Central Coast	Santa Barbara County Apcd	18.37	2.37	0.82	0.18	3.43	7.79	3.09	3.26	3.32
Santa Clara	San Francisco Bay Area	Bay Area Aqmd	48.83	6.30	2.17	0.47	9.11	20.70	8.22	8.66	8.82
Santa Cruz	North Central Coast	Monterey Bay Air Resources District	70.41	7.30	2.51	0.83	9.56	21.72	6.59	6.95	7.07

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County	Air Basin	Air District	CO	NH₃	NO_x	SO₂	VOC and ROG	TOG	PM2.5	PM10	TPM
Shasta	Sacramento Valley	Shasta County Aqmd	268.00	34.60	11.91	2.57	49.98	113.60	45.09	47.56	48.40
Sierra	Mountain Counties	Northern Sierra Aqmd	21.45	2.77	0.95	0.21	4.00	9.09	3.61	3.81	3.87
Siskiyou	Northeast Plateau	Siskiyou County Apcd	129.25	16.69	5.74	1.24	24.11	54.79	21.75	22.94	23.34
Solano	Sacramento Valley	Yolo-Solano Aqmd	0.19	0.02	0.01	0.00	0.04	0.08	0.03	0.03	0.03
Solano	San Francisco Bay Area	Bay Area Aqmd	1.69	0.22	0.08	0.02	0.32	0.72	0.28	0.30	0.31
Sonoma	North Coast	Northern Sonoma County Apcd	26.94	3.48	1.20	0.26	5.03	11.42	4.53	4.78	4.87
Sonoma	San Francisco Bay Area	Bay Area Aqmd	54.76	7.07	2.43	0.53	10.21	23.21	9.21	9.72	9.89
Stanislaus	San Joaquin Valley	San Joaquin Valley Apcd	3.91	0.50	0.17	0.04	0.73	1.66	0.66	0.69	0.71
Sutter	Sacramento Valley	Feather River Aqmd	2.28	0.29	0.10	0.02	0.42	0.97	0.38	0.40	0.41

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County	Air Basin	Air District	CO	NH₃	NO_x	SO₂	VOC and ROG	TOG	PM2.5	PM10	TPM
Tehama	Sacramento Valley	Tehama County Apcd	55.76	7.20	2.48	0.54	10.40	23.63	9.38	9.89	10.07
Trinity	North Coast	North Coast Unified Aqmd	69.44	8.97	3.09	0.67	12.95	29.44	11.68	12.32	12.54
Tulare	San Joaquin Valley	San Joaquin Valley Apcd	195.98	25.30	8.71	1.88	36.55	83.07	32.98	34.78	35.40
Tuolumne	Mountain Counties	Tuolumne County Apcd	105.78	13.66	4.70	1.02	19.73	44.84	17.80	18.77	19.10
Ventura	South Central Coast	Ventura County Apcd	21.71	2.80	0.97	0.21	4.05	9.20	3.65	3.85	3.92
Yolo	Sacramento Valley	Yolo-Solano Aqmd	0.81	0.10	0.04	0.01	0.15	0.34	0.14	0.14	0.15
Yuba	Sacramento Valley	Feather River Aqmd	84.99	10.97	3.78	0.82	15.85	36.03	14.30	15.08	15.35

Appendix C: Growth parameters used for modeling.

The table below includes growth parameters for modeling based on the assumptions detailed in the section Growth Forecasting.

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County	Air Basin	Air District	Percent Population Rural	Growth Detail
Alpine	Great Basin Valleys	Great Basin Unified Apcd	100%	Population-based from Department of Finance.
Amador	Mountain Counties	Amador County Apcd	69%	Population-based from Department of Finance.
Butte	Sacramento Valley	Butte County Aqmd	21%	Population-based from Department of Finance.
Calaveras	Mountain Counties	Calaveras County Apcd	82%	Population-based from Department of Finance.
Colusa	Sacramento Valley	Colusa County Apcd	43%	Population-based from Department of Finance.
Del Norte	North Coast	North Coast Unified Aqmd	44%	Population-based from Department of Finance.
El Dorado	Lake Tahoe	El Dorado County Aqmd	37%	Population-based from Department of Finance.
El Dorado	Mountain Counties	El Dorado County Aqmd	37%	Population-based from Department of Finance.
Glenn	Sacramento Valley	Glenn County Apcd	41%	Population-based from Department of Finance.
Humboldt	North Coast	North Coast Unified Aqmd	32%	Population-based from Department of Finance.
Inyo	Great Basin Valleys	Great Basin Unified Apcd	42%	Population-based from Department of Finance.
Lake	Lake County	Lake County Aqmd	41%	Population-based from Department of Finance.
Lassen	Northeast Plateau	Lassen County Apcd	73%	Population-based from Department of Finance.
Madera	San Joaquin Valley	San Joaquin Valley Apcd	39%	Population-based from Department of Finance.
Mariposa	Mountain Counties	Mariposa County Apcd	100%	Population-based from Department of Finance.

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County	Air Basin	Air District	Percent Population Rural	Growth Detail
Mendocino	North Coast	Mendocino County Aqmd	48%	Population-based from Department of Finance.
Modoc	Northeast Plateau	Modoc County Apcd	100%	Population-based from Department of Finance.
Mono	Great Basin Valleys	Great Basin Unified Apcd	47%	Population-based from Department of Finance.
Nevada	Mountain Counties	Northern Sierra Aqmd	48%	Population-based from Department of Finance.
Plumas	Mountain Counties	Northern Sierra Aqmd	100%	Population-based from Department of Finance.
San Benito	North Central Coast	Monterey Bay Air Resources District	23%	Population-based from Department of Finance.
Shasta	Sacramento Valley	Shasta County Aqmd	34%	Population-based from Department of Finance.
Sierra	Mountain Counties	Northern Sierra Aqmd	99%	Population-based from Department of Finance.
Siskiyou	Northeast Plateau	Siskiyou County Apcd	71%	Population-based from Department of Finance.
Tehama	Sacramento Valley	Tehama County Apcd	57%	Population-based from Department of Finance.
Trinity	North Coast	North Coast Unified Aqmd	100%	Population-based from Department of Finance.
Tulare	San Joaquin Valley	San Joaquin Valley Apcd	20%	Population-based from Department of Finance.
Tuolumne	Mountain Counties	Tuolumne County Apcd	48%	Population-based from Department of Finance.
Yuba	Sacramento Valley	Feather River Aqmd	30%	Population-based from Department of Finance.
Alameda	San Francisco Bay Area	Bay Area Aqmd	0%	No Growth

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County	Air Basin	Air District	Percent Population Rural	Growth Detail
Contra Costa	San Francisco Bay Area	Bay Area Aqmd	1%	No Growth
Fresno	San Joaquin Valley	San Joaquin Valley Apcd	11%	No Growth
Imperial	Salton Sea	Imperial County Apcd	18%	No Growth
Kern	San Joaquin Valley	San Joaquin Valley Apcd	13%	No Growth
Kern	Mojave Desert	Eastern Kern Apcd	13%	No Growth
Kings	San Joaquin Valley	San Joaquin Valley Apcd	11%	No Growth
Los Angeles	South Coast	South Coast Aqmd	1%	No Growth
Los Angeles	Mojave Desert	Antelope Valley Aqmd	1%	No Growth
Marin	San Francisco Bay Area	Bay Area Aqmd	6%	No Growth
Merced	San Joaquin Valley	San Joaquin Valley Apcd	17%	No Growth
Monterey	North Central Coast	Monterey Bay Air Resources District	14%	No Growth
Napa	San Francisco Bay Area	Bay Area Aqmd	15%	No Growth
Orange	South Coast	South Coast Aqmd	0%	No Growth
Placer	Lake Tahoe	Placer County Apcd	15%	No Growth
Placer	Mountain Counties	Placer County Apcd	15%	No Growth
Placer	Sacramento Valley	Placer County Apcd	15%	No Growth

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County	Air Basin	Air District	Percent Population Rural	Growth Detail
Riverside	South Coast	South Coast Aqmd	5%	No Growth
Riverside	Salton Sea	South Coast Aqmd	5%	No Growth
Riverside	Mojave Desert	Mojave Desert Aqmd	5%	No Growth
Riverside	Mojave Desert	South Coast Aqmd	5%	No Growth
Sacramento	Sacramento Valley	Sacramento Metropolitan Aqmd	2%	No Growth
San Bernardino	South Coast	South Coast Aqmd	5%	No Growth
San Bernardino	Mojave Desert	Mojave Desert Aqmd	5%	No Growth
San Diego	San Diego County	San Diego County Apcd	4%	No Growth
San Francisco	San Francisco Bay Area	Bay Area Aqmd	0%	No Growth
San Joaquin	San Joaquin Valley	San Joaquin Valley Apcd	8%	No Growth
San Luis Obispo	South Central Coast	San Luis Obispo County Apcd	19%	No Growth
San Mateo	San Francisco Bay Area	Bay Area Aqmd	2%	No Growth
Santa Barbara	South Central Coast	Santa Barbara County Apcd	6%	No Growth
Santa Clara	San Francisco Bay Area	Bay Area Aqmd	1%	No Growth
Santa Cruz	North Central Coast	Monterey Bay Air Resources District	13%	No Growth
Solano	Sacramento Valley	Yolo-Solano Aqmd	4%	No Growth

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County	Air Basin	Air District	Percent Population Rural	Growth Detail
Solano	San Francisco Bay Area	Bay Area Aqmd	4%	No Growth
Sonoma	North Coast	Northern Sonoma County Apcd	14%	No Growth
Sonoma	San Francisco Bay Area	Bay Area Aqmd	14%	No Growth
Stanislaus	San Joaquin Valley	San Joaquin Valley Apcd	8%	No Growth
Sutter	Sacramento Valley	Feather River Aqmd	15%	No Growth
Ventura	South Central Coast	Ventura County Apcd	3%	No Growth
Yolo	Sacramento Valley	Yolo-Solano Aqmd	8%	No Growth