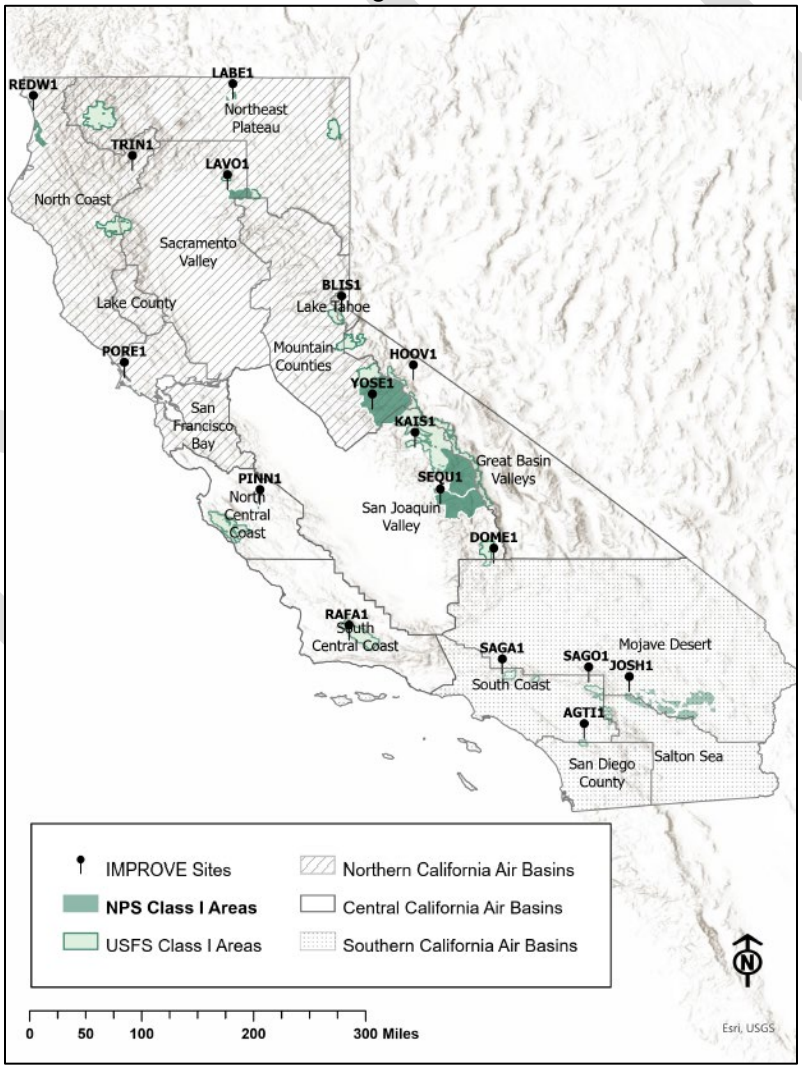
Description of California's Mandatory Federal Class I Areas

This appendix provides descriptions of each of California's Class I areas, the representative monitoring sites, visibility conditions and projections, and sources of visibility impairment. Note that the acreage estimate for individual Class I areas varies among sources and has changed since the U.S. EPA's promulgation of the list of mandatory federal Class I areas in 1979. The acreage estimates provided in the following sections are from the original list published in 40 CFR 81.405.

Like the discussion in the main body of this Regional Haze Plan, Class I areas are organized in three regional groups (Northern, Central, and Southern California) based on the air basin where the representative Interagency Monitoring of Protected Visual Environments (IMPROVE) monitor is located. See Chapter 2 for an overview of each region.

Figure C-1: Air Basins and IMPROVE Monitoring Sites in Northern, Central, and Southern California



Northern California

Most of the Northern California region is sparsely populated, except for some areas in the Sacramento Valley and San Francisco Bay Air Basins. The capital city of Sacramento, with a population just over 500,000, is in the southern part of the Sacramento Valley Air Basin. The cities of Oakland, San Francisco, and San Jose, located within the San Francisco Air Basin, are home to more than two million people combined. When outlying suburban areas surrounding these urban cities are considered, the population is more than five million. Emissions from these populous areas contribute to visibility impairment in this region.

The movement of goods and people are a significant source of emissions throughout Northern California. The Port of Oakland, located in the San Francisco Bay Air Basin, is the eighth busiest port in the country. Ninety-nine percent of the containerized goods that move through Northern California are discharged at the Port, with most of the container volume coming from Asia. In 2017 alone, a total of 2,420,837 twenty-foot equivalent units (TEU) moved through the Port of Oakland.[1]

The San Francisco International Airport, also located in the San Francisco Bay Air Basin, consistently ranks among the ten busiest airports in the nation. In 2019, more than 27 million passengers traveled through the airport. San Jose, Oakland, and Sacramento International Airports are also major air transportation hubs that annually rank among the top 50 busiest airports in the nation. In 2019, more than 20 million passengers enplaned at these three airports combined.[2]

The Sacramento Valley Air Basin is a major transportation corridor. Miles of freight lines and interstate highways transit this air basin. Average daily traffic volume in the most remote sections of the air basin exceeds 15,000 vehicles, with around 30 percent being heavy-duty trucks.[3] Emissions from mobile sources are the primary anthropogenic source of haze pollutants in this region.

Emissions from the Sacramento Valley and San Francisco Bay Air Basins account for most of the region's emissions. Emissions from the Sacramento Valley and San Francisco Bay Air Basins accounted for 31 percent and 47 percent of 2014 oxides of nitrogen (NOx) emissions in this region, respectively. Mobile sources are the dominant NOx emission source sector in each air basin.

Seven IMPROVE monitoring sites are in the Northern California region. From north to south, the monitoring sites in this region are located at Lava Beds National Monument, Redwood

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[1] *https://www.oaklandseaport.com/performance/facts-figures/*

[2] *https://www.bts.gov/content/passengers-boarded-top-50-us-airports*

[3] *https://dot.ca.gov/programs/traffic-operations/census*

National Park, Trinity Wilderness, Lassen Volcanic National Park, DL Bliss State Park, Point Reyes National Seashore, and Yosemite National Park. The following section provides an overview of each monitoring site and Class I areas characterized by data collected at the site, as well as a description of visibility conditions and source apportionment for each location.

Lava Beds National Monument (LABE1) IMPROVE Monitoring Site

The LABE1 monitoring site, shown in Figure C-2, is in the southern portion of Lava Beds National Monument at 4,790 feet (1,460 m) asl. The monitoring site was established in March 2000 southeast of the Lava Beds Visitor Center. The Indian Well Campground is located about a half mile northeast of the site. It has 31 developed camp sites and is lightly used with approximately 10,000 overnight visitor stays annually.[4] Monitoring data collected at this site are representative of visibility conditions in Lava Beds National Monument and the South Warner Wilderness Area.

Figure C-2: Photograph looking southwest toward LABE1 Monitoring Site

Photograph Source: http://vista.cira.colostate.edu/Improve/monitoring-site-browser/

Lava Beds National Monument includes 28,640 acres along the north flank of Medicine Lake Volcano in the southern Cascades Range. The arid landscape features buttes and calderas that underscore the active volcanic nature of the region. The South Warner Wilderness Area covers 68,507 acres along the southern end of the Warner Mountains of northeast California. The remote area is lightly visited and minimally developed. Lava Beds National Monument and the South Warner Wilderness Area are in the Northeast Plateau Air Basin.

As shown in Table C-1, visibility impairment on the clearest days during the baseline period was 3.2 deciviews (dv). Visibility impairment on the clearest days decreased by 0.7 dv between the baseline and the current periods. During the current period, visibility

[4] *https://irma.nps.gov/STATS/Reports/Park/LABE*

impairment was 2.5 dv which is equivalent to a visual range of 189 miles (304 km) at Lava Beds National Monument and the South Warner Wilderness Area.

Visibility impairment on the most impaired days during the baseline period was 11.3 dv. Visibility impairment decreased by 1.6 dv between the baseline and the current periods. On the most impaired days during the current period visibility impairment was 9.7 dv, which is equivalent to a visual range of 92 miles (148 km) at Lava Beds National Monument and the South Warner Wilderness Area. Between the baseline and current periods, visibility improved by an average of 0.11 dv each year. This rate of improvement is faster than the uniform rate of progress (URP) adjusted to account for international emissions and prescribed fire as well as the unadjusted URP.

Table C-1: Visibility Tracking Metrics for Lava Beds National Monument and South Warner Wilderness Area

Days	Baseline (dv)	Current (dv)	Natural (dv)	Difference: Baseline - Current	Difference: Current - Natural	Uniform Rate of Progress (Adjusted)	Current Rate of Progress
Clearest	3.2	2.5	1.3	0.7 dv	1.2 dv	--	--
Most Impaired	11.3	9.7	6.2	1.6 dv	3.5 dv	0.09 dv/year (0.07 dv/year)	0.11 dv/year

Monitoring data, shown in Figures C-3 and C-4, indicate that on the clearest and most impaired days, organic mass and ammonium sulfate account for the largest share of light extinction at the LABE1 monitor. Between the baseline and the current periods, light extinction from organic mass decreased by 18 percent on the clearest days and by 10 percent most impaired days. Light extinction from ammonium sulfate decreased by 27 percent on the clearest and by 26 percent most impaired days.

Figure C-3: Average Extinction Composition for LABE1 on the Clearest Days

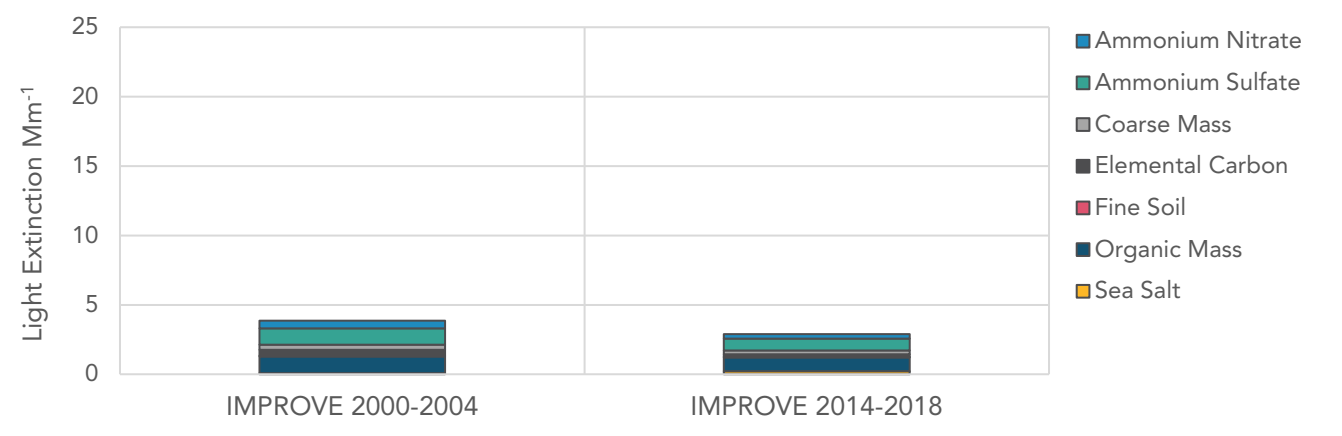

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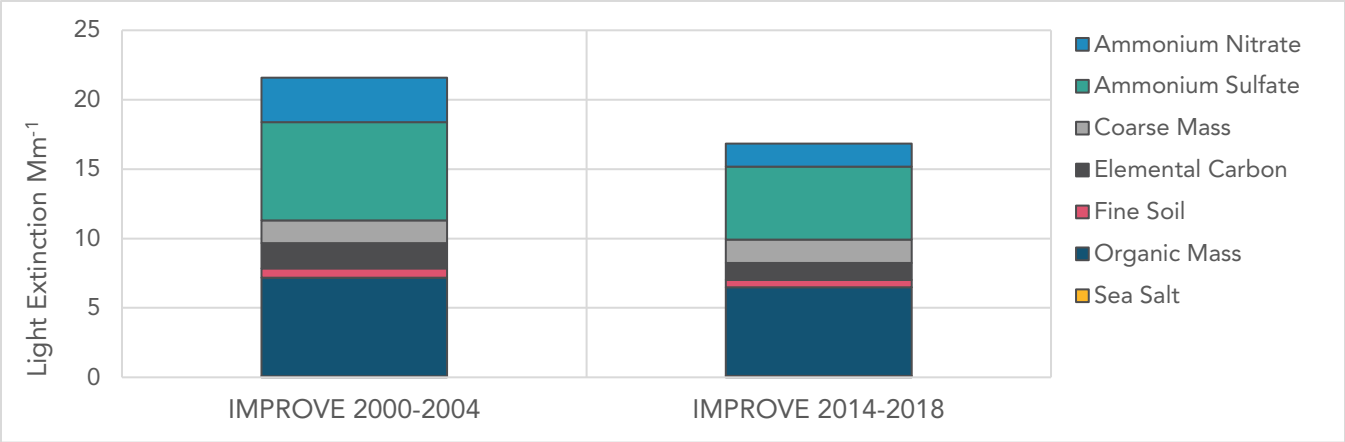
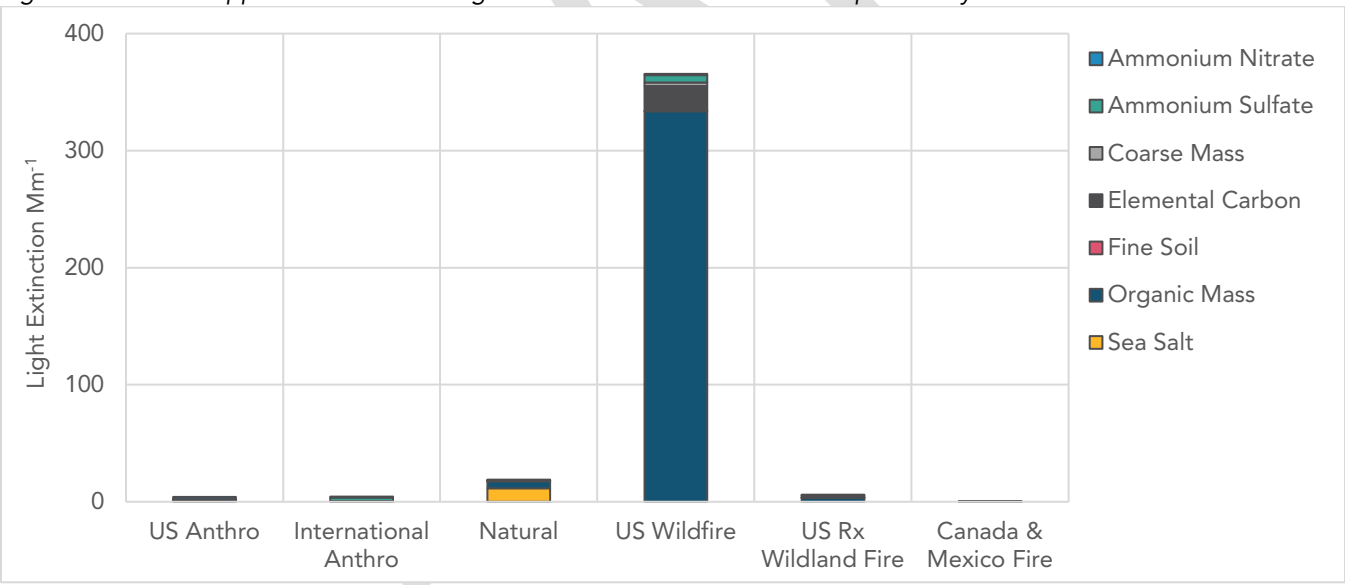
Figure C-4: Average Extinction Composition for LABE1 on the Most Impaired Days



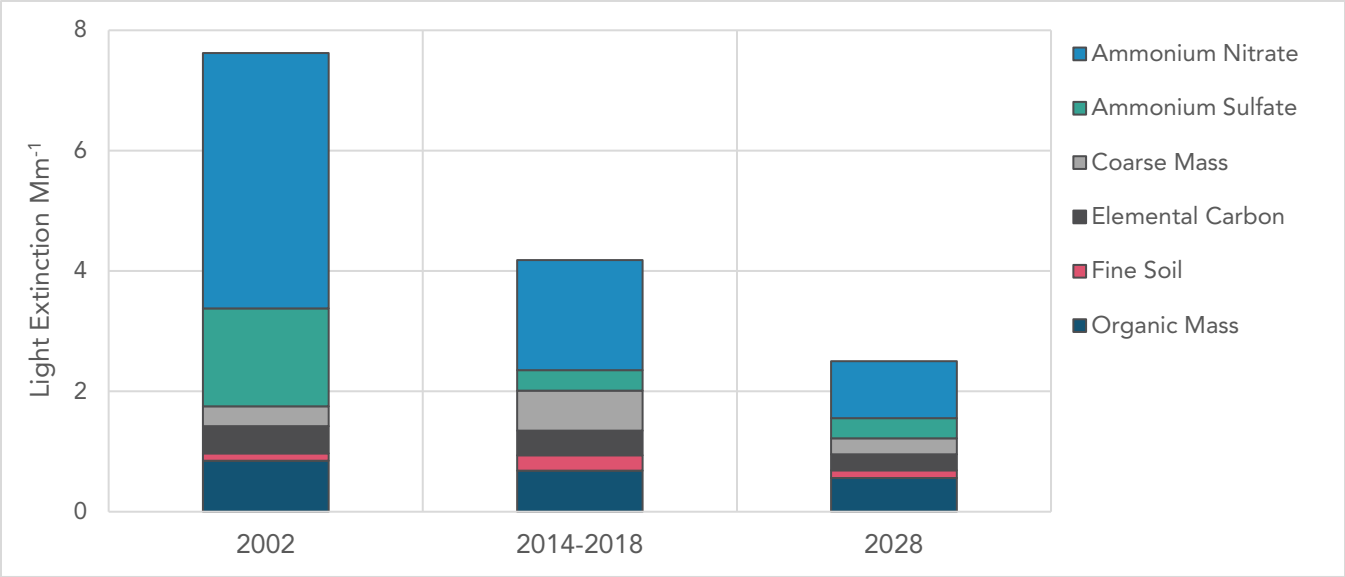
Source apportionment modeling, shown in Figure C-5, indicates that wildfires are the dominant source of visibility reducing particles at the LABE1 monitoring site. Prescribed wildland fire emissions and other non-fire natural sources also contribute to impaired visibility. U.S. anthropogenic emissions make a relatively small contribution to visibility impairment.

Figure C-5: Source Apportionment Modeling Results for LABE1 on the Most Impaired Days in 2014-2018



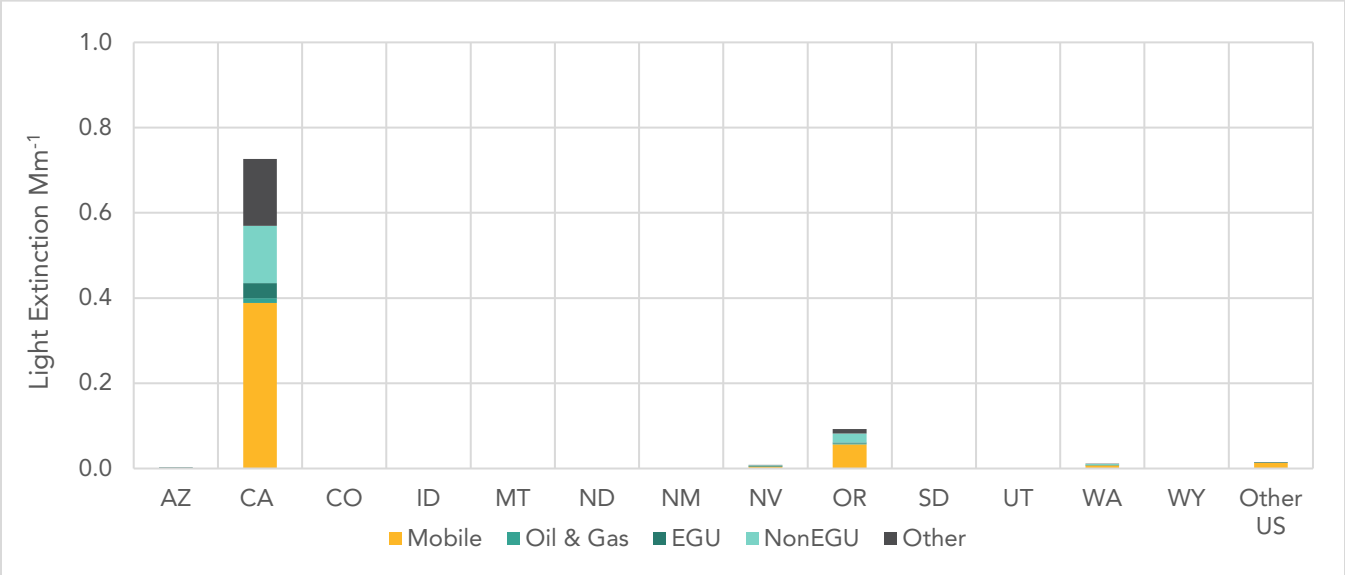
As shown in Figure C-6, the portion of light extinction attributed to U.S. sources is dominated by ammonium nitrate. Between the current period and 2028, baseline (adopted) emission controls are expected to reduce light extinction attributable to ammonium nitrate by 50 percent. Modest reductions are projected for other PM species. Ammonium nitrate is projected to continue to account for the largest share of light extinction attributable to U.S. emission sources in 2028.

Figure C-6: Light Extinction from PM Attributed to U.S. Anthropogenic Sources at LABE1 on the Most Impaired Days



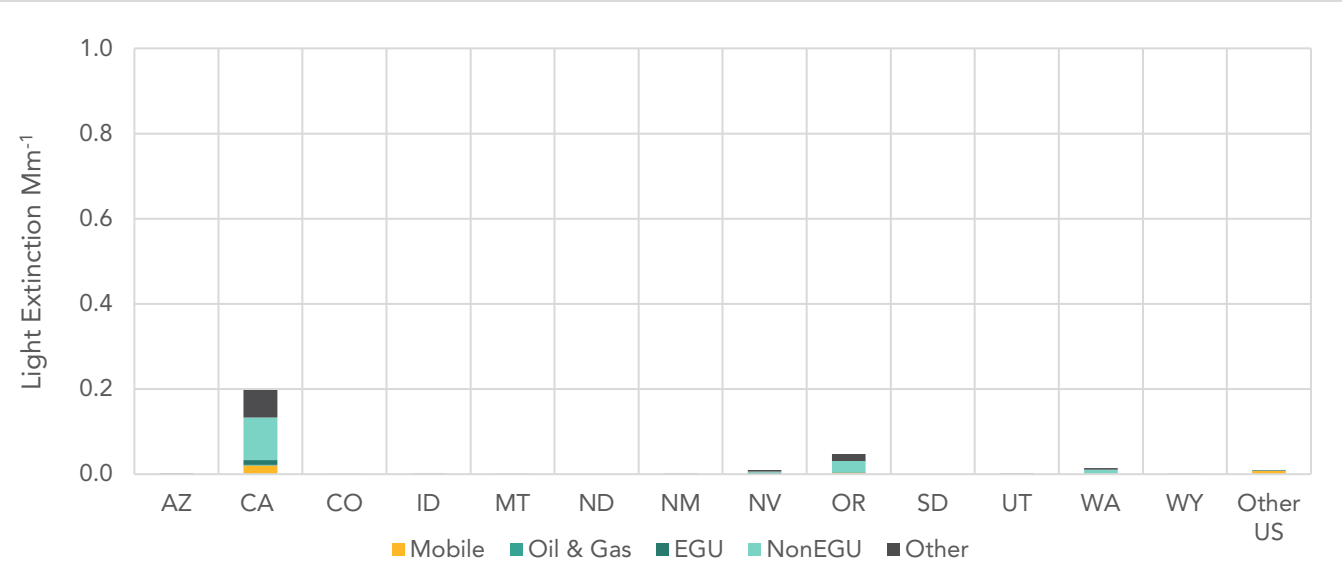
The results of regional source apportionment modeling, shown in Figure C-7, indicates that California mobile sources will continue to be the largest regional source of ammonium nitrate in 2028. These results suggest that continued efforts to reduce emissions from the mobile source sector in California will be an important part of improving visibility.

Figure C-7: Regional Source Apportionment for Ammonium Nitrate from U.S. Anthropogenic Sources in 2028 at LABE1



As shown in Figure C-8, California emissions account for the largest portion of the small share of light extinction from ammonium sulfate attributable to regional anthropogenic emissions. However, the projected portion of light extinction from ammonium sulfate attributable to regional sources is 0.3 Mm^{-1}, about a third of the portion from ammonium nitrate.

Figure C-8: Regional Source Apportionment for Ammonium Sulfate from U.S. Anthropogenic Sources in 2028 at LABE1



California's long-term strategy for regional haze is focused on improving visibility through reduction of NOx emissions from mobile sources. Reducing emissions of NOx, which generally drives the formation of ammonium nitrate in California, will lead to a reduction in haze pollutants in Lava Beds National Monument and the South Warner Wilderness Area. Regional photochemical modeling analyses support this conclusion.

The current and projected trends for the visibility tracking metrics at Lava Beds National Monument and the South Warner Wilderness Area are shown in Figure C-9. Accounting for baseline (adopted) emission controls and emission reduction commitments included in this Regional Haze Plan, visibility impairment on the most impaired days is projected to be 8.9 dv in 2028, which is equivalent to a visual range of 100 miles (160 km). The 2028 projection is below the adjusted glidepath, which accounts for international and wildland prescribed fire emissions, indicating that the site is on track to meet 2064 visibility targets.

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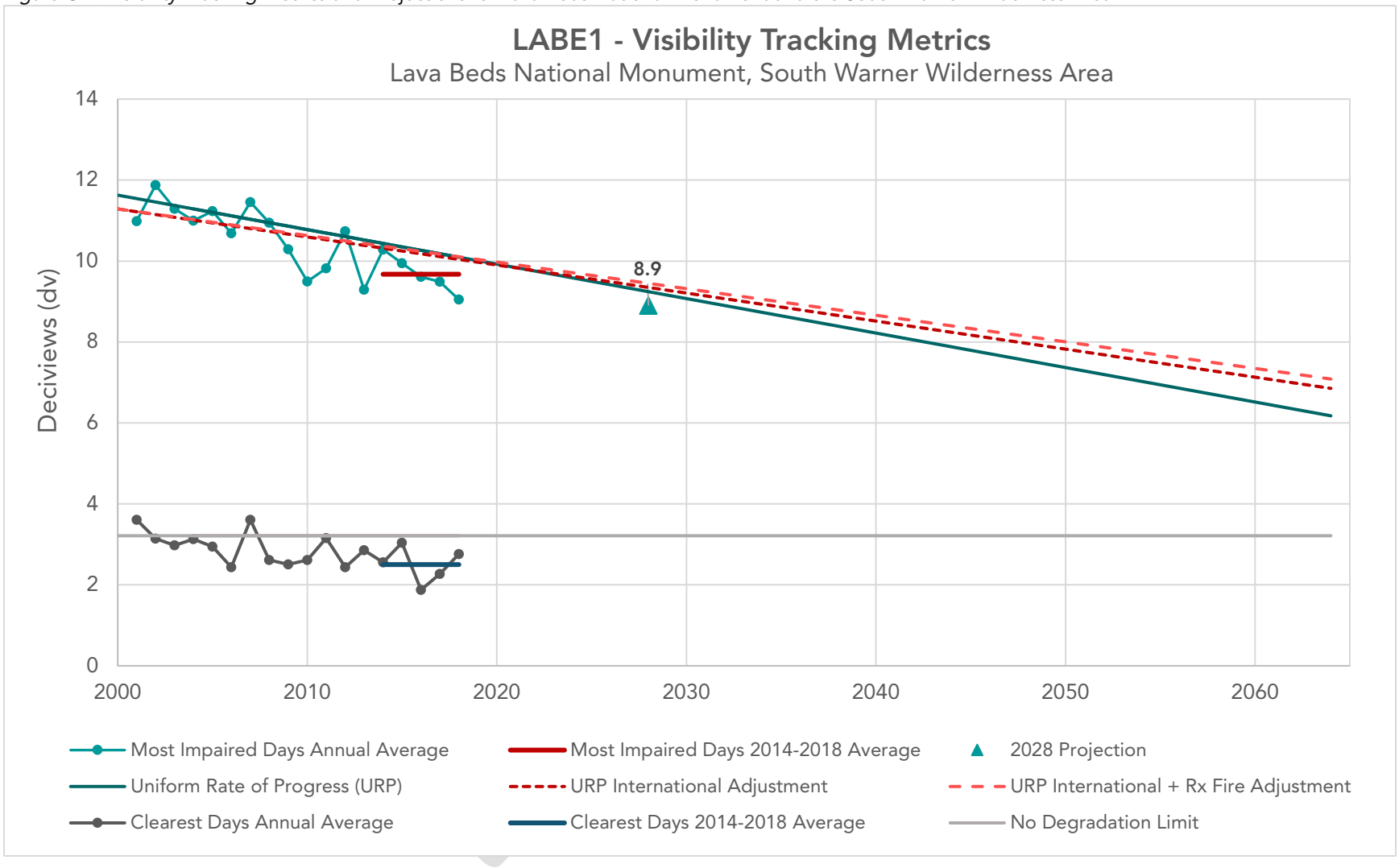
Figure C-9: Visibility Tracking Metrics and Projections for Lava Beds National Monument and the South Warner Wilderness Area



Redwood National Park (REDW1) IMPROVE Monitoring Site

The REDW1 monitoring site, shown below in Figure C-10, is in the central portion of Redwood National Park at 801 feet (244 m) asl. The monitoring site was established in March 1988 at a former U.S. Air Force radar facility. The site is less than a mile east of the Pacific Ocean and north of the Klamath River. Data collected at the site are representative of visibility conditions in Redwood National Park.

Figure C-10: Photograph looking northwest towards REDW1 Monitoring Site

Photograph Source: http://vista.cira.colostate.edu/Improve/monitoring-site-browser/

[5] Redwood National Park is contiguous with several of California Redwoods State Parks and the area has been cooperatively managed since 1994.

As shown in Table C-2, visibility impairment on the clearest days during the baseline period was 6.1 dv. Visibility impairment on the clearest days decreased by 0.8 dv between the baseline and the current periods. Visibility impairment was 5.3 dv during the current period, which is equivalent to a visual range of 143 miles (230 km) at Redwood National Park.

On the most impaired days, visibility impairment was 13.7 dv during the baseline period and 12.6 dv during the current period, which is equivalent to a visual range of 69 miles (111 km). Between the baseline and current periods, visibility on the most impaired days improved by

[5] *https://irma.nps.gov/STATS/Reports/Park/REDW*

an average of 0.08 dv each year. This rate of improvement is faster than the uniform rate of progress adjusted to account for international emissions and prescribed fire.

Table C-2: Visibility Tracking Metrics for REDW1

Days	Baseline (dv)	Current (dv)	Natural (dv)	Difference: Baseline - Current	Difference: Current - Natural	Uniform Rate of Progress (Adjusted)	Current Rate of Progress
Clearest	6.1	5.3	3.5	0.8 dv	1.8 dv	--	--
Most Impaired	13.7	12.6	8.6	1.1 dv	4.0 dv	0.09 dv/year (0.07 dv/year)	0.08 dv/year

Monitoring data, shown in Figures C-11 and C-12, indicate that ammonium sulfate accounts for the largest share of light extinction on the clearest and most impaired days at the REDW1 monitoring site. Emissions from offshore shipping routinely impact this area. Between the baseline and the current periods, CARB implemented low-sulfur diesel regulations that apply to ocean-going vessels operating in California waters. The implementation of these regulations has had a measurable impact on reducing sulfur emissions from ocean-going vessels. Subsequently, between the baseline and the current periods, light extinction from ammonium sulfate decreased by 71 percent on the clearest days and by 65 percent on the most impaired days.

Figure C-11: Average Extinction Composition for REDW1 on the Clearest Days

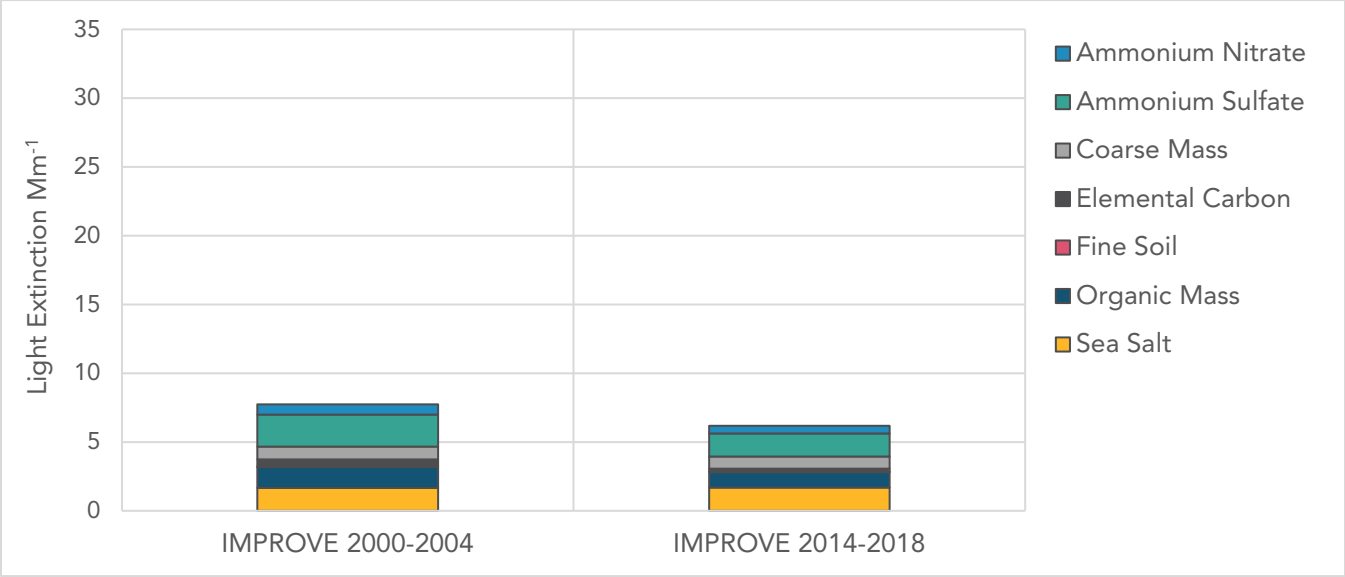


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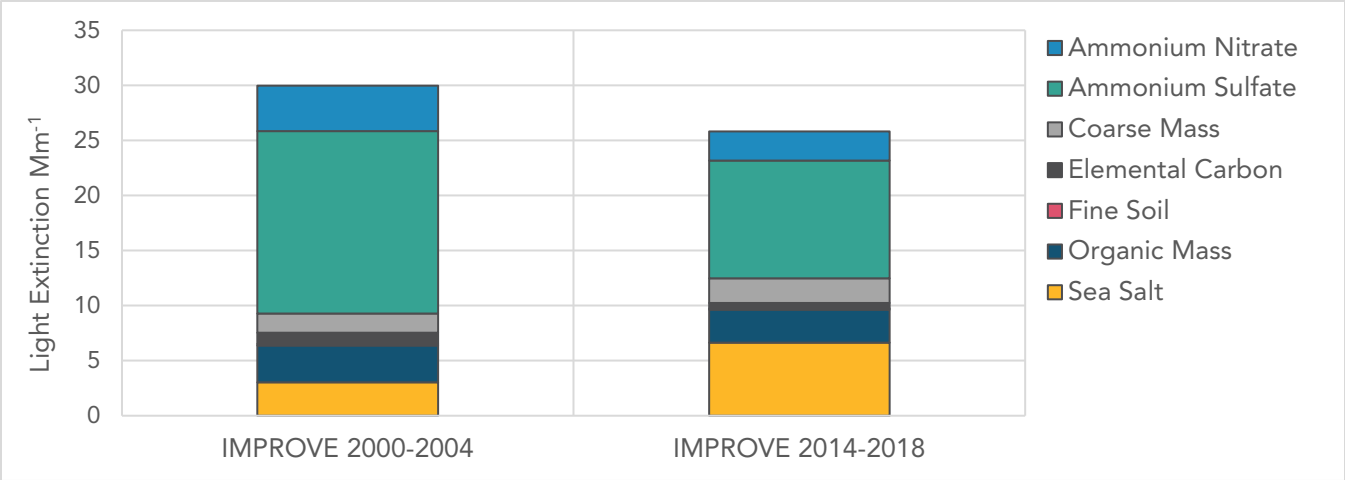
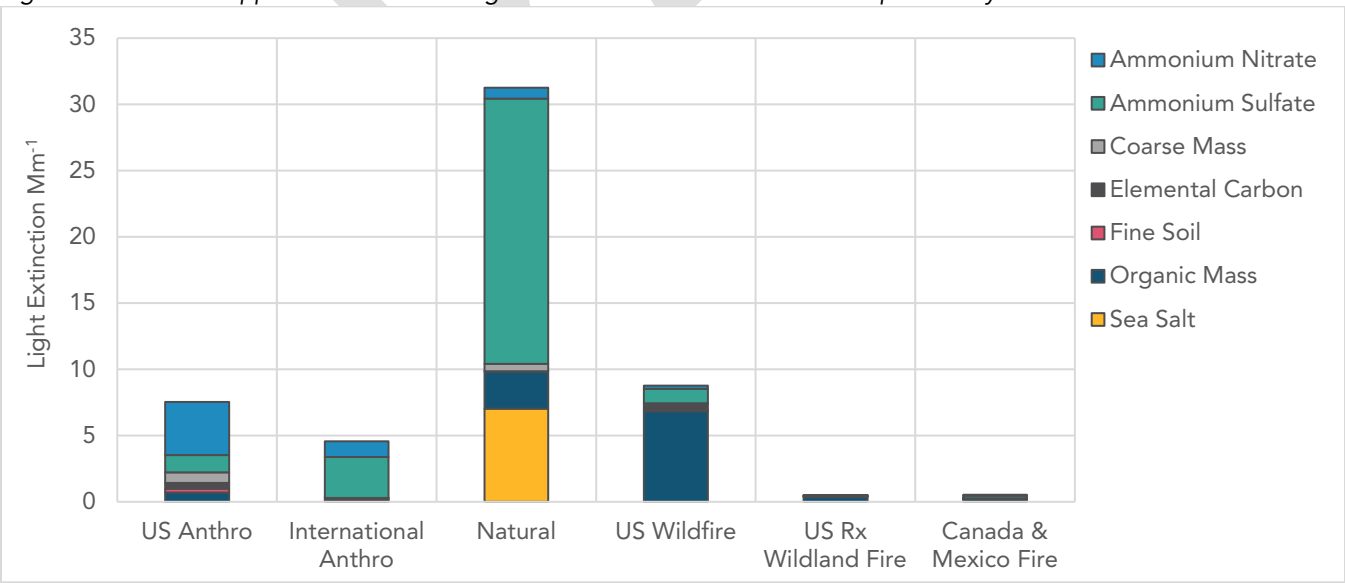
Figure C-12: Average Extinction Composition for REDW1 on the Most Impaired Days



Source apportionment modeling, shown in Figure C-13, indicates that natural emissions are the dominant source of visibility reducing particles measured at the REDW1 monitoring site. Ammonium sulfate and sea salt account for the largest portions of light extinction attributable to natural sources. Wildfire, international anthropogenic, and U.S. anthropogenic emission sources also contribute to visibility impairment. Organic mass and ammonium sulfate account for the largest share visibility reducing particles attributable to U.S. wildfire and international anthropogenic sources on the most impaired days, respectively.

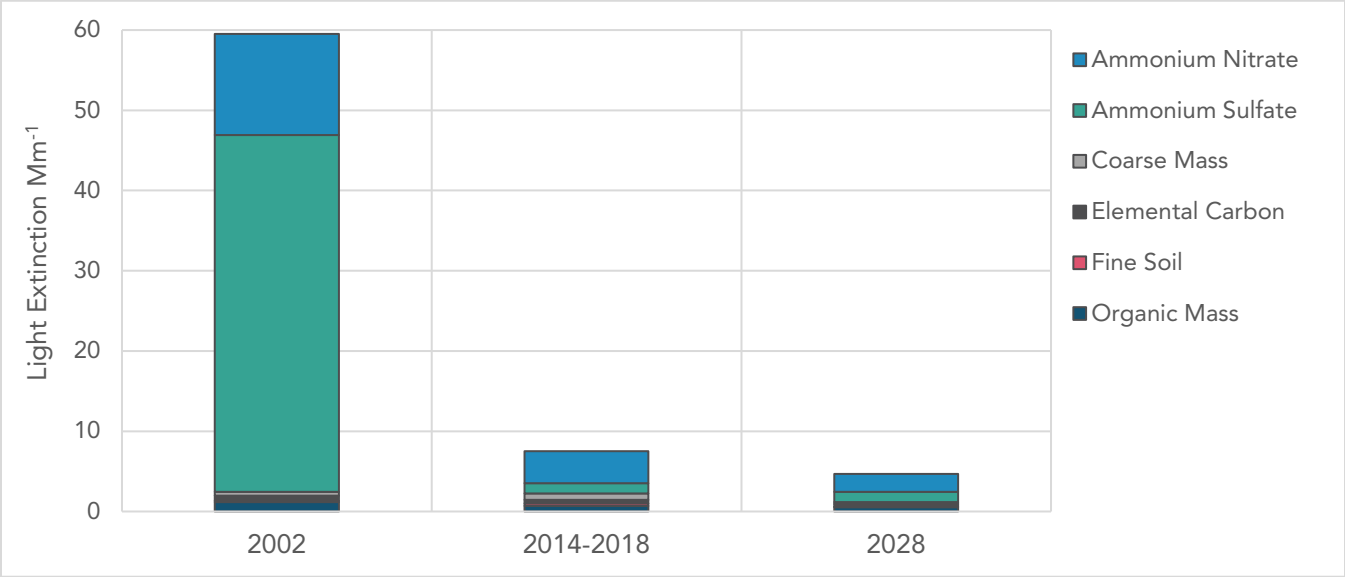
Figure C-13: Source Apportionment Modeling Results for REDW1 on the Most Impaired Days in 2014-2018



As shown in Figure C-14, ammonium sulfate impacts have been reduced dramatically since the baseline period and light extinction attributable to U.S. sources was dominated by ammonium nitrate during the current period. Between the current period and 2028, adopted

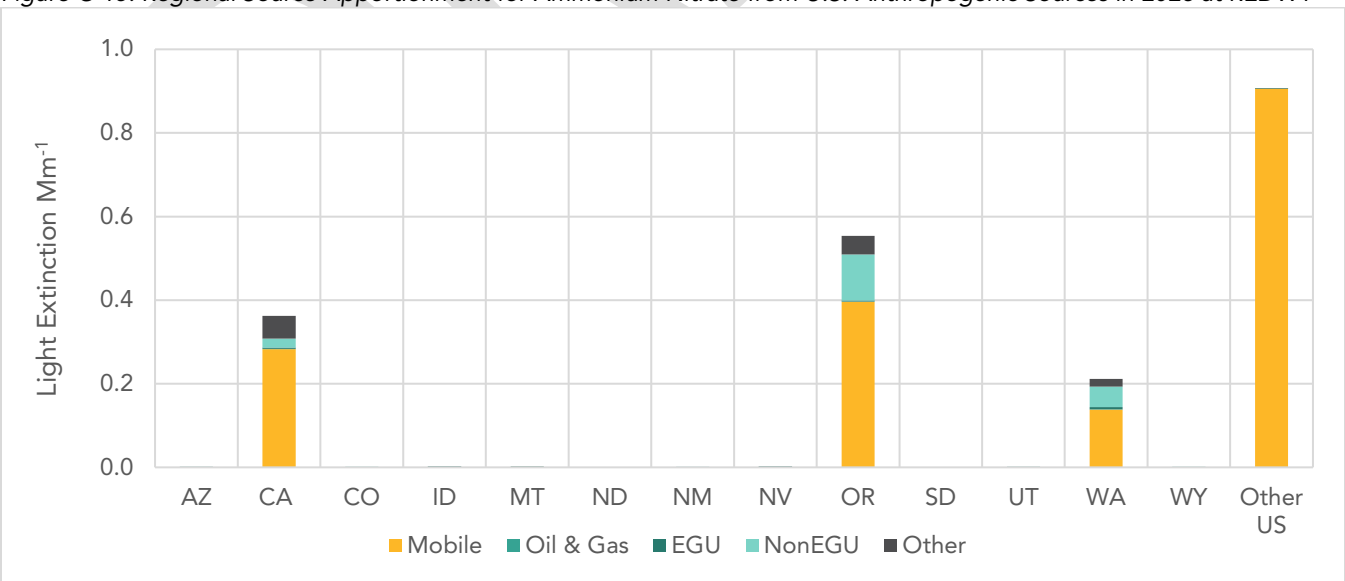
emission controls are expected to reduce light extinction attributable to ammonium nitrate from U.S. sources by 45 percent. Projections indicate that ammonium nitrate will continue to account for the largest share of light extinction attributable to U.S. emission sources.

Figure C-14: Light Extinction from PM Attributed to U.S. Anthropogenic Sources at REDW1 on the Most Impaired Days



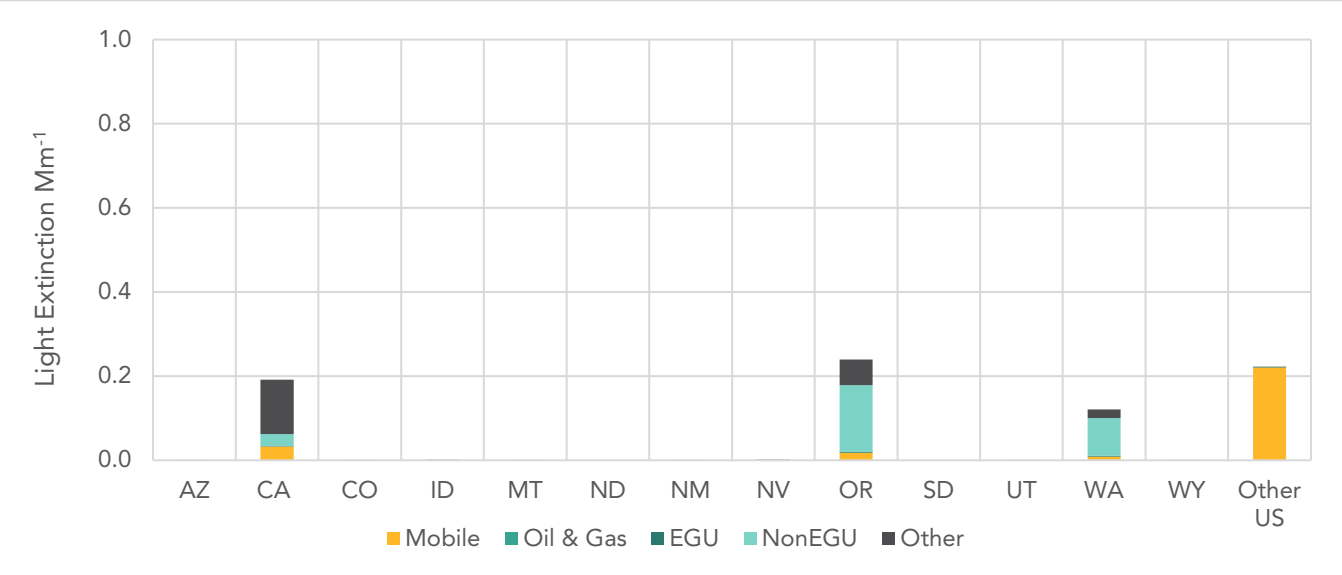
Regional source apportionment projections, shown in Figure C-15, indicates that mobile sources will continue to be the largest regional source of ammonium nitrate in 2028. These results underscore the need to continue efforts to reduce emissions from mobile source sectors. Efforts focused on mobile source control programs will yield a wide range of benefits, including improved visibility.

Figure C-15: Regional Source Apportionment for Ammonium Nitrate from U.S. Anthropogenic Sources in 2028 at REDW1



As shown in Figure C-16, light extinction from ammonium sulfate is projected to amount to less than half of the amount of light extinction from ammonium nitrate. Regional source apportionment results indicate that a combination of regional emissions contribute to ammonium sulfate on the most impaired days. The largest single source group contribution is from "Other US" mobile sources, which includes emissions from ocean-going vessels operating off the coast in U.S. waters.

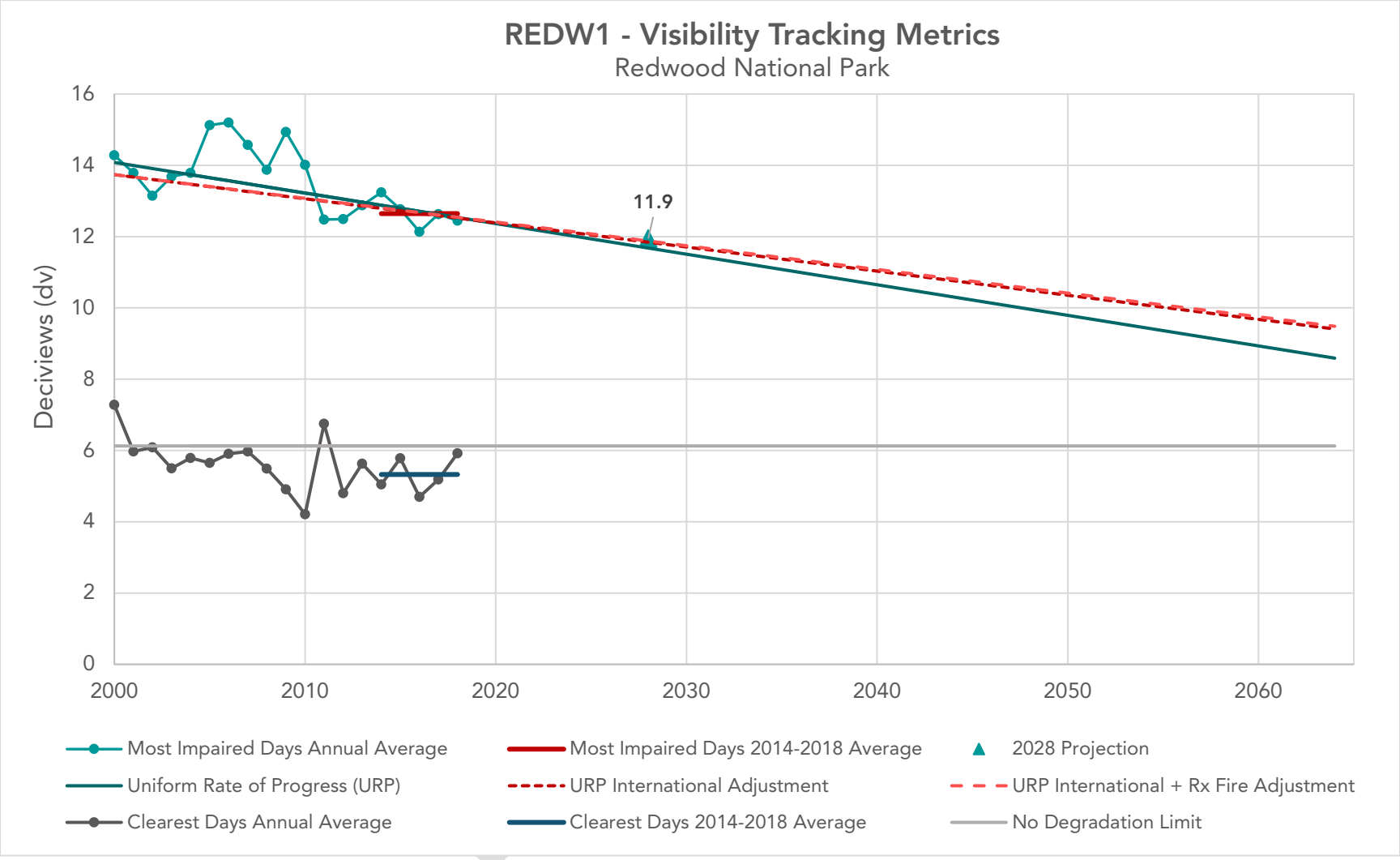
Figure C-16: Regional Source Apportionment for Ammonium Sulfate from U.S. Anthropogenic Sources in 2028 at REDW1



California's long-term strategy for regional haze is focused on improving visibility through reduction of NOx emissions from mobile sources. This strategy is expected to lead to improved visibility at Redwood National Park. However, offshore shipping emissions, the primary component of the "Other US" regional source group in Figures C-15 and C-16, is projected to have a continued impact on visibility at this coastal site. Action by the U.S. EPA in cooperation with the International Maritime Organization could help achieve emission reductions from offshore shipping and accelerate the pace of visibility improvement for Redwood National Park and other Class I areas influenced by offshore emissions.

The current and projected trends for visibility tracking metrics at Redwood National Park are shown in Figure C-17. Accounting for baseline (adopted) emission controls and emission reduction commitments included in this Regional Haze Plan, visibility impairment on the most impaired days is projected be 11.9 dv in 2028, which is equivalent to a visual range of 74 miles (119 km). The 2028 projection is below the adjusted glidepath, which accounts for international and wildland prescribed fire emissions, indicating that the site is on track to meet 2064 visibility targets.

Figure C-17: Visibility Tracking Metrics and Projections for Redwood National Park



Trinity National Forest (TRIN1) IMPROVE Monitoring Site

The TRIN1 monitoring site, shown below in Figure C-18, is in the Trinity National Forest at 3,327 feet (1,014 m) asl. The monitoring site was established in October 2000, just south of Trinity River Conservation Camp #3. A helipad is located just north of the site. Data collected at this site are representative of visibility conditions in the Marble Mountain Wilderness Area and Yolla Bolly-Middle Eel Wilderness Area. While not in a Class I area, the TRIN1 monitor is in a rural area equidistant between the Marble Mountain and Yolla Bolly-Middle Eel Wilderness Areas at a location that is accessible and equipped with reliable power.

Figure C-18: Photograph looking north towards the TRIN1 Monitoring Site

Photograph Source: http://vista.cira.colostate.edu/Improve/monitoring-site-browser/

The Marble Mountain Wilderness Area spans 213,743 acres. The landscape is characterized by craggy mountain peaks, high elevation meadows, lakes, deep glacial-carved valleys, and dense forests. The Marble Mountain Wilderness Area is in the Northeast Plateau Air Basin. The Yolla Bolly-Middle Eel Wilderness Area is remote and rugged, covering 109,091 acres and straddling the border of the North Coast and Sacramento Valley Air Basins. The TRIN1 monitoring site is in the North Coast Air Basin.

As shown in Table C-3, visibility impairment on the clearest days during the baseline period was 3.4 dv. Visibility impairment on the clearest days decreased by 0.3 dv between the baseline and current periods. During the current period visibility impairment was 3.1 dv, which is equivalent to a visual range of 178 miles (286 km) at Marble Mountain and Yolla Bolly-Middle Eel Wilderness Areas.

Visibility impairment on the most impaired days during the baseline period was 11.9 dv. Visibility impairment decreased by 1.5 dv between baseline monitoring period and the current period. During the current period, visibility impairment was 10.4 dv, which is equivalent to a visual range of 86 miles (138 km) at Marble Mountain and Yolla Bolly-Middle Eel Wilderness Areas.

Table C-3: Visibility Tracking Metrics for TRIN1

Days	Baseline (dv)	Current (dv)	Natural (dv)	Difference: Baseline - Current	Difference: Current - Natural	Uniform Rate of Progress (Adjustment)	Current Rate of Progress
Clearest	3.4	3.1	1.2	0.3 dv	1.9 dv	--	--
Most Impaired	11.9	10.4	6.5	1.5 dv	3.9 dv	0.09 dv/year (0.05 dv/year)	0.11 dv/year

Monitoring data, shown in Figures C-19 and C-20, indicate that organic mass and ammonium sulfate have the most dominant impact on light extinction at the TRIN1 monitor on both the clearest days and the most impaired days. Between the baseline monitoring period and the current period, light extinction from organic mass decreased by 5 percent on the clearest days and by 15 percent on the most impaired days. During this same time period, light extinction from ammonium sulfate decreased by 19 percent on the clearest and 20 percent most impaired days.

Figure C-19: Average Extinction Composition for TRIN1 on the Clearest Days

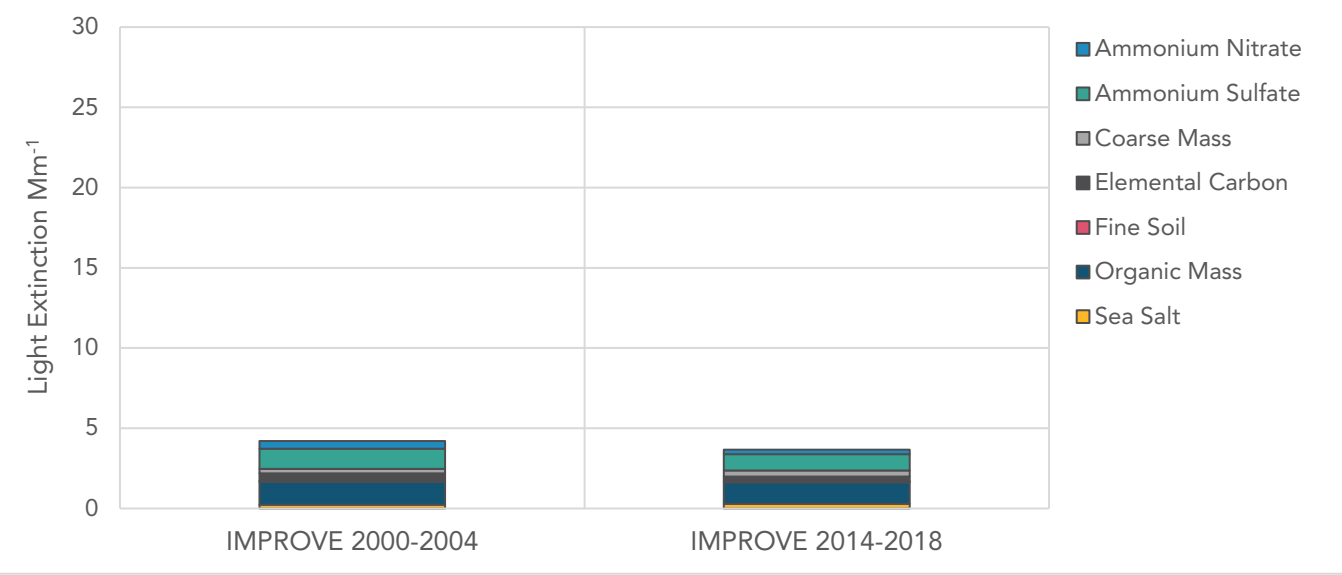


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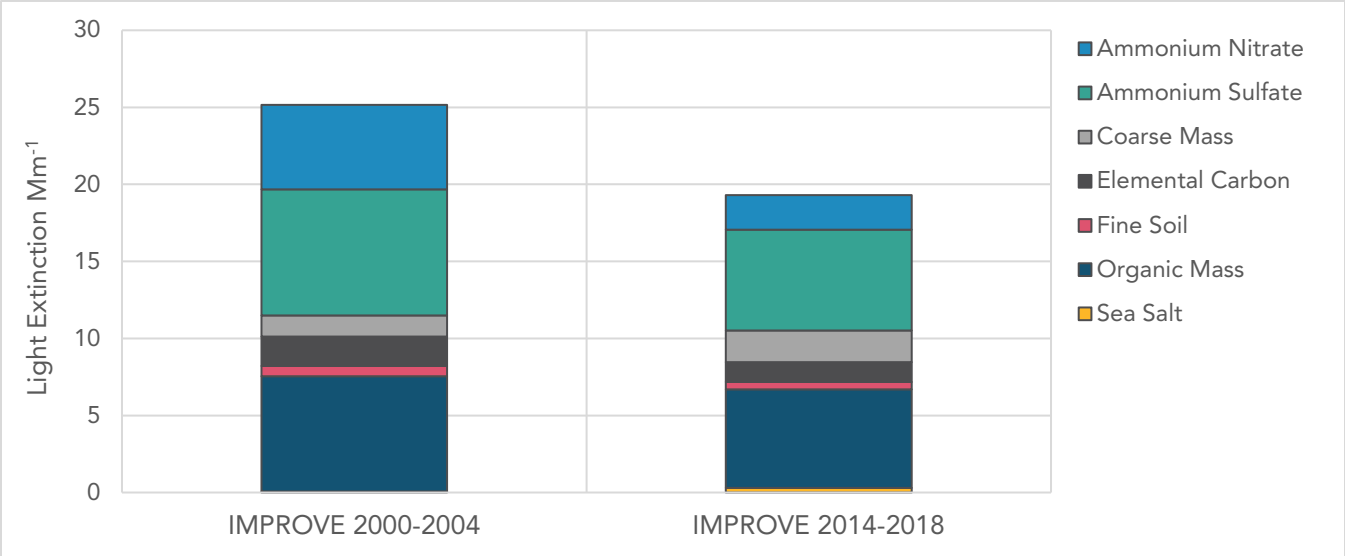
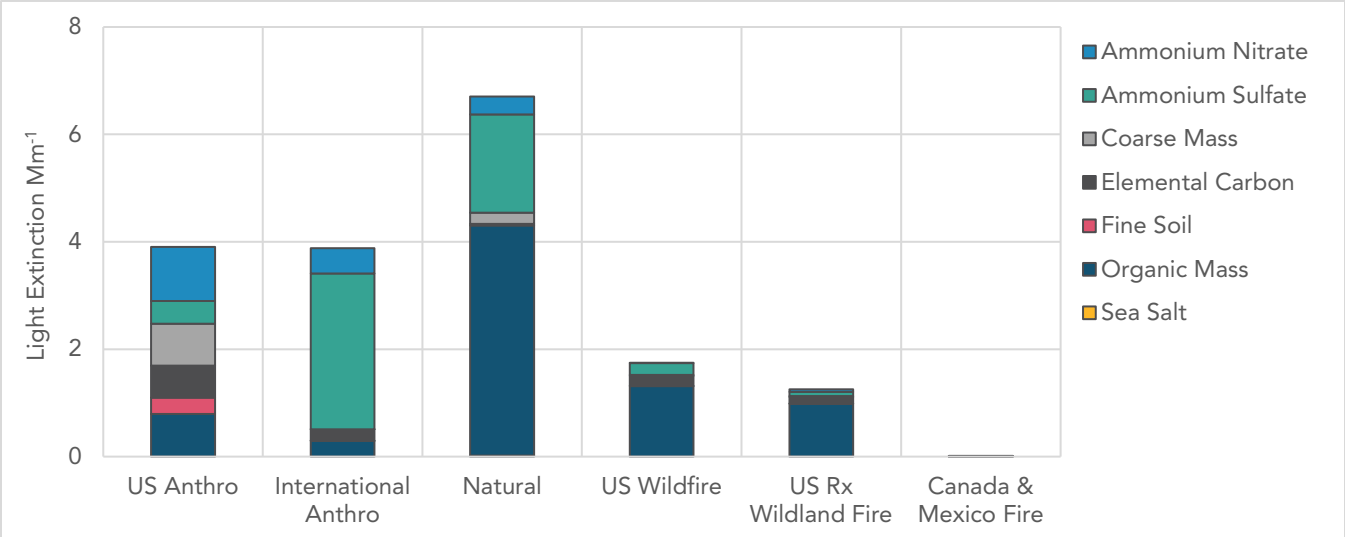
Figure C-20: Average Extinction Composition for TRIN1 on the Most Impaired Days



Source apportionment modeling, shown in Figure C-21, indicates that natural emissions are the dominant source of light extinction from visibility reducing particles measured at the TRIN1 monitor on the most impaired days. Emissions from U.S. sources, international sources, and fire also contribute to visibility impairment. Organic mass is the dominant PM species in the light extinction budget for natural and fire source groups on the most impaired days, whereas ammonium sulfate accounts for the largest portion of international emissions.

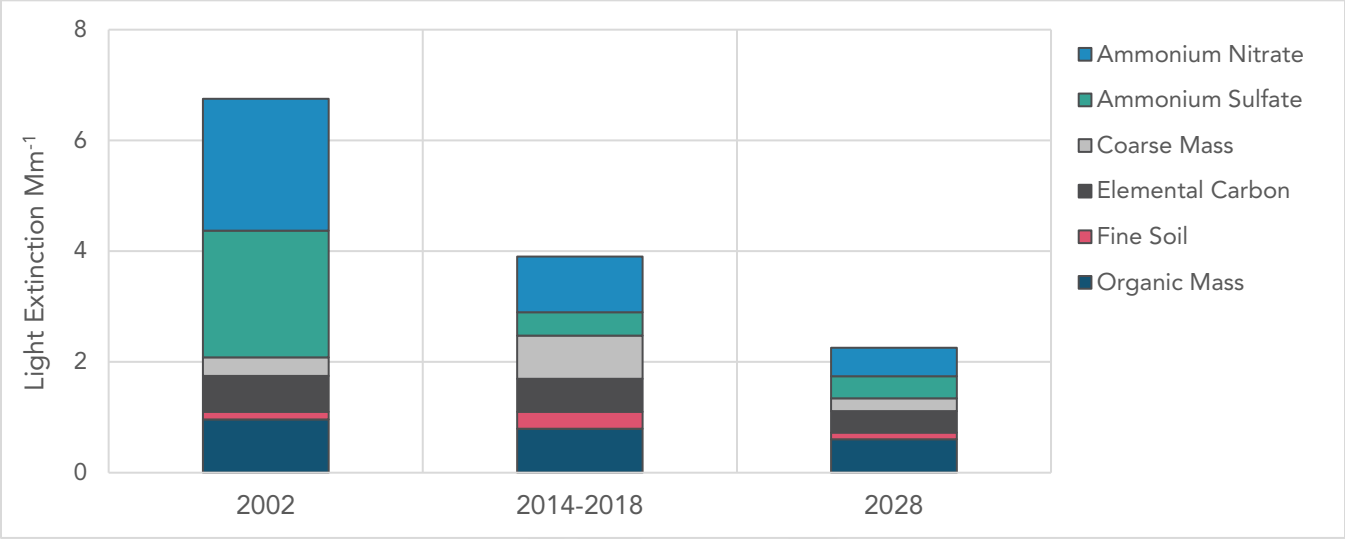
Figure C-21: Source Apportionment Modeling Results for TRIN1 on the Most Impaired Days in 2014-2018



As shown in Figure C-22, ammonium nitrate accounted for the largest share of light extinction attributed to U.S. sources during the baseline and current periods. Ammonium nitrate was followed closely by ammonium sulfate during the baseline period and organic mass in the current period, both of which are species that can be emitted from combustion

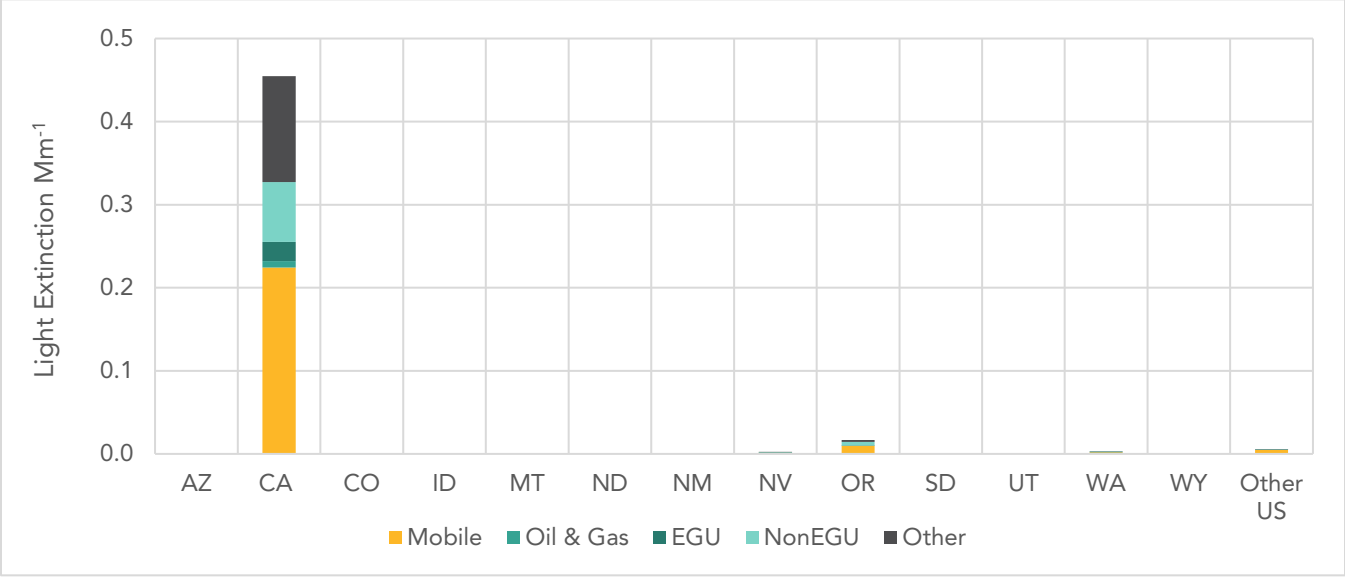
processes. Between the current period and 2028, adopted emission controls are expected to reduce ammonium nitrate by 50 percent. A reduction of 25 percent is expected for light extinction attributed to the U.S. portion of organic mass.

Figure C-22: Light Extinction from PM Attributed to U.S. Anthropogenic Sources at TRIN1 on the Most Impaired Days



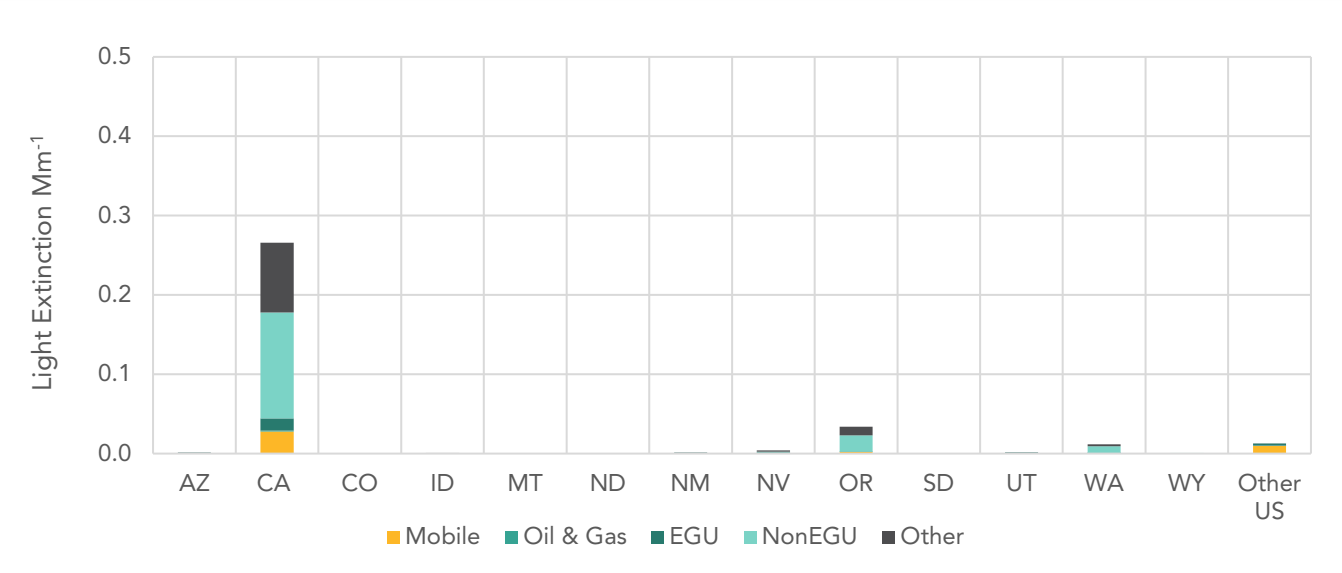
Regional source apportionment modeling, shown in Figure C-23, indicates that mobile sources in California are projected to account for the largest share of light extinction attributable to ammonium nitrate in 2028. California's strategy for regional haze is focused on improving visibility through reduction of NOx emissions from mobile sources. This strategy is expected to lead to visibility improvement in the Marble Mountain and Yolla Bolly-Middle Eel Wilderness Areas.

Figure C-23: Regional Source Apportionment for Ammonium Nitrate from U.S. Anthropogenic Sources in 2028 at TRIN1



As shown in Figure C-23, California emissions account for the largest portion of light extinction from ammonium sulfate attributable to regional emissions. Note that, however, the projected portion of light extinction from ammonium sulfate is a fraction of light extinction attributable to ammonium nitrate in 2028.

Figure C-24: Regional Source Apportionment for Ammonium Sulfate from U.S. Anthropogenic Sources in 2028 at TRIN1



The current and projected trends for the visibility tracking metrics in the Marble Mountains and the Yolla Bolly-Middle Eel Wilderness Areas are shown in Figure C-25. Accounting for the adopted emission controls and emission reduction commitments included in this Regional Haze Plan, visibility impairment on the most impaired days is projected to be 9.5 dv in 2028, which is equivalent to a visual range of 94 miles (151 km). The 2028 projection is below the adjusted glidepath, which accounts for international and wildland prescribed fire emissions, indicating these areas are on track to meet 2064 visibility targets.

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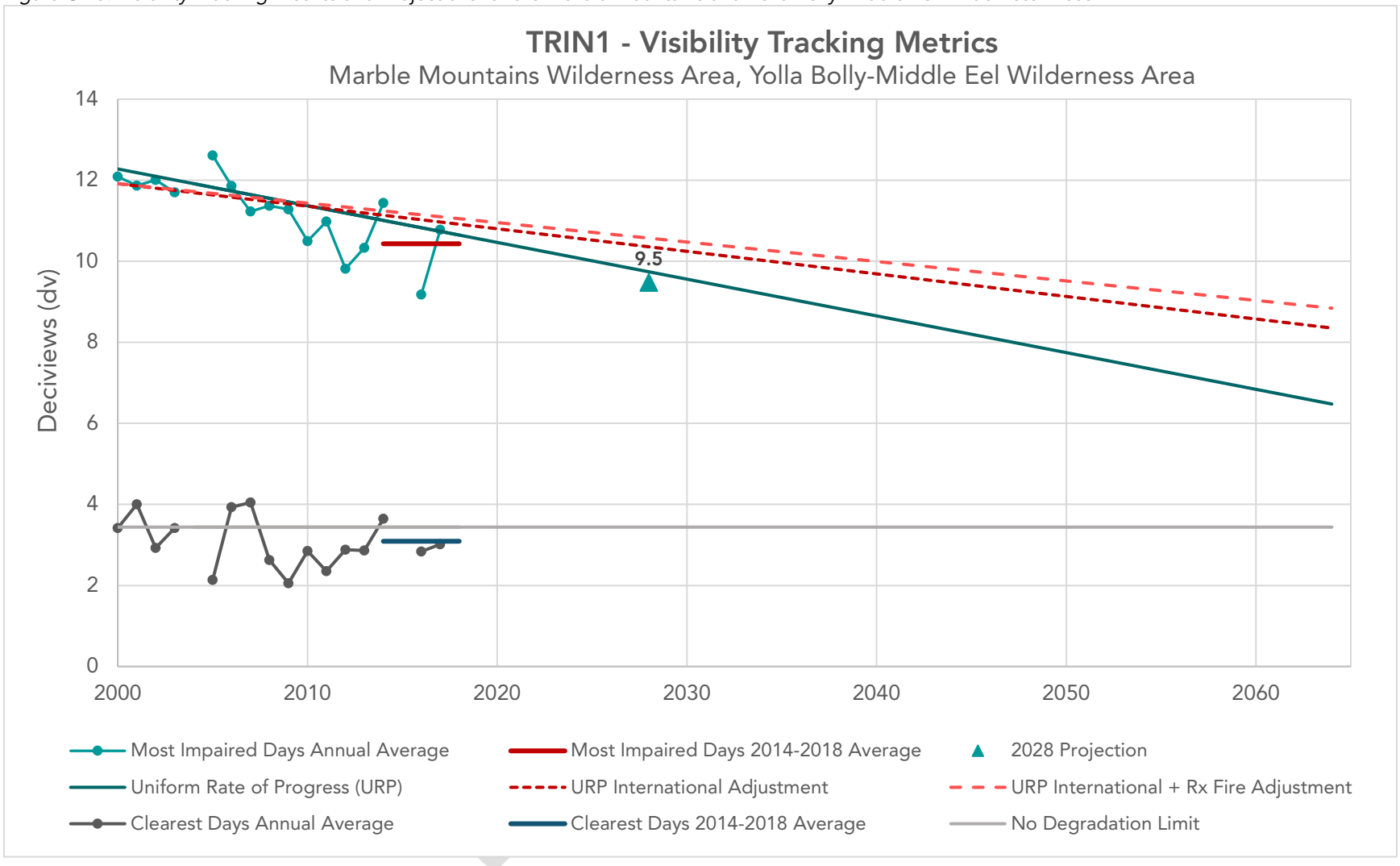
Figure C-25: Visibility Tracking Metrics and Projections for the Marble Mountains and Yolla Bolly-Middle Eel Wilderness Areas



Lassen Volcanic National Park (LAVO1) IMPROVE Monitoring Site

The LAVO1 monitoring site, shown below in Figure C-26, is in the northwest portion of Lassen Volcanic National Park at 5,682 feet (1732 m) asl, adjacent to the ranger station at the Manzanita Lake entrance and southeast of the fire station. Park amenities are concentrated in the Manzanita Lake area including a large, developed campground with 125 sites and camping cabins. Annual visitation during the current period was around 500,000 people.[6] The monitoring site was established in March 1988. Data collected at this site are representative of visibility conditions in the Caribou Wilderness Area, Lassen Volcanic National Park, and the Thousand Lakes Wilderness Area.

Figure C-26: Photograph looking north towards the LAVO1 monitoring site

Photograph Source: http://vista.cira.colostate.edu/Improve/monitoring-site-browser/

The Caribou Wilderness Area covers 19,080 acres of high elevation forested plateau. The landscape is dotted with numerous lakes. The Caribou Wilderness Area is just east of Lassen Volcanic National Park. Lassen Volcanic National Park spans 105,800 acres and includes eight different active hydrothermal areas, a variety of volcanic domes that include all four types of volcanoes, as well as numerous lakes and streams. North of Lassen Volcanic National Park, the Thousand Lakes Wilderness Area spans 15,695 acres. The landscape in the Thousand

[6] *https://irma.nps.gov/STATS/Reports/Park/LAVO*

Lakes Wilderness Area is characterized by volcanic peaks, glacial carved valleys, a handful of high elevation lakes, and dense stands of fir and pine trees.

The Thousand Lakes Wilderness Area and the majority of Lassen Volcanic National Park are within the Sacramento Valley Air Basin. The LAVO1 monitoring site is also within the Sacramento Valley Air Basin. The northeast portion of Lassen Volcanic National Park and the majority of the Caribou Wilderness Area are in the Northeast Plateau Air Basin. The southeastern edge of Lassen Volcanic National Park and southern edge of the Caribou Wilderness Area are in the Mountain Counties Air Basin.

As shown in Table C-4, visibility impairment on the clearest days during the baseline period was 2.7 dv. Visibility impairment on the clearest days decreased by 0.5 dv between the baseline and the current periods. During the current period, visibility impairment was 2.2 dv, which is equivalent to a visual range of 194 miles (313 km) at Caribou Wilderness Area, Lassen Volcanic National Park, and the Thousand Lakes Wilderness Area.

Visibility impairment on the most impaired days during the baseline period was 11.5 dv. Visibility impairment decreased by 1.3 dv between the baseline and current periods. During the current period visibility impairment was 10.2 dv, which is equivalent to a visual range of 87 miles (141 km) at Caribou Wilderness Area, Lassen Volcanic National Park, and the Thousand Lakes Wilderness Area. Between the baseline and current periods, visibility improved by an average of 0.09 dv per year. This rate of improvement is greater than the URP adjusted to account for international emissions and prescribed fire.

Table C-4: Visibility Tracking Metrics for LAVO1

Days	Baseline (dv)	Current (dv)	Natural (dv)	Difference: Baseline - Current	Difference: Current - Natural	Uniform Rate of Progress (Adjusted)	Current Rate of Progress
Clearest	2.7	2.2	1.0	0.5 dv	1.2 dv	--	--
Most Impaired	11.5	10.2	6.1	1.3 dv	4.1 dv	0.09 dv/year (0.06 dv/year)	0.09 dv/year

Monitoring data, shown in Figures C-27 and C-28, indicate that on the clearest and most impaired days ammonium sulfate and organic mass account for the largest portion of light extinction at the LAVO1 monitor. The low sulfur diesel regulations adopted in California between the baseline and current periods have led to decreased sulfur emissions from mobile sources and subsequently decreased sulfate particles. Between the baseline monitoring and current periods, light extinction from ammonium sulfate decreased

20 percent on the clearest days and 23 percent on the most impaired days. Light extinction from organic mass decreased by 22 percent on the clearest and 6 percent most impaired days.

Figure C-27: Average Extinction Composition for LAVO1 on the Clearest Days

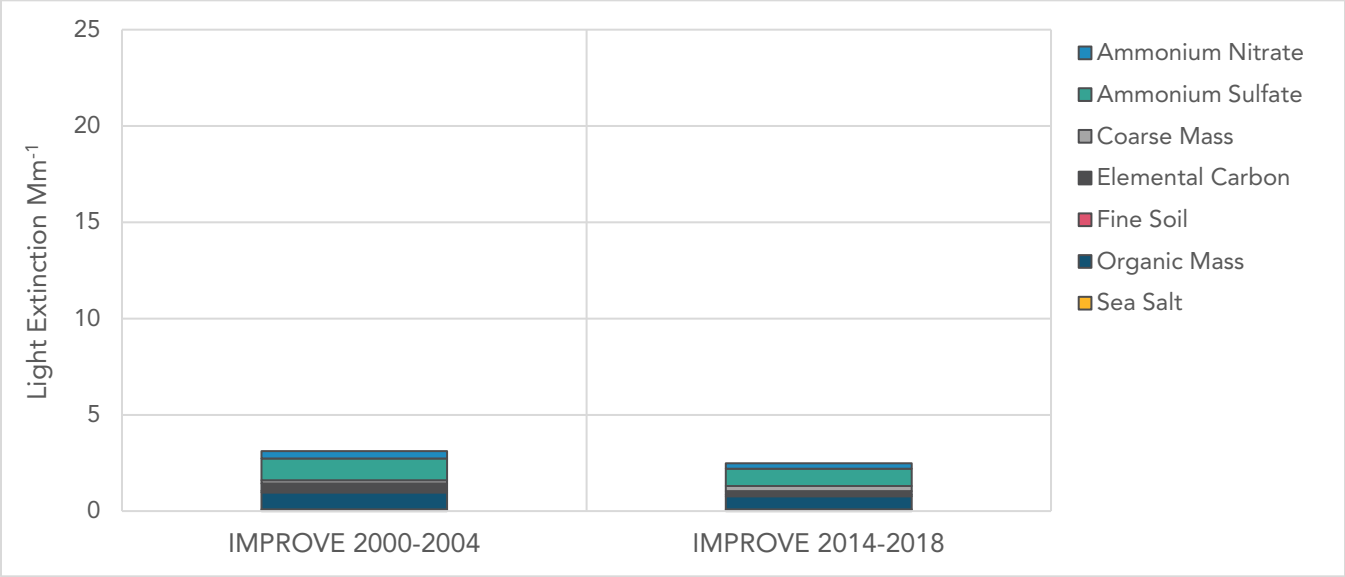
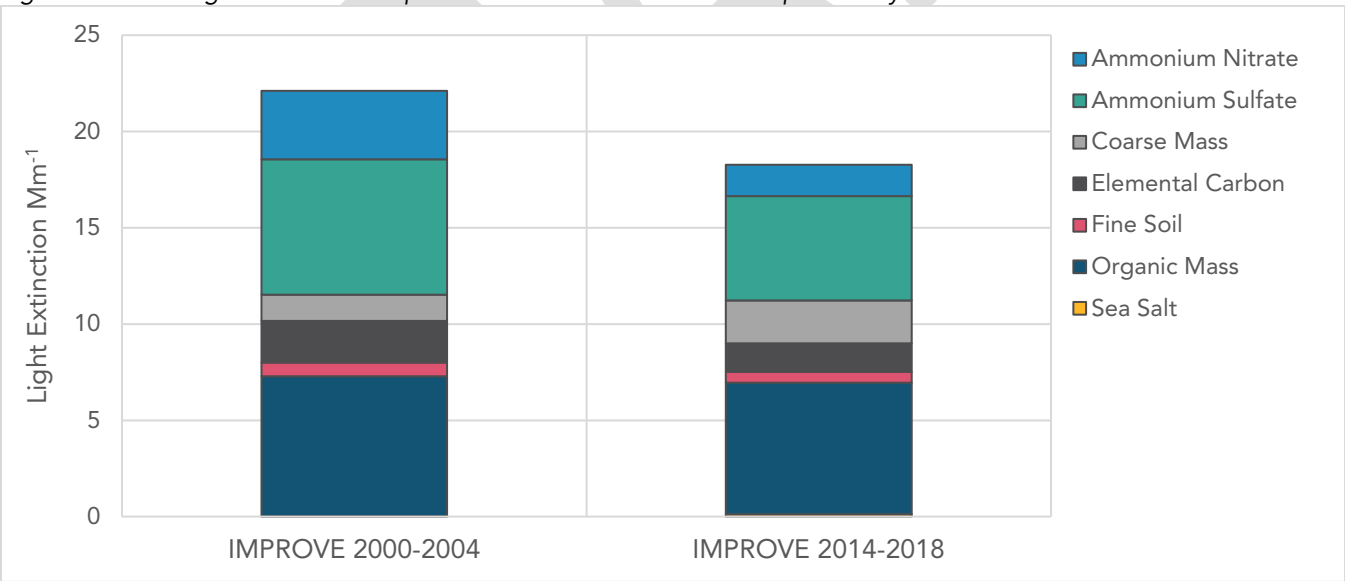
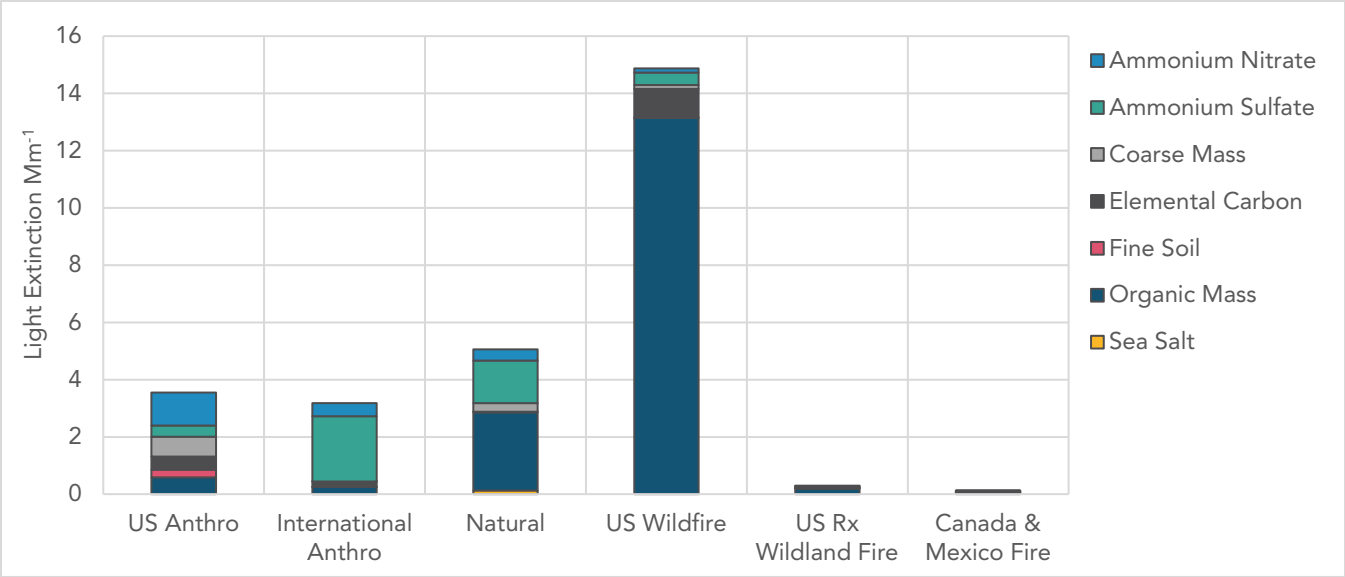


Figure C-28: Average Extinction Composition for LAVO1 on the Most Impaired Days



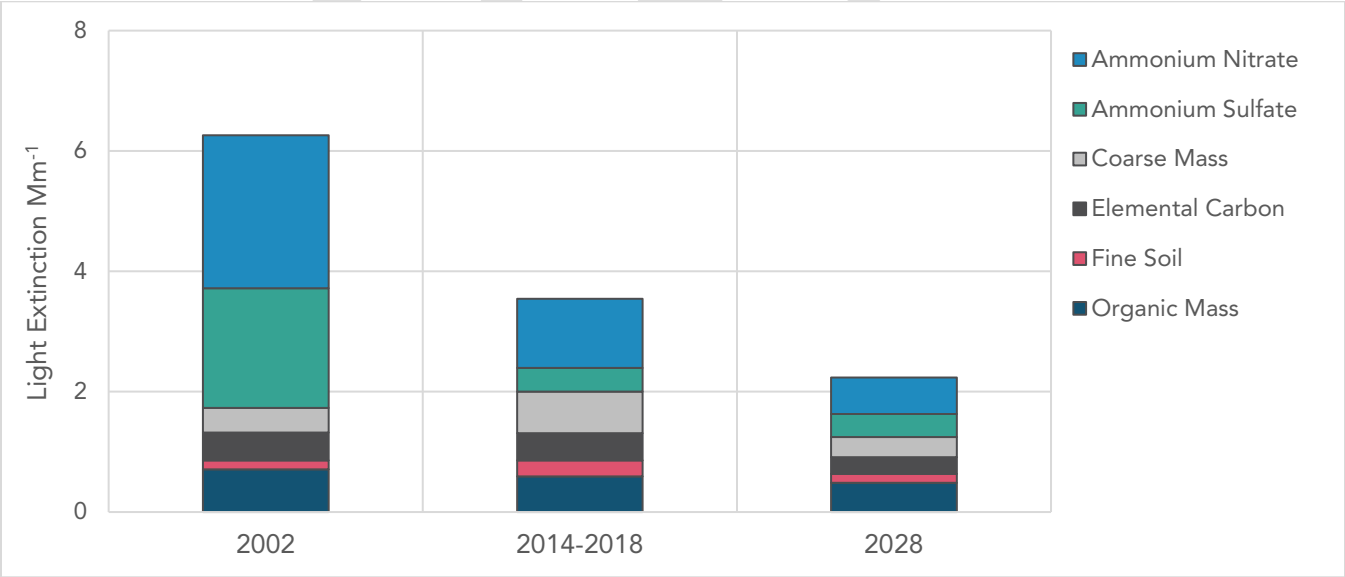
Source apportionment modeling, shown in Figure C-29, indicates that wildfires are the dominant source of visibility reducing particles measured at the LAVO1 monitoring site. Emissions from other natural, U.S., and international sources also contribute to visibility impairment on the most impaired days. Organic mass is primarily from wildfires and natural emission sources. Ammonium sulfate is primarily from international and natural sources.

Figure C-29: Source Apportionment Modeling Results for LAVO1 on the Most Impaired Days in 2014-2018



As shown in Figure C-30, the portion of light extinction attributed to U.S. sources is dominated by ammonium nitrate. Between the current period and 2028, emission controls are expected to reduce light extinction attributable to ammonium nitrate by 45 percent. Projections for 2028, indicate that ammonium nitrate will continue to account for the largest share of light extinction from U.S. sources.

Figure C-30: Light Extinction from PM Attributed to U.S. Anthropogenic Sources at LAVO1 on the Most Impaired Days



Regional source apportionment, shown in Figures C-31 and C-32, indicates that California sources continue to be the largest regional sources of ammonium nitrate and ammonium sulfate in 2028. Light extinction attributable to ammonium nitrate is projected to be about

twice the amount as that attributable to ammonium sulfate. Mobile sources in California will continue to be the dominant source of ammonium nitrate.

Figure C-31: Regional Source Apportionment for Ammonium Nitrate from U.S. Anthropogenic Sources in 2028 at LAVO1

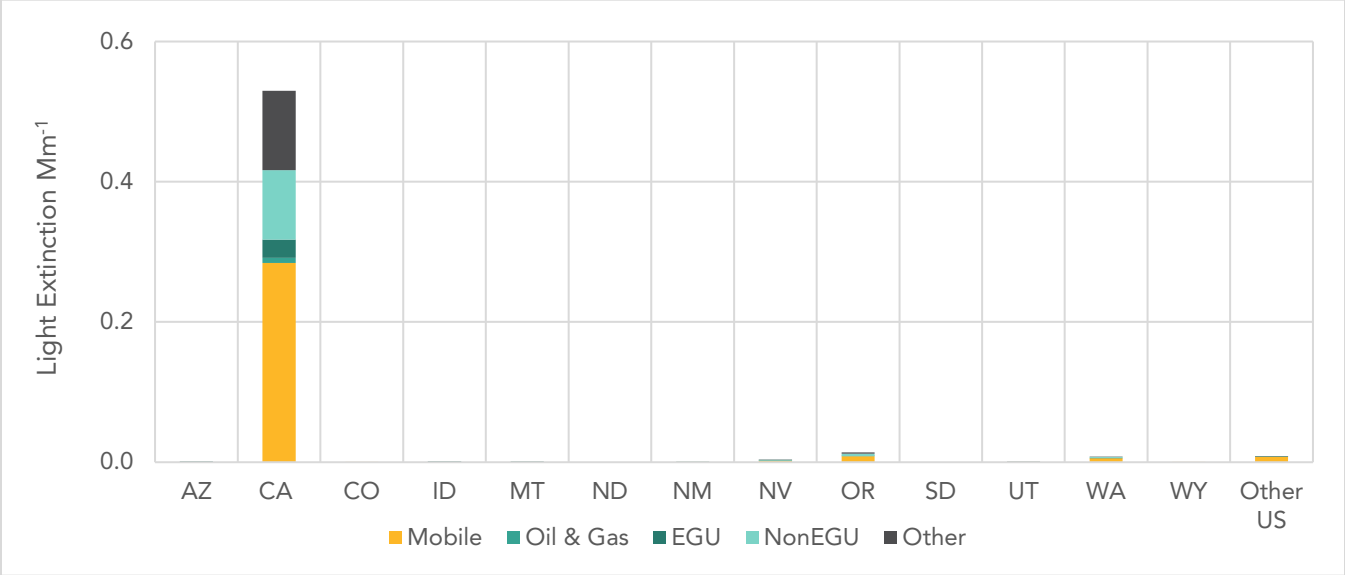
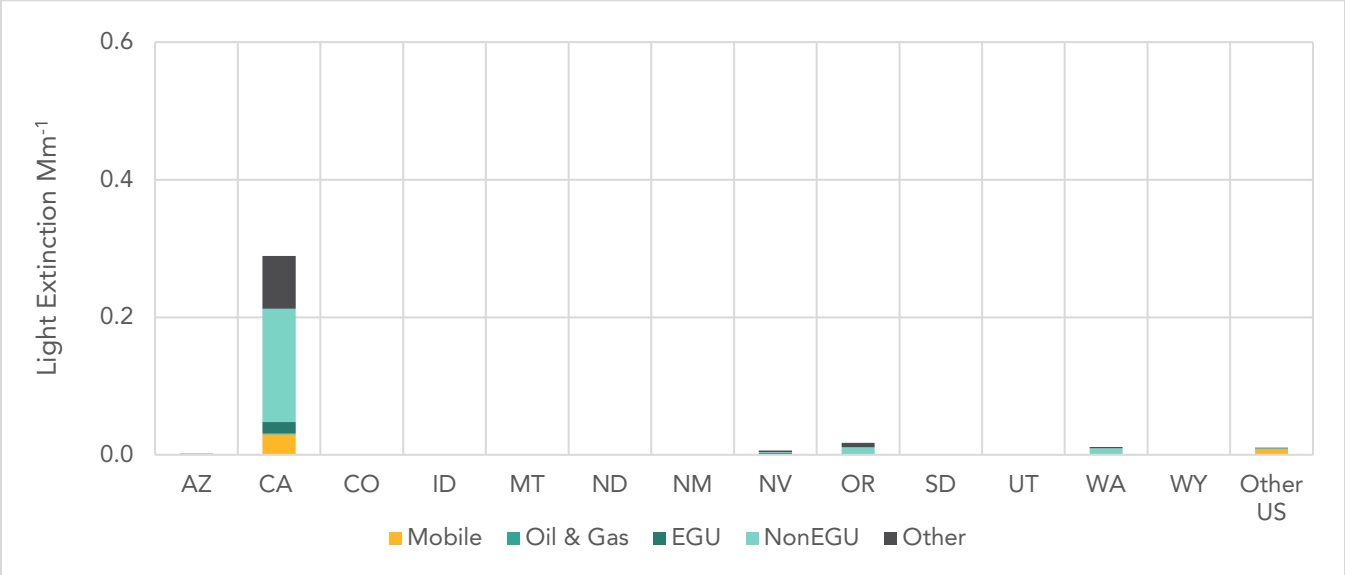


Figure C-32: Regional Source Apportionment for Ammonium Sulfate from U.S. Anthropogenic Sources in 2028 at LAVO1



California's long-term strategy for regional haze is focused on improving visibility through reduction of NOx emissions from mobile sources. This strategy is expected to lead to improved visibility in the Caribou Wilderness Area, Lassen Volcanic National Park, and the Thousand Lakes Wilderness Area.

The current and projected trends for visibility tracking metrics for the Caribou Wilderness Area, Lassen Volcanic National Park, and the Thousand Lakes Wilderness Area are shown in

Figure C-33. Accounting for adopted emission controls and emission reduction commitments included in this Regional Haze Plan, visibility impairment on the most impaired days is projected to be 9.4 dv in 2028, which corresponds to a visual range of 95 miles (152 km). This 2028 projection is below the adjusted glidepath, which accounts for international and wildland prescribed fire emissions, indicating that these areas are on track to meet 2064 visibility targets.

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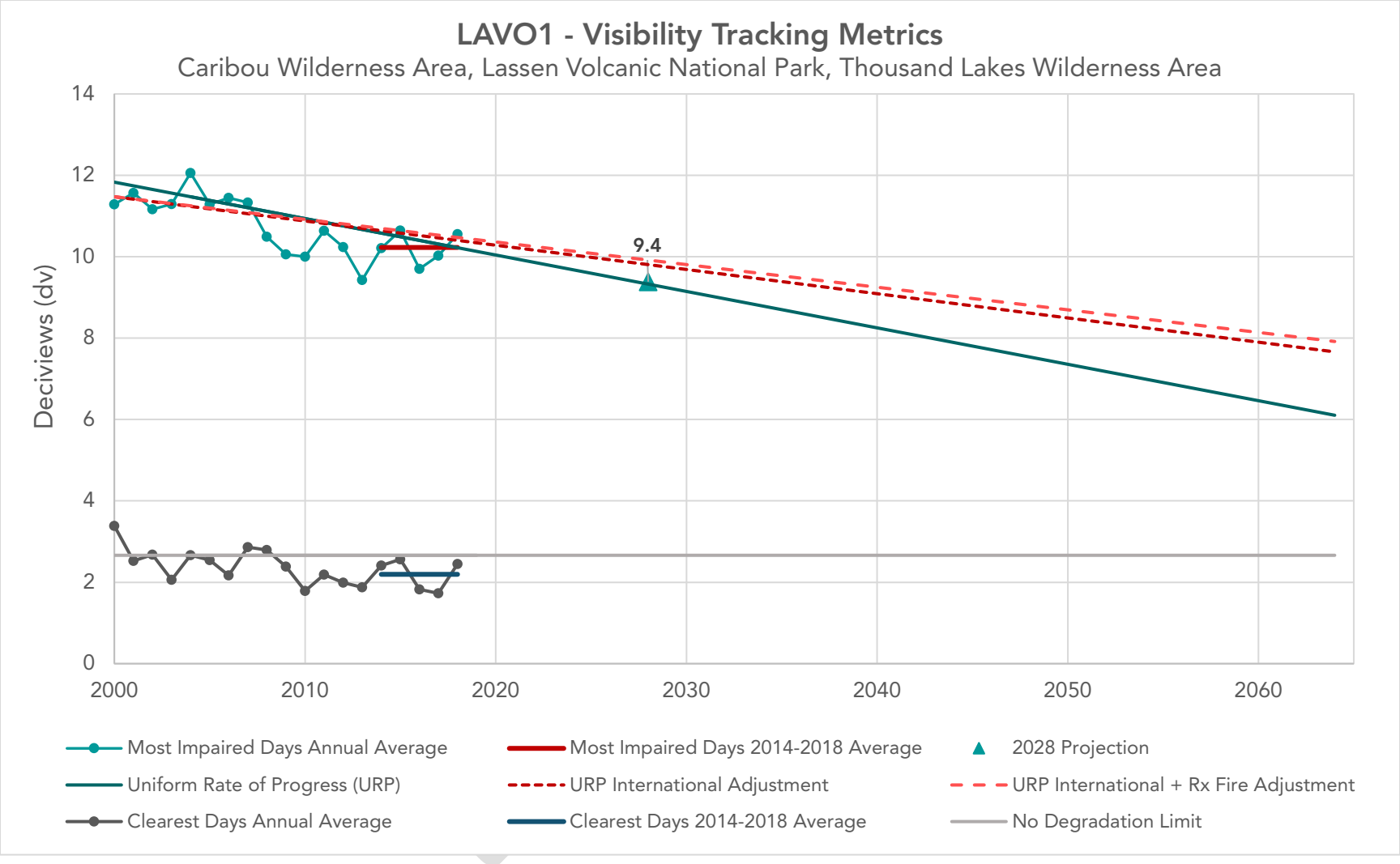
Figure C-33: Visibility Tracking Metrics and Projections for Caribou Wilderness Area, Lassen Volcanic National Park, and Thousand Lakes Wilderness Area



DL Bliss State Park (BLIS1) IMPROVE Monitoring Site

The BLIS1 monitoring site, shown below in Figure C-34, is located at DL Bliss State Park at 6,991 feet (2,131 m) asl on a service road near the southwest shore of Lake Tahoe and park headquarters. The monitoring site is within the Lake Tahoe Air Basin, northeast of the Desolation Wilderness Area. The monitoring site was established in November 1990. Data collected at this site are intended to be representative of visibility conditions in the Desolation and Mokelumne Wilderness Areas. Local emission sources including campground operations at DL Bliss State Park, residential wood combustion from communities within the Lake Tahoe Air Basin, and mobile sources operating within the Lake Tahoe Air Basin likely contribute to PM collected at the BLIS1 monitor.

Figure C-34: Photograph looking northeast towards BLIS1 Monitoring Site

Photograph Source: http://vista.cira.colostate.edu/Improve/monitoring-site-browser/

The Desolation Wilderness Area spans 63,469 acres and the Mokelumne Wilderness Area covers 50,400 acres. These Wilderness Areas encompass vast expanses of rugged, high elevation mountainous terrain that include sub-alpine and alpine forests replete with granite peaks and glacially formed valleys. The Desolation Wilderness Area is located west of Lake Tahoe and north of U.S. Highway 50 whereas the Mokelumne Wilderness Area is located south of Lake Tahoe. The Desolation Wilderness Area straddles the border of the Lake Tahoe and Mountain Counties Air Basins. The Mokelumne Wilderness Area lies along the border of the Mountain Counties Air Basin and the Great Basin Valleys Air Basin. Campfires and charcoal are prohibited throughout the Desolation Wilderness Area and travel is restricted to foot or horseback only. Campfires are permitted in certain areas of the Mokelumne Wilderness Area.

As shown in Table C-5, visibility impairment on the clearest days during the baseline period was 2.5 dv. Visibility impairment on the clearest days decreased by 0.7 dv between the baseline and the current periods. During the current period, visibility impairment was 1.8 dv,

which corresponds to a visual range of 202 miles (326 km) in the Desolation and Mokelumne Wilderness Areas.

Visibility impairment on the most impaired days during the baseline period was 10.1 dv. Visibility impairment decreased by 0.8 dv between the baseline and current periods. During the current period, visibility impairment was 9.3 dv, which is equivalent to a visual range of 96 miles (154 km) at the Desolation and Mokelumne Wilderness Areas. Between the baseline and current periods, visibility improved by an average of 0.06 dv each year, which is equivalent to the URP adjusted to account for prescribed fire and international emissions.

Table C-5: Visibility Tracking Metrics for BLIS1

Days	Baseline (dv)	Current (dv)	Natural (dv)	Difference: Baseline - Current	Difference: Current - Natural	Uniform Rate of Progress (Adjusted)	Current Rate of Progress
Clearest	2.5	1.8	0.4	0.7 dv	1.4 dv	--	--
Most Impaired	10.1	9.3	4.9	0.8 dv	4.4 dv	0.09 dv/year (0.06 dv/year)	0.06 dv/year

Monitoring data, shown in Figures C-35 and C-36, indicate that on the clearest and most impaired days, organic mass and ammonium sulfate have the most dominant impact on light extinction at the BLIS1 monitor. Between the baseline and the current periods, light extinction from organic mass decreased by 12 percent on the clearest days but increased by 3 percent on the most impaired days. This observed increase is likely indicative of the ongoing and significant contribution that fire emissions make to visibility impairment in these areas. Light extinction from ammonium sulfate decreased by 28 percent on the clearest days and by 17 percent on the most impaired days.

Figure C-35: Average Extinction Composition for BLIS1 on the Clearest Days

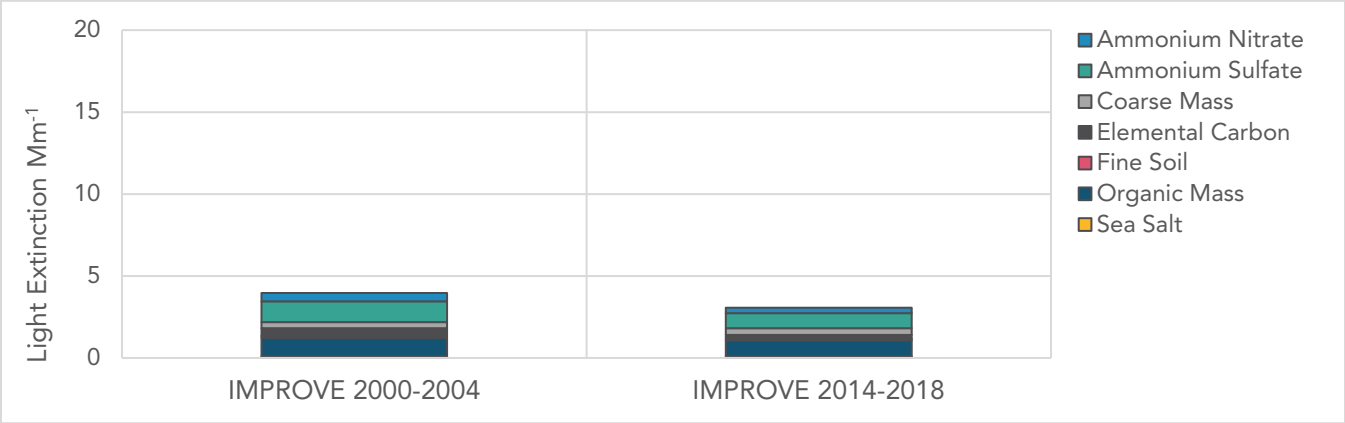


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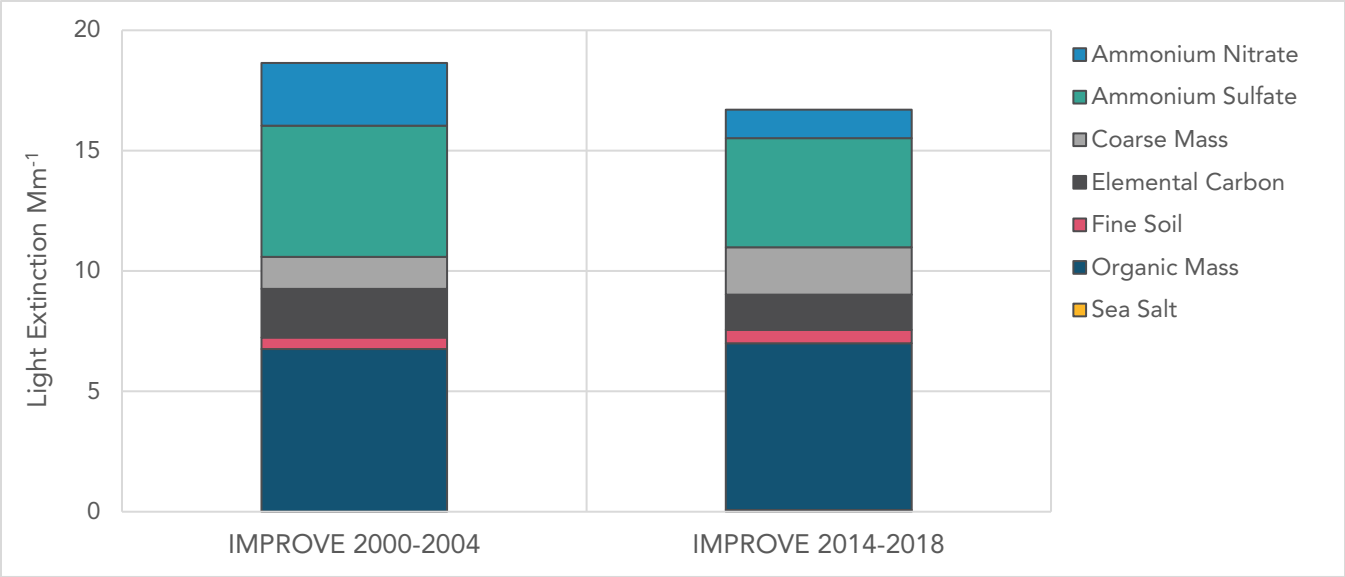
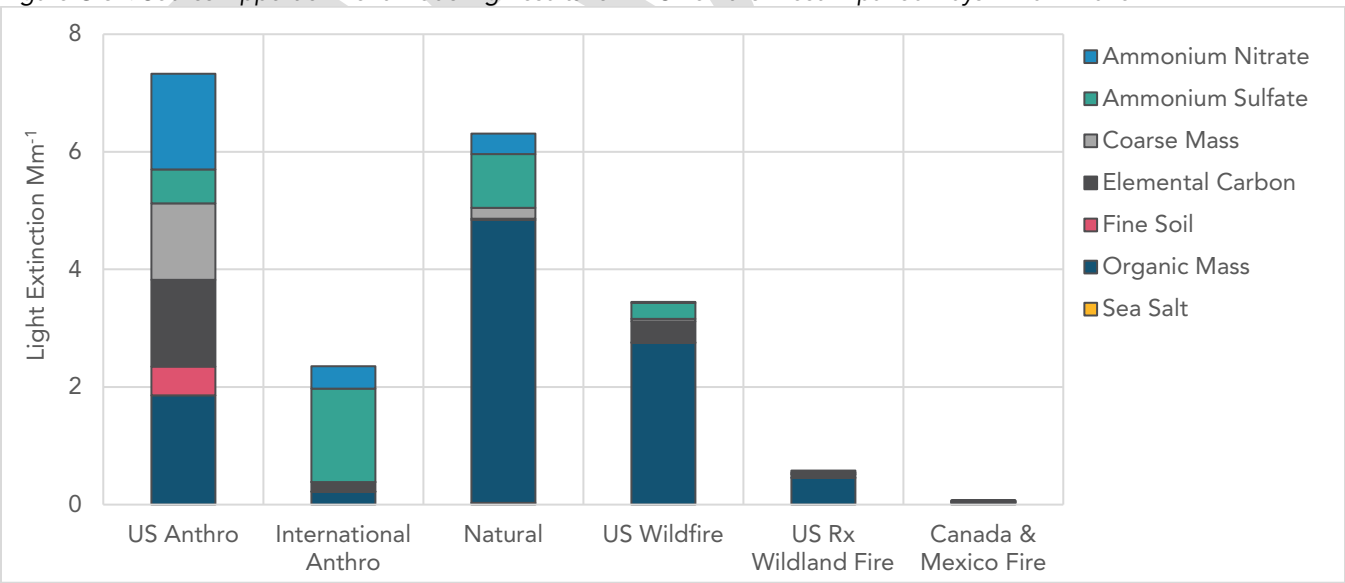
Figure C-36: Average Extinction Composition for BLIS1 on the Most Impaired Days



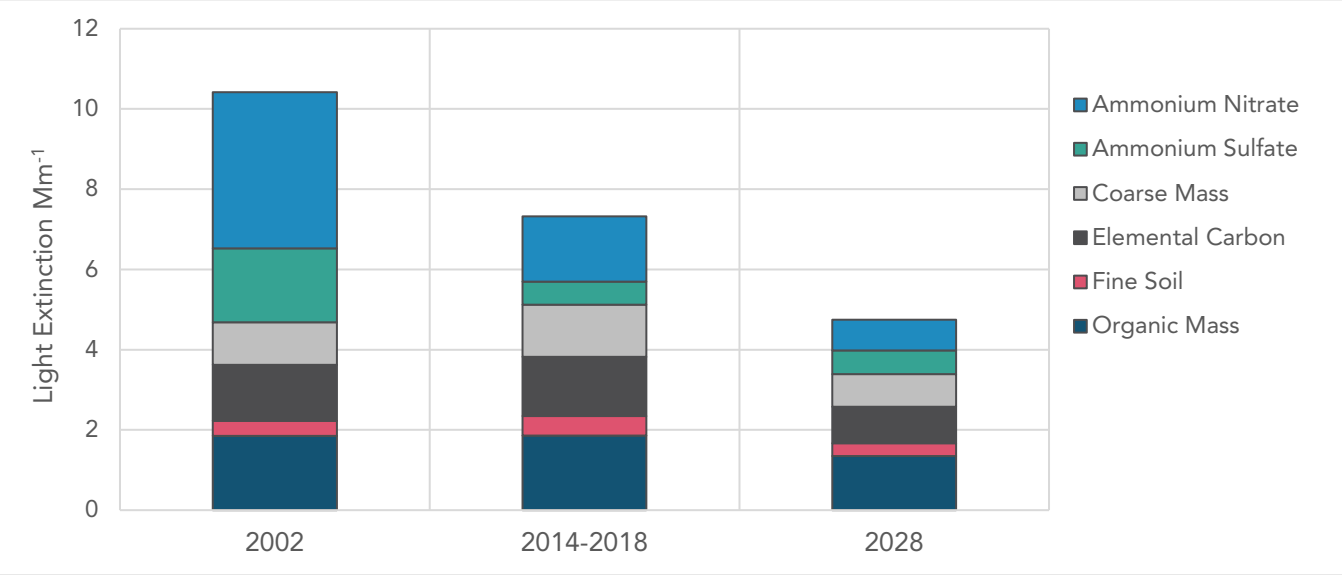
Source apportionment modeling, shown in Figure C-37, indicates that a combination U.S., natural, fire, and international emissions contribute to light extinction on the most impaired days at the BLIS1 monitoring site. This combination of sources underscores that sites throughout the western mountain ranges are ideally positioned to intercept emissions from a wide-array of sources and that, while highly resolved photochemically modeling in areas of complex terrain is a tall task, continued efforts to improve models and measurements will be needed to craft effective strategies as we move through the iterative planning periods and close in on the 2064 targets.

Figure C-37: Source Apportionment Modeling Results for BLIS1 on the Most Impaired Days in 2014-2018



As shown in Figure C-38, the portion of light extinction attributable to U.S. sources has generally been dominated by ammonium nitrate and organic mass. Moving from the current period into 2028, light extinction is attributable to a conglomerate of visibility impairing species. Organic mass, ammonium nitrate, coarse mass, and elemental carbon are shown to account for the largest portions of light extinction. Between the current period and 2028, projections show that light extinction from these sources is expected to decrease by 32 to 50 percent due to implementation of baseline (adopted) control measures. Ammonium sulfate and fine soil account for the smallest portion of the U.S. source light extinction contribution.

Figure C-38: Light Extinction from PM Attributed to U.S. Anthropogenic Sources at BLIS1 on the Most Impaired Days



A high degree of uncertainty is associated with the modeling for coarse mass and lower level source apportionment for elemental carbon and organic mass were not feasible for this planning period. However, these are species typically associated with wood combustion. Emissions from local sources such as residential burning likely contribute to light extinction at this monitoring site. Future efforts to resolve sources of coarse mass, elemental carbon, and organic mass will improve our undertstanding of the emission sources impacting visibility in these areas.

The results of regional source apportionment modeling projections for ammonium nitrate and ammonium sulfate are shown in Figures C-39 and C-40, respectively. California emissions account for nearly all of the light extinction attributable to regional sources. Mobile sources make the largest contribution to light extinction attributable to ammonium nitrate. California's regional haze strategy is focused on reducing NOx emissions from mobile sources. This strategy is projected to benefit visibility conditions in the Desolation and Mokelumne Wilderness Areas.

Figure C-39: Regional Source Apportionment for Ammonium Nitrate from U.S. Anthropogenic Sources in 2028 at BLIS1

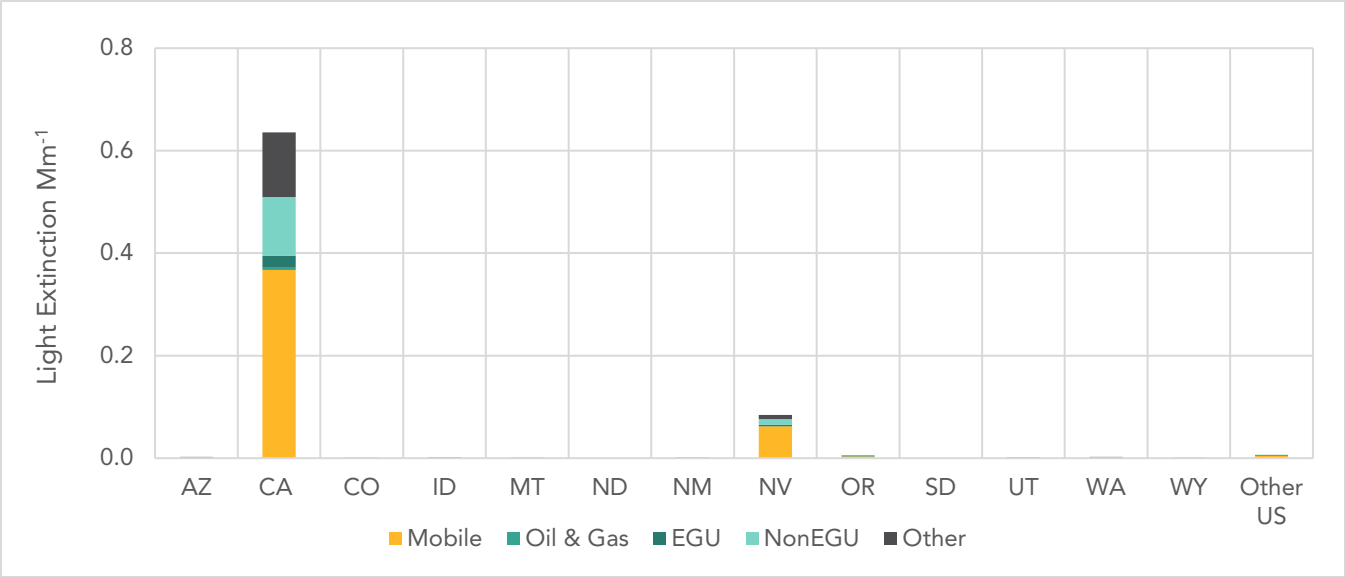
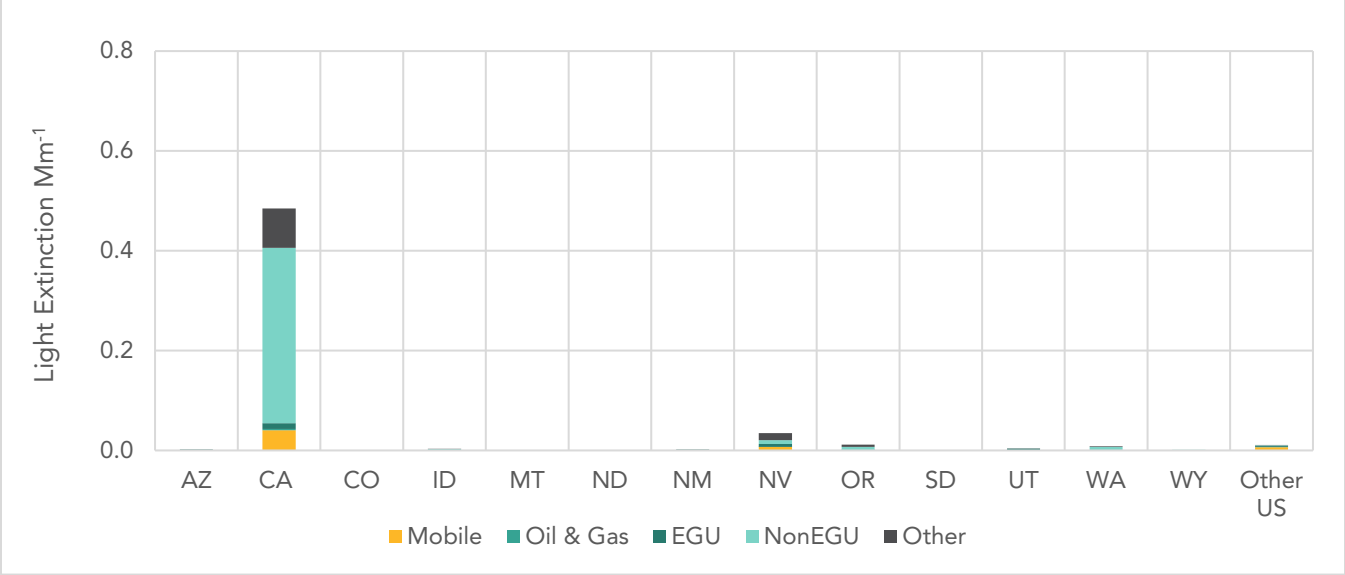
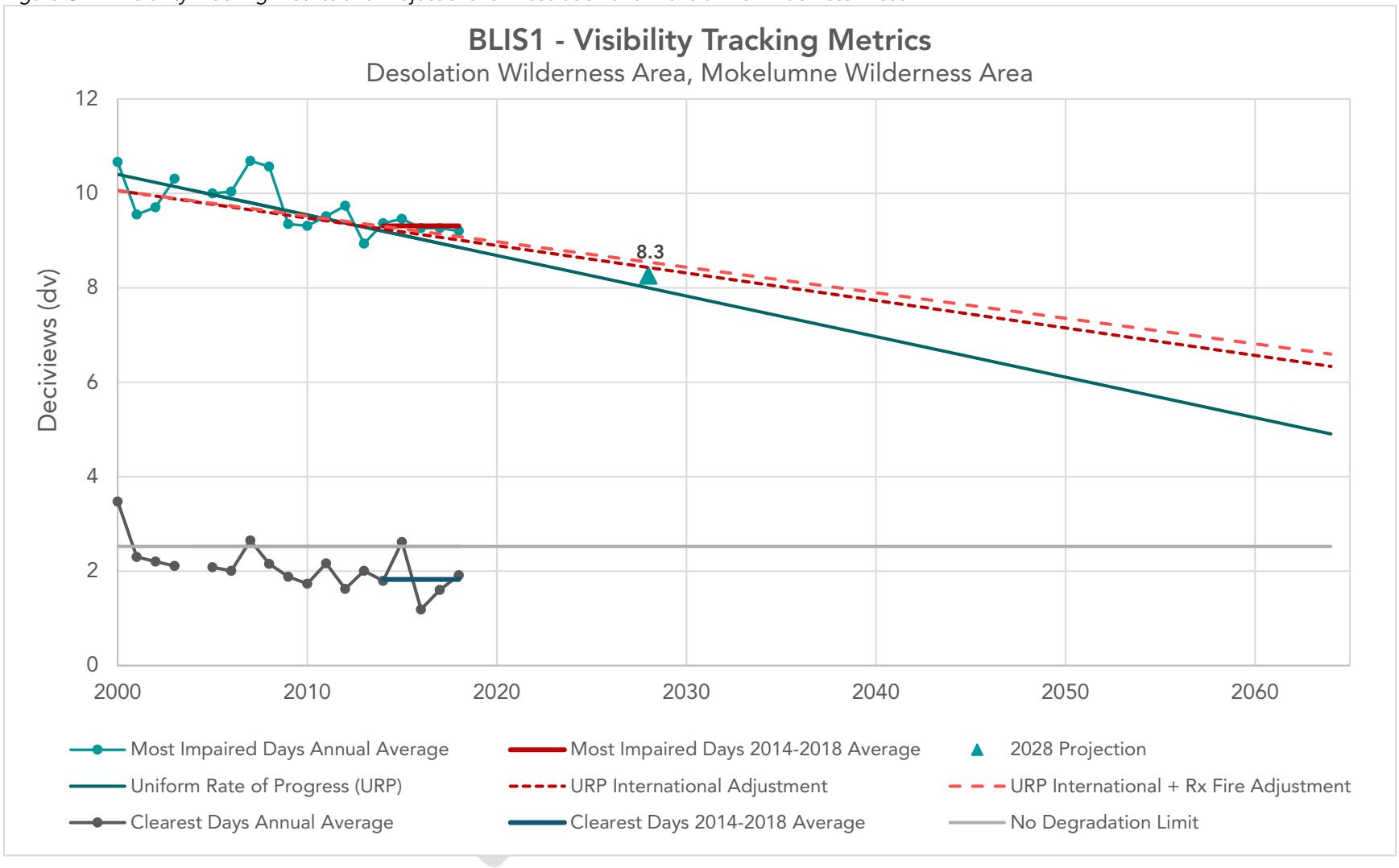


Figure C-40: Regional Source Apportionment for Ammonium Sulfate from U.S. Anthropogenic Sources in 2028 at BLIS1



The current and projected trends for visibility tracking metrics in the Desolation Wilderness Area and the Mokelumne Wilderness Area are shown in Figure C-41. Visibility impairment on the most impaired days is projected to be 8.3 dv in 2028, which represents a visual range of 106 miles (170 km). This 2028 projection is below the adjusted glidepath that accounts for international and wildland prescribed fire emissions, indicating that these areas are on track to reach 2064 visibility targets.

Figure C-41: Visibility Tracking Metrics and Projections for Desolation and Mokelumne Wilderness Areas



Point Reyes National Seashore (PORE1) IMPROVE Monitoring Site

The PORE1 monitoring site, shown below in Figure C-42, is in the northwest portion of Point Reyes National Seashore at 318 feet (97 m) asl. The monitoring site was established in March 1988 adjacent to the North District Ranger Station. Data collected at this site are representative of visibility conditions at Point Reyes National Seashore.

Figure C-42: Photograph looking northeast toward the PORE1 monitoring site

Photograph Source: http://vista.cira.colostate.edu/Improve/monitoring-site-browser/

Point Reyes National Seashore spans 25,370 acres characterized by rocky headlands, open grasslands, and expansive sandy beaches. Annual visitation routinely exceeds two million people[7] due in part to the proximity to the densely populated San Francisco Bay Area. Point Reyes National Seashore is within the northwest corner of the San Francisco Bay Air Basin. Emissions from adjacent urban areas contribute to visibility impairment.

As shown in Table C-6, visibility impairment on the clearest days during the baseline period was 10.5 dv. Visibility impairment on the clearest days decreased by 2.3 dv between the baseline and current periods. During the current period, visibility impairment was 8.2 dv, which corresponds to a visual range of 107 miles (172 km) at Point Reyes National Seashore.

Visibility impairment on the most impaired days during the baseline period was 19.4 dv. Visibility impaired decreased by 4.1 dv between the baseline and current periods. During the current period, visibility impairment was 15.3 dv, which is equivalent to a visual range of 52 miles (84 km) at Point Reyes National Seashore. The annual rate of improvement averaged

[7] *https://irma.nps.gov/STATS/Reports/Park/PORE*

0.29 dv per year, which is faster than the URP and more than twice as fast as the adjusted URP.

Table C-6: Visibility Tracking Metrics for PORE1

Days	Baseline (dv)	Current (dv)	Natural (dv)	Difference: Baseline - Current	Difference: Current - Natural	Uniform Rate of Progress (Adjusted)	Current Rate of Progress
Clearest	10.5	8.2	4.8	2.3 dv	3.4 dv	--	--
Most Impaired	19.4	15.3	9.7	4.1 dv	5.6 dv	0.16 dv/year (0.14 dv/year)	0.29 dv/year

Monitoring data, shown in Figures C-43 and C-44, indicate that ammonium sulfate accounts for the largest portion of light extinction on the clearest days and ammonium nitrate accounts for the largest portion of light extinction on the most impaired days at the PORE1 monitoring site. Like other coastal sites, natural oceanic emissions and offshore sources contribute to visibility impairment. California regulations to reduce emissions from ocean-going vessels and other mobile sources has had a measurable impact on visibility. Between the baseline monitoring period and the current period, light extinction from ammonium sulfate decreased by 47 percent on the clearest days while light extinction from ammonium nitrate decreased by 59 percent on the most impaired days.

Figure C-43: Average Extinction Composition for PORE1 on the Clearest Days

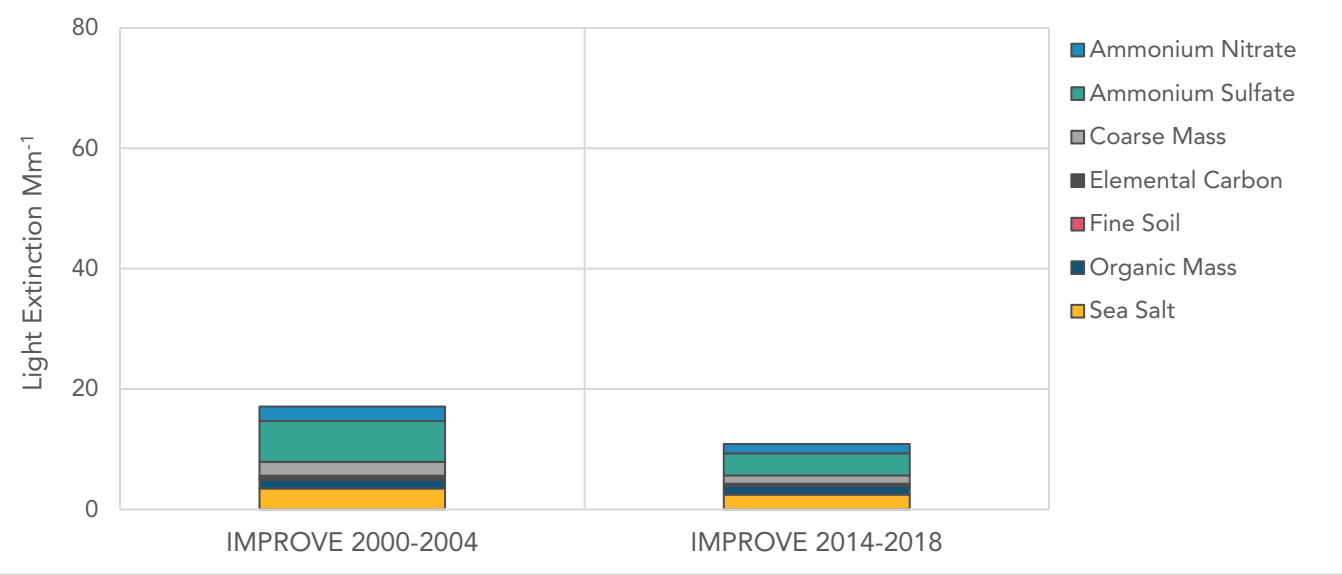


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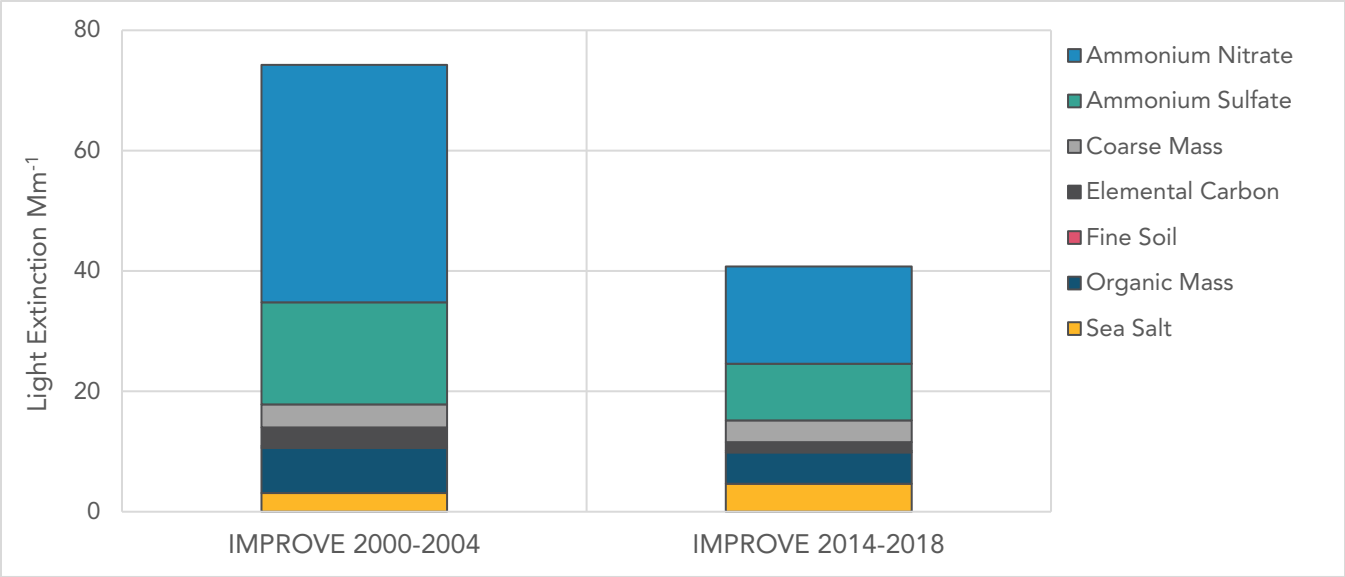
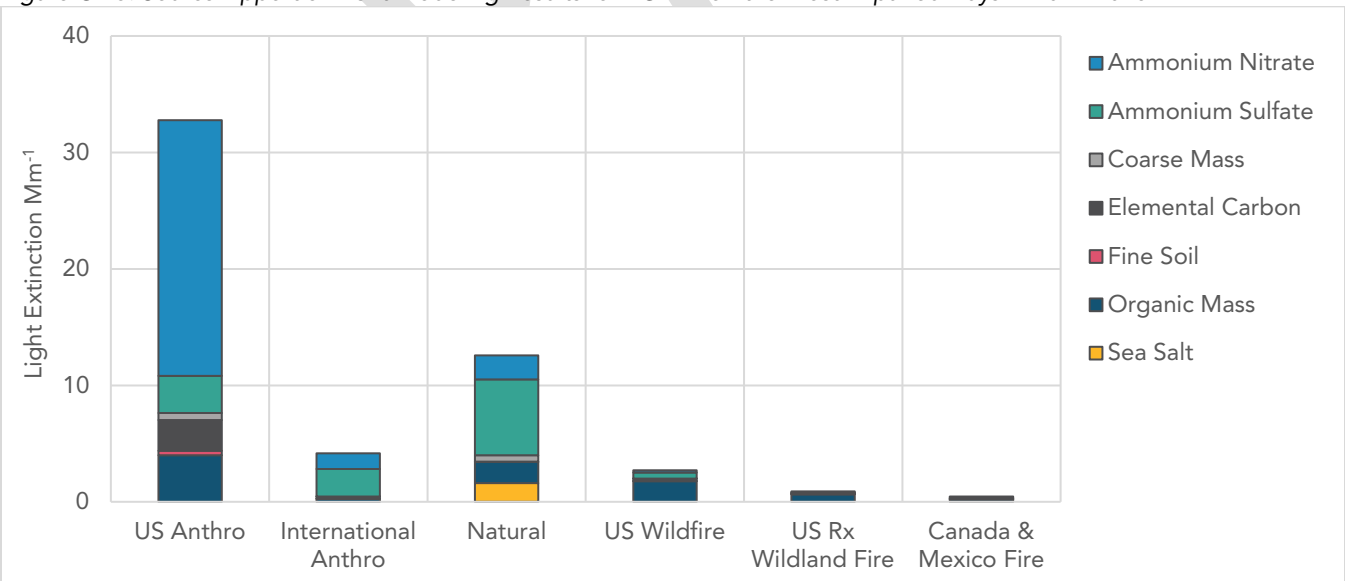
Figure C-44: Average Extinction Composition for PORE1 on the Most Impaired Days



Source apportionment modeling, shown in Figure C-45, indicates that U.S. emissions are the dominant source of visibility reducing particles measured at the PORE1 monitoring site. Emissions from natural sources, international sources, and fire also contribute to visibility impairment. Ammonium sulfate is the dominant PM species among those attributed to natural and international emissions. The portion of light extinction attributed to U.S. sources is dominated by ammonium nitrate.

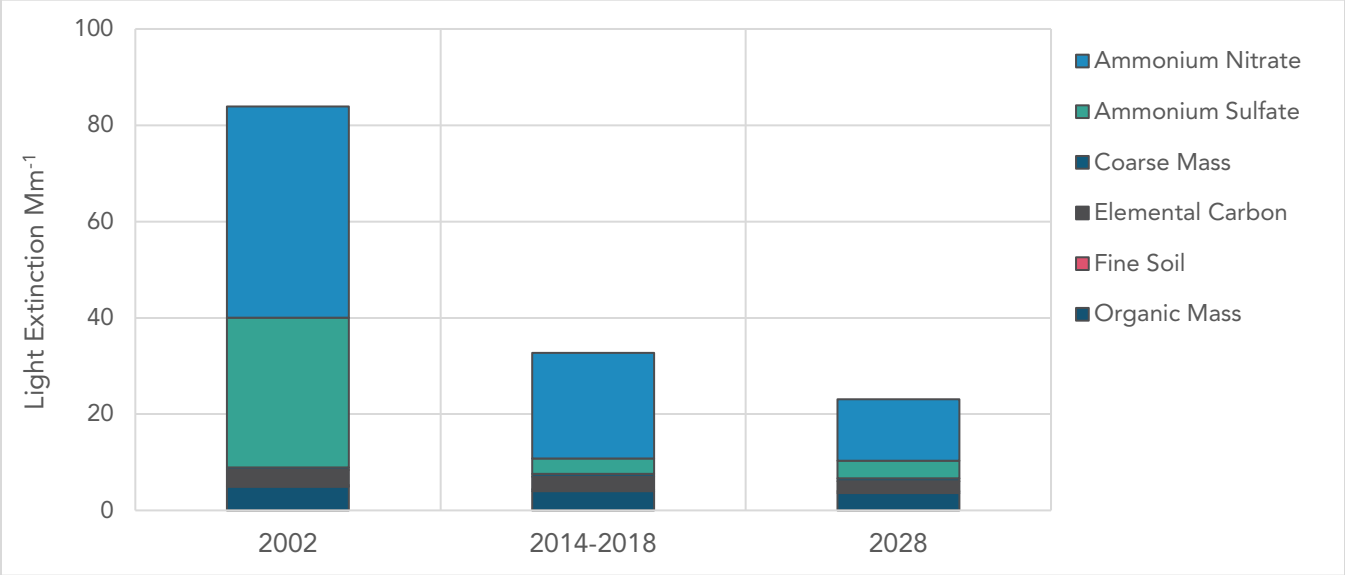
Figure C-45: Source Apportionment Modeling Results for PORE1 on the Most Impaired Days in 2014-2018



As shown in Figure C-46, between the current period and 2028, adopted emission controls are projected to reduce light extinction from the U.S. contribution to ammonium nitrate by

42 percent. However, ammonium nitrate is projected to continue to account for the largest share of light extinction attributable to U.S. sources.

Figure C-46: Light Extinction from PM Attributed to U.S. Anthropogenic Sources at PORE1 on the Most Impaired Days



The results of regional source apportionment for 2028 projections are shown in Figures C-47 and C-48. California mobile sources will continue to be the largest regional source of ammonium nitrate in 2028. Light extinction from ammonium sulfate attributable to regional sources is projected to be largely from stationary and area sources. However, the portion of light extinction from ammonium nitrate is more than three times greater than that from ammonium sulfate.

Figure C-47: Regional Source Apportionment for Ammonium Nitrate from U.S. Anthropogenic Sources in 2028 at PORE1

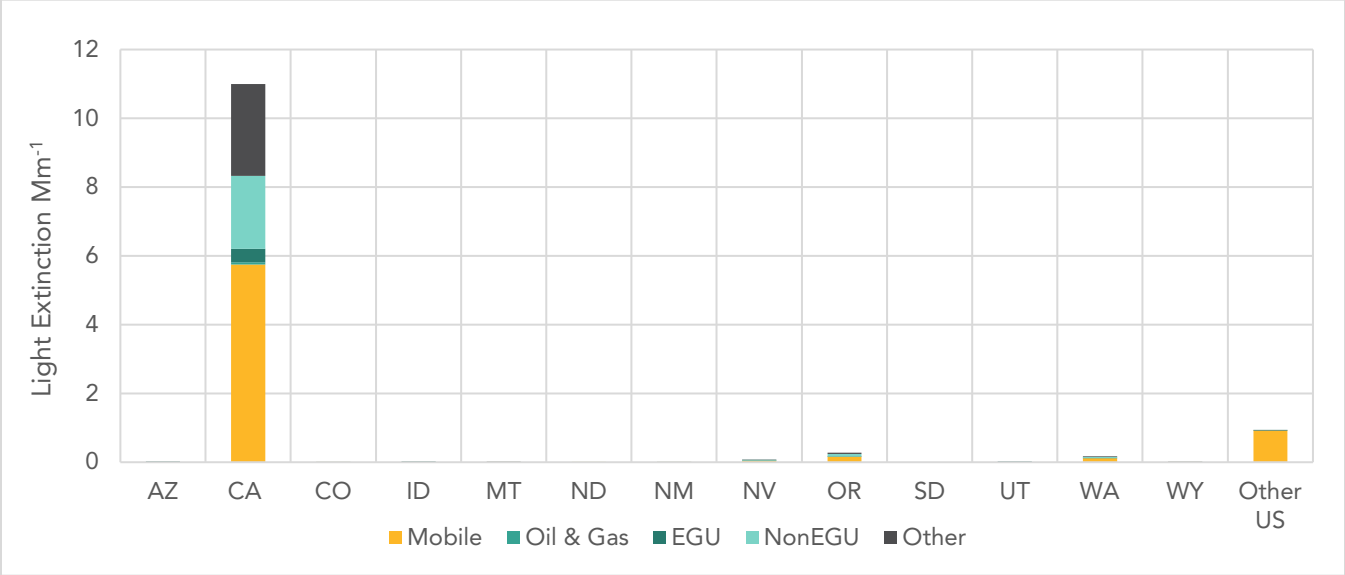
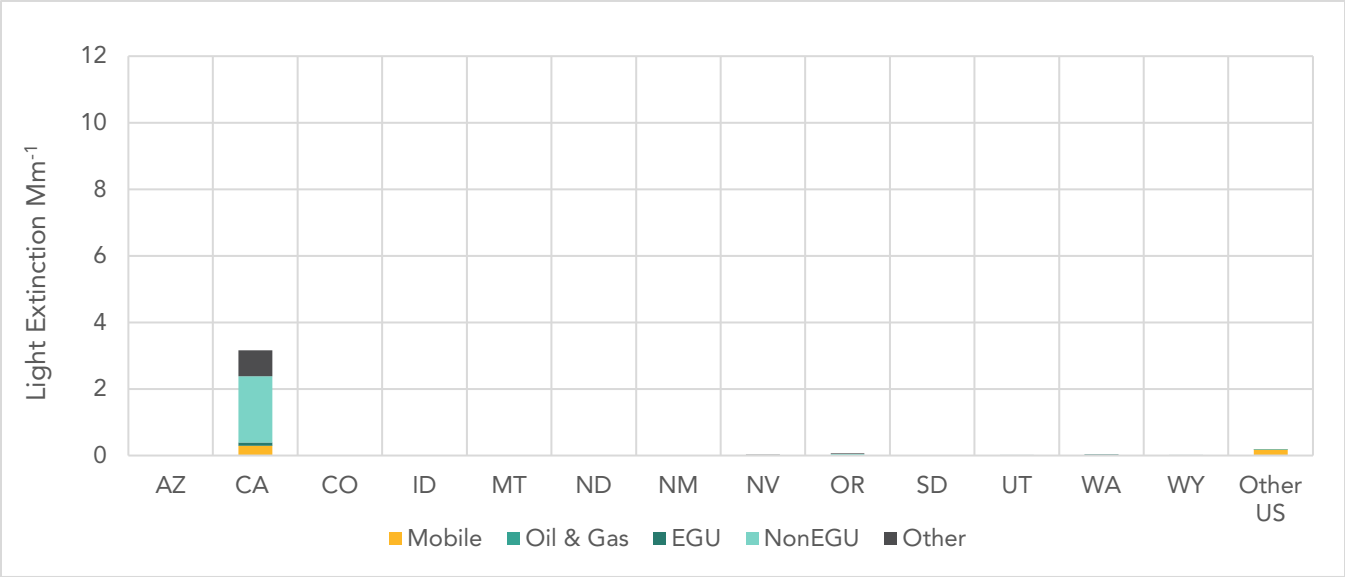


Figure C-48: Regional Source Apportionment for Ammonium Sulfate from U.S. Anthropogenic Sources in 2028 at PORE1



California's regional haze strategy is focused on reducing NOx emissions from mobile sources. Reducing NOx emissions, which generally drives the formation of ammonium nitrate in California, is projected to lead to a reduction in haze pollutants impacting visibility at Point Reyes National Seashore. Regional photochemical modeling analyses support this conclusion.

The current and projected trends for visibility tracking metrics at Point Reyes National Seashore are shown in Figure C-49. Accounting for adopted emission controls and emission reduction commitments included in this Regional Haze Plan, visibility impairment on the most impaired days is projected to be 14.4 dv in 2028, which represents a visual range of 57 miles (92 km). This 2028 projection is below the adjusted glidepath that accounts for international and wildland prescribed fire emissions, indicating that this area is on track to meet 2064 visibility targets.

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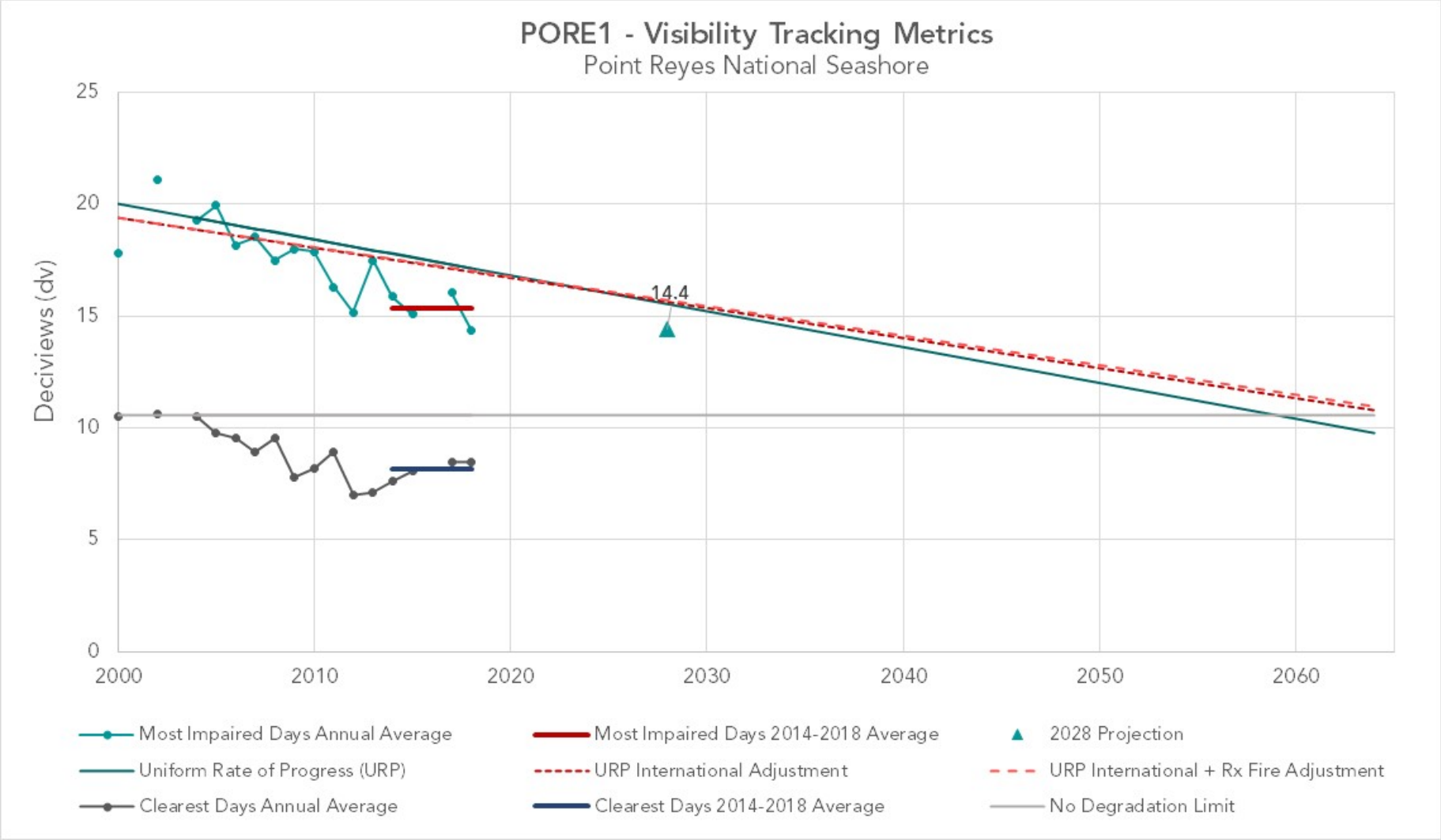
Figure C-49: Visibility Tracking Metrics and Projections for Point Reyes National Seashore



Yosemite National Park (YOSE1) IMPROVE Monitoring Site

The YOSE1 monitoring site, shown in Figure C-50, is in the southwest portion of Yosemite National Park at 5,259 feet (1,603 m) asl. The monitoring site was established in March 1988 at Turtleback Dome, one mile west of Tunnel View. More than four million people visit the park annually, with nearly 800,000 visitors staying overnight in one of the thirteen campgrounds in either tents or RV campers. Concessioners operate multiple hotels, cabins, and tent cabins that host more than 600,000 visitors annually.[8] The heavy usage is promoted by Yosemite National Park's international acclaim and proximity to several urban areas. Data collected at the YOSE1 monitoring site are representative of visibility conditions in the Emigrant Wilderness Area and Yosemite National Park.

Figure C-50: Photograph of YOSE1 Monitoring Site

Photograph Source: https://www.nps.gov/yose/learn/nature/airquality.htm

The Emigrant Wilderness Area covers 104,311 acres. The Emigrant Wilderness Area is north of Yosemite National Park, which spans 759,172 acres. The landscape in the Emigrant Wilderness Area and Yosemite National Park is dramatic and features numerous granite peaks, glaciated granite basins and canyons, towering waterfalls, alpine meadows, and dense stands of evergreen trees. The Emigrant Wilderness Area, most of Yosemite National Park, and the YOSE1 monitor is within the Mountain Counties Air Basin. The southeastern edge of Yosemite National Park is within the San Joaquin Valley Air Basin.

As shown in Table C-7, visibility impairment on the clearest days during the baseline period was 3.4 dv. Visibility impairment on the clearest days decreased by 0.5 dv between the baseline and the current periods. During the current period, visibility impairment was 2.9 dv,

[8] *https://irma.nps.gov/STATS/Reports/Park/YOSE*

which corresponds to a visual range of 181 miles (292 km) at Emigrant Wilderness Area and Yosemite National Park.

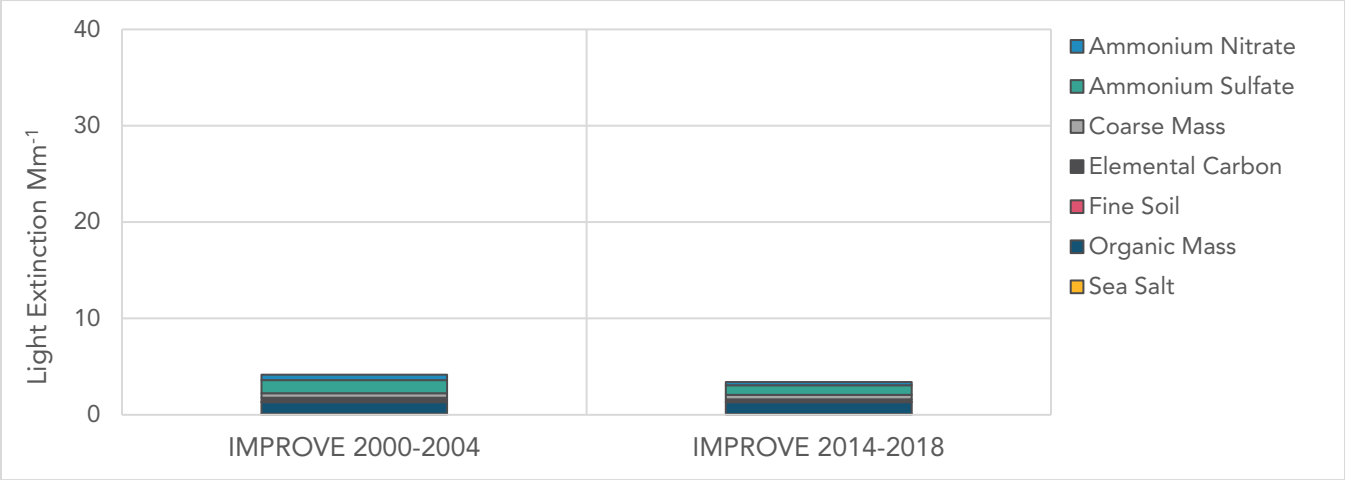
Visibility impairment on the most impaired days during the baseline period was 13.5 dv. Visibility impairment on the most impaired days decreased by 1.9 dv between the baseline and the current periods. During the current period, visibility impairment was 11.6 dv, which corresponds to a visual range of 76 miles (122 km) at Emigrant Wilderness Area and Yosemite National Park. The average rate of progress between the baseline and current periods was 0.14 dv per year. This rate is greater than both the URP and the URP adjusted to account for international and prescribed fire emissions.

Table C-7: Visibility Tracking Metrics for YOSE1

Days	Baseline (dv)	Current (dv)	Natural (dv)	Difference: Baseline - Current	Difference: Current - Natural	Uniform Rate of Progress (Adjusted)	Current Rate of Progress
Clearest	3.4	2.9	1.0	0.5 dv	1.9 dv	--	--
Most Impaired	13.5	11.6	6.3	1.9 dv	5.3 dv	0.12 dv/year (0.08 dv/year)	0.14 dv/year

Monitoring data, shown in Figures C-51 and C-52, indicate that ammonium sulfate and organic mass have the most dominant impact on light extinction on the clearest days and the most impaired days.

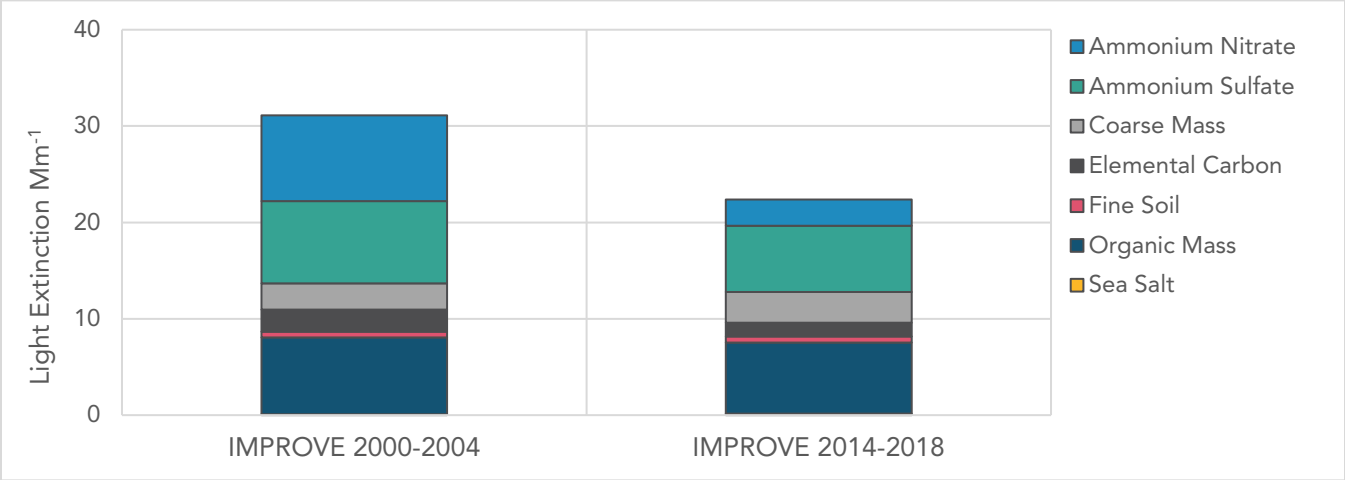
Figure C-51: Average Extinction Composition for YOSE1 on the Clearest Days



It is interesting to note that during the baseline monitoring period, ammonium nitrate accounted for the largest portion of light extinction on the most impaired days, closely

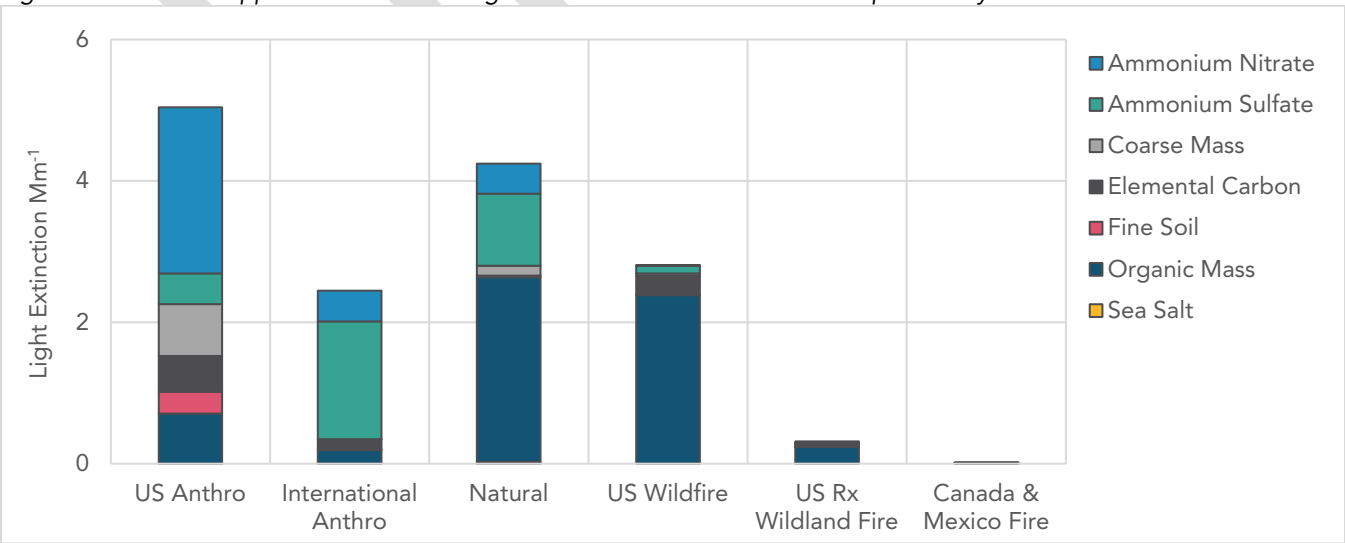
followed by ammonium sulfate and organic mass. Between the baseline and current periods, light extinction from ammonium nitrate on the most impaired days decreased by 69 percent. Light extinction due to organic mass increased by four percent on the clearest days and decreased by seven percent on the most impaired days, whereas light extinction due to ammonium sulfate decreased by 26 percent on the clearest and 19 percent most impaired days.

Figure C-52: Average Extinction Composition for YOSE1 on the Most Impaired Days



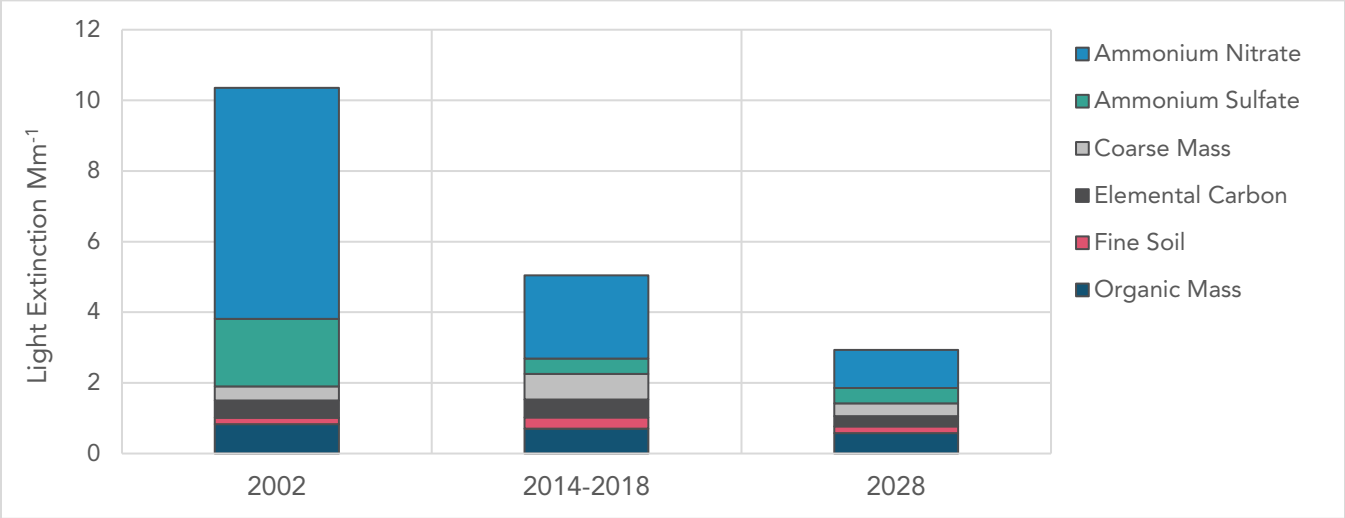
Source apportionment modeling, shown in Figure C-53, indicates that emissions from U.S. sources, natural sources, wildfires, and international sources contribute to visibility reducing particles measured at the YOSE1 monitoring site. Light extinction attributable to natural sources and wildfires is primarily due to organic mass, whereas light extinction attributable to international sources is largely due to ammonium sulfate. Ammonium nitrate is the dominant PM species attributable to U.S. sources contributing to light extinction.

Figure C-53: Source Apportionment Modeling Results for YOSE1 on the Most Impaired Days in 2014-2018



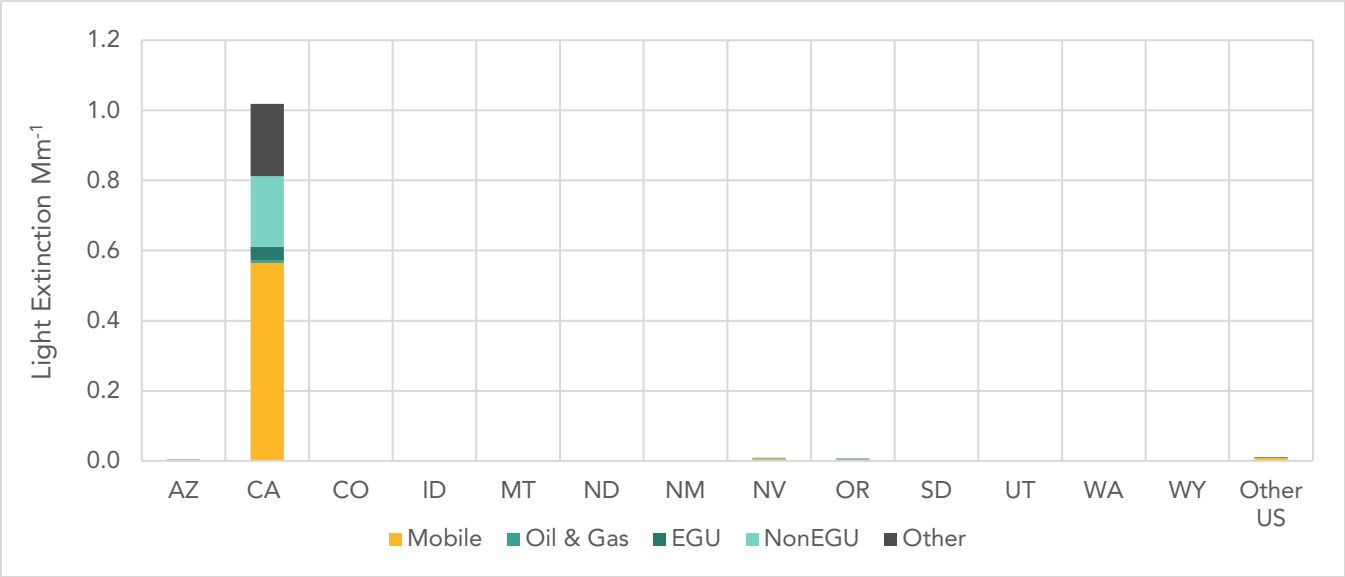
As shown in Figure C-54, emission reduction efforts have markedly reduced light extinction from ammonium nitrate and ammonium sulfate. Further reductions are expected. Between the current period and 2028, adopted emission controls are expected reduce light extinction from the U.S. sources contributing to ammonium nitrate by over 50 percent. Ammonium nitrate is projected to continue to account for the largest share of light extinction attributable to U.S. emission sources in 2028.

Figure C-54: Light Extinction from PM Attributed to U.S. Anthropogenic Sources at YOSE1 on the Most Impaired Days



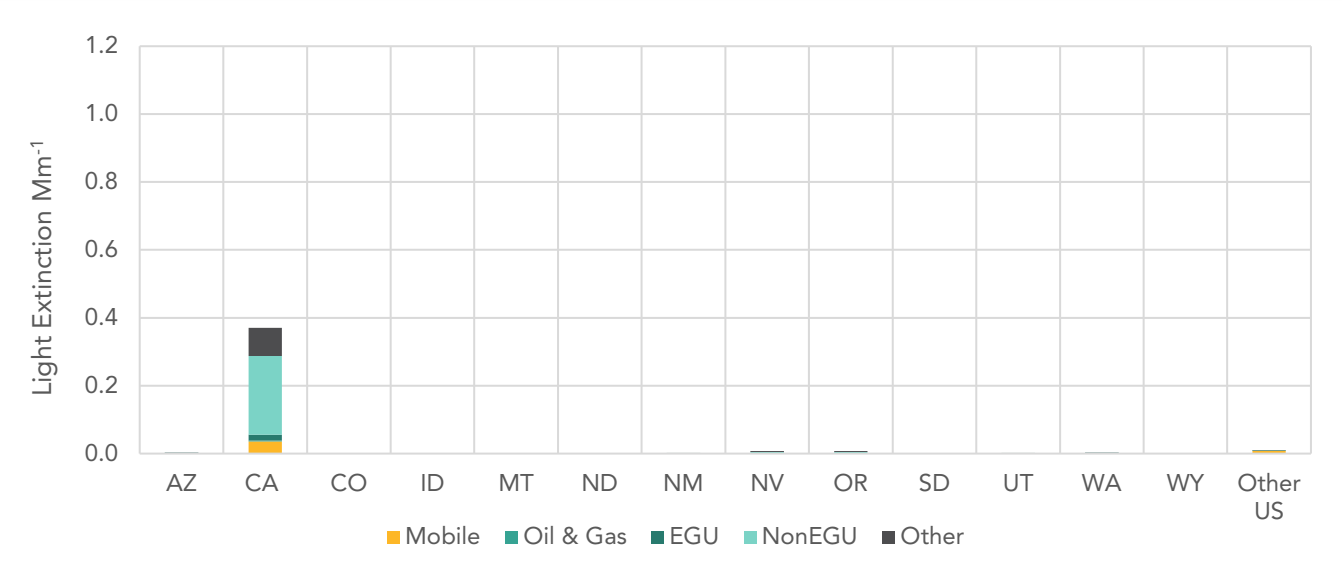
Regional source apportionment results are shown in Figures C-55 and C-56. The results indicate that California mobile sources will continue to be the largest regional source of ammonium nitrate in 2028, suggesting that continued efforts to reduce emissions from the mobile source sector will be an effective strategy to improve visibility in these areas.

Figure C-55: Regional Source Apportionment for Ammonium Nitrate from U.S. Anthropogenic Sources in 2028 at YOSE1



As shown in Figure C-56, California emissions account for the largest portion of light extinction from ammonium sulfate attributable regional anthropogenic emissions. The projected portion of light extinction from ammonium sulfate is less than half that from ammonium nitrate.

Figure C-56: Regional Source Apportionment for Ammonium Sulfate from U.S. Anthropogenic Sources in 2028 at YOSE1



The current and projected visibility tracking metrics for the Emigrant Wilderness Area and Yosemite National Park are shown in Figure C-57. Accounting for adopted emission controls and emission reduction commitments included in this Regional Haze Plan, visibility impairment on the most impaired days is projected to be 10.4 dv in 2028, which is comparable to a visual range of 86 miles (138 km). This 2028 projection is below the adjusted glidepath that accounts for international emissions and wildland prescribed fire emissions, indicating that these areas are on track to meet 2064 visibility targets.

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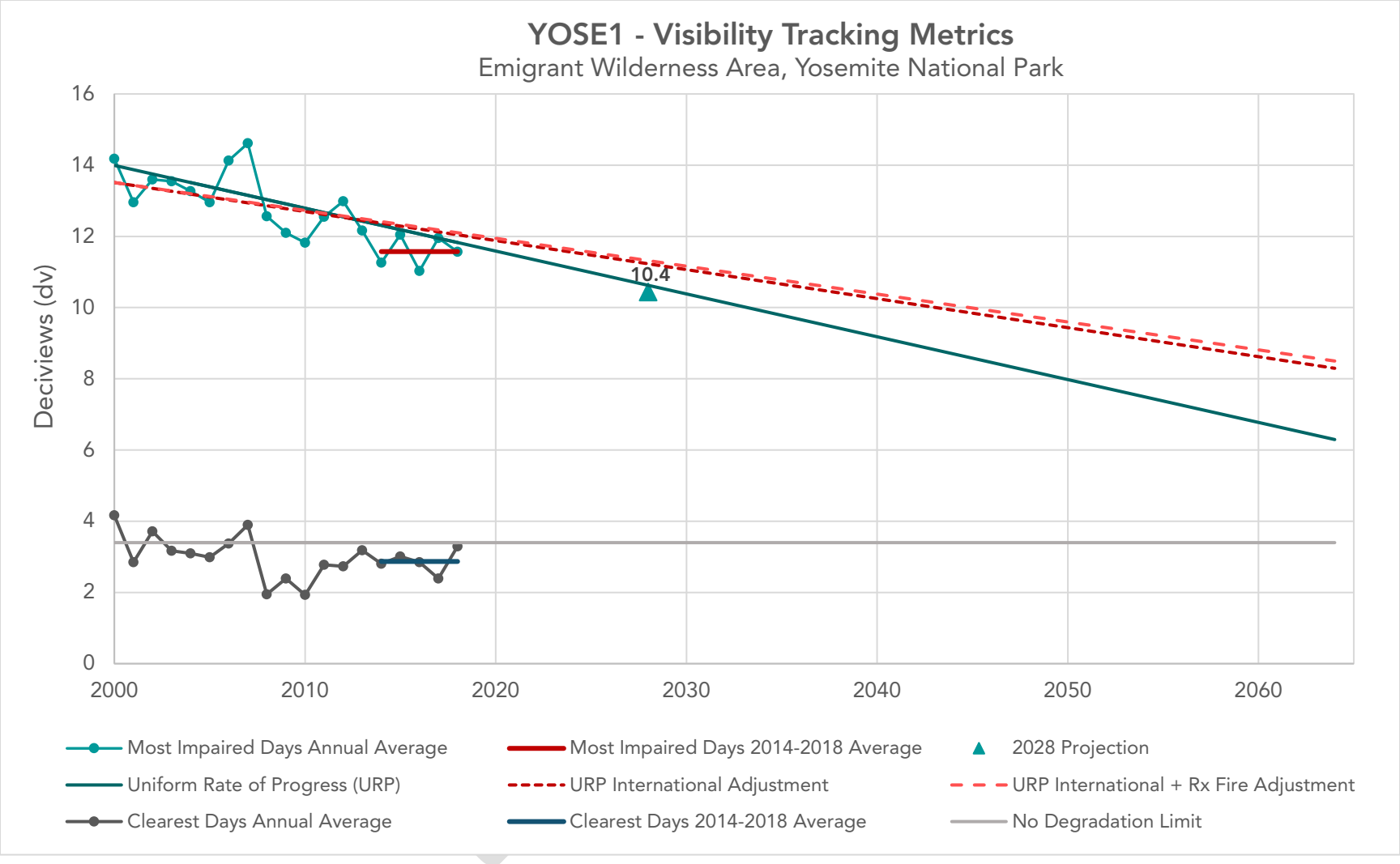
Figure C-57: Visibility Tracking Metrics and Projections for Emigrant Wilderness Area and Yosemite National Park



Central California

The population in the Central California region is concentrated around the cities of Stockton, Modesto, Fresno, and Bakersfield in the San Joaquin Valley Air Basin. These cities are hubs along one of California's busiest transportation corridors and surrounded by rural agricultural lands. The other air basins in the region are less populated.

The terrain and thermally driven circulation patterns play a critical role in the accumulation and transport of pollutants throughout this region. Differential heating between the land and the sea promotes a diurnal sea breeze circulation along the coastal areas. The sea breeze promotes onshore transport of marine air, while the mountains that border the Coast Range provide a physical barrier that prevents direct intrusion of marine air into the inland San Joaquin Valley. However, during the warmer months of the year, the pressure gradient driven by temperature contrasts between the inland valley and Pacific Ocean, promotes transport of marine air through the San Francisco Bay and into the northern end of the San Joaquin Valley. The mountainous terrain, combined with this pressure gradient, moves air from the northern end of the valley towards the southern end of the valley. The Hoover Wilderness Area, one of the Class I areas in Central California, is shown below in Figure C-58.

Figure C-58: Hoover Wilderness Area

Photo courtesy of Nicole Dolney

Emissions from urban areas, transportation corridors, and agricultural areas are entrained as air moves through the valley. The mountains surrounding the San Joaquin Valley limit dispersion. Meteorological conditions routinely promote formation of a shallow mixed layer throughout the valley and surrounding foothills, concentrating pollutants and further limiting dispersion. Differential heating between the valleys and the mountains promotes localized mountain valley flow, where accumulated emissions are recirculated within the valley and the flanks of the mountainous areas that surround the valley.

Emissions from the San Joaquin Valley Air Basin account for most of the region's emissions. The San Joaquin Valley is one of the most productive agricultural areas in the U.S., accounting for nearly two thirds of all fruit and nut production in the country. The movement of goods and people through the San Joaquin Valley and surrounding areas is the dominant source of emissions. Mobile sources accounted for nearly 80 percent of the region's NOx emissions in 2014 and were the largest emission source sector for each of the air basins in the Central California region.

Five IMPROVE monitoring sites are in the Central California region. From north to south, the monitoring sites in this region are the Hoover Wilderness Area, Kaiser Wilderness Area, Pinnacles National Park, San Rafael Wilderness Area, and Sequoia National Park. The following section provides an overview of the monitoring site, visibility monitoring data, and source apportionment for each location.

Hoover Wilderness Area (HOOV1) IMPROVE Monitoring Site

The HOOV1 monitoring site, shown in Figure C-59, is located at 8,398 feet (2,560 m) asl, east of the Hoover Wilderness Area. The monitoring site was established in July 2001, just east Conway Summit and U.S. Highway 395. Mono Lake is southeast of the site. The highway is the main thoroughfare along the eastern side of Sierra Nevada Mountains but is lightly traveled relative to most highways in California. Cal Trans traffic count data reported an annual average daily traffic count of 4,100 vehicles in 2017 at the Lee Vining visitor center, just a few miles south of the site.[9] Data collected at the HOOV1 monitoring site are representative of visibility conditions in the Hoover Wilderness Area.

Figure C-59: Photograph looking east towards the HOOV1 Monitoring Site

Photograph Source: http://vista.cira.colostate.edu/Improve/monitoring-site-browser/

[9] *https://dot.ca.gov/programs/traffic-operations/census/traffic-volumes/2017*

The Hoover Wilderness Area spans 47,916 acres and is characterized by dramatic mountainous terrain rising abruptly from the Great Basin to the crest of the Sierra Nevada Mountains. Numerous high alpine lakes, meadows, and isolated stands of aspen, cottonwood, hemlock, and pine populate the landscape. The Hoover Wilderness Area is in the Great Basin Valleys Air Basin.

As shown in Table C-8, visibility impairment on the clearest days during the baseline period was 1.4 dv. Visibility impairment on the clearest days decreased by 0.4 dv between the baseline and the current periods. During the current period, visibility impairment was 1.0 dv, which corresponds to a visual range of 219 miles (353 km) at Hoover Wilderness Area.

Visibility impairment on the most impaired days during the baseline period was 8.9 dv. Visibility impairment on the most impaired days decreased by 1.1 dv between the baseline and the current periods. During the current period visibility impairment was 7.8 dv, which is equivalent to a visual range of 111 miles (179 km) at Hoover Wilderness Area. The average rate of progress between the baseline and current periods was 0.08 dv per year. This rate is faster than the URP and more than double the adjusted URP.

Table C-8: Visibility Tracking Metrics for HOOV1

Days	Baseline (dv)	Current (dv)	Natural (dv)	Difference: Baseline - Current	Difference: Current - Natural	Uniform Rate of Progress (Adjusted)	Current Rate of Progress
Clearest	1.4	1.0	0.1	0.4 dv	0.9 dv	--	--
Most Impaired	8.9	7.8	4.9	1.1 dv	2.9 dv	0.07 dv/year (0.03 dv/year)	0.08 dv/year

Monitoring data shown in Figures C-60 indicates that on the clearest days, ammonium sulfate accounts for the largest portion of light extinction at the HOOV1 monitoring site. Between the baseline period and current period, light extinction from ammonium sulfate decreased by 13 percent.

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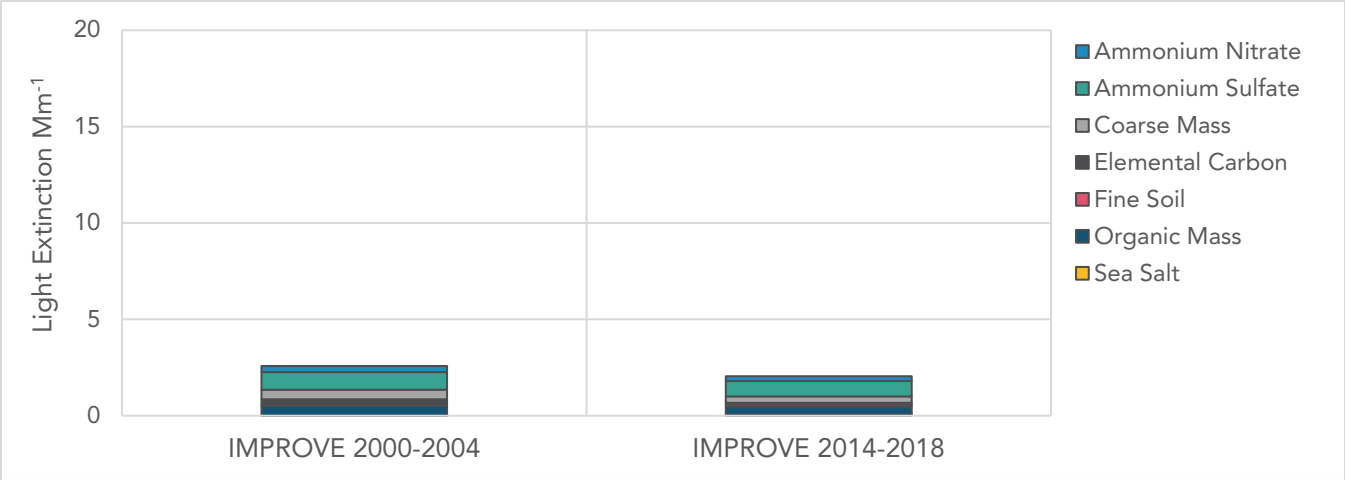
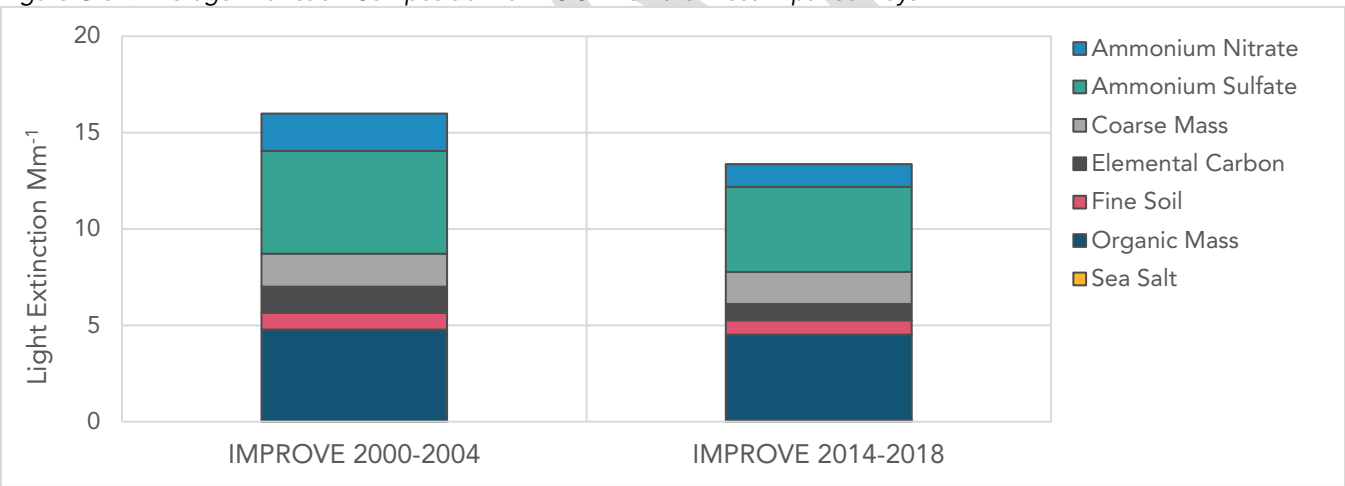
Figure C-60: Average Extinction Composition for HOOV1 on the Clearest Days



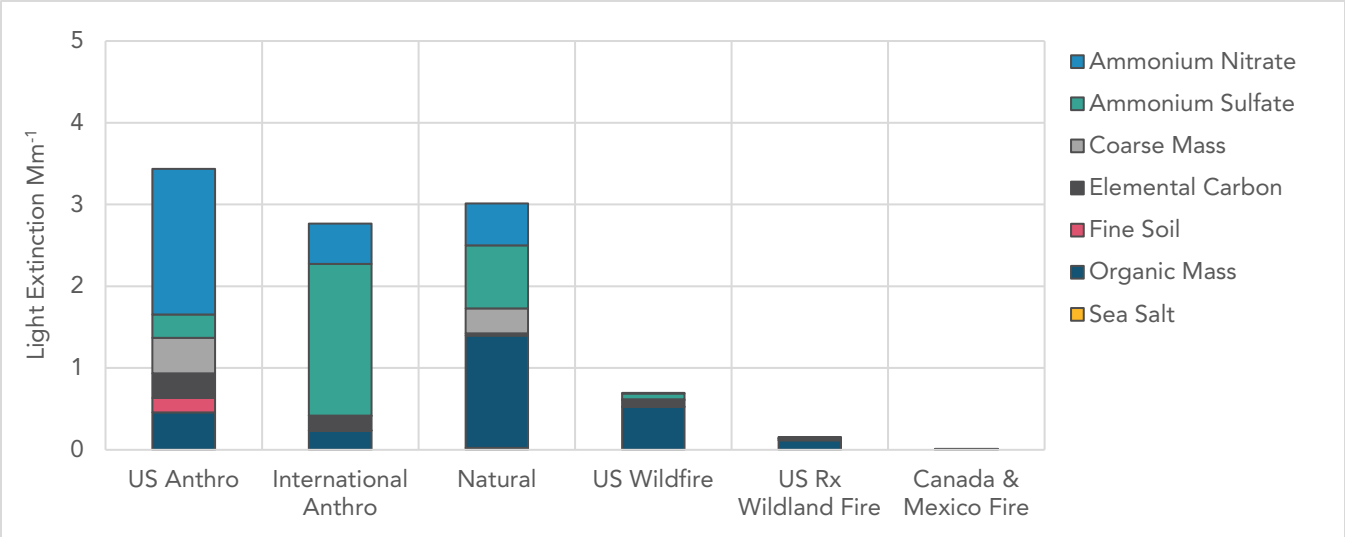
As shown in Figure C-61, ammonium sulfate and organic mass combine to account for over 60 percent of light extinction on the most impaired days. Between the baseline and current periods, light extinction from ammonium sulfate and organic mass on the most impaired days decreased by 17 percent and 7 percent, respectively.

Figure C-61: Average Extinction Composition for HOOV1 on the Most Impaired Days



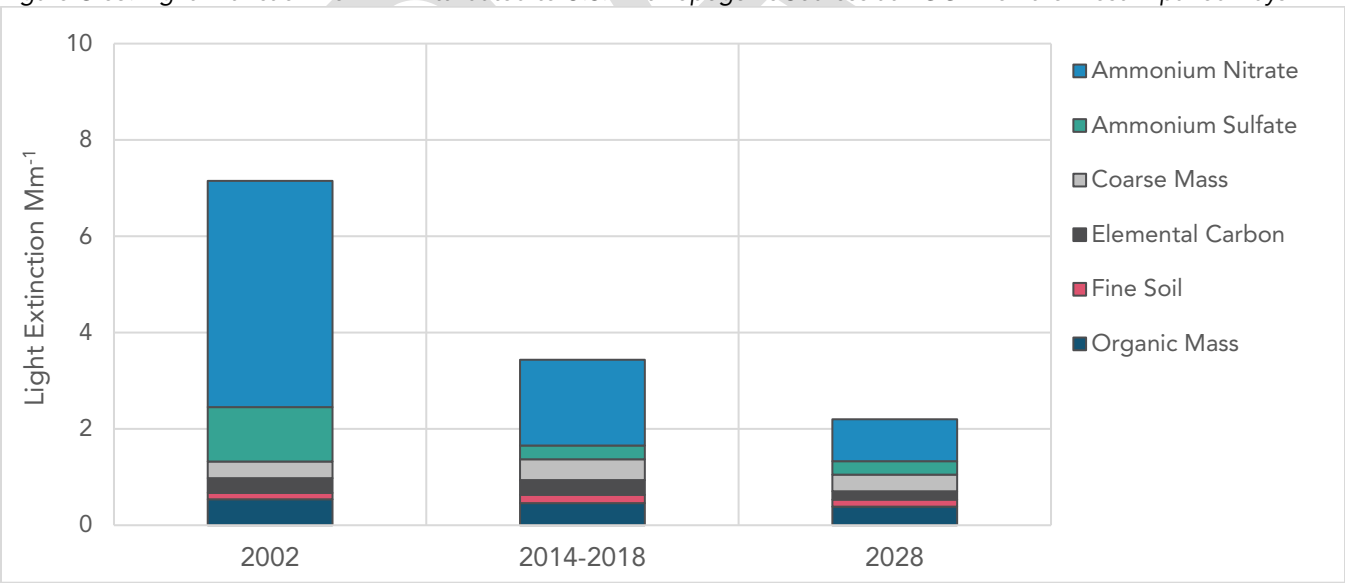
Source apportionment modeling, shown in Figure C-62, indicates that emissions from U.S., international, and natural sources make the largest contributions to impairment in the Hoover Wilderness Area. Light extinction from ammonium sulfate is primarily attributable to international and natural emissions, whereas organic mass is primarily from natural emissions and wildfires. Light extinction from U.S. sources is dominated by ammonium nitrate.

Figure C-62: Source Apportionment Modeling Results for HOOV1 on the Most Impaired Days in 2014-2018



As shown in Figure C-63, light extinction attributable to ammonium nitrate has decreased markedly between the baseline and current periods. Between the current period and 2028, light extinction attributable ammonium nitrate is projected to decrease by and additional 50 percent. Ammonium nitrate is projected to continue to account for the largest share of light extinction attributable to U.S. emission sources in 2028.

Figure C-63: Light Extinction from PM Attributed to U.S. Anthropogenic Sources at HOOV1 on the Most Impaired Days



The results of regional source apportionment projections for ammonium nitrate and ammonium sulfate are shown in Figures C-64 and C-65. Light extinction attributable to ammonium nitrate is projected to be more than double ammonium sulfate. Ammonium

nitrate California mobile source emissions are projected to make the largest contribution to ammonium nitrate in 2028.

Figure C-64: Regional Source Apportionment for Ammonium Nitrate from U.S. Anthropogenic Sources in 2028 at HOOV1

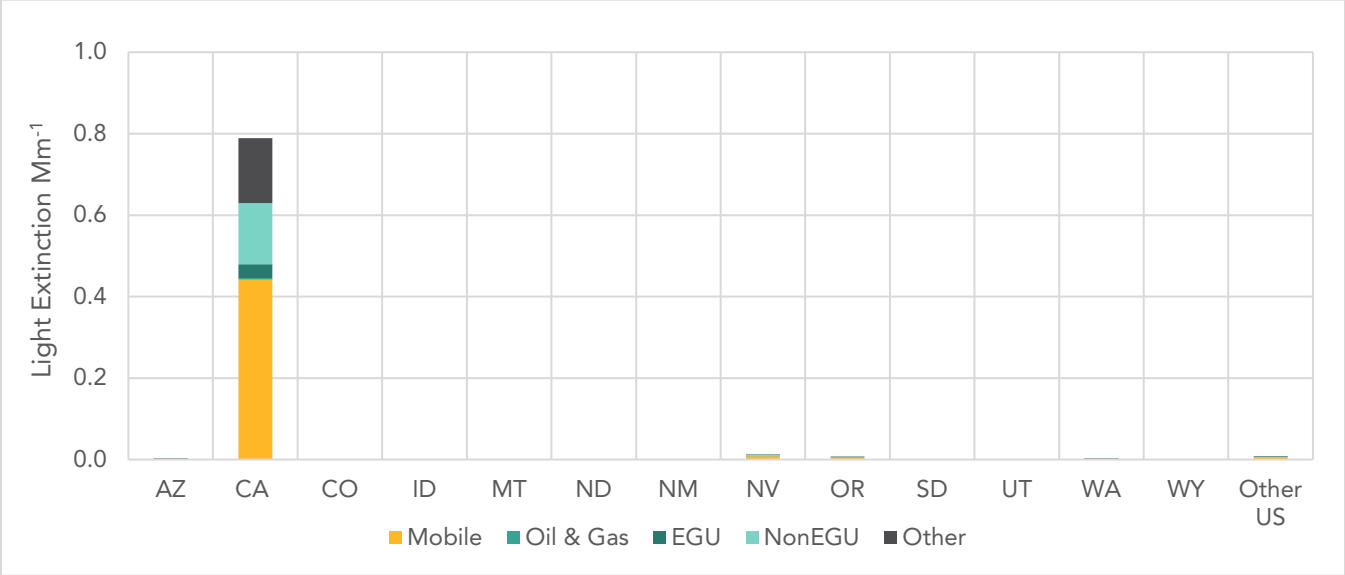
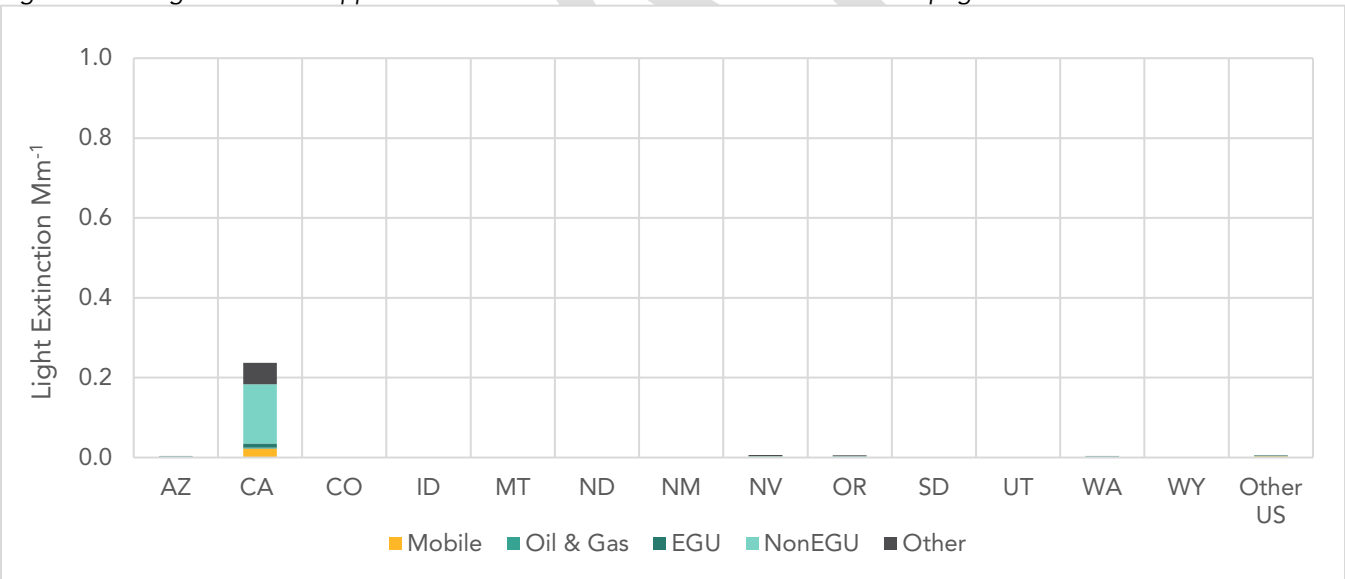


Figure C-65: Regional Source Apportionment for Ammonium Sulfate from U.S. Anthropogenic Sources in 2028 at HOOV1



California's long-term strategy for regional haze is focused reducing NOx emissions from mobile sources. Projections indicate that this focus will lead to visibility benefits in the Hoover Wilderness Area. The current and projected trends for visibility tracking metrics at the Hoover Wilderness Area are shown in Figure C-66. Accounting for adopted emission controls and emission reduction commitments included in this Regional Haze Plan, visibility impairment on the most impaired days is projected to be 7.1 dv in 2028, which is comparable

to a visual range of 119 miles (192 km). This 2028 projection is below the adjusted glidepath that accounts for international emissions and wildland prescribed fire emissions, indicating visibility in the Hoover Wilderness Area is on track to meet 2064 targets.

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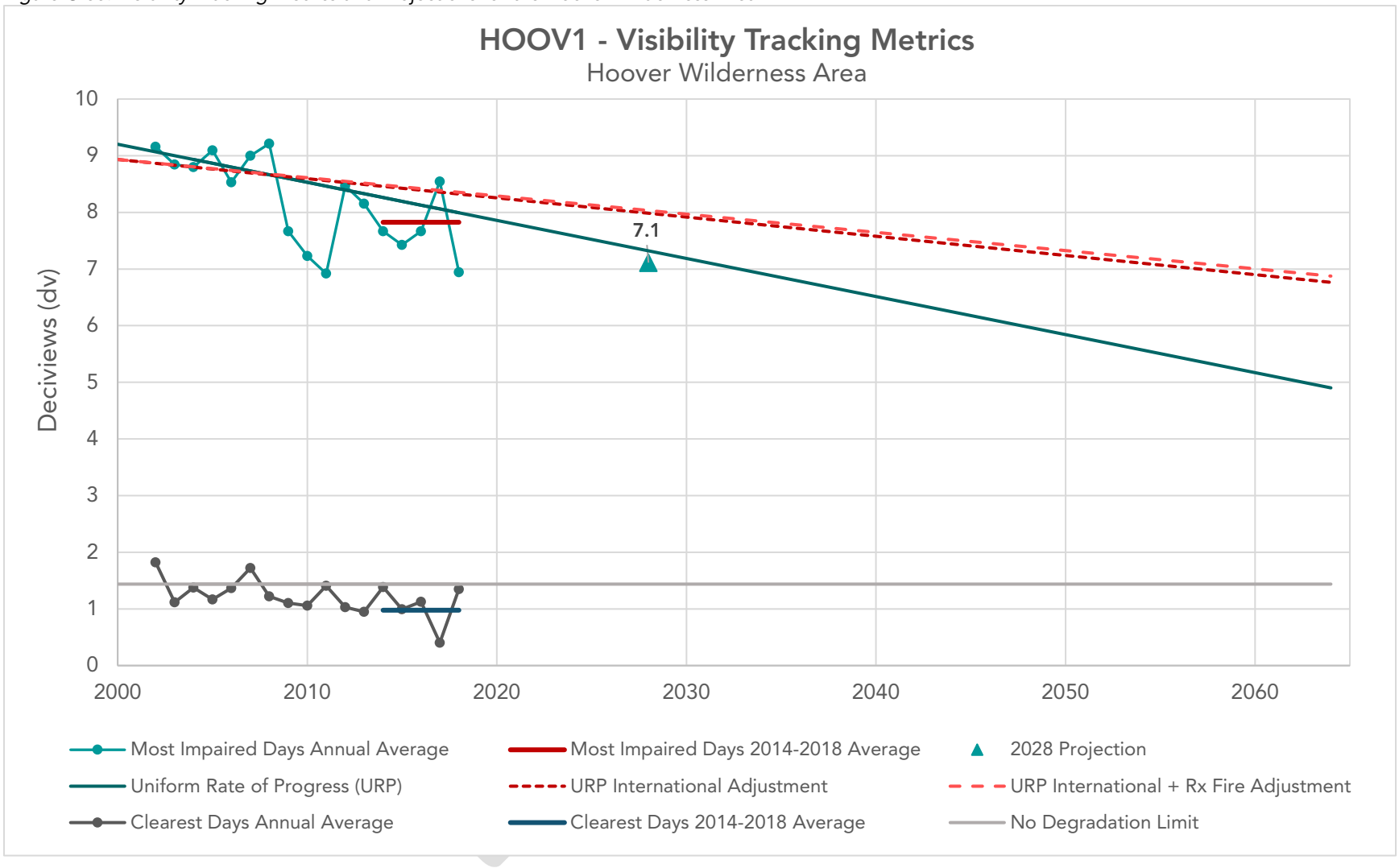
Figure C-66: Visibility Tracking Metrics and Projections for the Hoover Wilderness Area



Kaiser Wilderness Area (KAIS1) IMPROVE Monitoring Site

The KAIS1 monitoring site, shown in Figure C-67, is located near the southern border of the Kaiser Wilderness at 8,520 feet (2,597 m) asl. The monitoring site was established in January 2000 southeast of Huntington Lake, on the backside of the Summit Ski Patrol Hut at China Peak Mountain Resort. Data collected at this site are representative of visibility conditions in the Ansel Adams, John Muir, and Kaiser Wilderness Areas.

Figure C-67: Photograph looking southeast towards the KAIS1 Monitoring Site

Photograph Source: http://vista.cira.colostate.edu/Improve/monitoring-site-browser/

The Ansel Adams Wilderness Area covers 109,484 acres. When it was first established in 1964, it was known as the Minarets Wilderness. It was renamed in tribute to the well-known nature photographer and environmentalist following his death in 1984. The landscape is characterized by stunning mountains and glacial carved valleys. Elevations range from 3,500 to 13,157 feet (1,067 to 4,010 m) asl. The southern portion of Ansel Adams Wilderness is in the San Joaquin Valley Air Basin and the northern portion is in the Great Basin Valleys Air Basin.

The John Muir Wilderness Area stretches along the crest of the Sierra Nevada Mountains. It spans 484,673 acres and is contiguous with several Class I areas including the Ansel Adams Wilderness Area, Kings Canyon National Park, and Sequoia National Park. Most of the John Muir Wilderness Area is in the San Joaquin Valley Air Basin except for the eastern edge,

which is in the Great Basin Valleys Air Basin. Elevations range from 4,000 feet to 14,496 feet (1,219 to 4,418 m) asl. Lower elevations are dominated by mixed forests of pine, cedar, and fir whereas higher elevations are barren granite replete with numerous alpine lakes. Due to the proximity to California's major cities, this area sees very heavy usage and quota systems are in place to limit overnight use during the busiest periods.

The Kaiser Wilderness Area was established in 1976 and includes 22,500 acres. The Kaiser Wilderness Area is in the San Joaquin Valley Air Basin. Elevation ranges from 6,600 to 9,370 feet (2,012 to 2,856 m) asl. The terrain in the southern portion is dominated by dense stands of fir and pine forest. Forest cover in the northern portion is less dense and alpine lakes dot the landscape.

As shown in Table C-9, visibility impairment on the clearest days during the baseline period was 2.3 dv. Visibility impairment on the clearest days decreased by 0.8 dv between the baseline and the current periods. During the current period, visibility impairment on the clearest days was 1.5 dv, which corresponds to a visual range of 209 miles (336 km) at Ansel Adams, John Muir, and Kaiser Wilderness Areas.

Visibility impairment on the most impaired days during the baseline period was 12.9 dv. Visibility impairment on the most impaired days decreased by 1.9 dv between the baseline and the current periods. During the current period, visibility impairment on the most impaired days was 11.0 dv, which corresponds to a visual range of 81 miles (130 km) at Ansel Adams, John Muir, and Kaiser Wilderness Areas.

Table C-9: Visibility Tracking Metrics for KAIS1

Days	Baseline (dv)	Current (dv)	Natural (dv)	Difference: Baseline - Current	Difference: Current - Natural	Uniform Rate of Progress (Adjusted)	Current Rate of Progress
Clearest	2.3	1.5	0.0	0.8 dv	1.5 dv	--	--
Most Impaired	12.9	11.0	6.1	1.9 dv	4.9 dv	0.11 dv/year (0.06 dv/year)	0.14 dv/year

Like monitoring data from the YOSE1 monitoring site, monitoring data from the KAIS1 site indicate that ammonium sulfate and organic mass have the most dominant impact on light extinction on the clearest days and the most impaired days except for the most impaired days during the baseline monitoring period (Figures C-68 and C-69). During the baseline period, ammonium nitrate accounted for the largest portion of light extinction on the most impaired days, closely followed by ammonium sulfate and organic mass.

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Visibility impairment attributable to these key visibility reducing PM species has markedly decreased between the baseline and current periods. Light extinction attributable to ammonium nitrate on the most impaired days decreased by 52 percent. Light extinction attributable to organic mass decreased by 26 percent on the clearest days and 17 percent on the most impaired days. Light extinction attributable to ammonium sulfate decreased by 14 percent and 12 percent on the clearest and most impaired days, respectively.

Figure C-68: Average Extinction Composition for KAIS1 on the Clearest Days

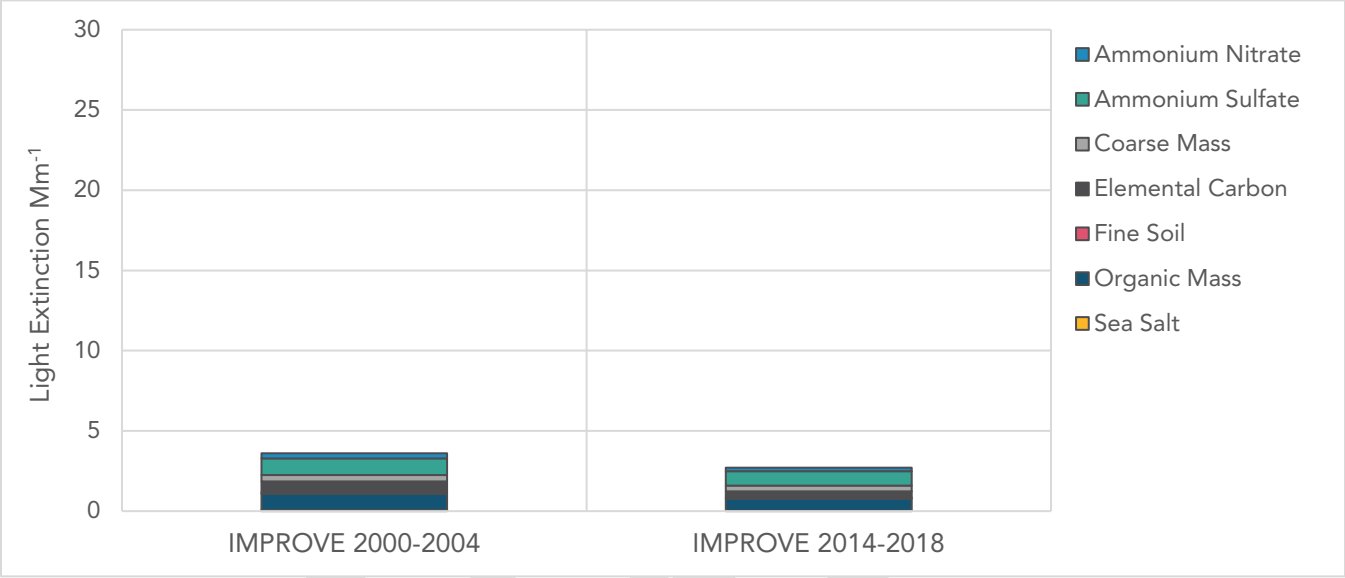
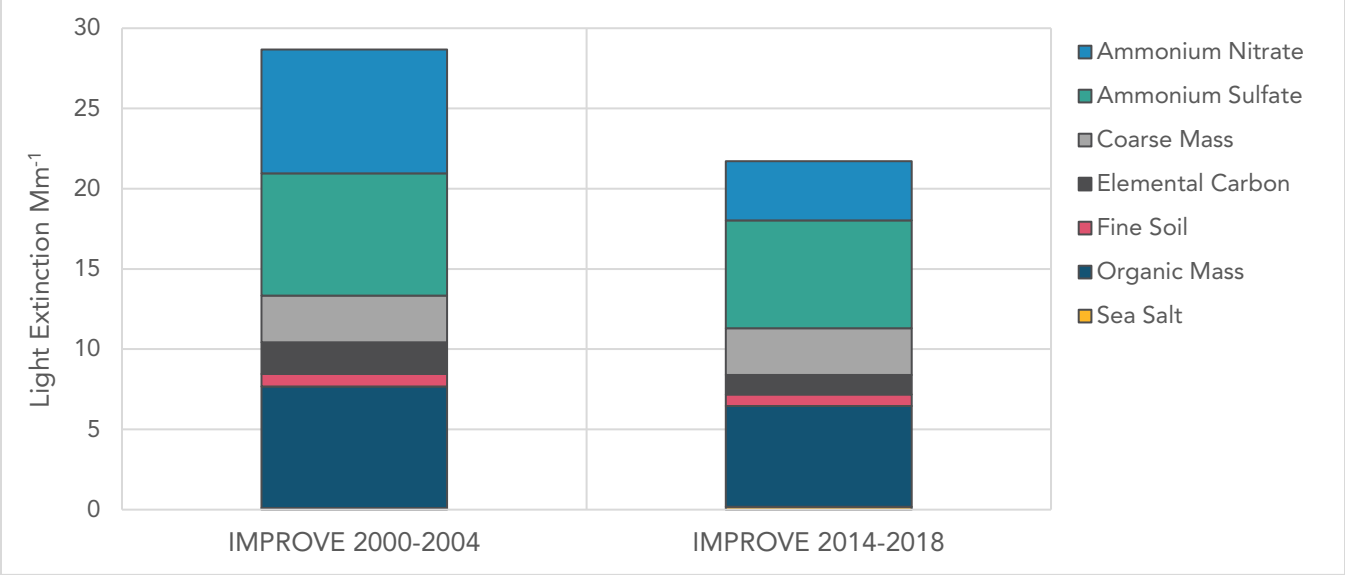


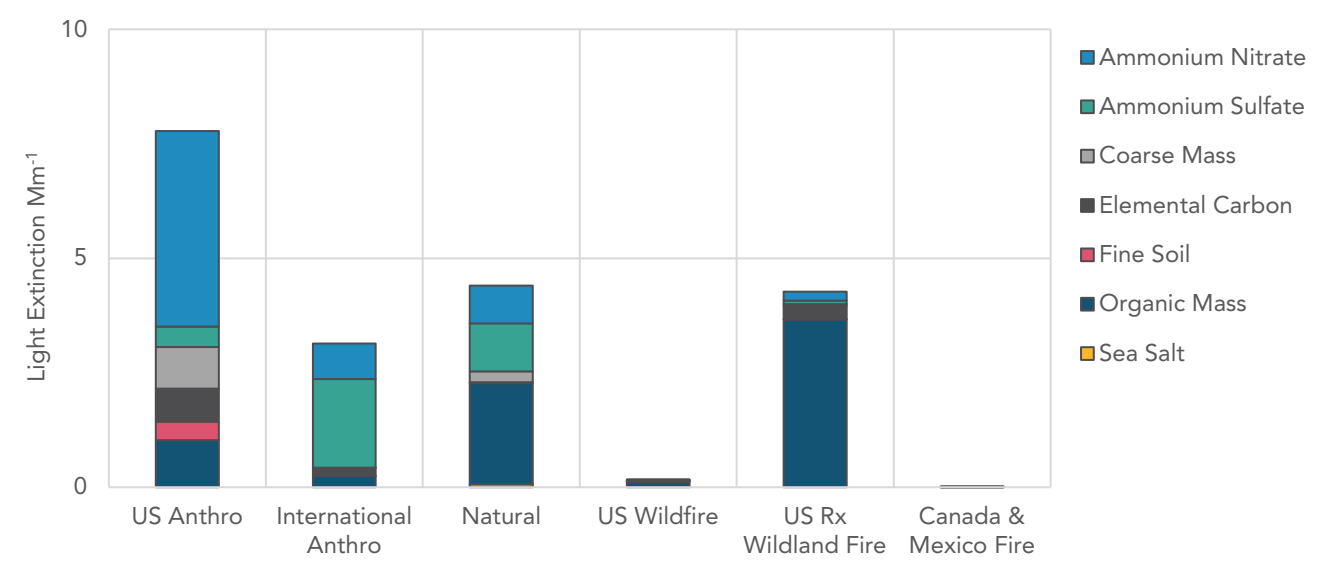
Figure C-69: Average Extinction Composition for KAIS1 on the Most Impaired Days



Source apportionment modeling, shown in Figure C-70, indicates that U.S. sources, wildland fire, natural sources, and international sources contribute to visibility impairment at the KAIS1

monitoring site. Light extinction attributable to organic mass is primarily from fire and natural emission sources, whereas ammonium sulfate is primarily attributable to international and natural emission sources. The portion of light extinction attributed to U.S. sources is dominated by ammonium nitrate.

Figure C-70: Source Apportionment Modeling Results for KAIS1 on the Most Impaired Days in 2014-2018



As shown in Figure C-71, light extinction between the baseline and current periods decreased significantly. Further decreases are expected moving forward. Between the current period and 2028, adopted emission controls are expected to reduce light extinction attributable to ammonium nitrate by an additional 56 percent. Ammonium nitrate is projected to continue to account for the largest share of light extinction attributable to U.S. emission sources in 2028.

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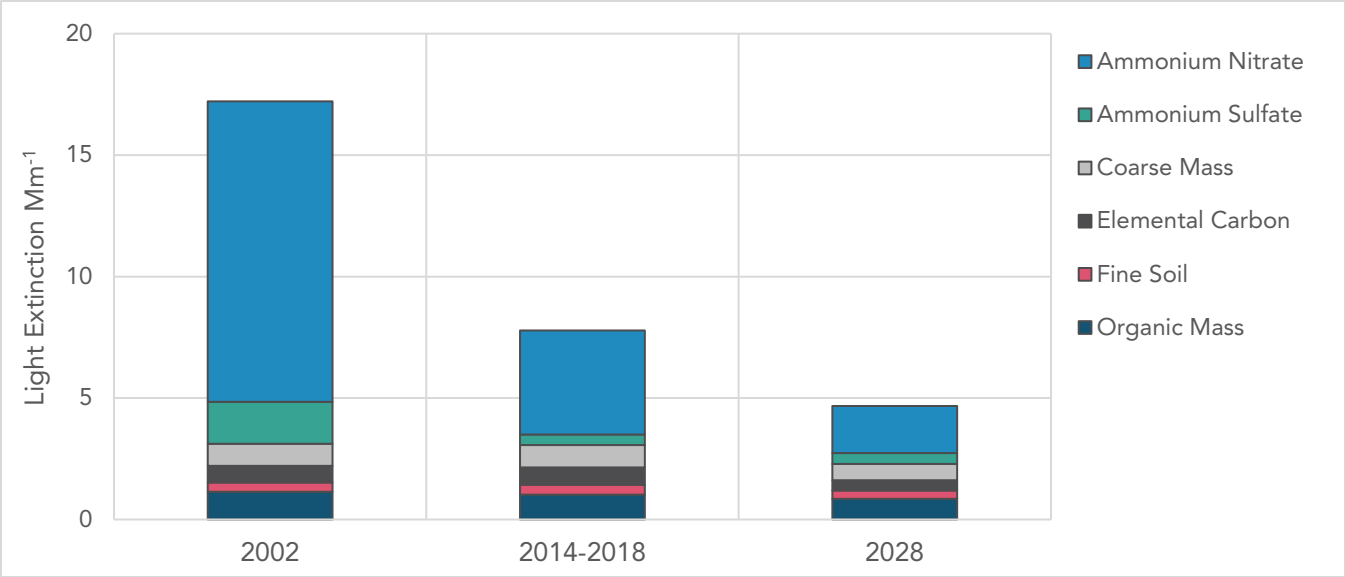
Figure C-71: Light Extinction from PM Attributed to U.S. Anthropogenic Sources at KAIS1 on the Most Impaired Days



Regional source apportionment projections are shown in Figures C-72 and 73. California's regional haze strategy is focused on reducing NOx emissions from mobile sources. California mobile sources are projected to account for the largest share of light extinction attributable to ammonium nitrate. The share of light extinction attributable to ammonium nitrate from U.S. sources is more than five time greater than ammonium sulfate. California's regional haze strategy for this planning period is focused on NOx, the precursor to ammonium nitrate formation. This focus is expected to benefit visibility in the Ansel Adams, John Muir, and Kaiser Wilderness Areas.

Figure C-72: Regional Source Apportionment for Ammonium Nitrate from U.S. Anthropogenic Sources in 2028 at KAIS1

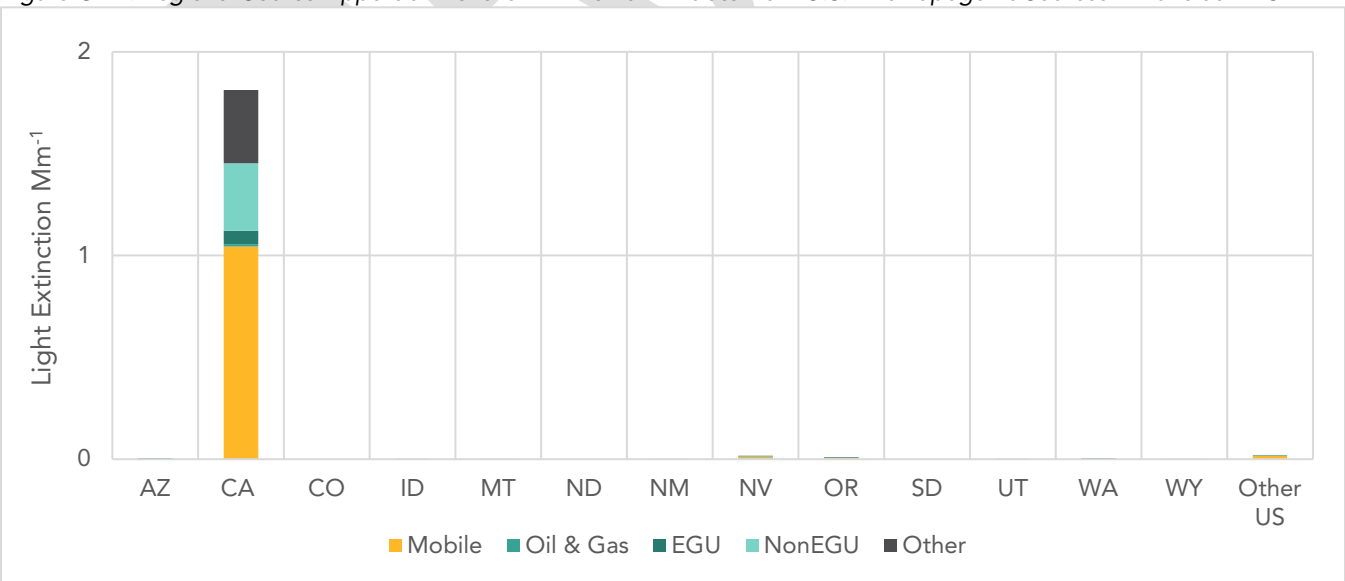
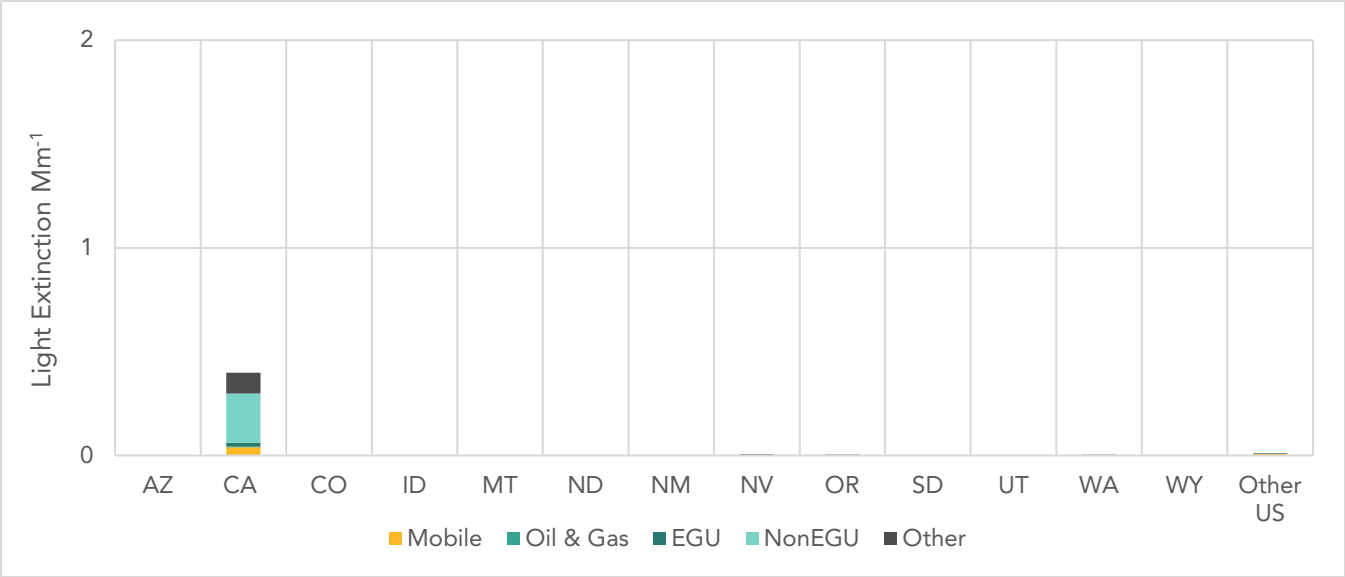


Figure C-73: Regional Source Apportionment for Ammonium Sulfate from U.S. Anthropogenic Sources in 2028 at KAIS1



The current and projected trends in the visibility tracking metrics for the Ansel Adams, John Muir, and Kaiser Wilderness Areas are shown in Figure C-74. Accounting for adopted emission controls and emission reduction commitments included in this Regional Haze Plan, visibility impairment on the most impaired days is projected to be 9.8 dv in 2028, which is comparable to a visual range of 91 miles (146 km). This 2028 projection is below the adjusted glidepath which accounts for international and wildland prescribed fire emissions, indicating that visibility in these areas is on track to meet 2064 targets.

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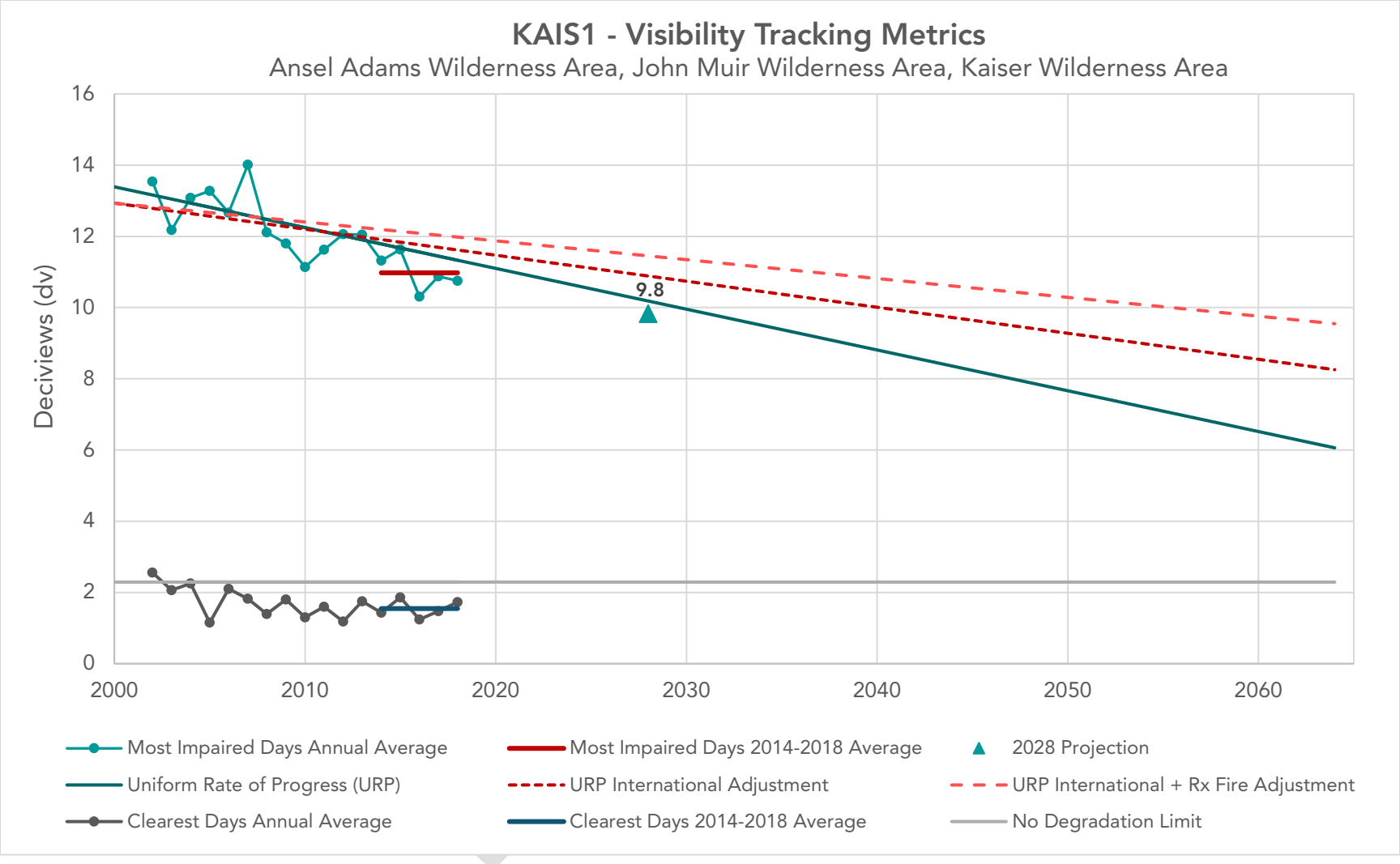
Figure C-74: Visibility Tracking Metrics and Projections for the Ansel Adams, John Muir, and Kaiser Wilderness Areas



Pinnacles National Park (PINN1) IMPROVE Monitoring Site

The PINN1 monitoring site, shown in Figure C-75, is located at 991 feet (302 m) asl near the eastern border of Pinnacles National Park. The monitoring site was established in March 1988, southwest of the east entrance. Pinnacle National Park's 134 site developed campground is located just inside the east entrance. Each camp site is equipped with a fire ring and campfires are generally allowed. RV sites have electrical hookups. Data collected at this monitoring site are representative of the visibility conditions in Pinnacles National Park and the Ventana Wilderness Area.

Figure C-75: Photograph looking southwest towards the PINN1 Monitoring Site

Photograph Source: http://vista.cira.colostate.edu/Improve/monitoring-site-browser/

Pinnacles National Park spans 12,952 acres. It was originally established as a national monument but was redesignated as a national park in 2013. The landscape is a mix of oak woodlands and chaparral covered hills, and towering rock spires. The Ventana Wilderness Area is 95,152 rugged acres replete with dense communities of chaparral, oak woodlands, and pine stands. Pinnacles National Park and Ventana Wilderness Area are in the North Central Coast Air Basin.

As shown in Table C-10, visibility impairment on the clearest days during the baseline period was 8.9 dv. Visibility impairment on the clearest days decreased by 1.2 dv between the baseline and the current periods. During the current period, visibility impairment was 7.7 dv which is comparable to a visual range of 112 miles (181 km) at Pinnacles National Park and Ventana Wilderness Area.

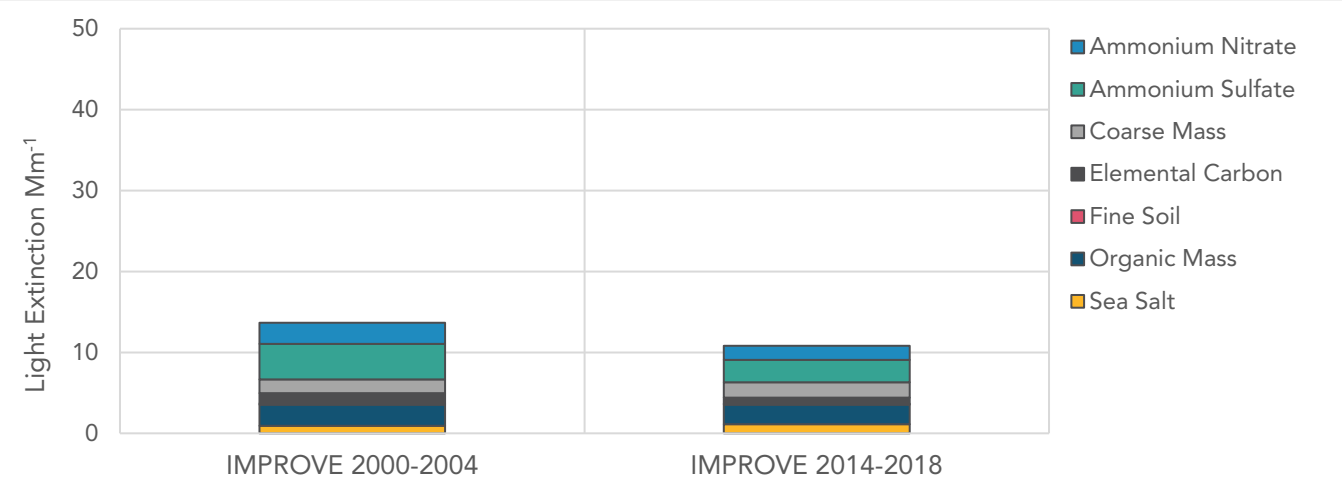
Visibility impairment on the most impaired days during the baseline period was 17.0 dv. Visibility impairment on the most impaired days decreased by 2.9 dv between the baseline and current periods. During the current period, visibility impairment was 14.1 dv, which is comparable to a visual range of 59 miles (95 km) at Pinnacles National Park and Ventana Wilderness Area. The average rate of progress between the baseline and current periods averaged 0.21 dv per year. This rate is faster than both the URP and the adjusted URP.

Table C-10: Visibility Tracking Metrics for PINN1

Days	Baseline (dv)	Current (dv)	Natural (dv)	Difference: Baseline - Current	Difference: Current - Natural	Uniform Rate of Progress (Adjusted)	Current Rate of Progress
Clearest	8.9	7.7	3.5	1.2 dv	4.2 dv	--	--
Most Impaired	17.0	14.1	6.9	2.9 dv	7.2 dv	0.17 dv/year (0.13 dv/year)	0.21 dv/year

Monitoring data, shown in Figures C-76, indicates that on clearest days ammonium sulfate accounts for the largest portion of light extinction. Between the baseline period and the current period, light extinction attributed to ammonium sulfate decreased by 38 percent on the clearest days.

Figure C-76: Average Extinction Composition for PINN1 on the Clearest Days



As shown in Figure C-77, ammonium nitrate and ammonium sulfate accounted for the largest portion of light extinction on the most impaired days. Between the baseline monitoring period and the current period, light extinction attributable to ammonium nitrate decreased

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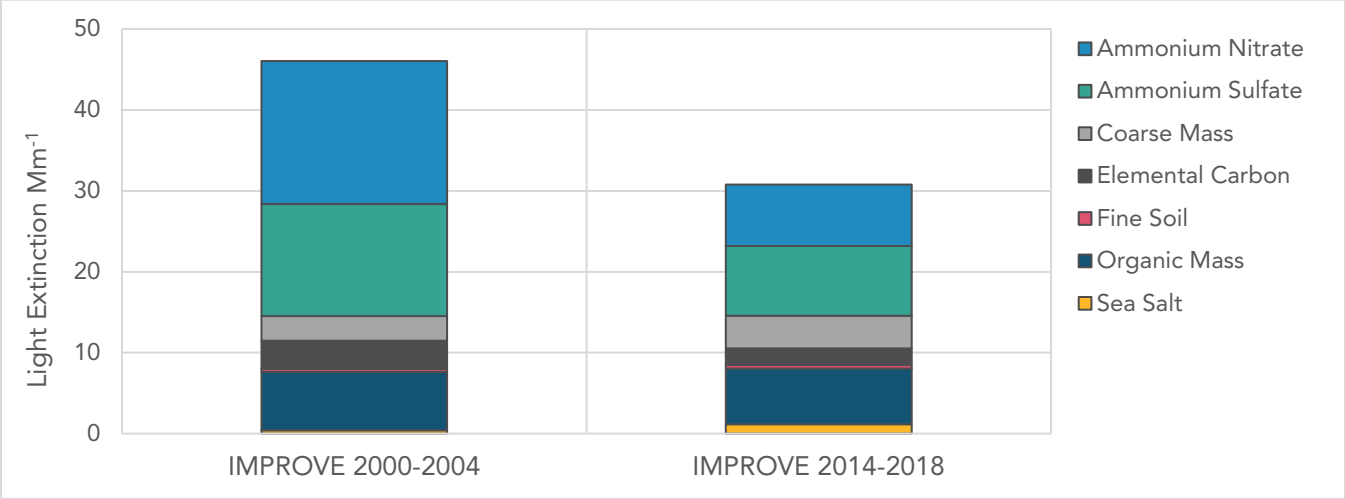
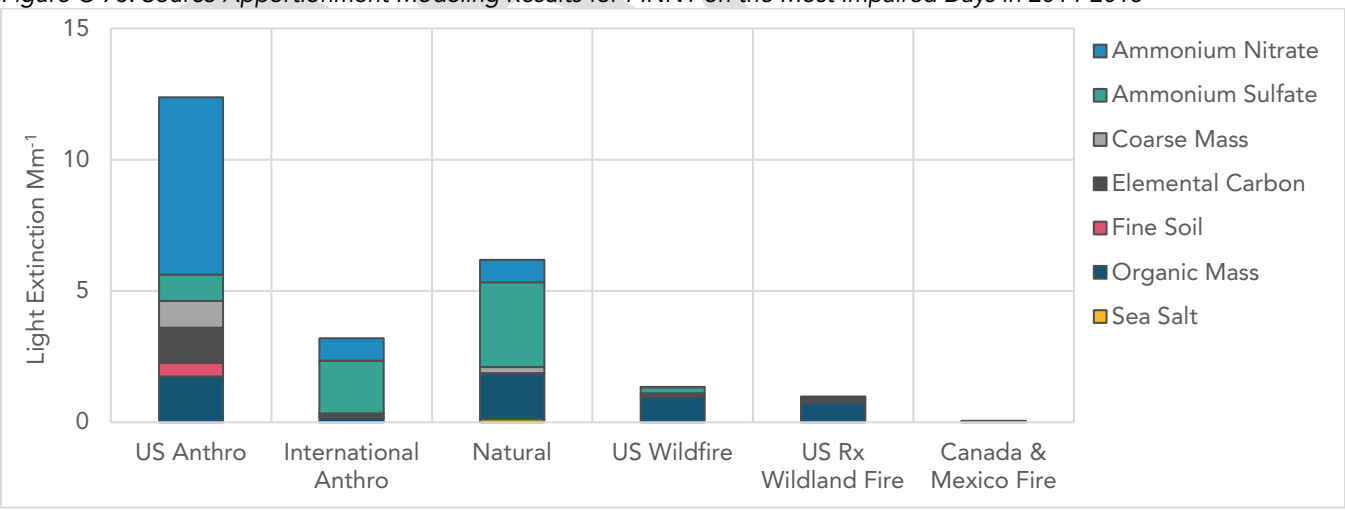
by 57 percent and light extinction attributable to ammonium sulfate decreased by 38 percent on the most impaired days.

Figure C-77: Average Extinction Composition for PINN1 on the Most Impaired Days



Source apportionment modeling, shown in Figure C-78, indicates that U.S. emissions are the dominant source of visibility reducing particles measured at the PINN1 monitoring site. Emissions from natural sources, international sources, and fire also contribute to visibility impairment at the site. Ammonium nitrate is the dominant source of light extinction attributable to U.S. sources whereas ammonium sulfate is the dominant source of light extinction attributable to international and natural sources. Organic mass is the dominant source of light extinction attributable to fire sources.

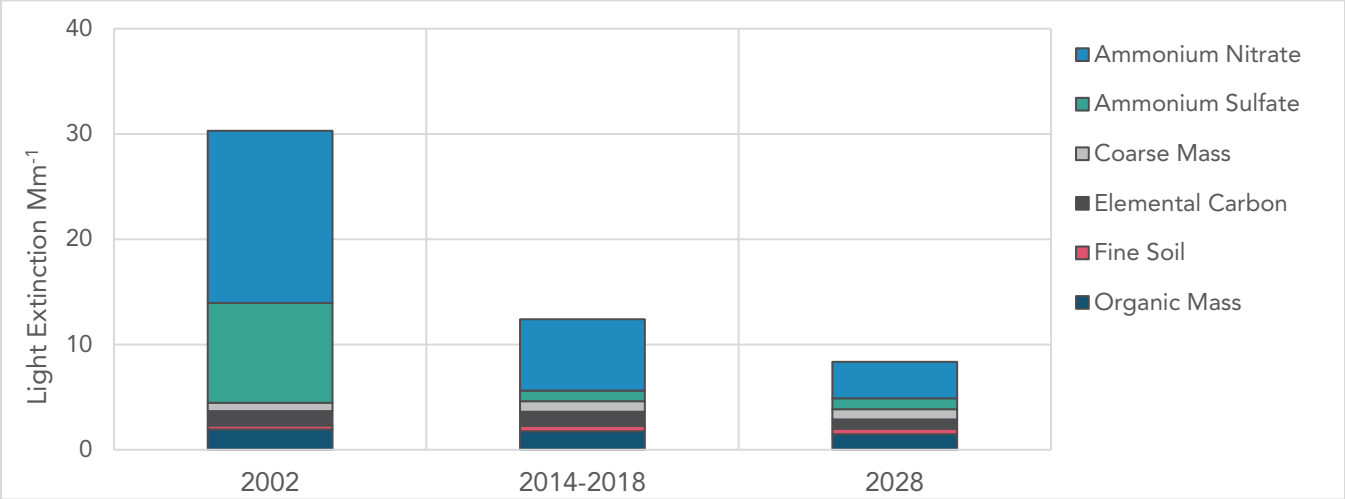
Figure C-78: Source Apportionment Modeling Results for PINN1 on the Most Impaired Days in 2014-2018



As shown in Figure C-79, light extinction from ammonium nitrate and ammonium sulfate decrased substantially between the baseline and current periods. Between the current period and 2028, adopted emissions controls are expected to reduce light extinction attributable to

ammonium nitrate by and additional 49 percent. Ammonium nitrate is projected to continue to account for the largest share of light extinction attributable to U.S. emission sources on the most impaired days in 2028.

Figure C-79: Light Extinction from PM Attributed to U.S. Anthropogenic Sources at PINN1 on the Most Impaired Days



Regional source apportionment projections are shown in Figures C-80 and C-81. Mobile sources operating in California are projected to account for the largest share of light extinction attributable to ammonium nitrate. Light extinction attributable to ammonium sulfate is projected to be less than one-third of the amount of light extinction attributable to ammonium nitrate. California's long-term strategy is focused on reducing NOx emissions from mobile sources. This strategy is expected to yield visibility improvements for areas represented by the PINN1 monitor.

Figure C-80: Regional Source Apportionment for Ammonium Nitrate from U.S. Anthropogenic Sources in 2028 at PINN1

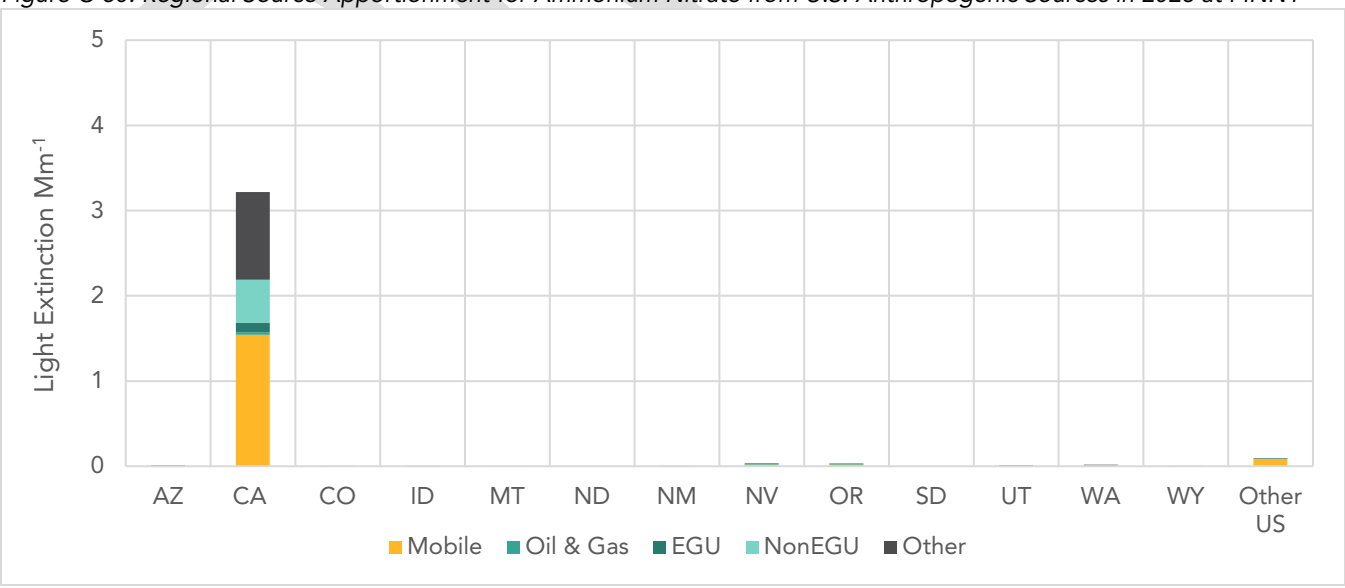
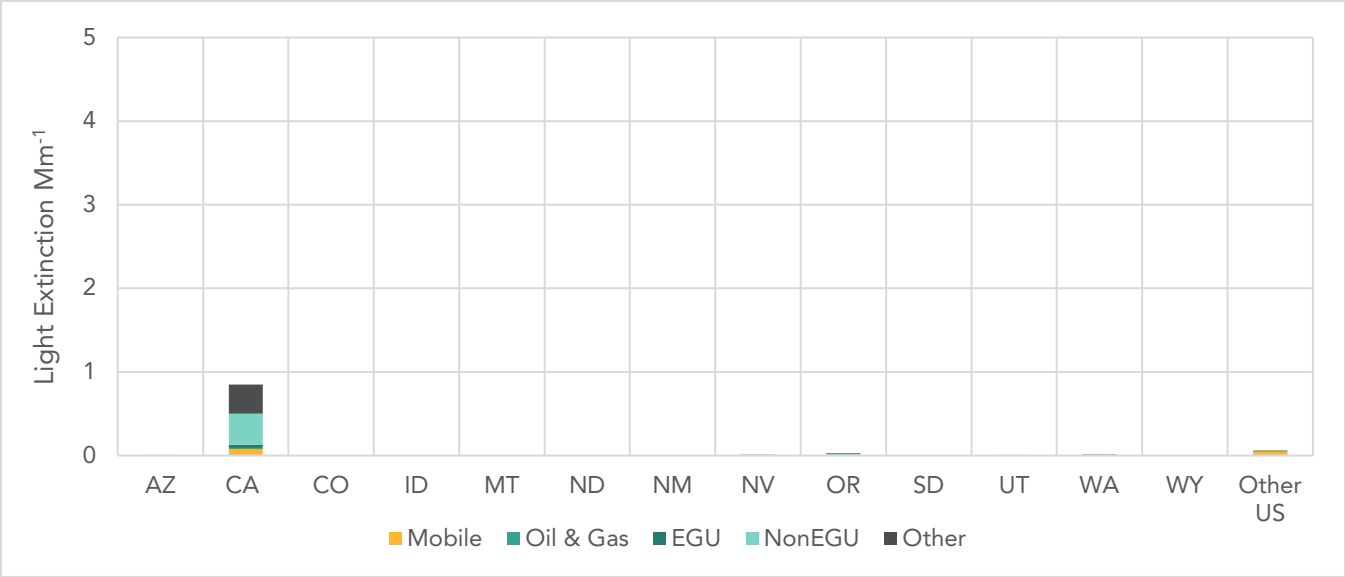


Figure C-81: Regional Source Apportionment for Ammonium Sulfate from U.S. Anthropogenic Sources in 2028 at PINN1



The current and projected visibility tracking metrics for Pinnacles National Park and Ventana Wilderness Area are shown in Figure C-82. Accounting for adopted emission controls and emission reduction commitments included in this Regional Haze Plan, visibility impairment on the most impaired days is projected to be 13.0 dv, which is comparable to a visual range of 66 miles (106 km). This 2028 projection is below the adjusted glidepath that accounts for international and wildland prescribed fire emissions, indicating that the progress occurring in this area is on track to meet 2064 visibility targets.

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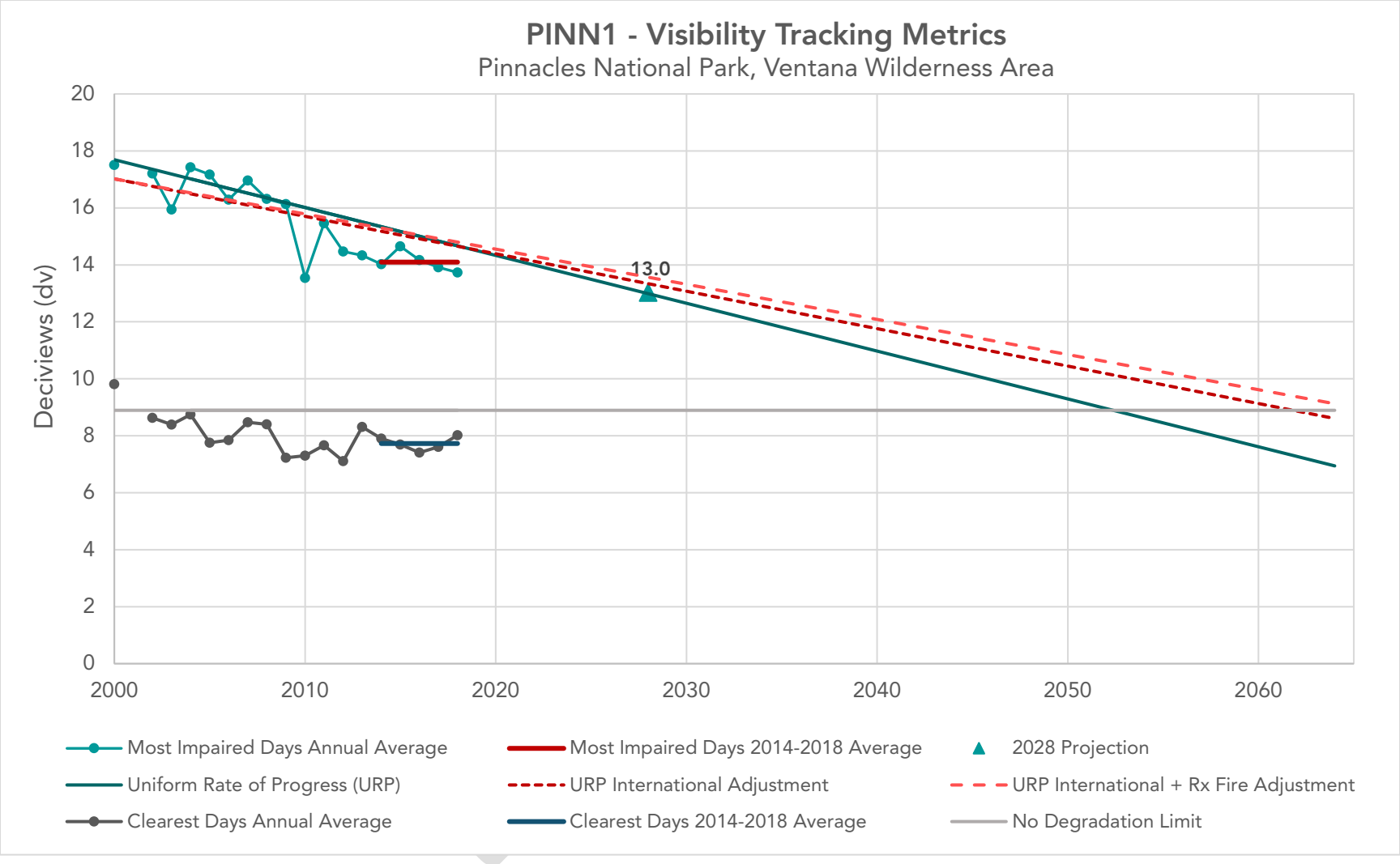
Figure C-82: Visibility Tracking Metrics and Projections for Pinnacles National Park and the Ventana Wilderness Area



Sequoia National Park (SEQU1) IMPROVE Monitoring Site

The SEQU1 monitoring site, shown in Figure C-83, is located at 1,703 feet (519 m) asl near the western edge of Sequoia National Park. The monitoring site was established in March 1992, in the residence area of park headquarters near the Ash Mountain water tank. Data collected at this site are representative of visibility conditions in Kings Canyon and Sequoia National Parks.

Figure C-83: Photograph looking northwest toward SEQUI Monitoring Site

Photograph Source: http://vista.cira.colostate.edu/Improve/monitoring-site-browser

Kings Canyon and Sequoia National Parks span 459,994 acres and 386,642 acres, respectively, in the southern Sierra Nevada Mountains on the east side of the San Joaquin Valley. The landscape is dramatic with deep valleys carved out by glaciers, lush meadows, dense forests, and high alpine environs. Twelve peaks rise more than 14,000 feet (4,267 m) asl including Mt. Whitney, the tallest peak in the contiguous U.S. Both parks are located within the San Joaquin Valley Air Basin.

Due to the ease of access from several of California's urban areas, visitation to these parks is high. Kings Canyon and Sequoia National Parks each have over one million visitors annually. During the busiest summer months, more than 40,000 vehicles pass through the main entrances to these parks over the course of a month. The fourteen campgrounds in these parks collectively host over 300,000 campers annually.[10]

As shown in Table C-11, visibility impairment on the clearest days during the baseline period was 8.8 dv. Visibility impairment on the clearest days decreased by 1.8 dv between the

[10] *https://irma.nps.gov/STATS/Reports/Park/SEQU*

baseline and the current periods. During the current period, visibility impairment on the clearest days was 7.0 dv, which is comparable to a visual range of 120 miles (194 km) at Kings Canyon and Sequoia National Parks.

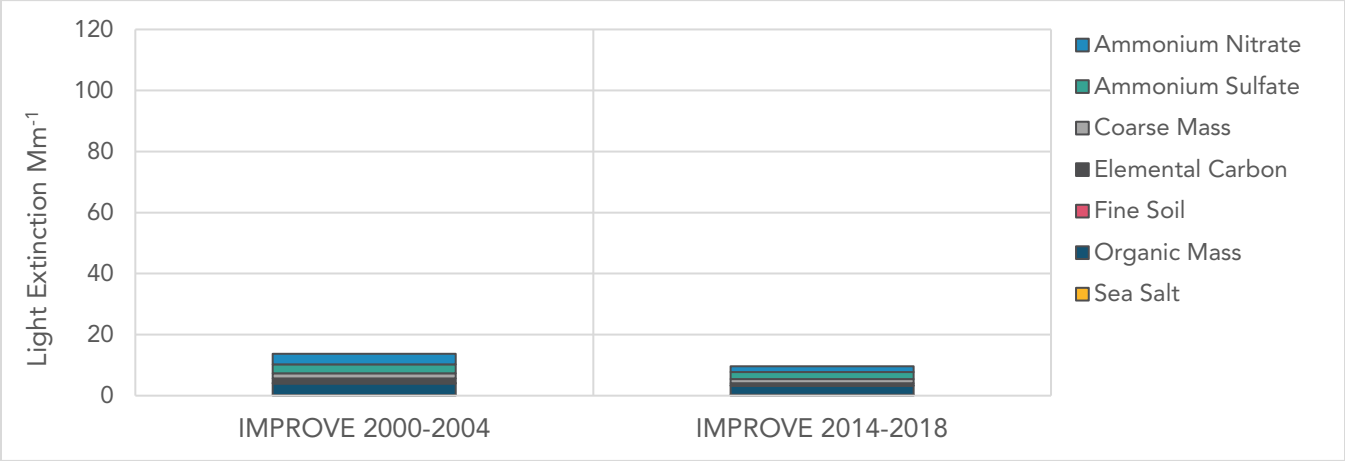
Visibility impairment on the most impaired days during the baseline period was 23.2 dv. Visibility impairment on the most impaired days decreased by 4.8 dv between the baseline and the current periods. During the current period, visibility impairment on the most impaired days was 18.4 dv, which is comparable to a visual range of 38 miles (62 km) at Kings Canyon and Sequoia National Parks. The average rate of progress between the baseline and current periods amounted to 0.34 dv per year. This rate is faster than both the URP and the adjusted URP.

Table C-11: Visibility Tracking Metrics for SEQU1

Days	Baseline (dv)	Current (dv)	Natural (dv)	Difference: Baseline - Current	Difference: Current - Natural	Uniform Rate of Progress (Adjusted)	Current Rate of Progress
Clearest	8.8	7.0	2.3	1.8 dv	4.7 dv	--	--
Most Impaired	23.2	18.4	6.3	4.8 dv	12.1 dv	0.28 dv/year (0.21 dv/year)	0.34 dv/year

Monitoring data, shown in Figure C-84, indicates that on the clearest days during the baseline monitoring period ammonium nitrate accounted for the largest portion of light extinction. Between the baseline and current periods, light extinction attributed to ammonium nitrate decreased by 46 percent. During the current period, organic mass and ammonium sulfate accounted for the largest portion of light extinction on the clearest days.

Figure C-84: Average Extinction Composition for SEQU1 on the Clearest Days



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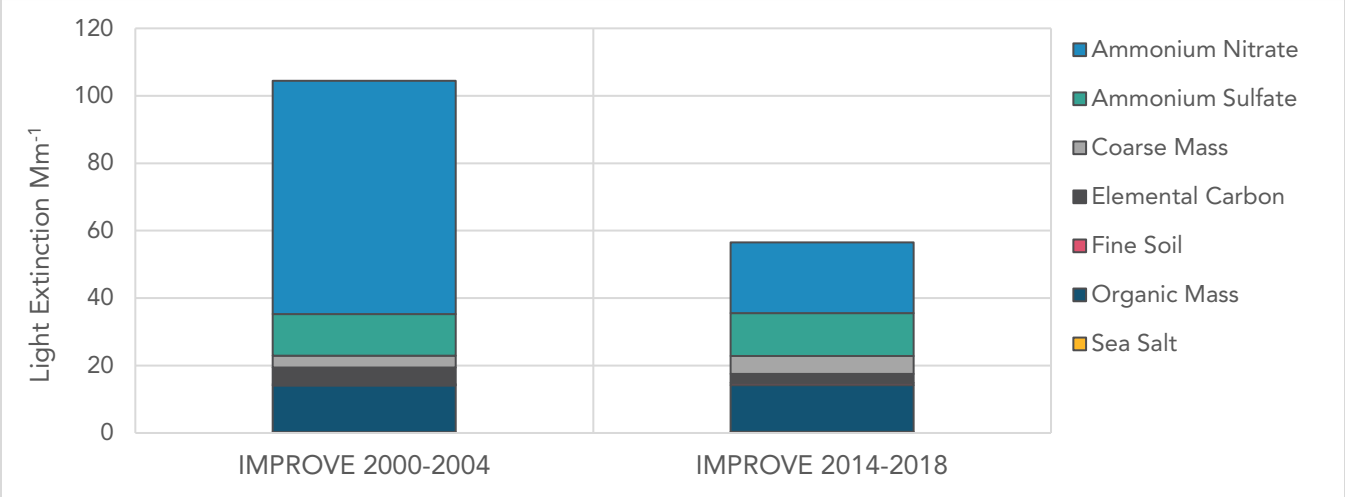
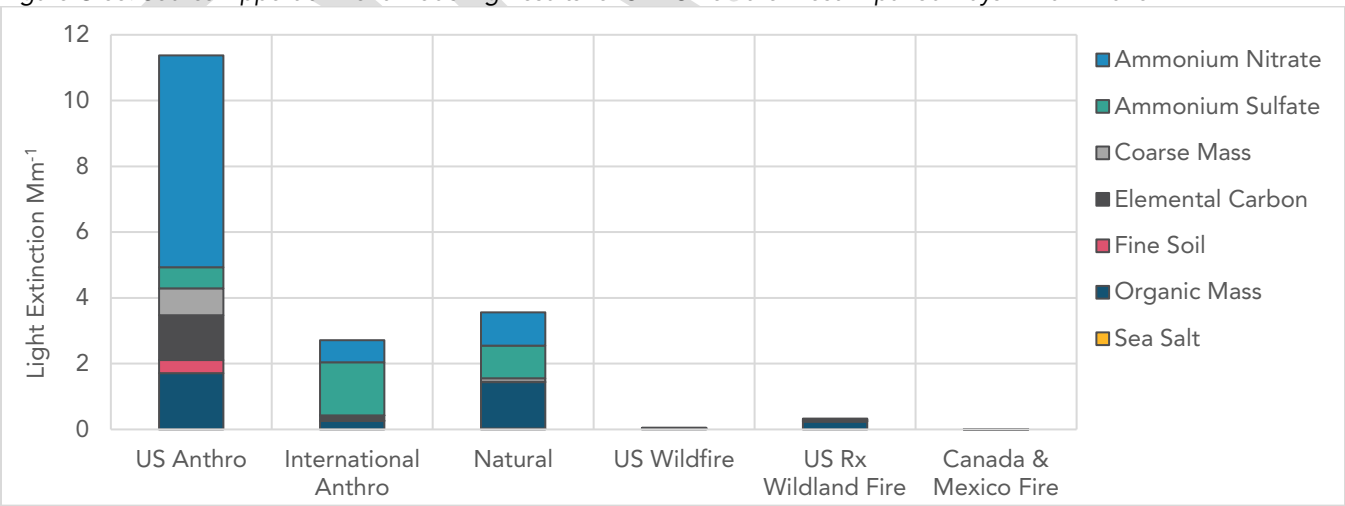
As shown in Figure C-85, ammonium nitrate is responsible for the largest portion of light extinction on the most impaired days. Between the baseline period and the current period, light extinction attributed to ammonium nitrate decreased by 70 percent on the most impaired days.

Figure C-85: Average Extinction Composition for SEQU1 on the Most Impaired Days



Source apportionment modeling, shown in Figure C-86, indicates that U.S. emissions are the dominant source of visibility reducing particles measured at the SEQU1 monitoring site. Emissions from natural and international sources also contribute to visibility impairment at the site. The portion of light extinction attributed to U.S. sources is dominated by ammonium nitrate. The portion of light extinction attributable to natural and international sources is dominated by organic mass and ammonium sulfate, respectively.

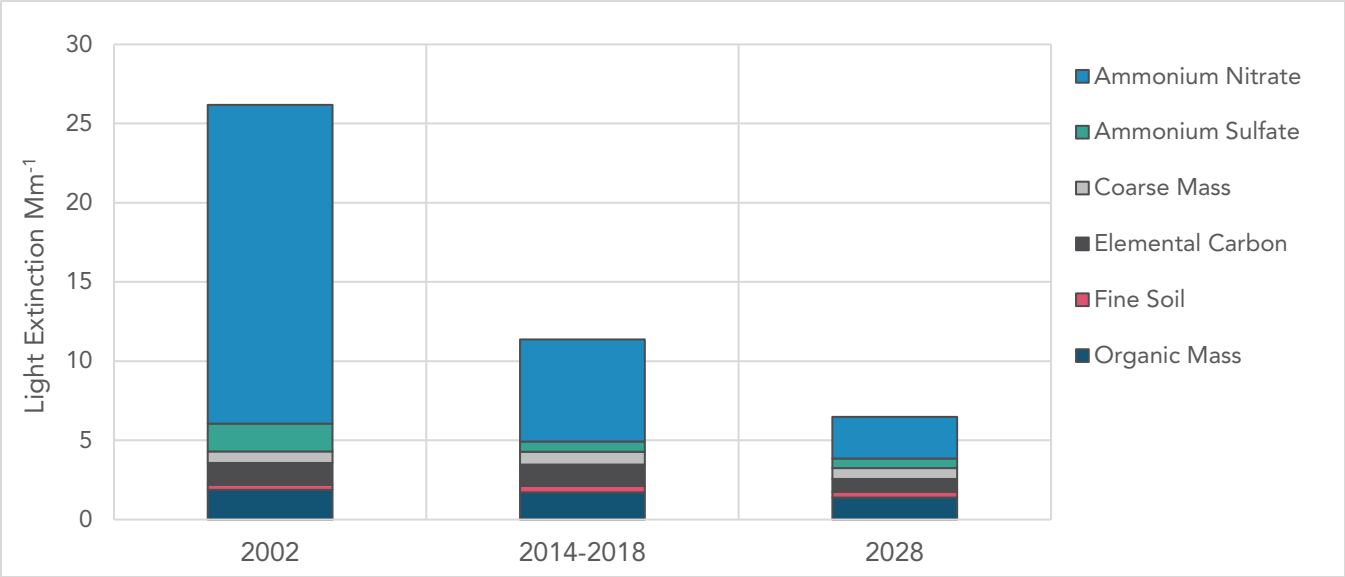
Figure C-86: Source Apportionment Modeling Results for SEQU1 on the Most Impaired Days in 2014-2018



As shown in Figure C-87, light extinction attributable to ammonium nitrate has decreased significantly and further reductions are projected for 2028. Between the current period and

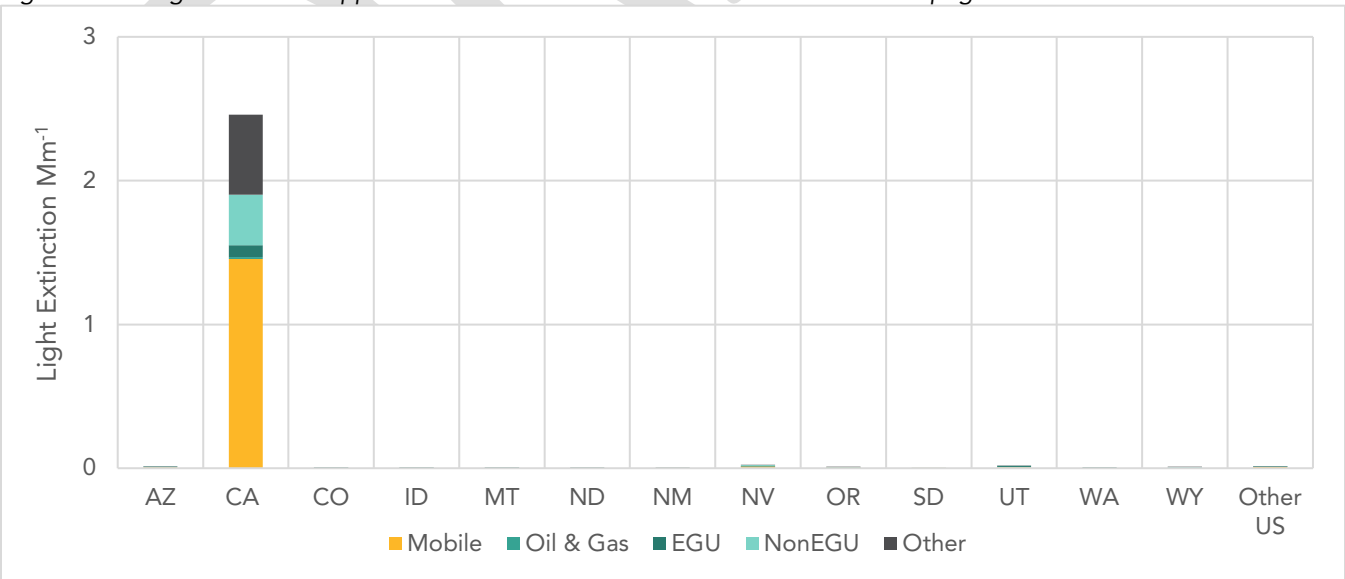
2028, adopted emissions controls are expected to reduce light extinction attributable to ammonium nitrate by an additional 59 percent on the most impaired days. Ammonium nitrate is projected to continue to account for the largest share of light extinction attributable to U.S. emission sources in 2028.

Figure C-87: Light Extinction from PM Attributed to U.S. Anthropogenic Sources at SEQU1 on the Most Impaired Days



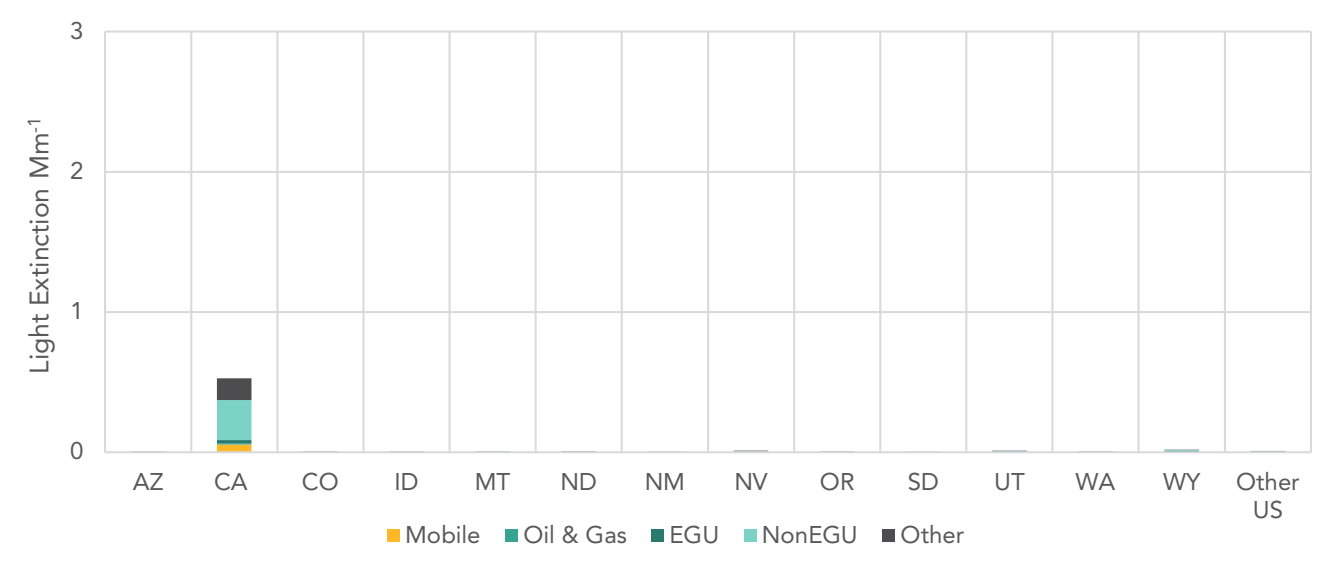
Regional source apportionment projections are shown in Figure C-88. California mobile sources are projected to be the largest regional source of ammonium nitrate in 2028. These results suggest that California's continued focus on reducing NOx emissions from mobile sources will be an effective means to improve visibility in these Class I areas.

Figure C-88: Regional Source Apportionment for Ammonium Nitrate from U.S. Anthropogenic Sources in 2028 at SEQU1



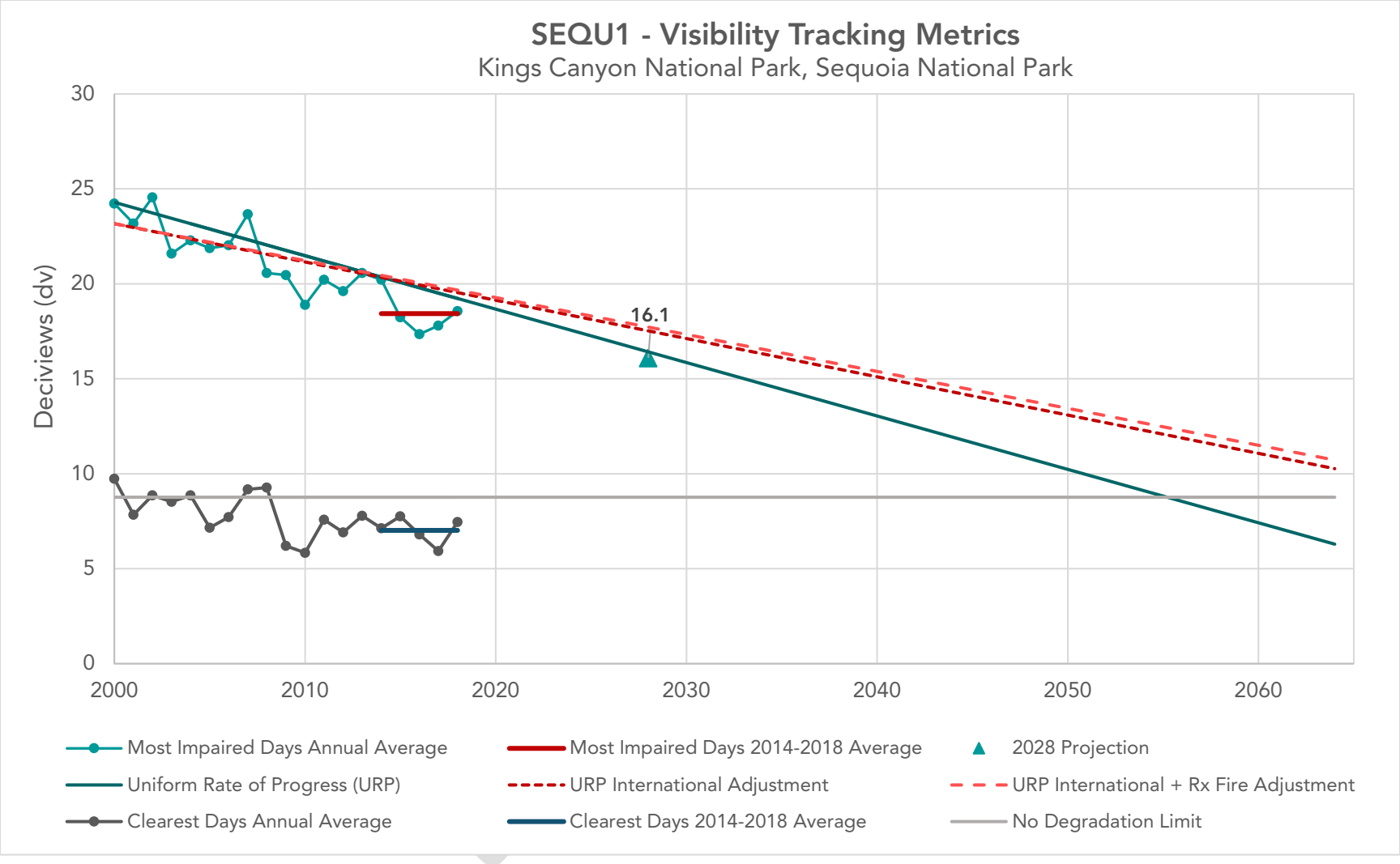
As shown in Figure C-89, light extinction from ammonium sulfate is projected to be less than a quarter of light extinction from ammonium nitrate. California's long-term strategy for regional haze is focused on reducing NOx emissions from mobile sources. Projections indicate that this strategy will lead to visibility benefits for Kings Canyon and Sequoia National Parks.

Figure C-89: Regional Source Apportionment for Ammonium Sulfate from U.S. Anthropogenic Sources in 2028 at SEQU1



The current and projected visibility tracking metrics for Kings Canyon and Sequoia National Parks are shown in Figure C-90. Accounting for adopted emission controls and emission reduction commitments included in this Regional Haze Plan, visibility impairment on the most impaired days is projected to be 16.1 dv, which is comparable to a visual range of 48 miles (78 km). This 2028 projection is below the adjusted glidepath that accounts for international and wildland prescribed fire emissions, indicating that the progress occurring in this area is on track to meet 2064 visibility targets.

Figure C-90: Visibility Tracking Metrics and Projections for Kings Canyon and Sequoia National Parks



San Rafael Wilderness Area (RAFA1) IMPROVE Monitoring Site

The RAFA1 monitoring site, shown in Figure C-91, is located near the southwestern border of the San Rafael Wilderness Area at 3,136 feet (956 m) asl. The monitoring site was established in February 2000, just south of the Figueroa Forest Service Ranger Station. The Figueroa Off Highway Vehicle Recreation Area is northeast of the site, as well as four developed family campgrounds: Figueroa (33 sites), Davy Brown (13 sites), Nira (12 sites), and Cachuma (7 sites). Data collected at the RAFA1 site are representative of visibility conditions at the San Rafael Wilderness Area.

Figure C-91: Photograph looking west towards the RAFA1 monitoring site

Photograph: http://vista.cira.colostate.edu/Improve/monitoring-site-browser/

The San Rafael Wilderness Area spans 142,722 acres in the South Central Coast Air Basin. Situated primarily within the southern portion of the Coastal Range, rugged chaparral covered hills and grassy meadows characterize much of the landscape.

As shown in Table C-12, visibility impairment on the clearest days during the baseline period was 6.5 dv. Visibility impairment on the clearest days decreased by 1.6 dv between the baseline and the current periods. During the current period, visibility impairment 4.9 dv, which is equivalent to a visual range of 148 miles (239 km) at San Rafael Wilderness Area.

Visibility impairment on the most impaired days during the baseline period was 17.3 dv. Visibility impairment on the most impaired days decreased by 3.2 dv between the baseline and the current periods. During the current period, visibility impairment was 14.1 dv, which is equivalent to a visual range of 59 miles (95 km) at San Rafael Wilderness Area. The rate of

progress at this site between the baseline and current periods averaged 0.23 dv per year, which is faster than both the URP and adjusted URP.

Table C-12: Visibility Tracking Metrics for RAFA1

Days	Baseline (dv)	Current (dv)	Natural (dv)	Difference: Baseline - Current	Difference: Current - Natural	Uniform Rate of Progress (Adjusted)	Current Rate of Progress
Clearest	6.5	4.9	1.8	1.6 dv	3.1 dv	--	--
Most Impaired	17.3	14.1	6.8	3.2 dv	7.3 dv	0.18 dv/year (0.14 dv/year)	0.23 dv/year

Monitoring data, shown in Figures C-92 and C-93, indicate that on the clearest and most impaired days ammonium sulfate accounts for the largest share of light extinction at the RAFA1 monitoring site. The low sulfur diesel regulations adopted in California have led to decreased sulfur emissions from mobile sources and subsequently decreased sulfate particles. Between the baseline and current periods, light extinction from ammonium sulfate decreased by 37 percent on the clearest days and by 43 percent on the most impaired days. On the most impaired days during the baseline period, ammonium nitrate accounted for the second largest portion of light extinction. Between the baseline monitoring and current periods, light extinction from ammonium nitrate decreased by 50 percent on the most impaired days.

Figure C-92: Average Extinction Composition for RAFA1 on the Clearest Days

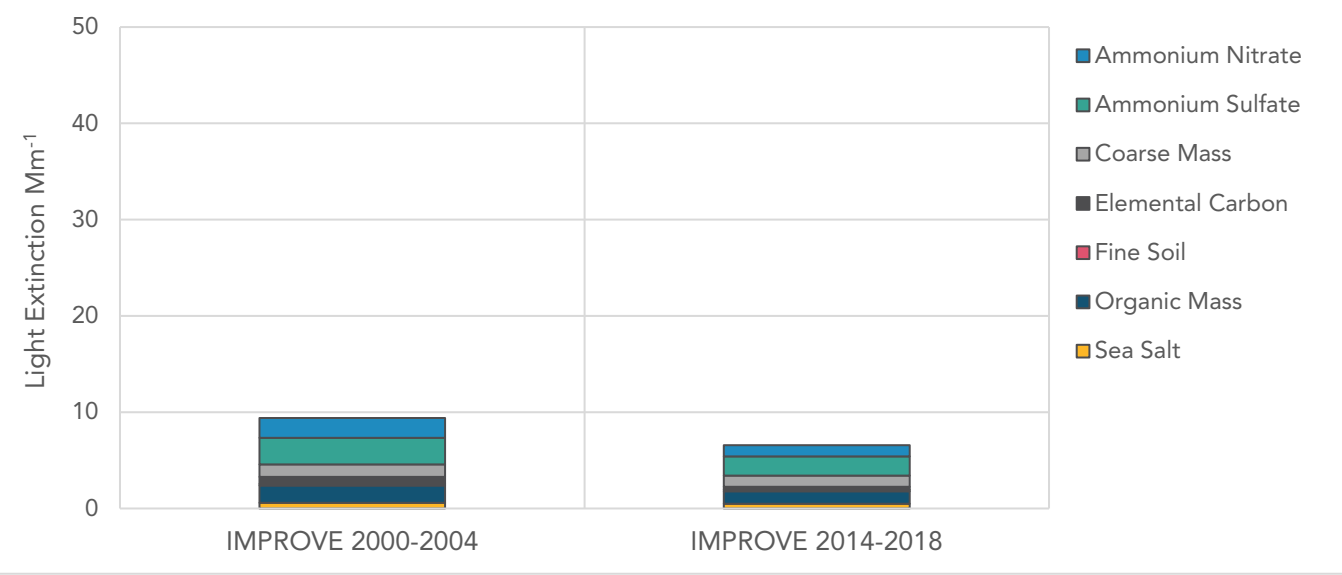
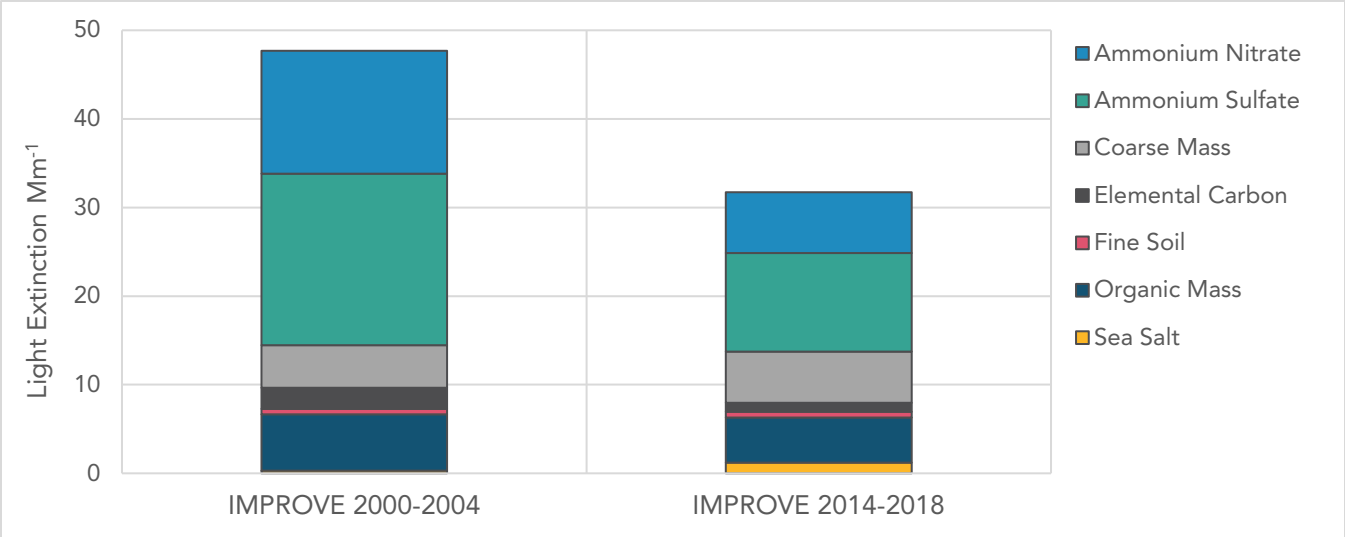
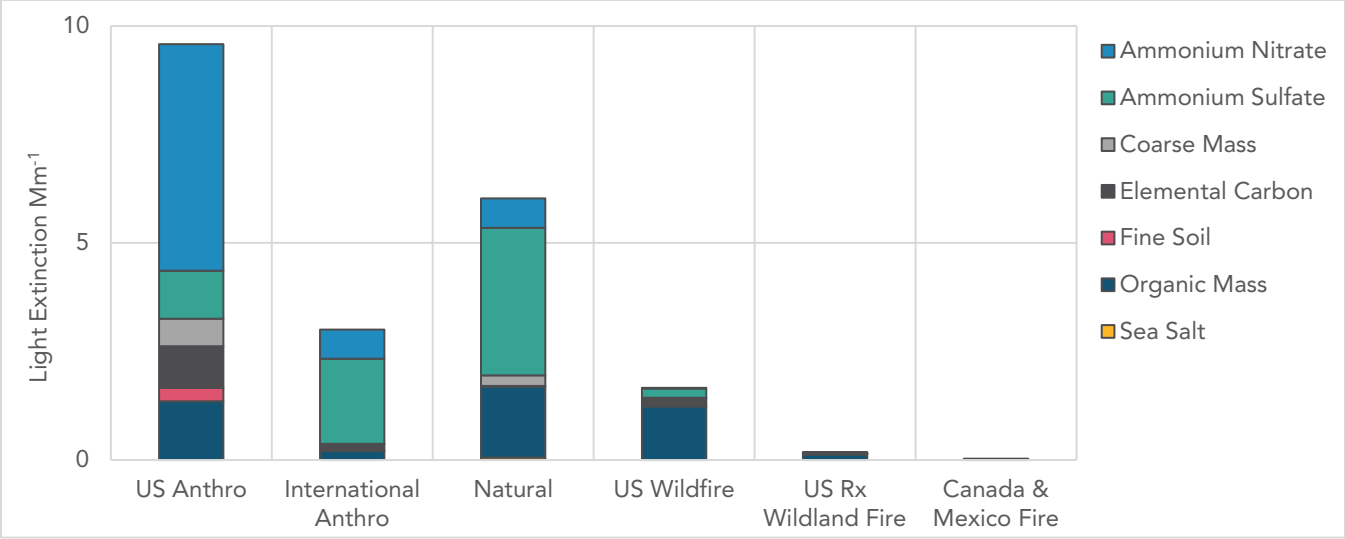


Figure C-93: Average Extinction Composition for RAFA1 on the Most Impaired Days



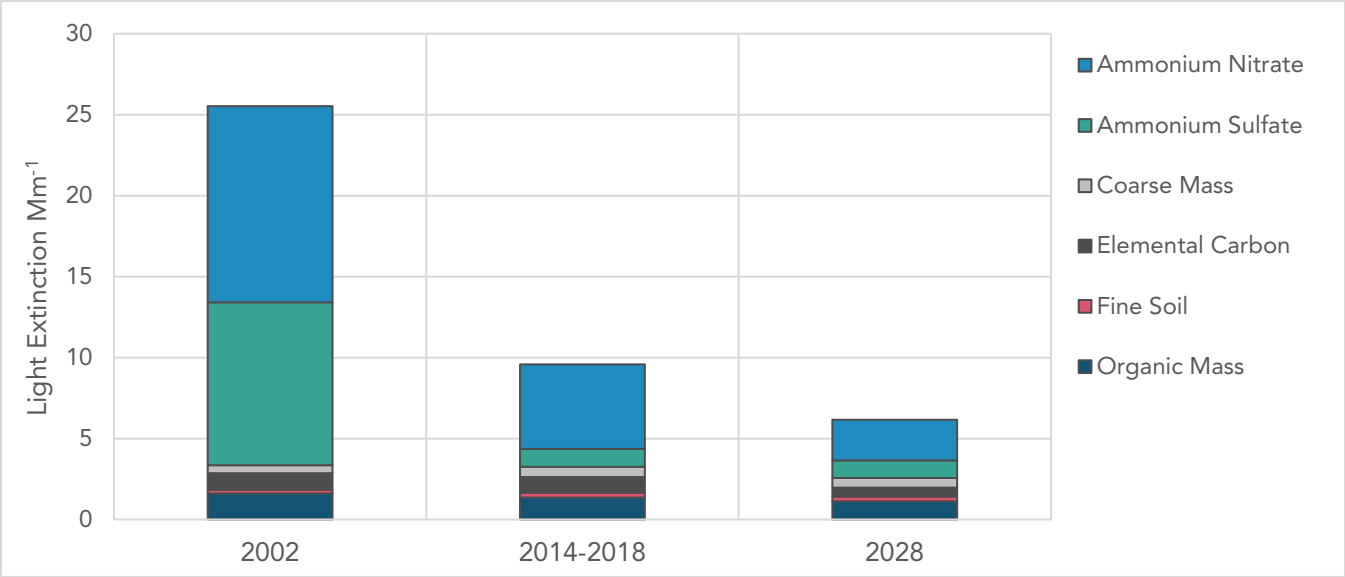
Source apportionment modeling, shown in Figure C-94, indicates most of the light extinction measured at the RAFA1 monitoring site is attributable to emissions from U.S. and natural sources. Emissions from international sources also contribute to visibility impairment on the most impaired days. Ammonium nitrate accounts for the largest share of light extinction attributable to U.S. sources and ammonium sulfate accounts for the largest share of light extinction attributable to international and natural sources.

Figure C-94: Source Apportionment Modeling Results for RAFA1 on the Most Impaired Days in 2014-2018



As shown in Figure C-95, light extinction attributable to U.S. source has decreased substantially, largely due to controls focused on sulfur and NOx emissions. Projections show that between the current period and 2028, adopted emission controls are expected to reduce light extinction attributable to ammonium nitrate by an additional 52 percent.

Figure C-95: Light Extinction from PM Attributed to U.S. Anthropogenic Sources at RAFA1 on the Most Impaired Days



Regional source apportionment modeling results are shown in Figures C-96 and C-97. These results indicate that California mobile sources are projected to account for the largest share of light extinction attributable to ammonium nitrate in 2028. Light extinction attributable to U.S. sources from ammonium nitrate is expected to be more than two times greater than light extinction from ammonium sulfate. California's long-term strategy for regional haze is focused on improving visibility through reduction of NOx emissions from mobile sources. This strategy is projected to yield visibility improvements for the San Rafael Wilderness Area.

Figure C-96: Regional Source Apportionment for Ammonium Nitrate from U.S. Anthropogenic Sources in 2028 at RAFA1

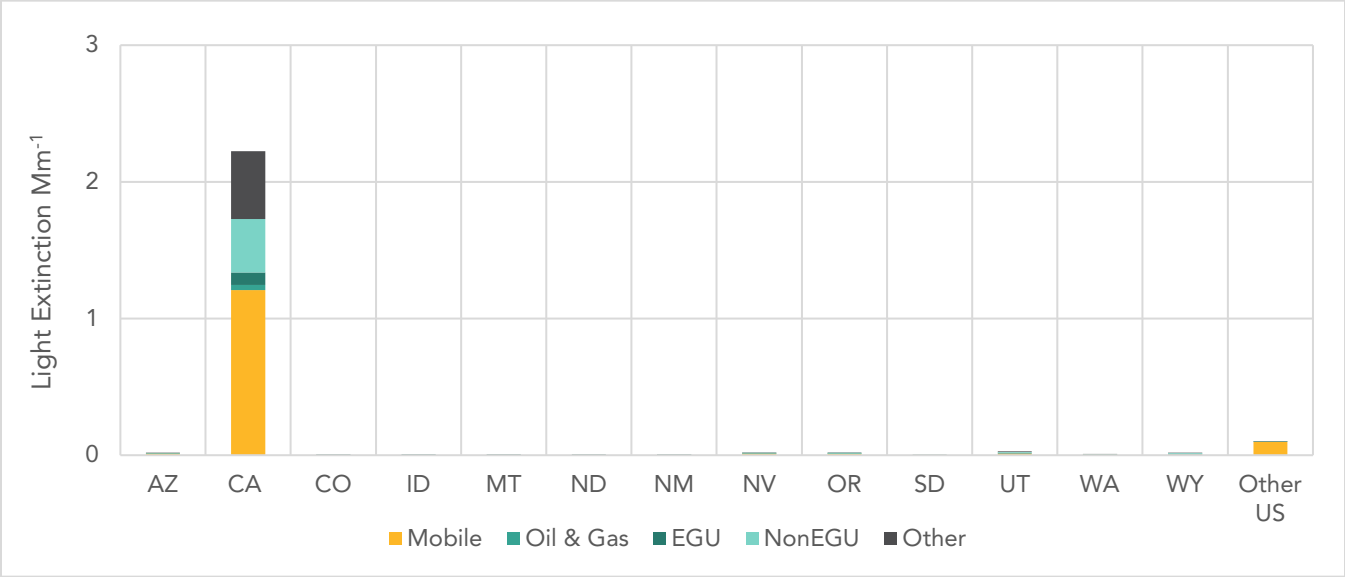
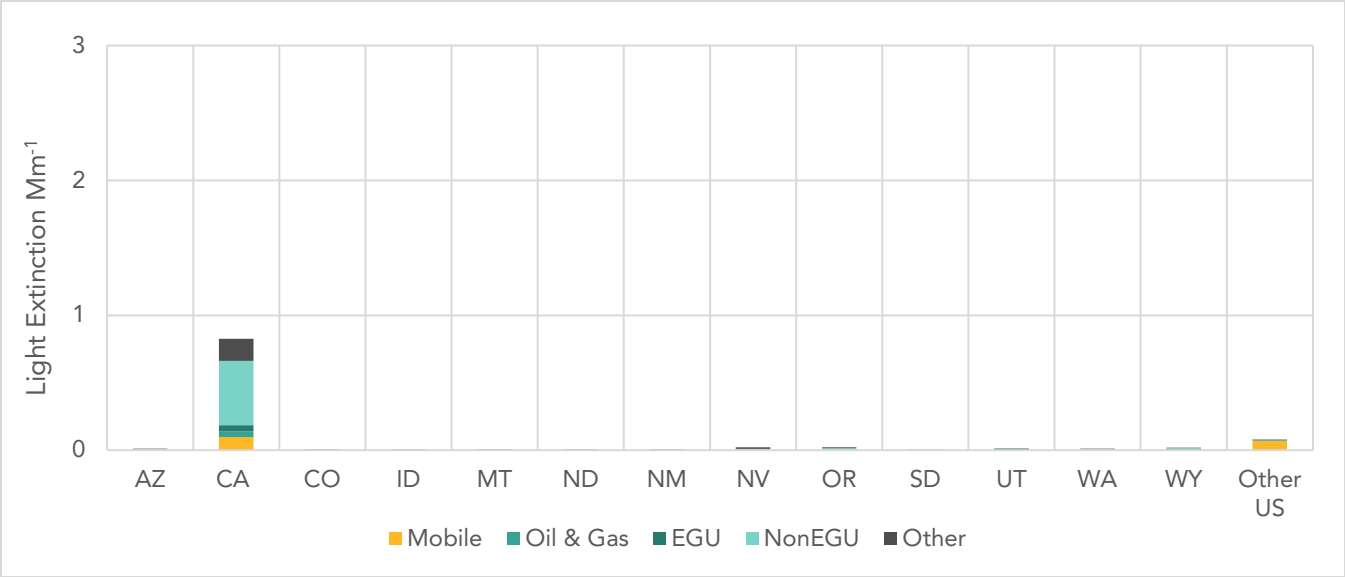


Figure C-97: Regional Source Apportionment for Ammonium Sulfate from U.S. Anthropogenic Sources in 2028 at RAFA1



The current and projected trends in visibility tracking metrics for the San Rafael Wilderness Area are shown in Figure C-98. Accounting for adopted emission controls and emission reduction commitments included in this Regional Haze Plan, visibility impairment on the most impaired days is projected to be 13.0 dv in 2028, which corresponds to a visual range of 66 miles (106 km). This 2028 projection is below the adjusted glidepath that accounts for international and wildland prescribed fire emissions, indicating that the rate of progress occurring in this area is on track to meet 2064 visibility targets.

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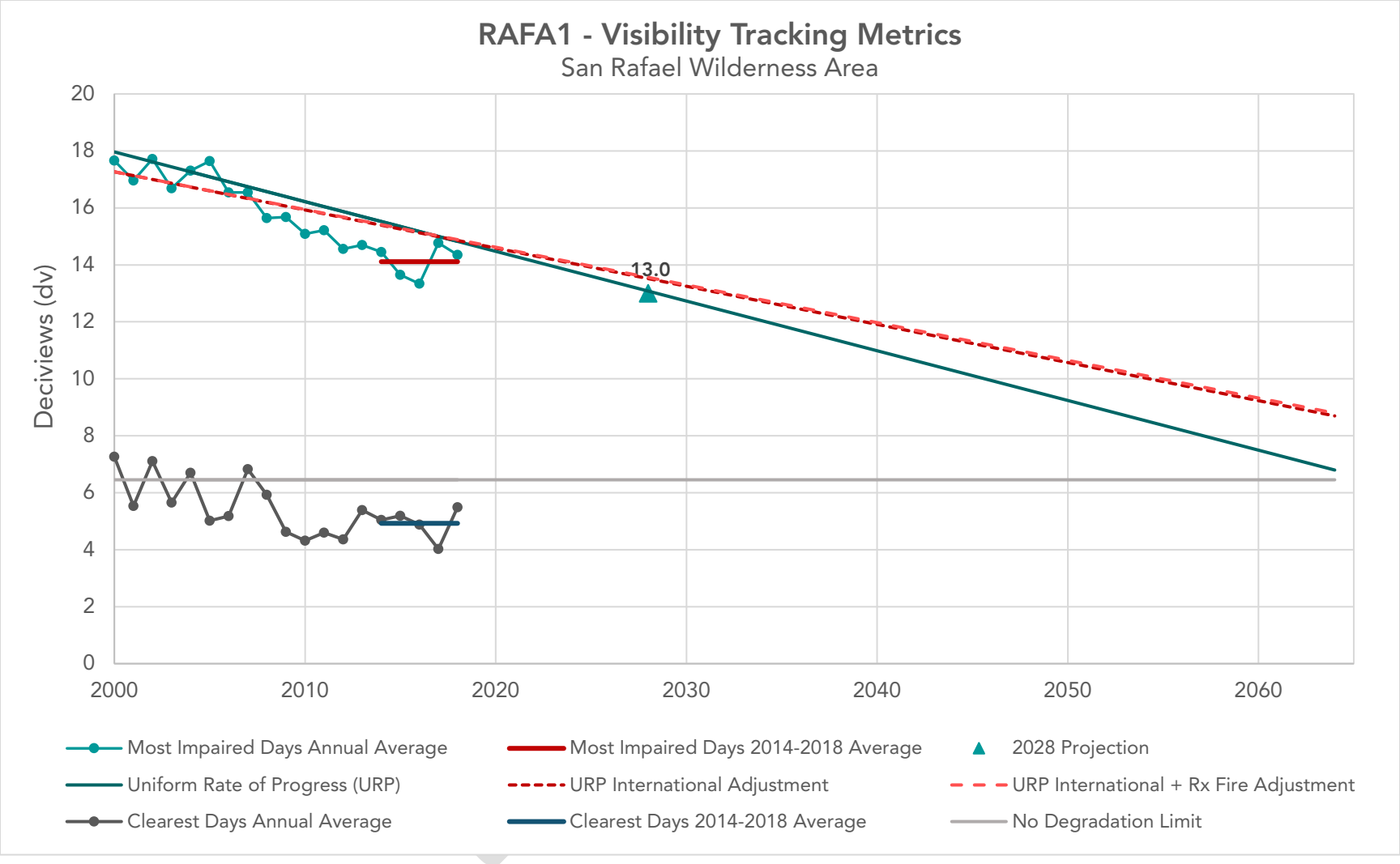
Figure C-98: Visibility Tracking Metrics and Projections for San Rafael Wilderness Area



Southern California

Southern California's population is concentrated in the coastal areas. More than 40 percent of California's population resides in the South Coast Air Basin. Nearly half of the residents in the San Diego County Air Basin live within the City of San Diego. The Salton Sea Air Basin's largest city is Indio, which has a population of about 90,000 people but draws in more than one million visitors annually to a wide range of music, food, and arts festivals. The largest cities in the Mojave Desert Air Basin include Lancaster, Palmdale, and Victorville, which are located just north of the South Coast Air Basin. The rest of the Mojave Desert Air Basin is sparsely populated. Emissions from urban areas contribute to visibility impairment at Class I areas in the Southern California region.

The movement of goods and people is a significant source of emissions in Southern California. The sea ports of Los Angeles and Long Beach, which are the busiest in North America, are in the South Coast Air Basin and the Port of San Diego is in the San Diego County Air Basin. Networks of highways, city streets, and rail lines are common features on the landscape.

Emissions from the South Coast Air Basin account for most of the Southern California region's emissions. In 2014, emissions from the South Coast Air Basin accounted for 61 percent of NOx emissions in the Southern California region. Mobile sources are the dominant NOx emission source sector in each air basin, and overall accounted for 82 percent of the region's NOx emissions in 2014.

Terrain and prevailing meteorological conditions play a predominant role in the transport of emissions in Southern California. Emission sources are generally concentrated in the western portion of the region. The sea-breeze circulation along the coast provides a mechanism to temper transport but also recirculate emissions in the coastal areas. Prevailing winds transport emissions inland. Mountainous terrain provides a physical barrier to trap pollutants and mountain passes provide a conduit to route emissions inland.

Five IMPROVE monitoring sites are in the Southern California region. From north to south, the monitoring sites in this region are in the Domeland Wilderness Area, San Gabriel Wilderness Area, San Gorgonio Wilderness Area, Joshua Tree National Park, and Agua Tibia Wilderness Area. The following section provides an overview of the monitoring sites and their associated Class I areas, visibility monitoring data, and source apportionment for each location.

Domeland Wilderness Area (DOME1) IMPROVE Monitoring Site

The DOME1 monitoring site, shown in Figure C-99, is located at 3,041 feet (927 m) asl near the southeast portion of the Domeland Wilderness Area. The monitoring site was established

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in February 2000 adjacent to California's State Route 178. Data collected at this site are representative of visibility conditions in the Domeland Wilderness Area.

Figure C-99: Photograph looking northeast towards DOME1 Monitoring Site

Photograph Source: http://vista.cira.colostate.edu/Improve/monitoring-site-browser/

The Domeland Wilderness Area includes 62,206 acres of semi-arid terrain. The landscape is covered in pinyon pine, juniper, and sagebrush that is interrupted by numerous outcrops of the area's namesake granite domes. Elevation ranges from 3,000 to 9,730 feet (914 to 2,966 m) asl. The northern portion of the Domeland Wilderness Area is within the San Joaquin Valley Air Basin. The southern portion and the IMPROVE monitoring site are within the Mojave Desert Air Basin.

As shown in Table C-13, visibility impairment on the clearest days during the baseline period was 5.1 dv. Visibility impairment on the clearest days decreased by 0.7 dv between the baseline and the current periods. During the current period, visibility impairment was 4.4 dv, which is comparable to a visual range of 156 miles (251 km) at Domeland Wilderness Area.

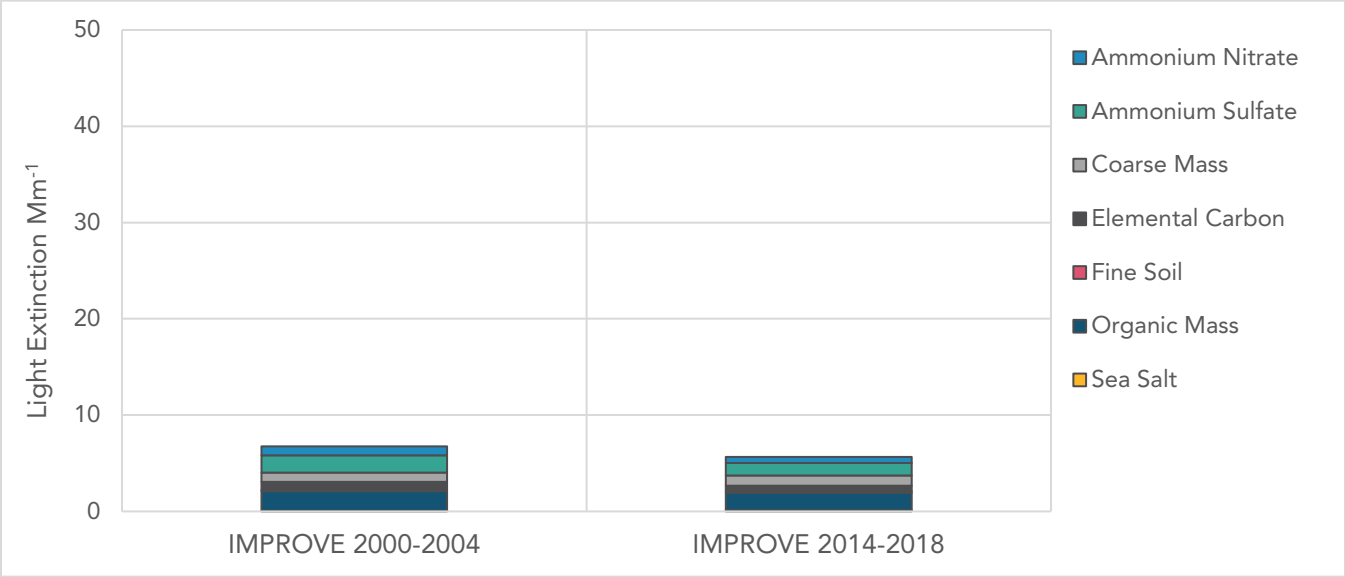
Visibility impairment on the most impaired days during the baseline period was 17.2 dv. Visibility impairment on the most impaired days decreased by 2.1 dv between the baseline and the current periods. During the current period, visibility impairment was 15.1 dv, which is comparable to a visual range of 54 miles (86 km) at Domeland Wilderness Area. Progress between the baseline and current periods averaged 0.15 dv per year, which is faster than the URP adjusted to account for international emissions and prescribed fire.

Table C-13: Visibility Tracking Metrics for DOME1

Days	Baseline (dv)	Current (dv)	Natural (dv)	Difference: Baseline - Current	Difference: Current - Natural	Uniform Rate of Progress (Adjusted)	Current Rate of Progress
Clearest	5.1	4.4	1.2	0.7 dv	3.2 dv	--	--
Most Impaired	17.2	15.1	6.2	2.1 dv	8.9 dv	0.18 dv/year (0.13 dv/year)	0.15 dv/year

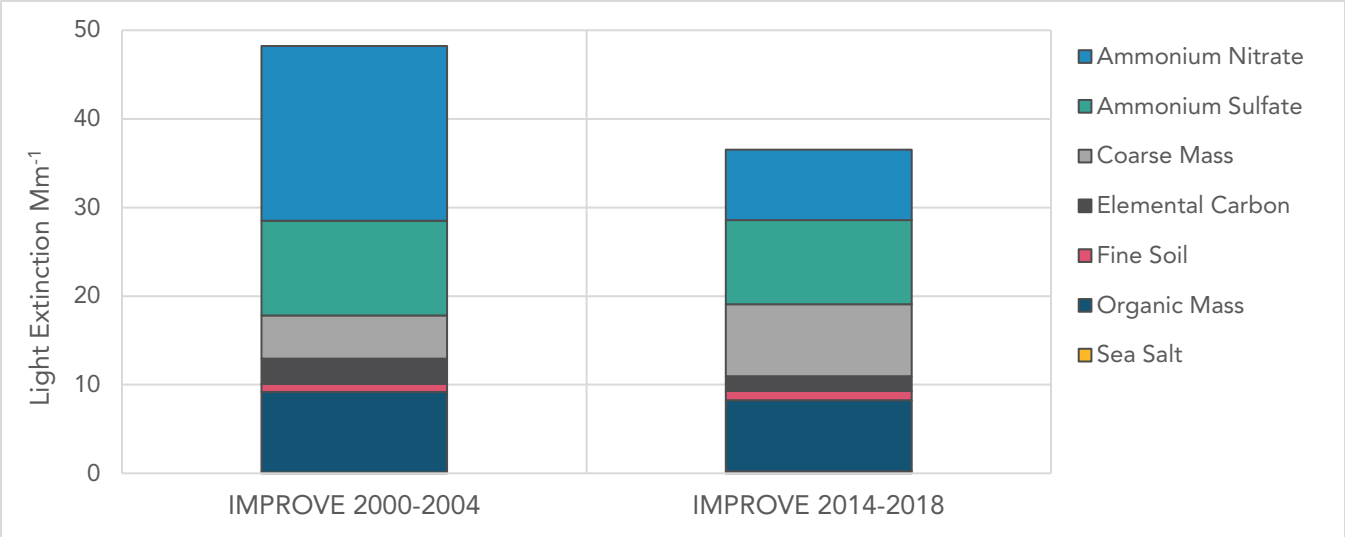
Monitoring data, shown in Figures C-100, indicate that on the clearest days, ammonium sulfate and organic mass account for the largest portion of light extinction at the DOME1 monitoring site. Between the baseline period and the current period, light extinction from ammonium sulfate decreased by 27 percent and light extinction from organic mass decreased by 11 percent on the clearest days.

Figure C-100: Average Extinction Composition for DOME1 on the Clearest Days



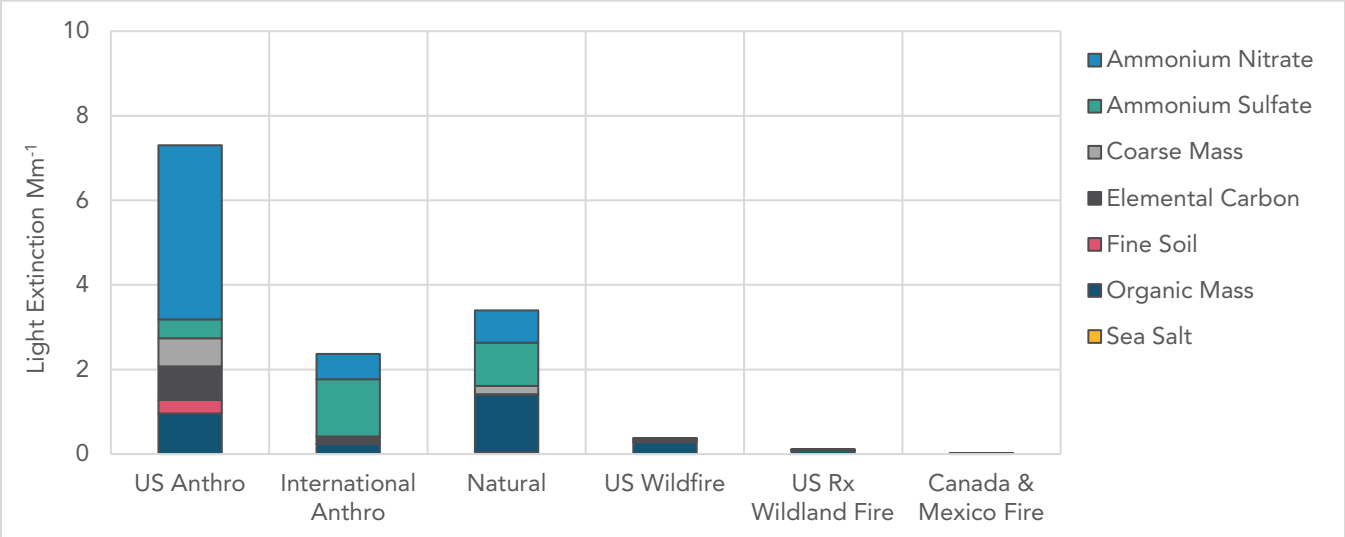
As shown in Figure C-101, ammonium nitrate accounted for the largest portion of light extinction on the most impaired days during the baseline period. Between the baseline monitoring period and the current period, the amount of light extinction attributed to ammonium nitrate decreased 60 percent. During the current period, ammonium nitrate, ammonium sulfate, coarse mass and organic mass contributed to visibility impairment on the most impaired days.

Figure C-101: Average Extinction Composition for DOME1 on the Most Impaired Days



Source apportionment modeling, shown in Figure C-102, indicates that emissions from U.S. sources account for the largest share of light extinction on the most impaired days at the DOME1 monitoring site. Emissions from natural and international sources also contribute to light extinction on the most impaired days. The portion of light extinction attributed to U.S. sources is dominated by ammonium nitrate. Ammonium sulfate accounts for the largest share of light extinction attributable to international sources and organic mass accounts for the largest share of the light extinction attributed to natural sources.

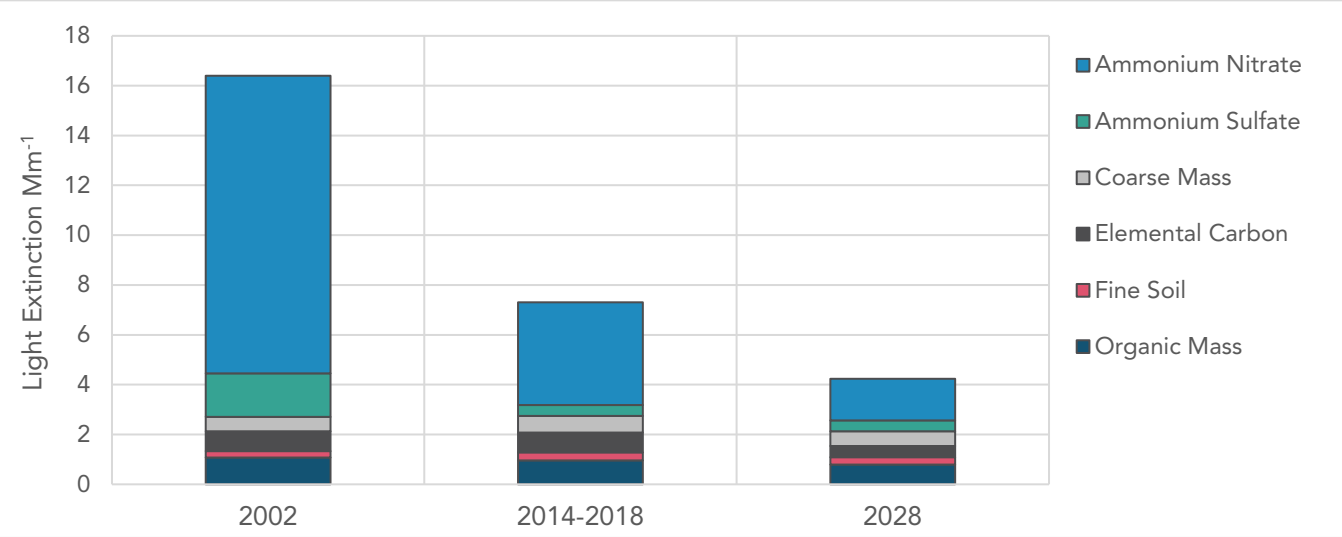
Figure C-102: Source Apportionment Modeling Results for DOME1 on the Most Impaired Days in 2014-2018



As shown in Figure C-103, ammonium nitrate is the dominant species in the portion of light extinction attributable to U.S. sources. The decreasing impact of ammonium nitrate on light extinction on the most impaired days is reflective of ongoing efforts to reduce NOx

emissions in California. Between the current period and 2028, the amount of light extinction from ammonium nitrate is projected to decrease by an additional 59 percent, signaling that emission control strategies are reducing visibility reducing PM in this Class I area.

Figure C-103: Light Extinction from PM Attributed to U.S. Anthropogenic Sources at DOME1 on the Most Impaired Days



The results of regional source apportionment modeling projections are shown in Figures C-104 and C-105. These results indicate that California mobile sources will continue to be the largest regional source of ammonium nitrate in 2028. The portion of light extinction from ammonium nitrate attributable to regional sources is more than four times larger than from ammonium sulfate. These results suggest that continued efforts focused on reducing emissions from the mobile source sector will continue to benefit visibility in the Domeland Wilderness Area.

Figure C-104: Regional Source Apportionment for Ammonium Nitrate from U.S. Anthropogenic Sources in 2028 at DOME1

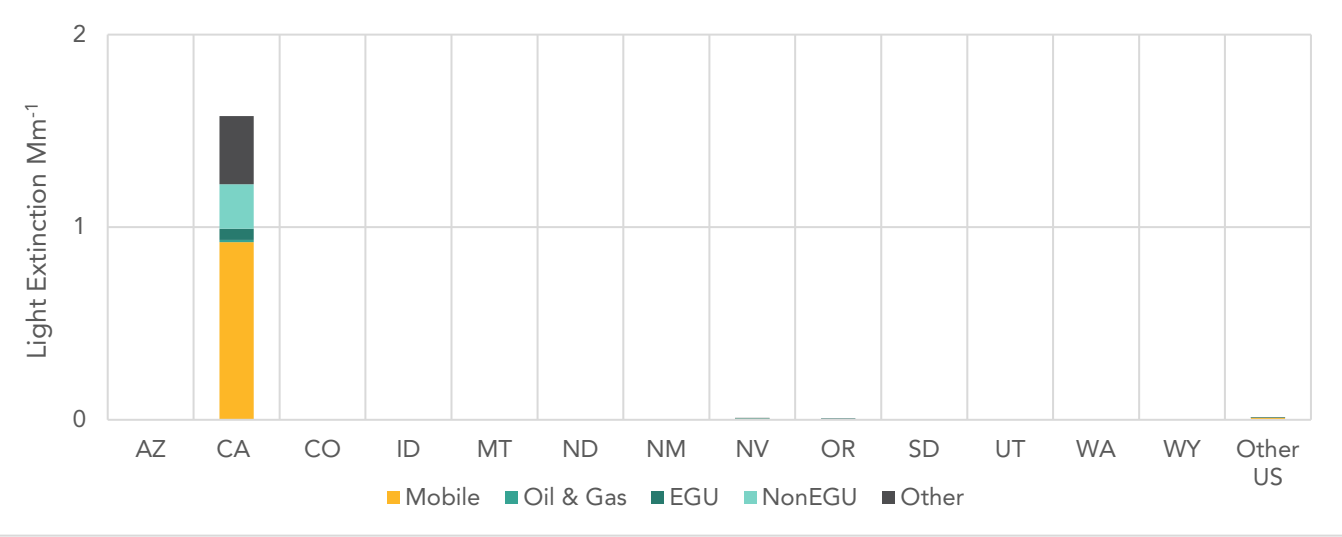
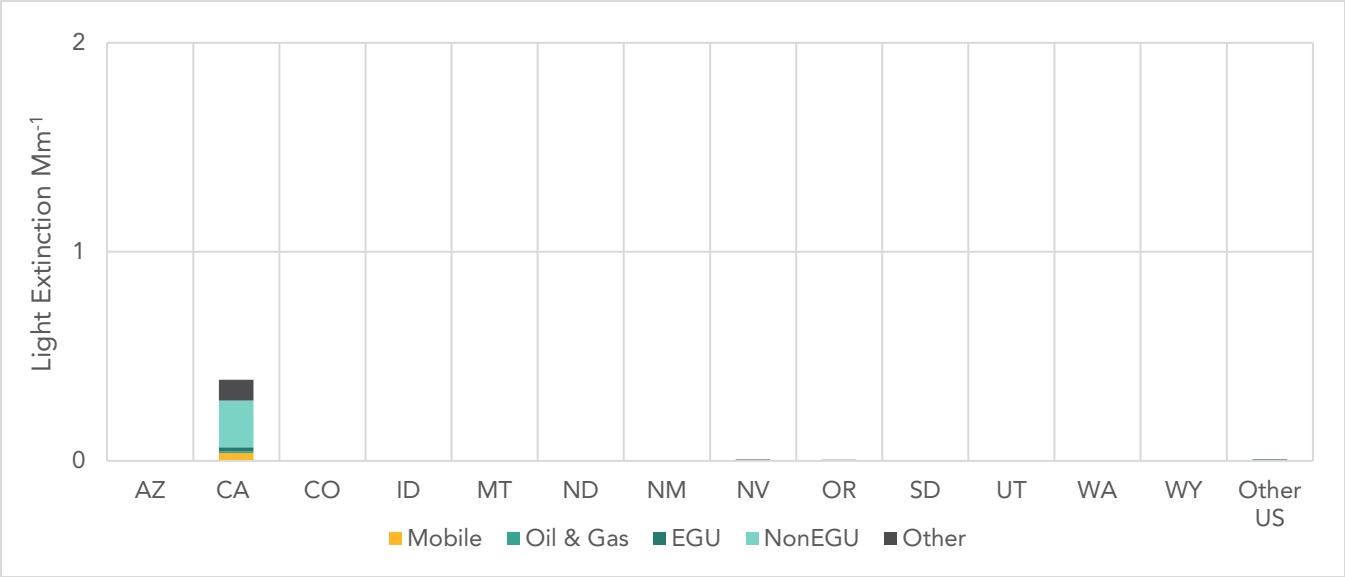


Figure C-105: Regional Source Apportionment for Ammonium Sulfate from U.S. Anthropogenic Sources in 2028 at DOME1



The current and projected trends for visibility tracking metrics in the Domeland Wilderness Area are shown in Figure C-106. Accounting for adopted emission controls and emission reduction commitments included in this Regional Haze Plan, visibility impairment on the most impaired days is projected to be 13.7 dv in 2028, which represents a visual range of 62 miles (99 km). This 2028 projection is below the adjusted glidepath that accounts for international and wildland prescribed fire emissions, indicating that this area is on track to reach 2064 visibility targets.

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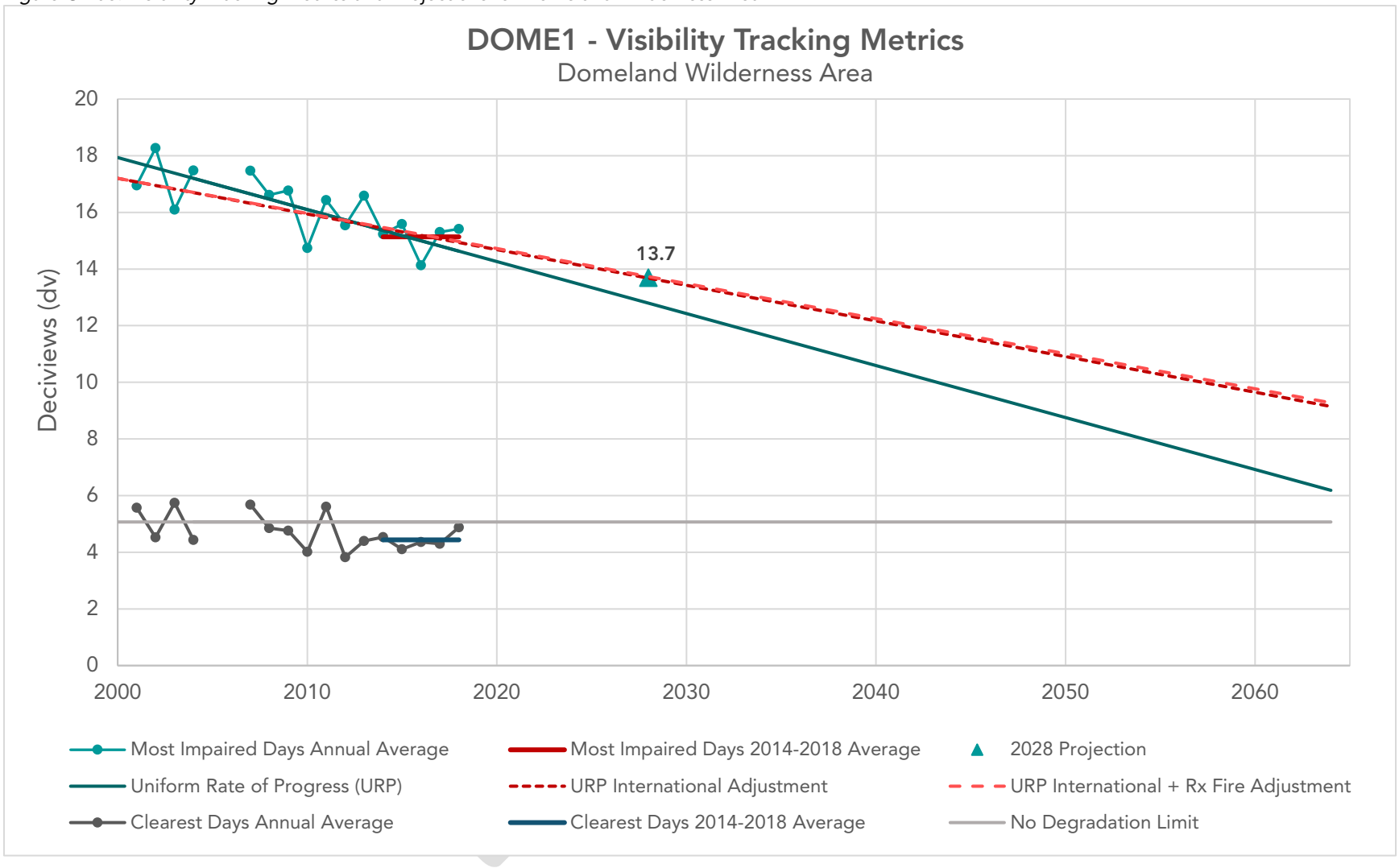
Figure C-106: Visibility Tracking Metrics and Projections for Domeland Wilderness Area



San Gabriel Wilderness Area (SAGA1) IMPROVE Monitoring Site

The SAGA1 monitoring site, shown in Figure C-107, is on the west side of the San Gabriel Wilderness Areas at 5,876 feet (1791 m) asl, adjacent to the Vetter Mountain Fire Lookout. The monitoring site was established in December 2001. Data collected at this site are representative of visibility conditions in the Cucamonga and San Gabriel Wilderness Areas.

Figure C-107: Photograph looking south toward the SAGA1 monitoring site

Photograph: http://vista.cira.colostate.edu/Improve/monitoring-site-browser/

The Cucamonga and San Gabriel Wilderness Areas span 9,022 acres and 36,137 acres, respectively. The landscape of the low elevation portion of the San Gabriel Wilderness Area is characterized by dense chaparral. The higher elevations of the San Gabriel and Cucamonga Wilderness Areas have dense fir and pine stands. More than 15 million people live within a 90-minute drive of these wilderness areas and both are very heavily used. The San Gabriel and Cucamonga Wilderness Areas are in the South Coast Air Basin. Emissions from the adjacent urban areas contribute to visibility impairment.

As shown in Table C-14, visibility impairment on the clearest days during the baseline period was 4.8 dv. Visibility impairment on the clearest days decreased by 2.6 dv between the baseline and the current periods. During the current period, visibility impairment was 2.8 dv, which is comparable to a visual range of 183 miles (295 km) in the San Gabriel and Cucamonga Wilderness Areas.

Visibility impairment on the most impaired days during the baseline period was 17.9 dv. Visibility impairment on the most impaired days decreased by 4.7 dv between the baseline

and the current periods. During the current period, visibility impairment was 13.2 dv, which is comparable to a visual range of 65 miles (104 km) in the San Gabriel and Cucamonga Wilderness Areas. The average rate of progress between the baseline and current periods was 0.34 dv per year. This rate is faster than the URP and double the adjusted URP.

Table C-14: Visibility Tracking Metrics for SAGA1

Days	Baseline (dv)	Current (dv)	Natural (dv)	Difference: Baseline - Current	Difference: Current - Natural	Uniform Rate of Progress (Adjusted)	Current Rate of Progress
Clearest	4.8	2.8	0.4	2.0 dv	2.4 dv	--	--
Most Impaired	17.9	13.2	6.1	4.7 dv	7.1 dv	0.20 dv/year (0.17 dv/year)	0.34 dv/year

Monitoring data, shown in Figures C-108 and C-109, indicate that ammonium nitrate and ammonium sulfate account for the largest portion of light extinction on the clearest days and the most impaired days at the SAGA1 monitor. Between the baseline period and the current period, light extinction from ammonium nitrate decreased by 55 percent on the clearest days and 64 percent on the most impaired days. Light extinction from ammonium sulfate decreased by 35 percent on the clearest days and by 25 percent on the most impaired days.

Figure C-108: Average Extinction Composition for SAGA1 on the Clearest Days

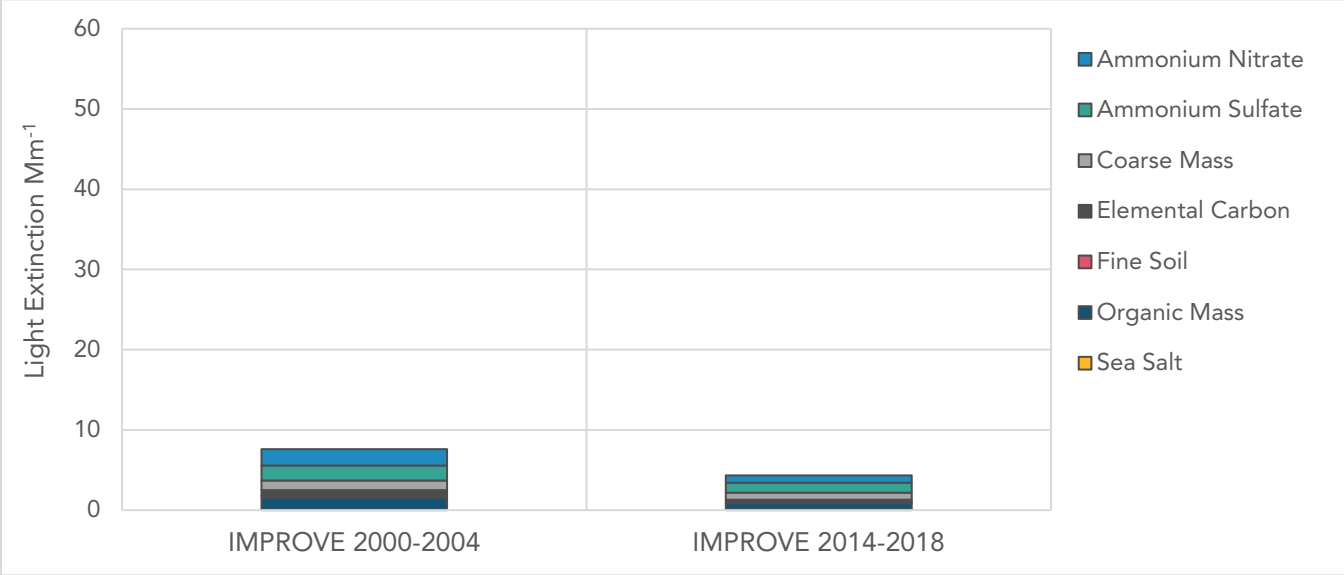


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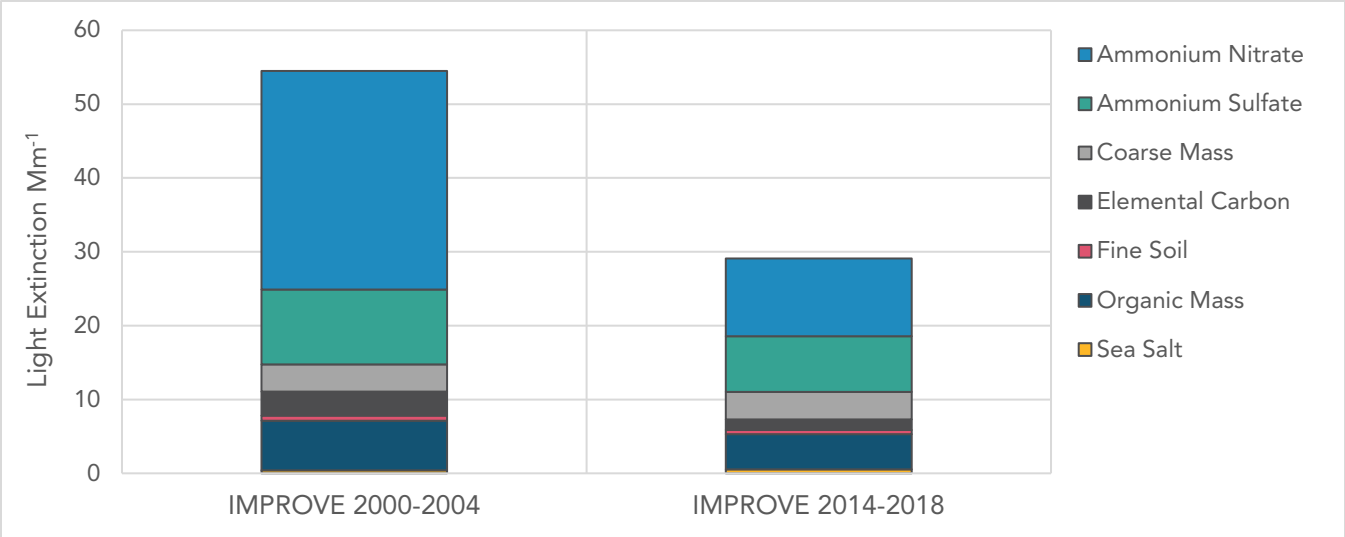
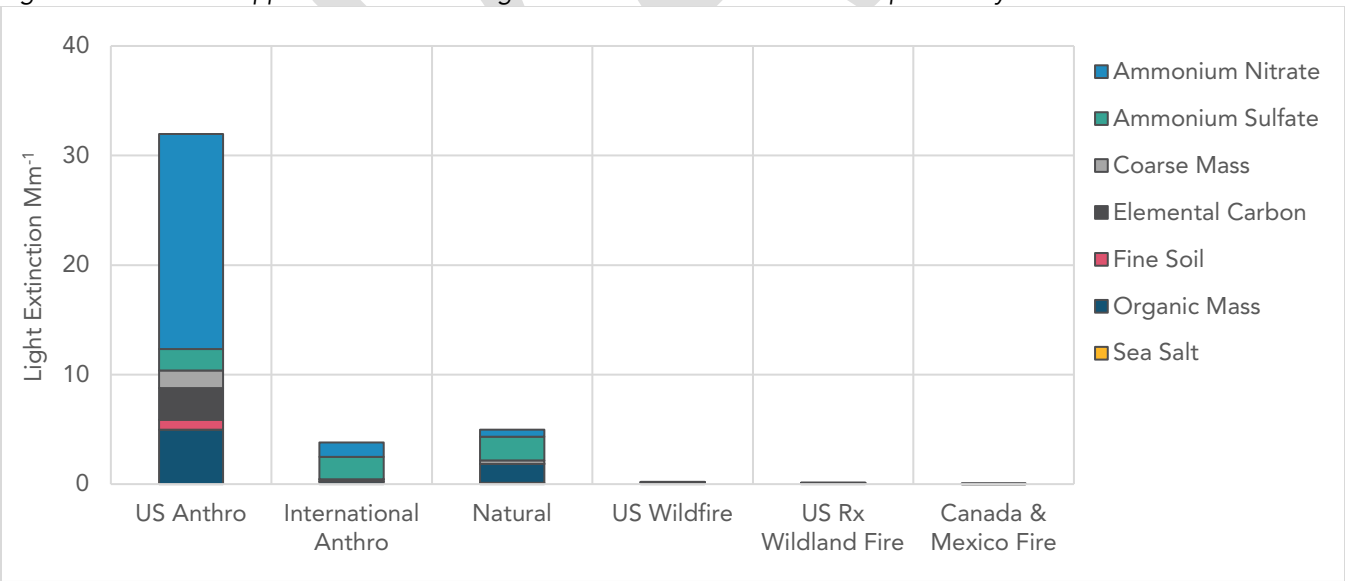
Figure C-109: Average Extinction Composition for SAGA1 on the Most Impaired Days



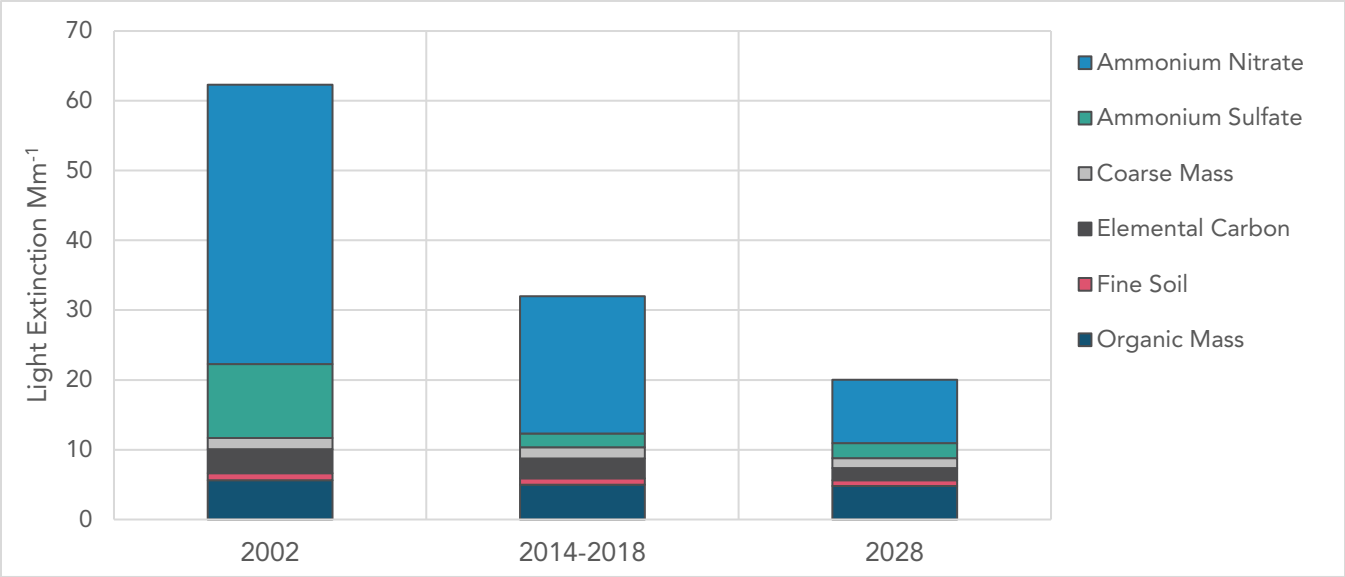
Source apportionment modeling, shown in Figure C-110, indicates that U.S. emissions account for the largest portion of light extinction measured at the SAGA1 monitoring site. Emissions from natural and international sources also contribute to visibility impairment. Ammonium nitrate accounts for the majority of light extinction attributable to U.S. sources. Ammonium sulfate accounts for the majority of light extinction attributable to international and natural sources.

Figure C-110: Source Apportionment Modeling Results for SAGA1 on the Most Impaired Days in 2014-2018



As shown in Figure C-111, ammonium nitrate attributable to U.S. sources is decreasing. Light extinction attributable to ammonium nitrate from U.S. sources is projected to decrease by an additional 54 percent on the most impaired days between the current period and 2028.

Figure C-111: Light Extinction from PM Attributed to U.S. Anthropogenic Sources at SAGA1 on the Most Impaired Days



Regional source apportionment projections are shown in Figures C-112 and C-113. The portion of light extinction attributable to ammonium nitrate from regional sources is more than four times larger than light extinction attributable to ammonium sulfate from regional sources. California mobile sources account for the largest share of ammonium nitrate attributable to regional sources. Continued efforts to reduce emissions from this sector will continue to yield visibility improvements for the Cucamonga and San Gabriel Wilderness Areas.

Figure C-112: Regional Source Apportionment for Ammonium Nitrate from U.S. Anthropogenic Sources in 2028 at SAGA1

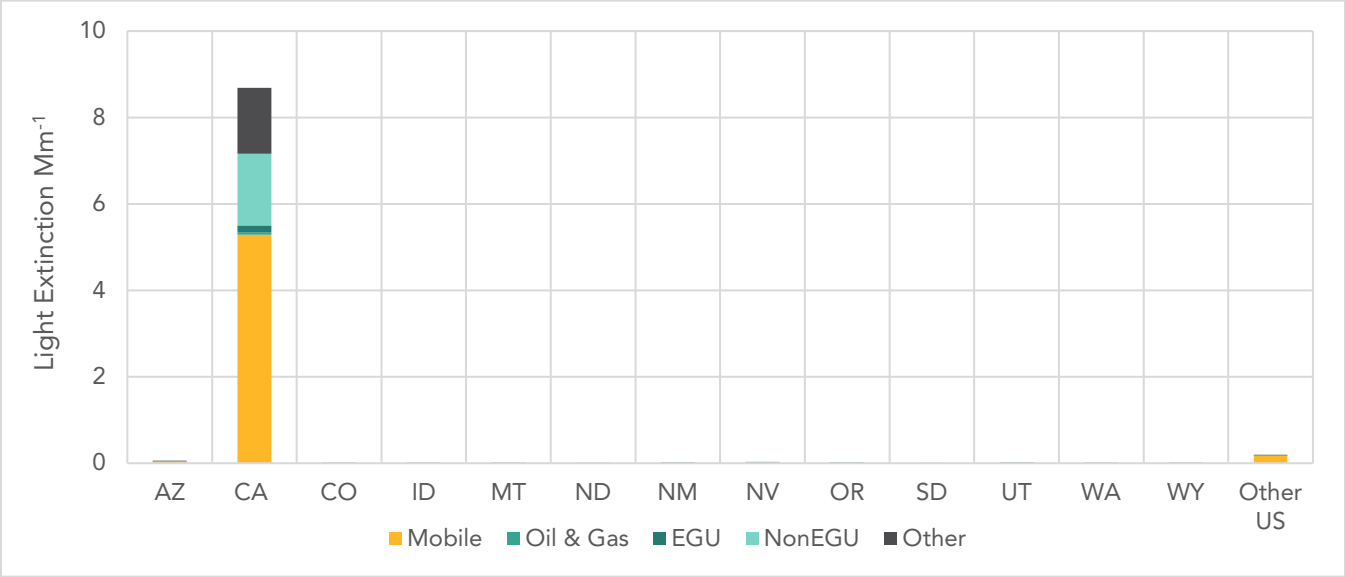
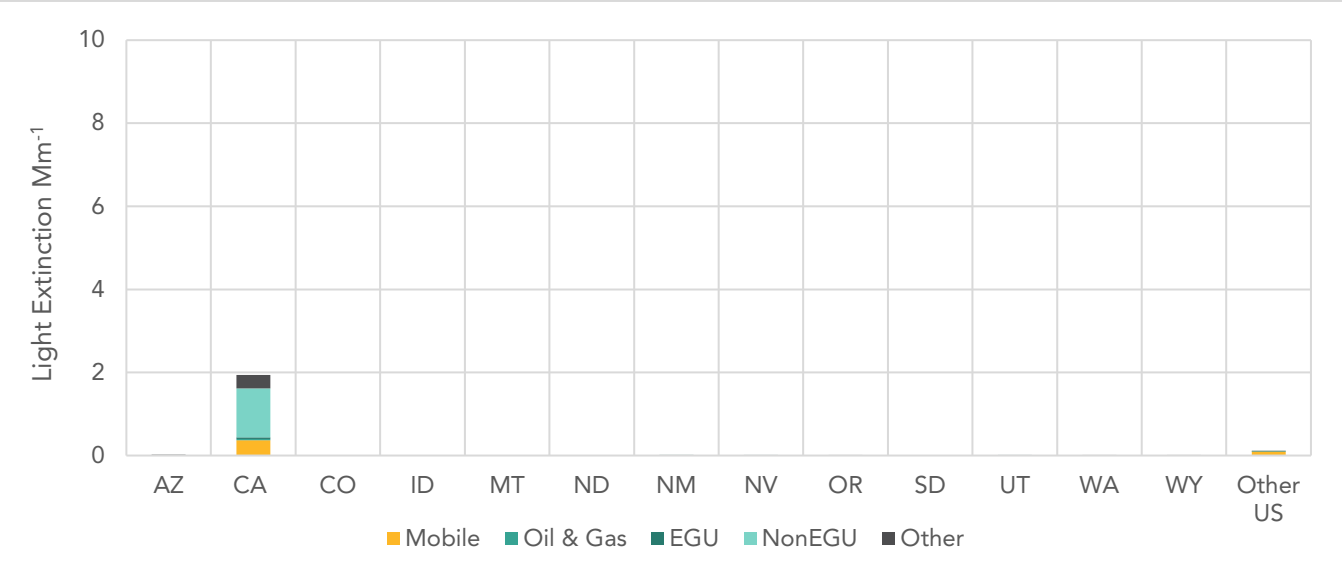


Figure C-113: Regional Source Apportionment for Ammonium Sulfate from U.S. Anthropogenic Sources in 2028 at SAGA1



The current and projected trends for visibility tracking metrics in the Cucamonga and San Gabriel Wilderness Areas are shown in Figure C-114. Accounting for adopted emission controls and emission reduction commitments included in this Regional Haze Plan, visibility on the most impaired days is projected to be 11.5 dv in 2028, which represents a visual range of 77 miles (123 km). This 2028 projection is below the adjusted glidepath adjusted that accounts for international and wildland prescribed fire emissions, indicating that these areas are on track to meet 2064 visibility targets.

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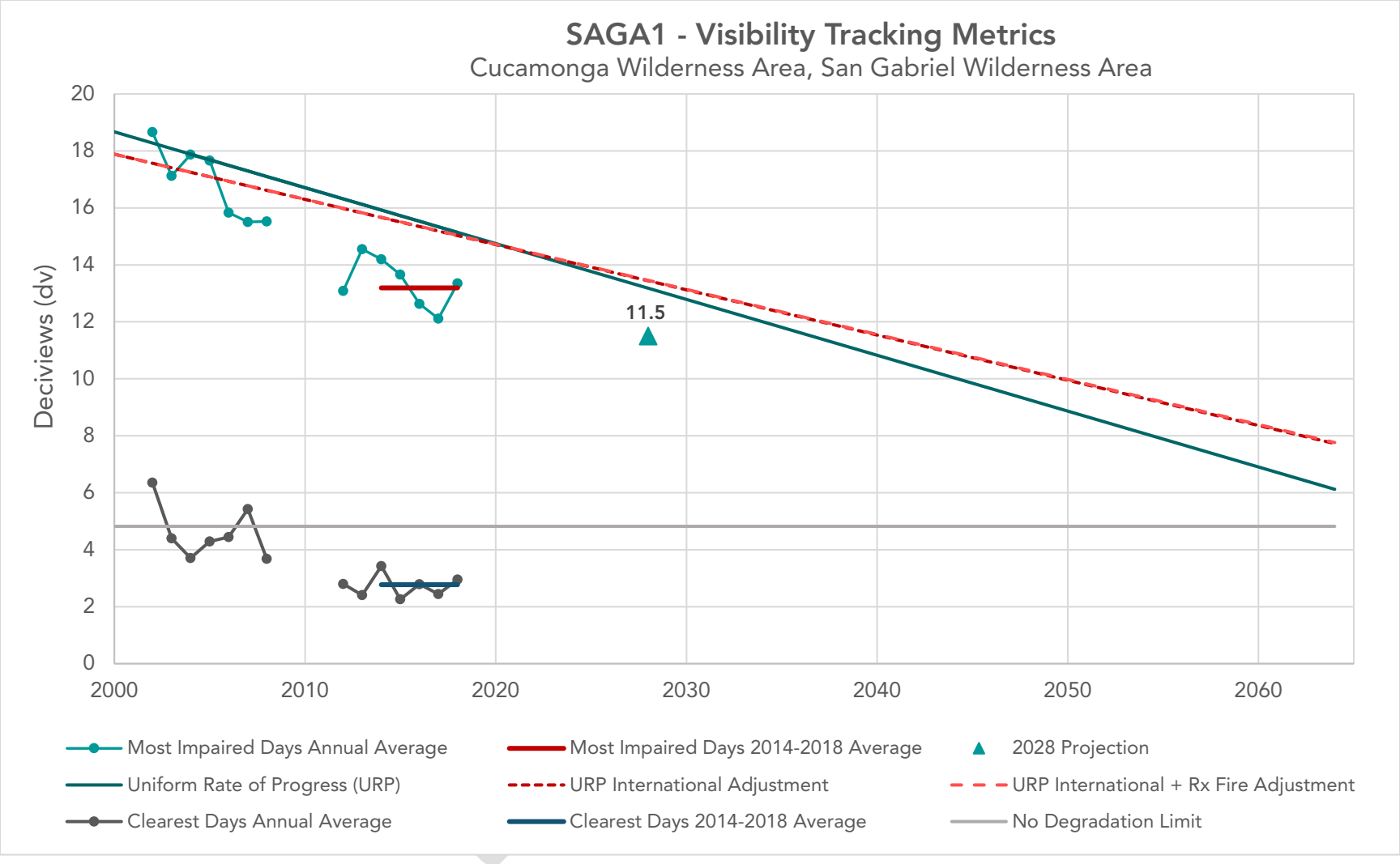
Figure C-114: Visibility Tracking Metrics and Projections for Cucamonga Wilderness Area and San Gabriel Wilderness Area



San Gorgonio Wilderness Area (SAGO1) IMPROVE Monitoring Site

The SAGO1 monitoring site, shown in Figure C-115, is located at 1,726 m asl near the northwest border of the San Gorgonio Wilderness Area. The monitoring site was established in March 1988 adjacent to the Converse Fire Station. The site is a couple of miles south of Big Bear Lake, a well-known recreational destination in southern California with ski areas and marinas. Data collected at the SAGO1 site are representative of visibility conditions in the San Gorgonio and San Jacinto Wilderness Areas.

Figure C-115: Photograph looking northwest toward the SAGO1 monitoring site

Photograph: http://vista.cira.colostate.edu/Improve/monitoring-site-browser/

The San Gorgonio Wilderness Area spans 34,644 acres. Terrain is forested and rugged with more than eleven peaks rising above 10,000 feet (3,048 m) asl. Like the San Gabriel and Cucamonga Wilderness Areas, the San Gorgonio Wilderness Area is in the South Coast Air Basin.

The San Jacinto Wilderness Area covers 20,564 acres. The northern portion is alpine terrain with dense pine stands. In contrast, the southern portion is high desert with dense chaparral. The San Jacinto Wilderness Area straddles the border of the South Coast and Salton Sea Air Basins. The San Gorgonio and San Jacinto Wilderness Areas are impacted by emissions from the upwind urban areas in the South Coast Air Basin.

As shown in Table C-15, visibility impairment on the clearest days during the baseline period was 5.4 dv. Visibility impairment on the clearest days decreased by 2.1 dv between the baseline and the current periods. During the current period, visibility impairment was 3.3 dv, which is comparable to a visual range of 174 miles (280 km) in the San Gorgonio and San Jacinto Wilderness Areas.

Visibility impairment on the most impaired days during the baseline period was 20.4 dv. Visibility impairment on the most impaired days decreased by 6.0 dv between the baseline period and the current period. During the current period, visibility impairment was 14.4 dv, which is equivalent to a visual range of 57 miles (92 km) in the San Gorgonio and San Jacinto Wilderness Areas. The rate of progress between the baseline and current periods amounted to an average of 0.43 dv per year. This rate is faster than the URP and more than double the adjusted URP.

Table C-15: Visibility Tracking Metrics for SAGO1

Days	Baseline (dv)	Current (dv)	Natural (dv)	Difference: Baseline - Current	Difference: Current - Natural	Uniform Rate of Progress (Adjusted)	Current Rate of Progress
Clearest	5.4	3.3	1.2	2.1 dv	2.1 dv	--	--
Most Impaired	20.4	14.4	6.2	6.0 dv	8.2 dv	0.24 dv/year (0.20 dv/year)	0.43 dv/year

Monitoring data, shown in Figures C-116 and C-117, indicate that ammonium sulfate accounts for the largest portion of light extinction on the clearest days and ammonium nitrate accounts for the largest portion of light extinction on the most impaired days at the SAGO1 monitoring site. Between the baseline period and the current period, light extinction from ammonium sulfate decreased by 39 percent on the clearest days and light extinction from ammonium nitrate decreased by 68 percent on the most impaired days.

Figure C-116: Average Extinction Composition for SAGO1 on the Clearest Days

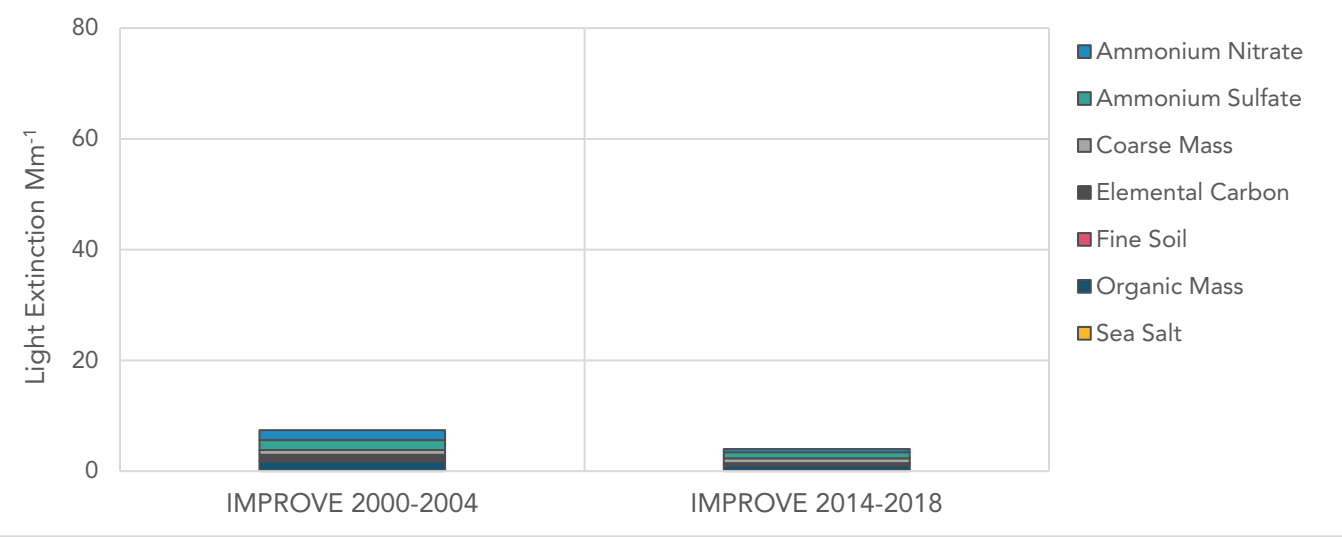
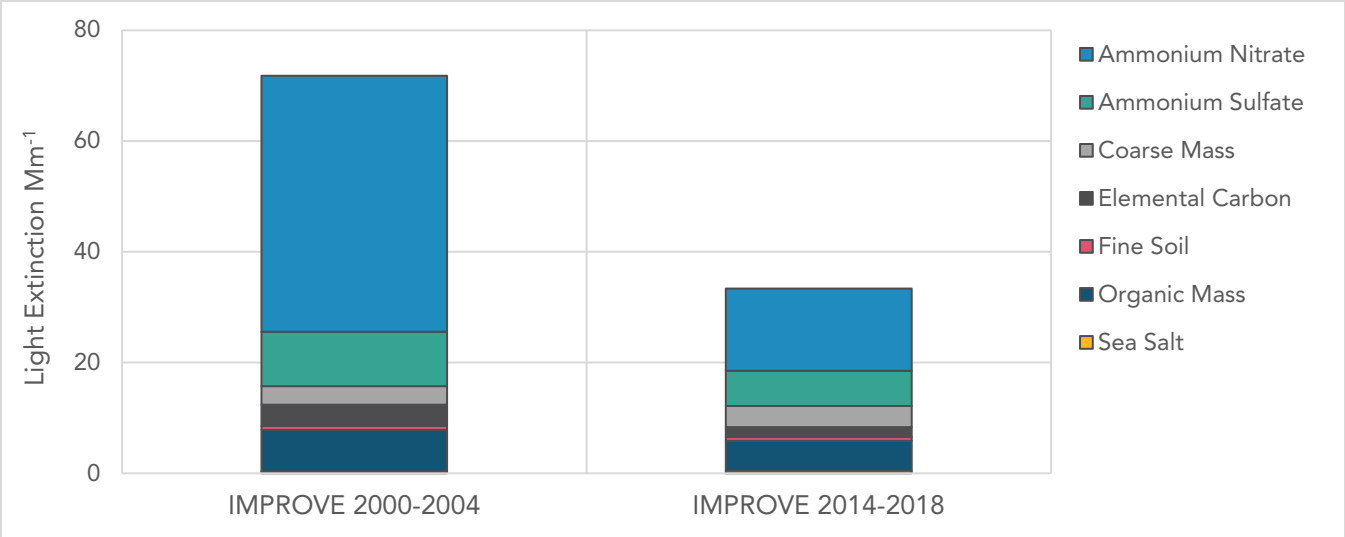
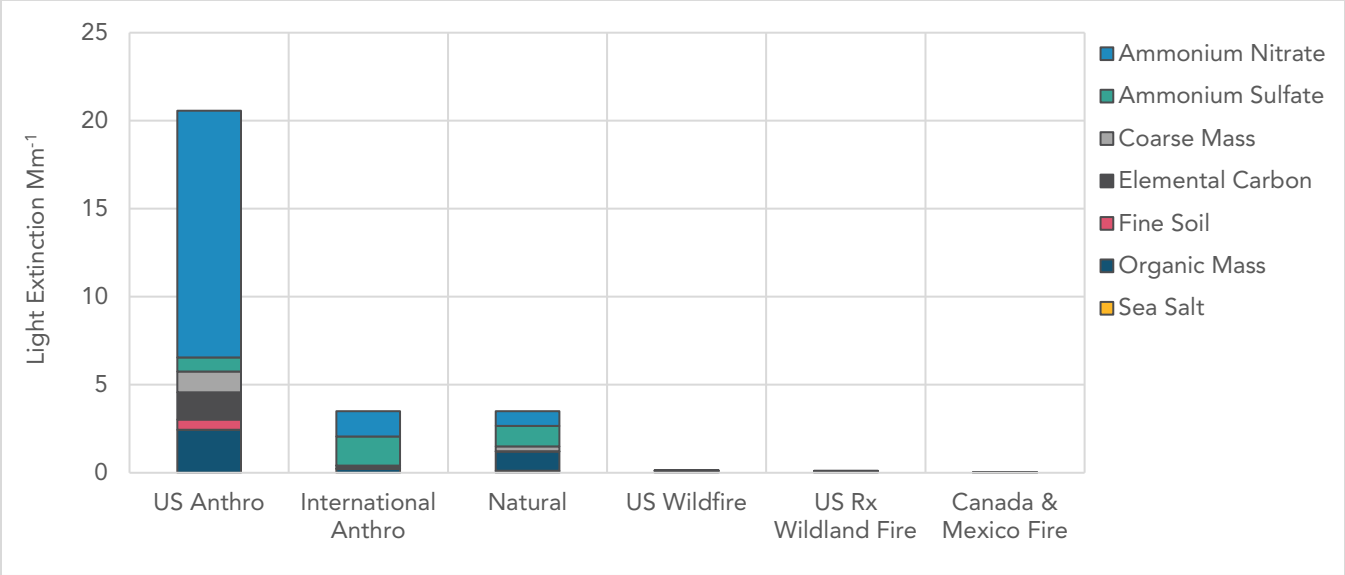


Figure C-117: Average Extinction Composition for SAGO1 on the Most Impaired Days



Source apportionment modeling, shown in Figure C-118, indicates that U.S. emissions account for the largest portion of light extinction on the most impaired days at the SAGO1 monitoring site. Emissions from international and natural sources also contribute to visibility impairment. Ammonium nitrate accounts for the largest portion of light extinction from U.S. sources and ammonium sulfate accounts for the largest portion of light extinction from the international and natural sources.

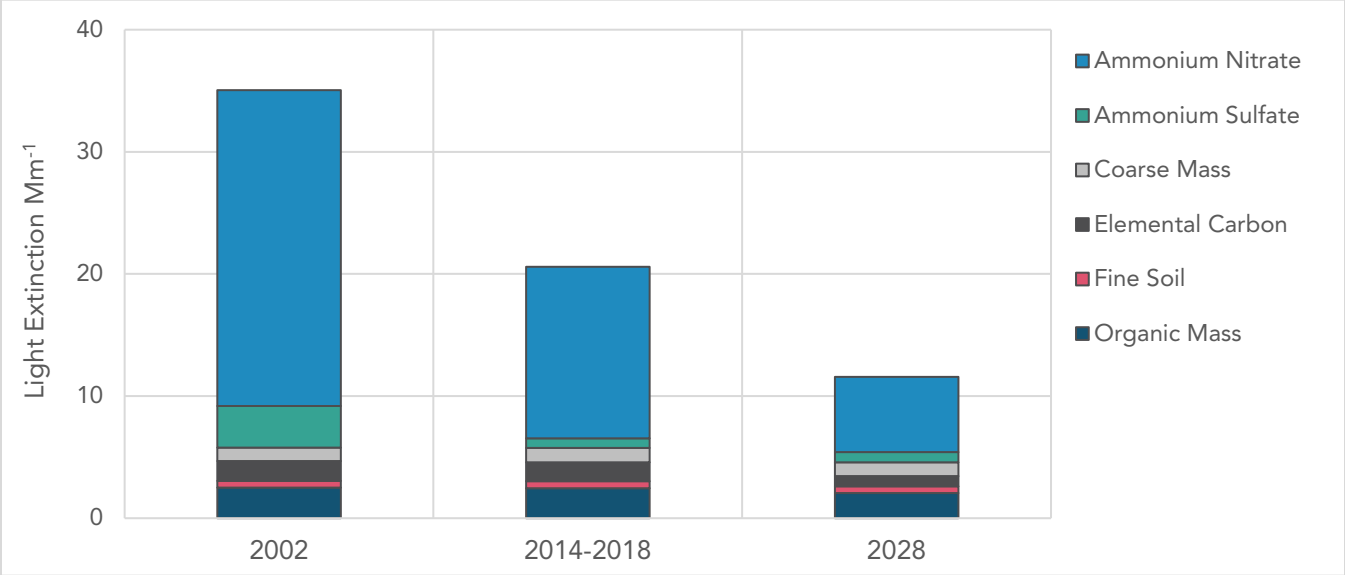
Figure C-118: Source Apportionment Modeling Results for SAGO1 on the Most Impaired Days in 2014-2018



As shown in Figure C-119, ammonium nitrate attributable to U.S. sources is decreasing. Emission control efforts are projected to decrease light extinction attributable to ammonium nitrate by an additional 56 percent between the current period and 2028. Ammonium nitrate

is projected to continue to account for the largest share of light extinction attributable to U.S. emission sources in 2028.

Figure C-119: Light Extinction from PM Attributed to U.S. Anthropogenic Sources at SAGO1 on the Most Impaired Days



Regional source apportionment projections are shown in Figures C-120 and C-121. Light extinction attributable to regional sources of ammonium nitrate is about ten times larger than light extinction attributable to regional sources of ammonium sulfate. California mobile sources continue to be the largest regional source of ammonium nitrate. California's strategy is focused on reducing NOx emissions from mobile sources. This strategy is expected to lead to visibility improvements in the San Gorgonio and San Jacinto Wilderness Areas.

Figure C-120: Regional Source Apportionment for Ammonium Nitrate from U.S. Anthropogenic Sources in 2028 at SAGO1

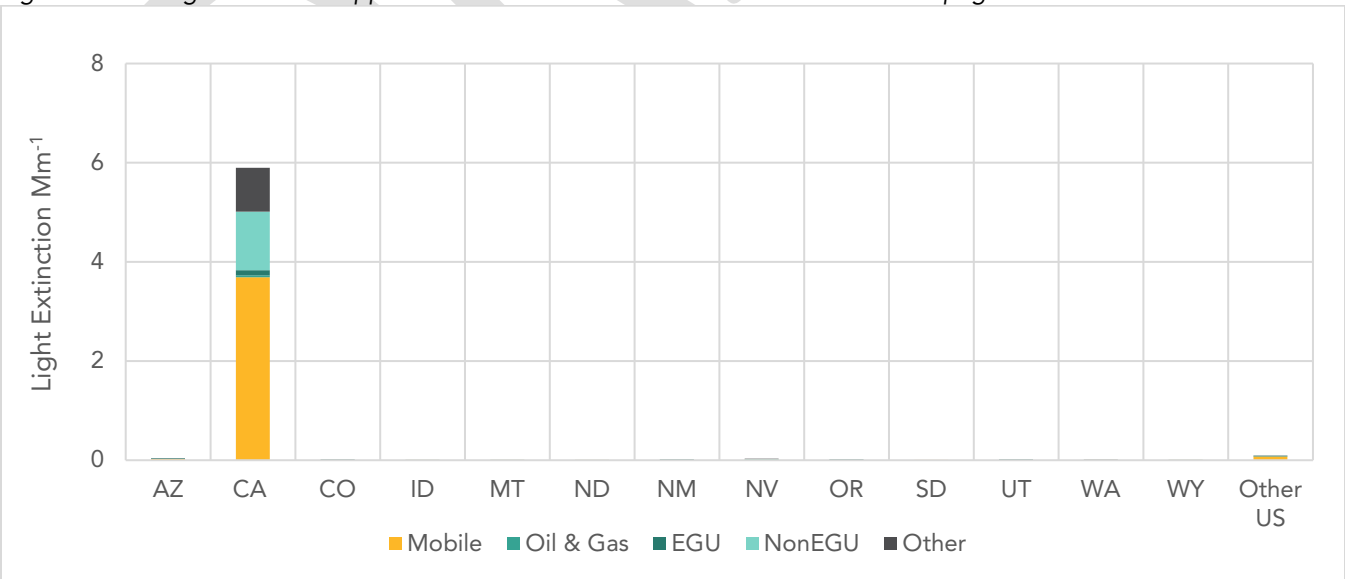
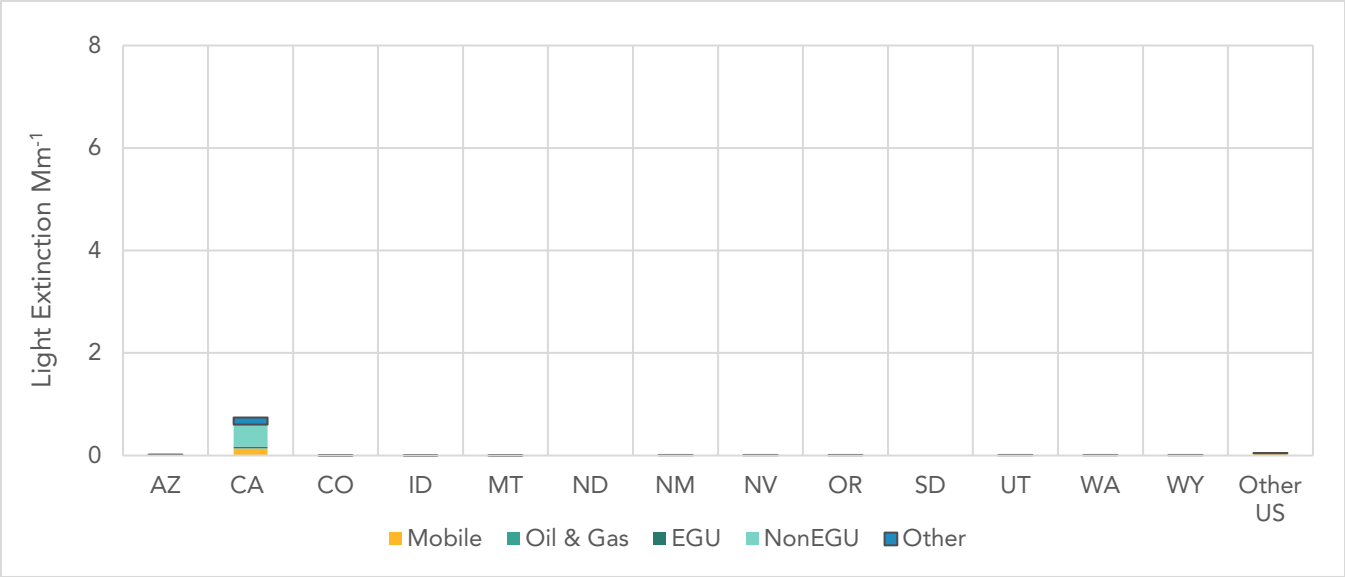


Figure C-121: Regional Source Apportionment for Ammonium Sulfate from U.S. Anthropogenic Sources in 2028 at SAGO1



The current and projected trends for visibility tracking metrics at the San Gorgonio and San Jacinto Wilderness Areas are shown in Figure C-122. Accounting for adopted emission controls and emission reduction commitments included in this Regional Haze Plan, visibility on the most impaired days is projected to be 12.0 dv in 2028, which represents a visual range of 73 miles (117 km). This 2028 projection is below the adjusted glidepath that accounts for international and wildland prescribed fire emissions, indicating that these areas are on track to meet 2064 visibility targets.

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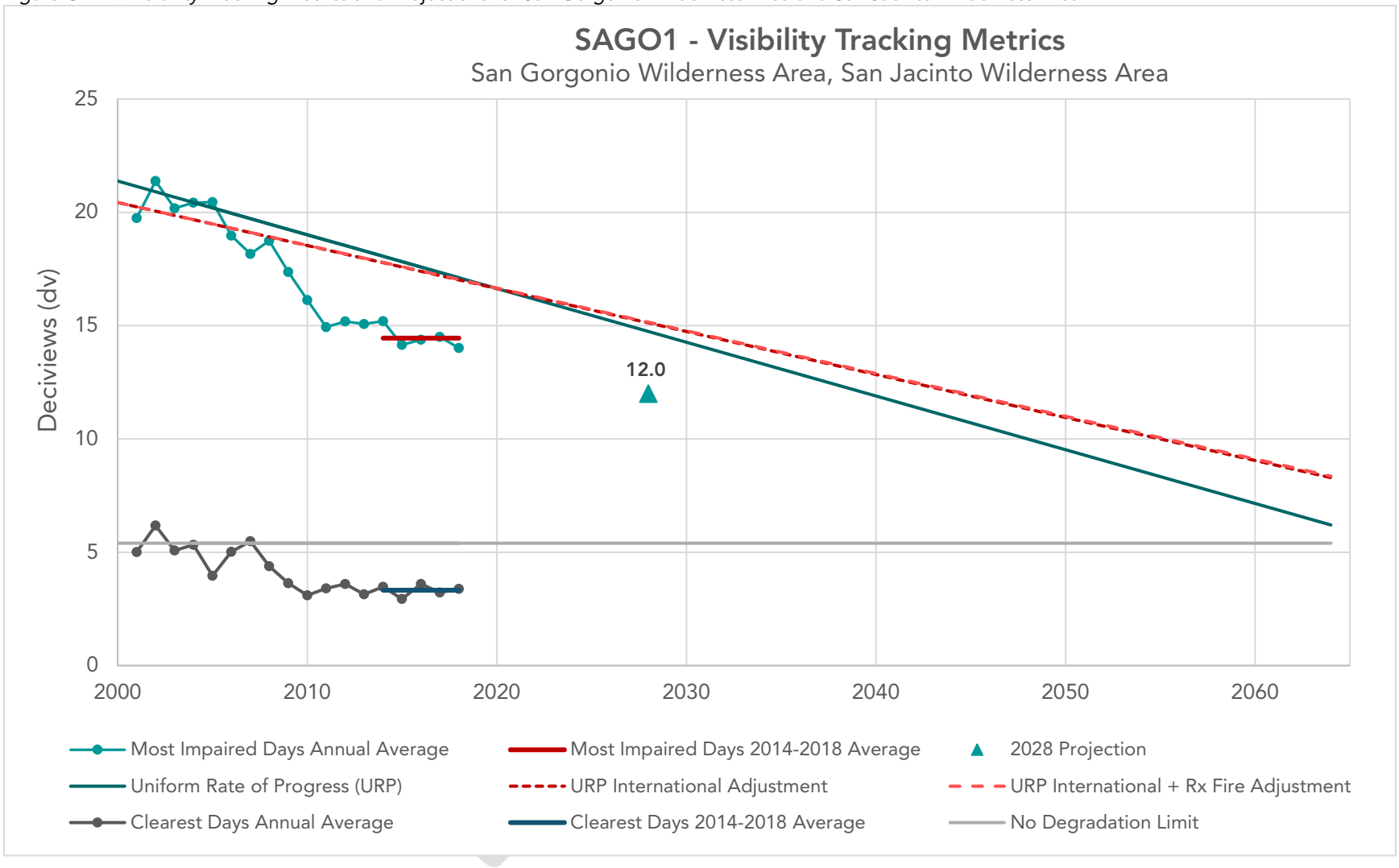
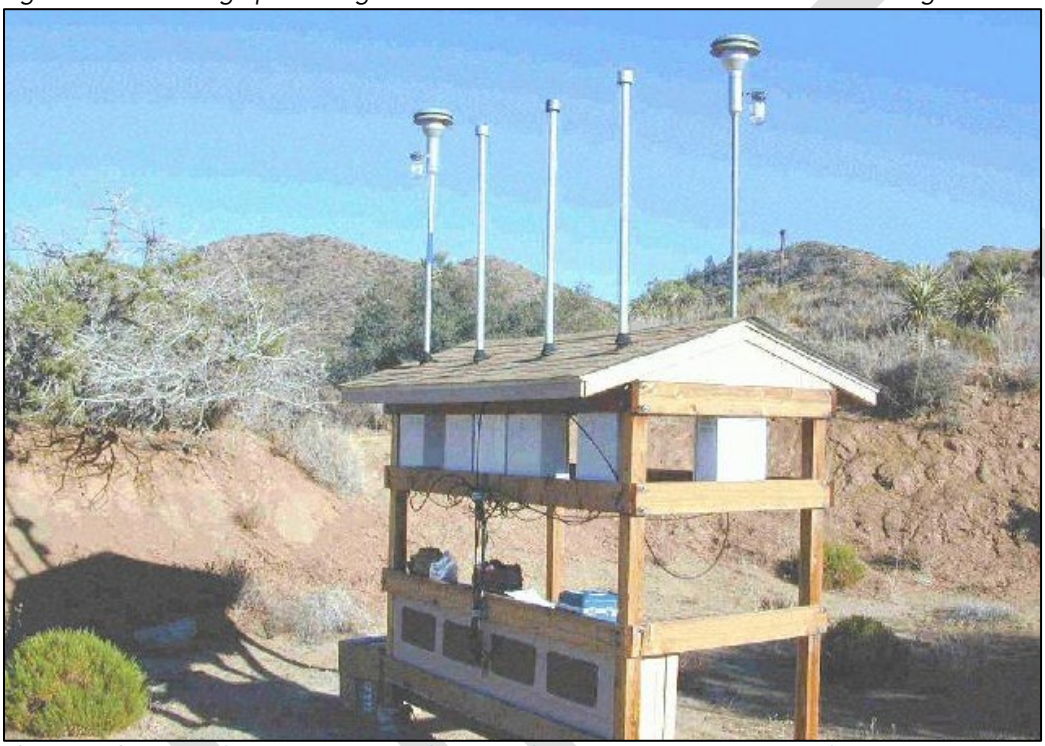
Figure C-122: Visibility Tracking Metrics and Projections for San Gorgonio Wilderness Area and San Jacinto Wilderness Area



Joshua Tree National Park (JOSH1) IMPROVE Monitoring Site

The JOSH1 monitoring site, shown below in Figure C-123, is in the western portion of Joshua Tree National Park at 4,051 feet (1,235 m) asl. The monitoring site was established in February 2000. The monitor is on the southern edge of Black Rock Campground, which has 99 developed camp sites. The town of Yucca Valley, with a population of around 20,000 people, is about 5 miles away. Data collected at the JOSH1 site are representative of visibility conditions in Joshua Tree National Park.

Figure C-123: Photograph looking northeast towards the JOSH1 IMPROVE Monitoring Site



Photograph Source: https://vista.cira.colostate.edu/Improve/monitoring-site-browser

Joshua Tree National Park spans 429,690 acres and includes vast portions of the Colorado and Mojave Deserts. The landscape is varied, ranging from dry lakebeds and sand dunes to rugged mountains. Joshua Tree National Park straddles the border of the Mojave Desert and Salton Sea Air Basins. Emissions from the adjacent urban areas contribute to visibility impairment.

As shown in Table C-16, visibility impairment on the clearest days during the baseline period was 6.1 dv. Visibility impairment on the clearest days decreased by 1.4 dv between the baseline and the current periods. During the current period, visibility impairment was 4.7 dv, which is comparable to a visual range of 151 miles (244 km) at Joshua Tree National Park.

Visibility impairment on the most impaired days during the baseline period was 17.7 dv. On the most impaired days, impairment decreased by 4.8 dv between the baseline and the

current periods. During the current period, visibility impairment was 12.9 dv, which is comparable to a visual range of 67 miles (107 km) at Joshua Tree National Park. The average rate of progress between the baseline period and the current period was 0.34 dv per year. This rate is faster than the URP and more than double the adjusted URP.

Table C-16: Visibility Tracking Metrics for JOSH1

Days	Baseline (dv)	Current (dv)	Natural (dv)	Difference: Baseline - Current	Difference: Current - Natural	Uniform Rate of Progress (Adjusted)	Current Rate of Progress
Clearest	6.1	4.7	1.7	1.4 dv	3.0 dv	--	--
Most Impaired	17.7	12.9	6.1	4.8 dv	6.8 dv	0.19 dv/year (0.15 dv/year)	0.34 dv/year

Monitoring data, shown in Figures C-124 and C-125, indicate that ammonium sulfate accounts for the largest portion of light extinction on the clearest days. Between the baseline monitoring period and the current period, light extinction from ammonium sulfate decreased by 37 percent on the clearest days. On the most impaired days, ammonium nitrate coupled with ammonium sulfate accounts for the most light extinction. Between the baseline monitoring period and the current period, light extinction from ammonium nitrate decreased by 78 percent and light extinction from ammonium sulfate decreased by 10 percent on the most impaired days.

Figure C-124: Average Extinction Composition for JOSH1 on the Clearest Days

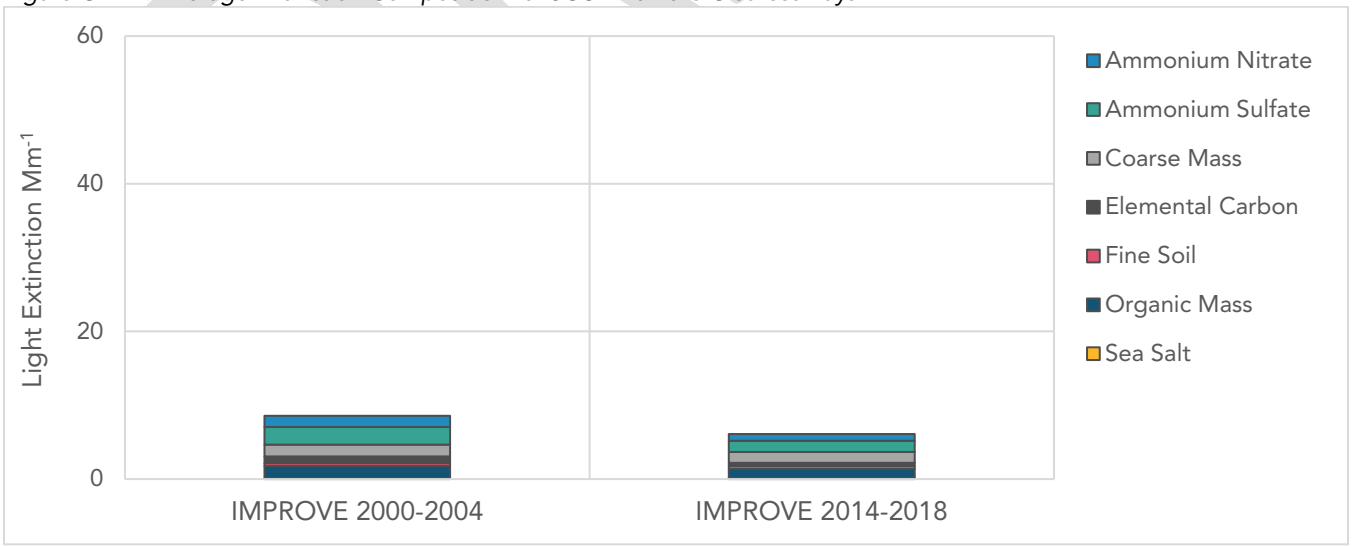


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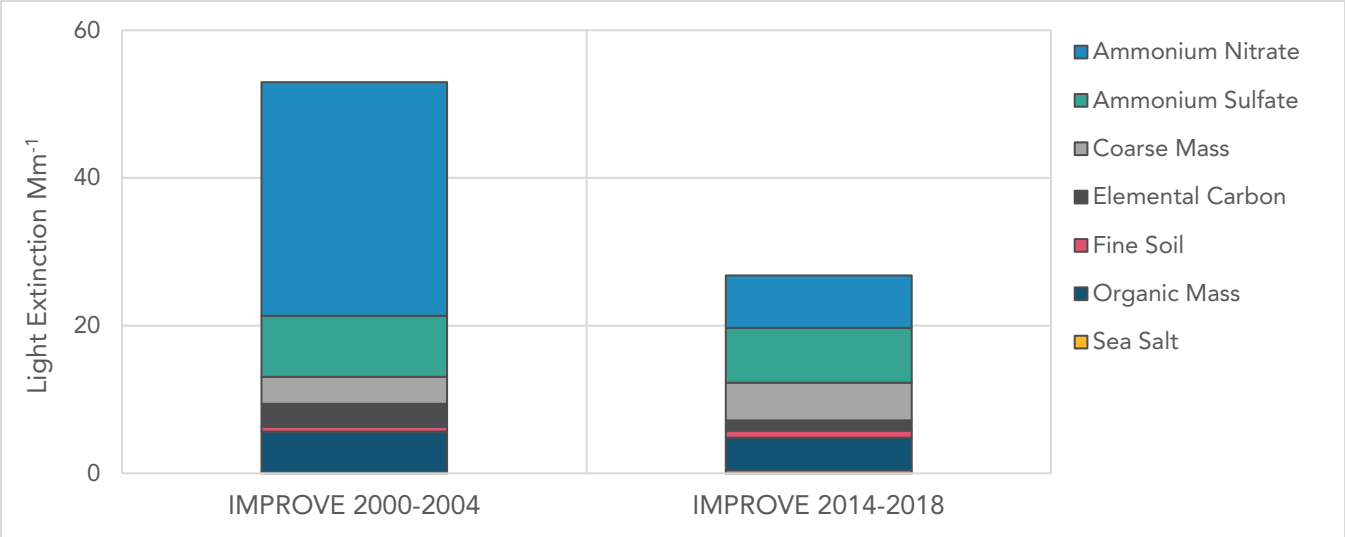
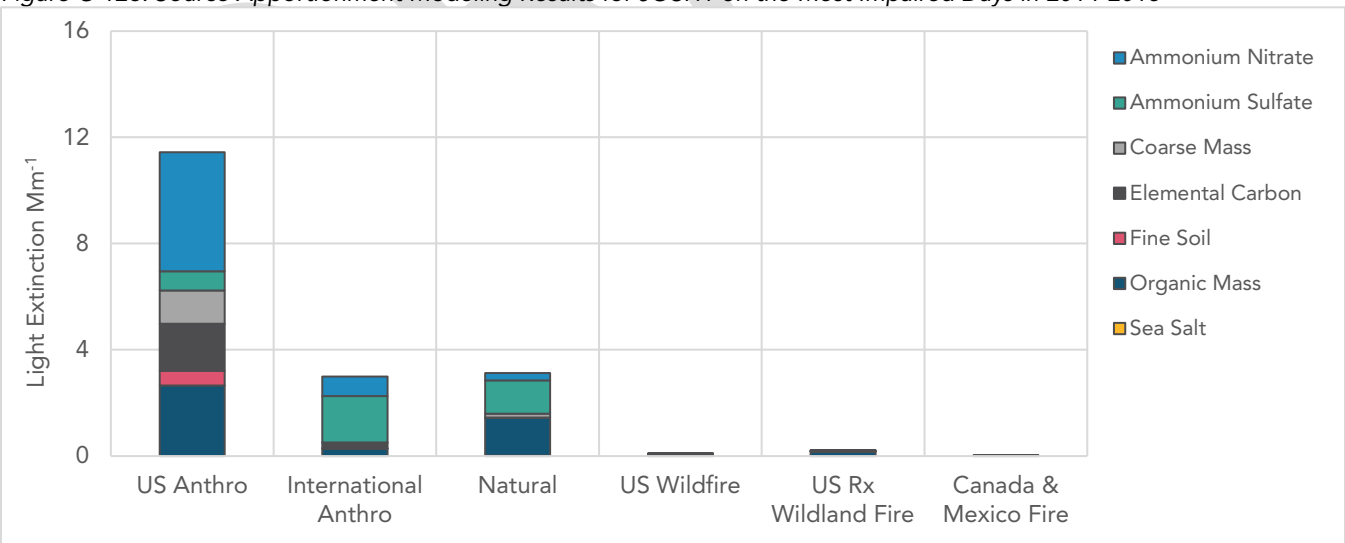
Figure C-125: Average Extinction Composition for JOSH1 on the Most Impaired Days



Source apportionment modeling, shown in Figure C-126, indicates that U.S. emissions make the largest contribution to light extinction measured at the JOSH1 monitoring site on the most impaired days. Emissions from natural and international sources also contribute to visibility impairment. Ammonium nitrate accounts for the largest share of light extinction attributable to U.S. sources. Ammonium sulfate accounts for the largest share of light extiction attributable to international sources and organic mass, closely followed by ammonium sulfate, accounts for the largest share of light extinction attributable to natural sources.

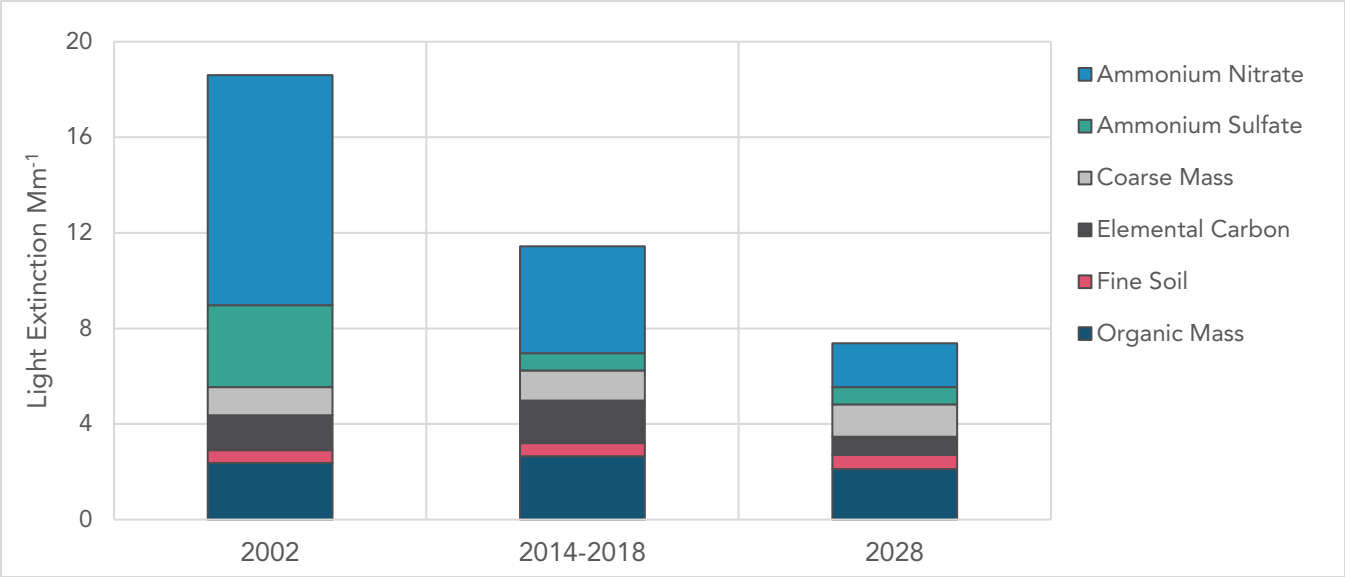
Figure C-126: Source Apportionment Modeling Results for JOSH1 on the Most Impaired Days in 2014-2018



Similar to other areas in this region and the rest of California, ammonium nitrate attributable to U.S. sources has been decreasing. As shown in Figure C-127, between the current period

and 2028, light extinction attributable to U.S. sources is projected to decrease by an additional 60 percent. In 2028, organic mass is projected to account for the largest share of light extinction on the most impaired days, suggesting that low level source apportionment for this PM species may be needed in the next planning period.

Figure C-127: Light Extinction from PM Attributed to U.S. Anthropogenic Sources at JOSH1 on the Most Impaired Days



Regional source apportionment projections are shown in Figures C-128 and C-129. Light extinction attributable to regional sources of ammonium nitrate is about three times larger than light extinction attributable to regional sources of ammonium sulfate. California mobile sources continue to represent the largest regional source of ammonium nitrate in 2028.

Figure C-128: Regional Source Apportionment for Ammonium Nitrate from U.S. Anthropogenic Sources in 2028 at JOSH1

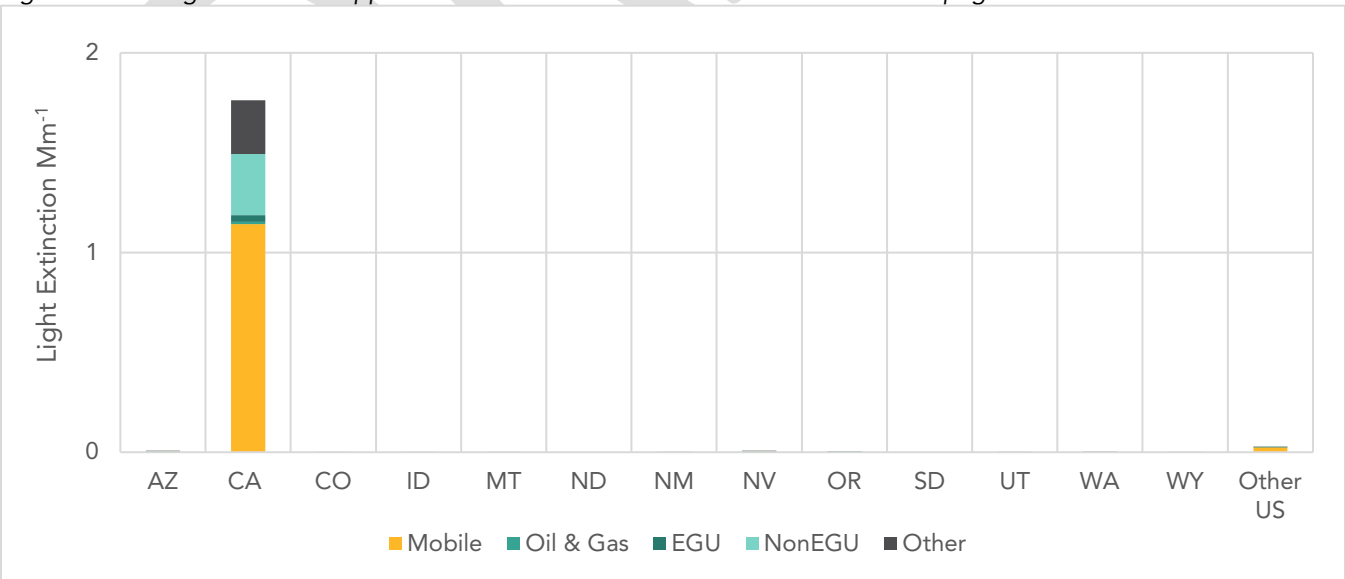
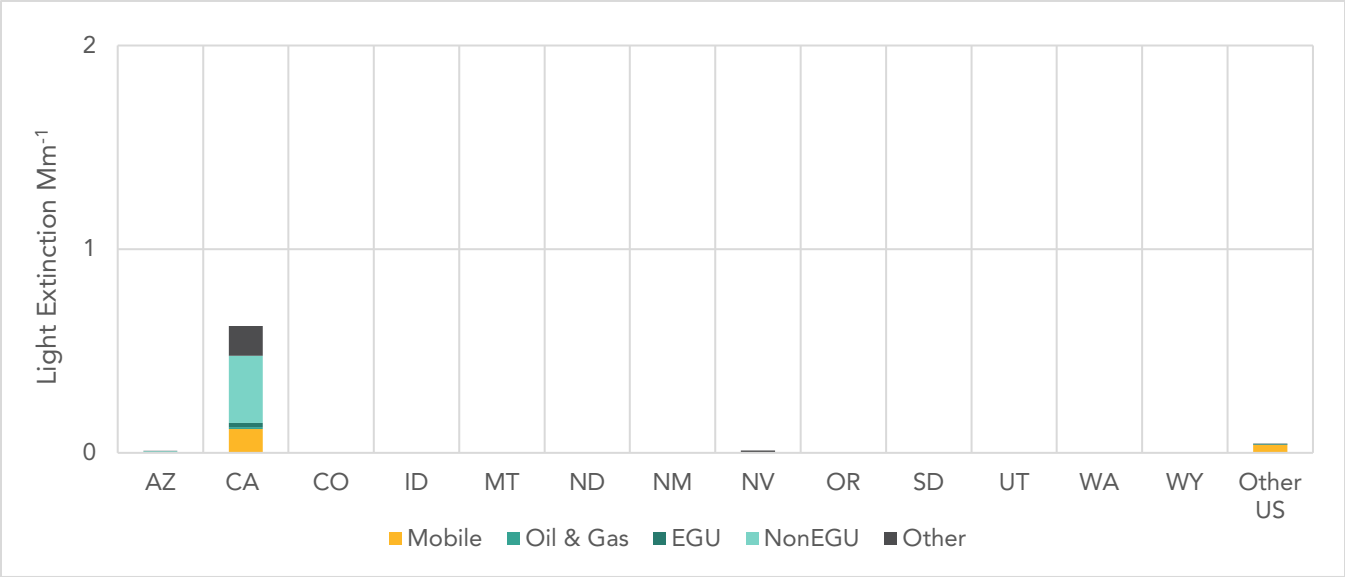


Figure C-129: Regional Source Apportionment for Ammonium Sulfate from U.S. Anthropogenic Sources in 2028 at JOSH1



The current and projected trends for visibility tracking metrics at Joshua Tree National Park are shown in Figure C-130. Accounting for adopted emission controls and the emission reduction commitment made in this Regional Haze Plan, visibility impairment on the most impaired days is projected to be 11.3 dv in 2028, which represents a visual range of 78 miles (126 km). This 2028 projection is below the adjusted glidepath that accounts for international and wildland prescribed fire emissions, indicating this area is on track to meet 2064 visibility targets.

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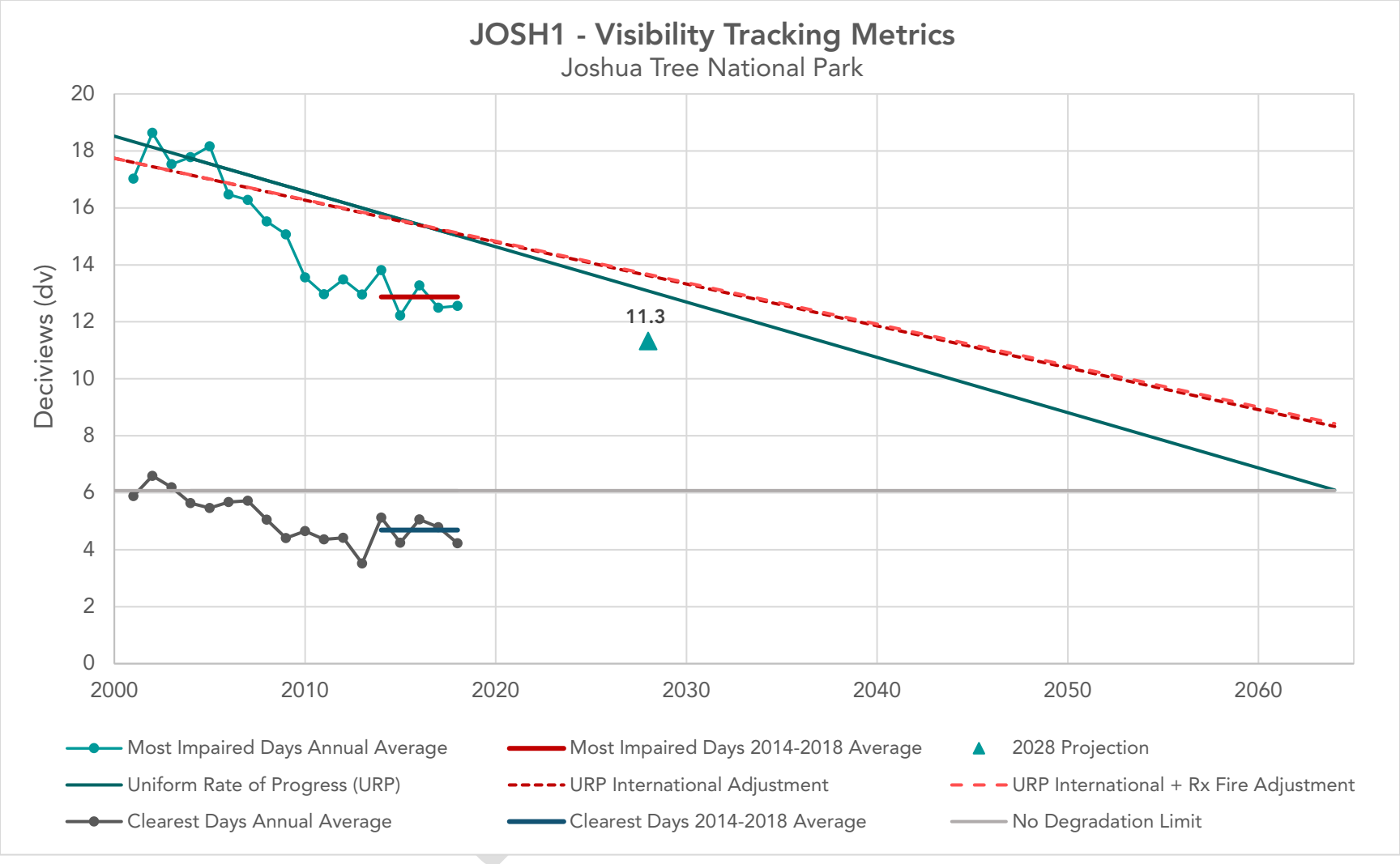
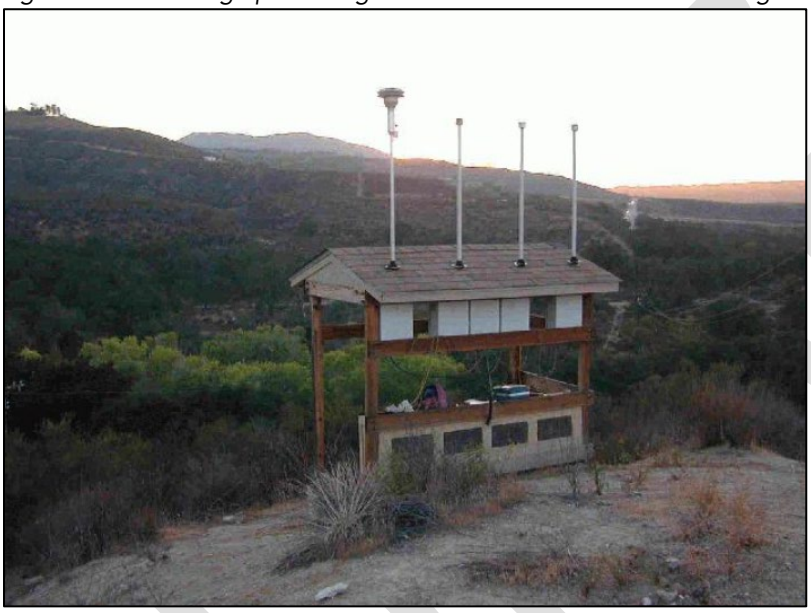
Figure C-130: Visibility Tracking Metrics and Projections for Joshua Tree National Park



Agua Tibia Wilderness Area (AGTI1) IMPROVE Monitoring Site

The AGTI1 monitoring site, shown in Figure C-131, is in the northern portion of the Agua Tibia Wilderness Area at 1663 feet (507 m) asl. The monitoring site was established in December 2000, south of California State Highway 79. Dripping Springs Campground is just south of the monitoring site and has 34 developed camp sites that are lightly used. Vail Lake, a municipal water storage reservoir and recreation destination is north of the site. The Temecula Valley wine grape growing area is northwest of Vail Lake. Interstate 15, the major connector between San Bernardino, Riverside, and San Diego Counties is about ten miles west of the site. Data collected at the AGTI1 site are representative of visibility conditions in the Agua Tibia Wilderness Area.

Figure C-131: Photograph looking southwest toward AGTI1 Monitoring Site



Photograph Source: https://vista.cira.colostate.edu/Improve/monitoring-site-browser

The Agua Tibia Wilderness Area is 15,934 acres in size with steep, densely forested terrain. Elevation ranges from 1,615 to 4,763 feet (492 to 1452 m) asl. The Agua Tibia Wilderness Area straddles the border between the South Coast and San Diego County Air Basins. Emissions from adjacent urban areas contribute to visibility impairment.

As shown in Table C-17, visibility impairment on the clearest days during the baseline period was 9.6 dv. Visibility impairment on the clearest days decreased by 2.6 dv between the baseline and the current periods. During the current period, visibility impairment was 7.0 dv, which is equivalent to a visual range of 120 miles (194 km) in the Agua Tibia Wilderness Area.

Visibility impairment on the most impaired days during the baseline period was 21.6 dv. Visibility impairment on the most impaired days decreased by 5.3 dv between the baseline period and the current period. During the current period, visibility impairment was 16.3 dv,

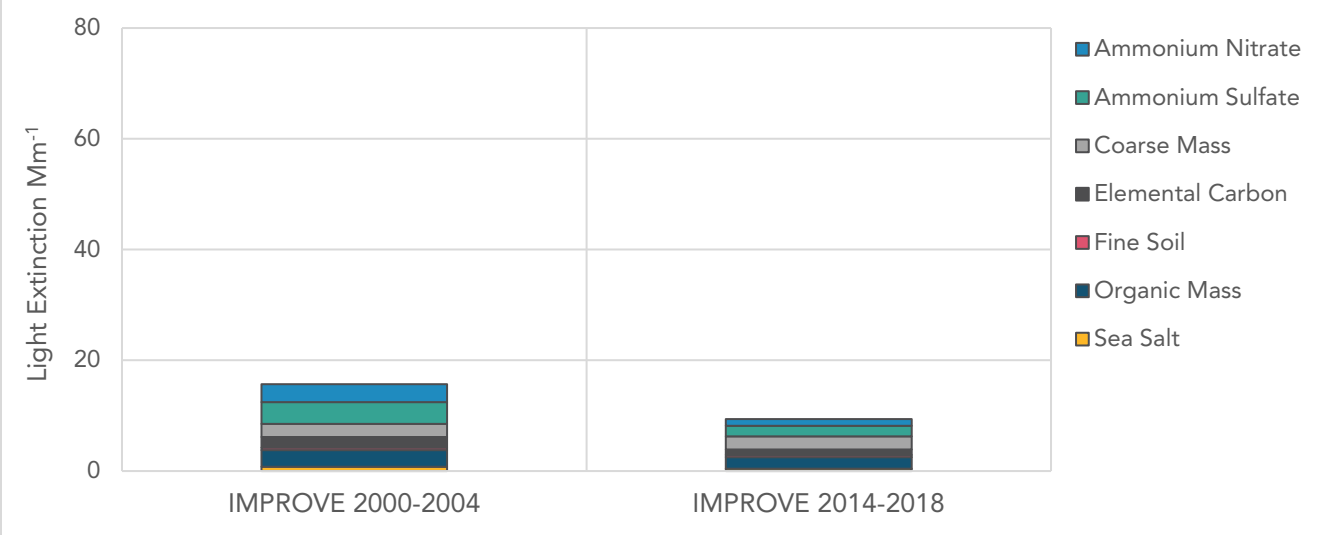
which is equivalent to a visual range of 47 miles (76 km) in the Agua Tibia Wilderness Area. The average rate of progress between the baseline and current periods was 0.38 dv per year. This rate is greater than the URP and more than double the adjusted URP.

Table C-17: Visibility Tracking Metrics for AGTI1

Days	Baseline (dv)	Current (dv)	Natural (dv)	Difference: Baseline - Current	Difference: Current - Natural	Uniform Rate of Progress (Adjusted)	Current Rate of Progress
Clearest	9.6	7.0	2.9	2.6 dv	4.1 dv	--	--
Most Impaired	21.6	16.3	7.7	5.3 dv	8.6 dv	0.23 dv/year (0.18 dv/year)	0.38 dv/year

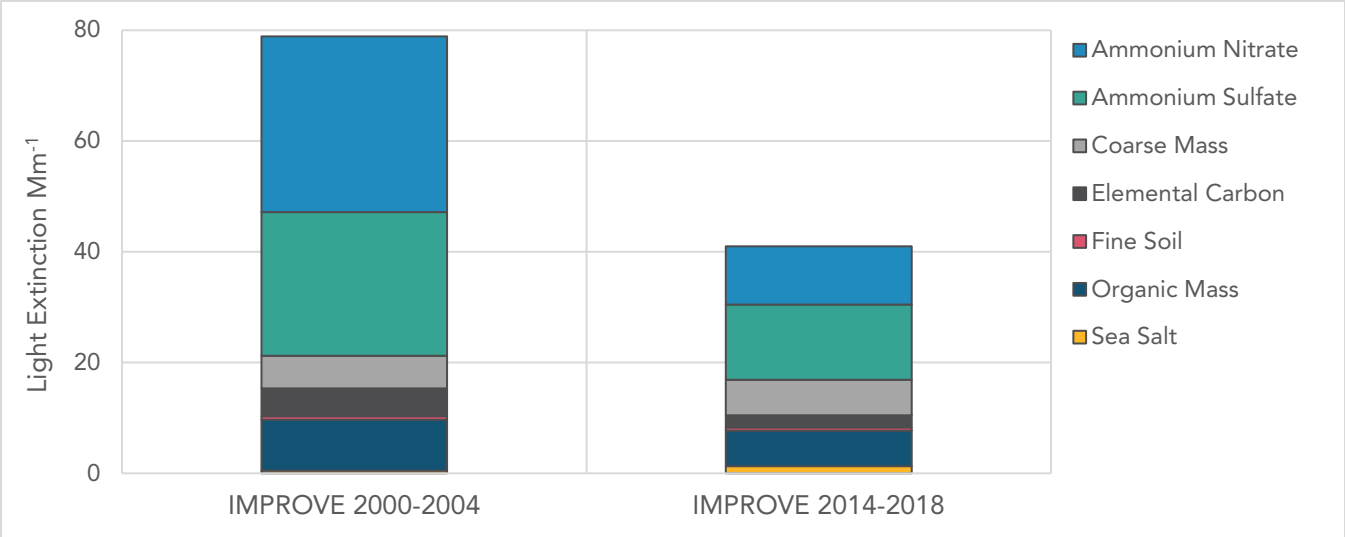
Monitoring data, shown in Figures C-132 and C-133, indicate that ammonium nitrate and ammonium sulfate had the largest contribution to light extinction on the clearest days during the baseline period. Between the baseline and current periods, light extinction from ammonium nitrate decreased by 64 percent and light extinction from ammonium sulfate decreased by 51 percent. During the current period, ammonium sulfate and coarse mass had the most dominant impact on light extinction on the clearest days.

Figure C-132: Average Extinction Composition for AGTI1 on the Clearest Days



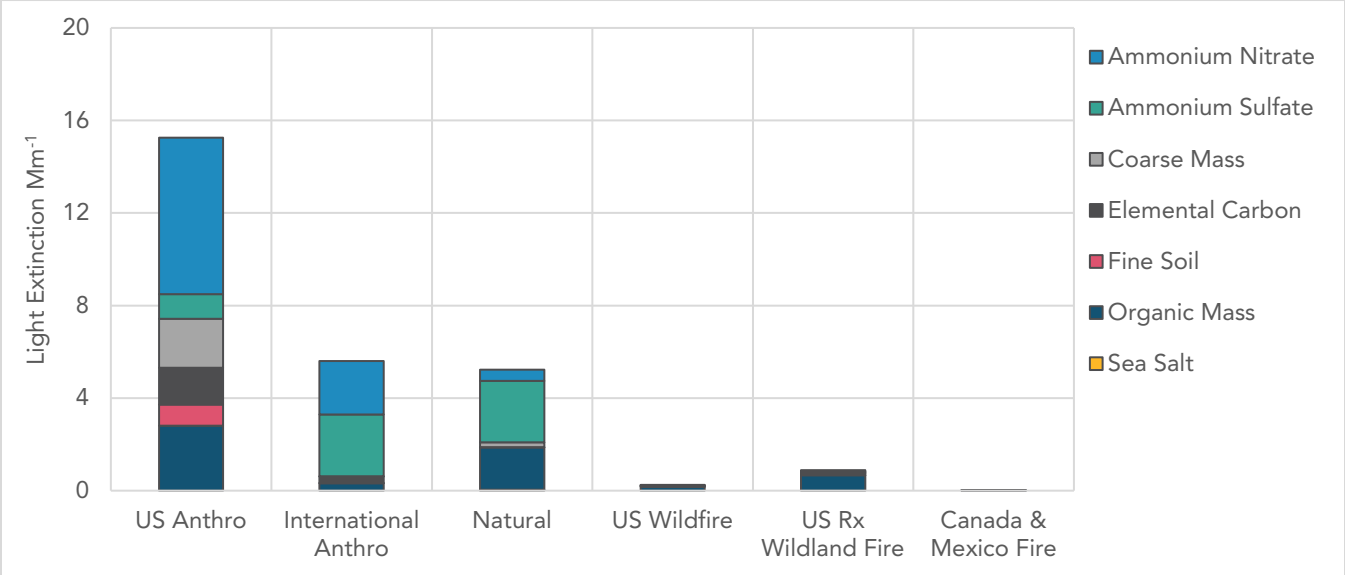
On the most impaired days, ammonium nitrate and ammonium sulfate accounted for the largest portion of the light extinction during the baseline and current periods. Between the baseline and current periods, light extinction from ammonium nitrate decreased by 67 percent and light extinction due to ammonium sulfate decreased by 48 percent.

Figure C-133: Average Extinction Composition for AGTI1 on the Most Impaired Days



Source apportionment modeling, shown in Figure C-134, indicates that emissions from U.S. sources account for the largest portion of light extinction on most impaired days. Emissions from international sources, natural sources, and fire also contribute to impaired visibility. Ammonium nitrate accounts for the largest portion of light extinction from the U.S. sources. Ammonium sulfate, closely followed by ammonium nitrate, accounts for the largest portion of light extinction from international sources. Ammonium sulfate accounts for the majority of light extinction from natural sources.

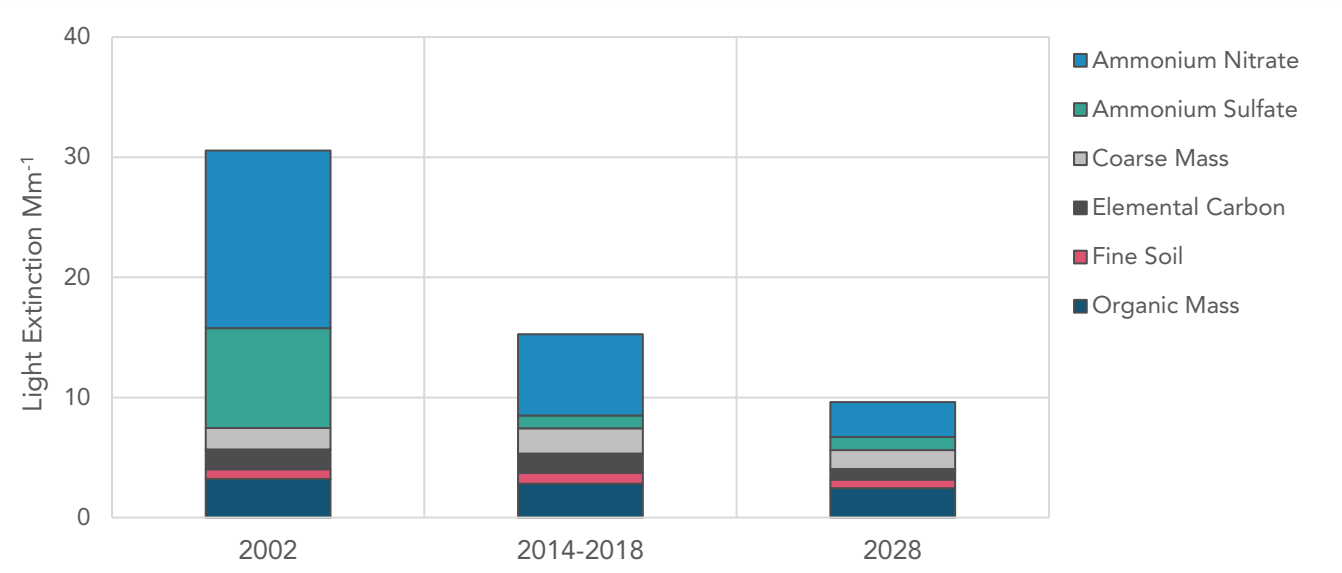
Figure C-134: Source Apportionment Modeling Results for AGTI1 on the Most Impaired Days in 2014-2018



As shown in Figure C-135, light extinction attributable to U.S. sources is decreasing. Ammonium nitrate has accounted for the largest share of light extinction attributable to this

source group. Between the current period and 2028, light extinction from ammonium nitrate is projected to decrease by 57 percent. Ammonium nitrate is projected to continue to account for the largest share of light extinction attributable to U.S. emission sources in 2028, but will be closely followed by light extinction attributable to organic mass.

Figure C-135: Light Extinction from PM Attributed to U.S. Anthropogenic Sources at AGTI1 on the Most Impaired Days



Regional source apportionment projections are shown in Figures C-136 and C-137. Light extinction attributable regional sources of ammonium nitrate is about three times greater than light extinction attributable to ammonium sulfate from regional sources. California mobile sources are the largest regional source of ammonium nitrate.

Figure C-136: Regional Source Apportionment for Ammonium Nitrate from U.S. Anthropogenic Sources in 2028 at AGTI1

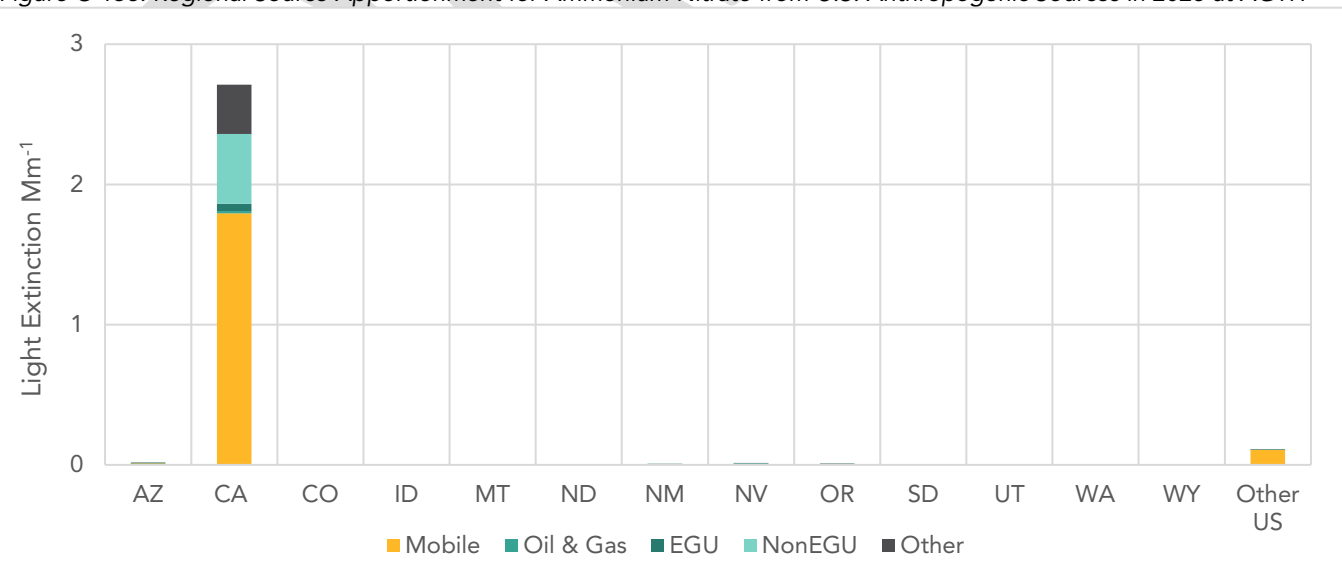
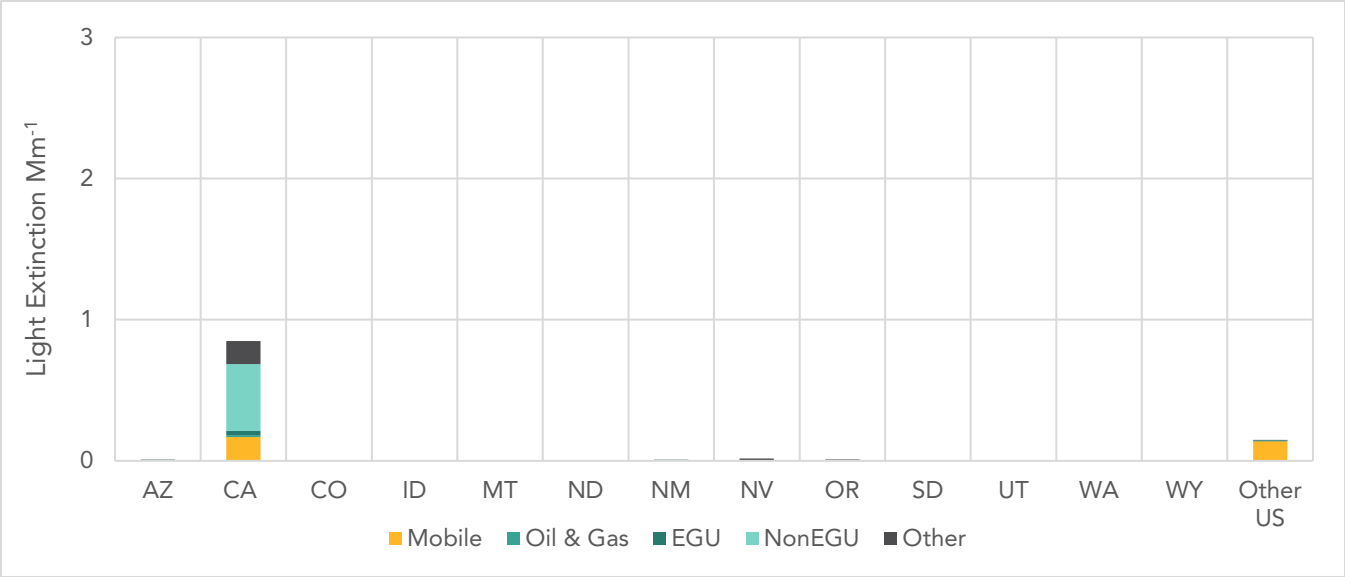


Figure C-137: Regional Source Apportionment for Ammonium Sulfate from U.S. Anthropogenic Sources in 2028 at AGTI1



California's long-term strategy for regional haze is focused on improving visibility through reduction of NOx emissions from mobiles sources. This strategy is projected to improve visibility conditions in the Agua Tibia Wilderness Area.

The current and projected visibility tracking metrics for the Agua Tibia Wilderness Area are shown in Figure C-138. Accounting for adopted emission controls and emission reduction commitments included in this Regional Haze Plan, visibility impairment on the most impaired days is projected to be 14.5 dv in 2028, which is comparable to a visual range of 57 miles (91 km). This 2028 projection is below the adjusted glidepath that accounts for international and wildland prescribed fire emissions, indicating that this area is on track to meet 2064 visibility targets.

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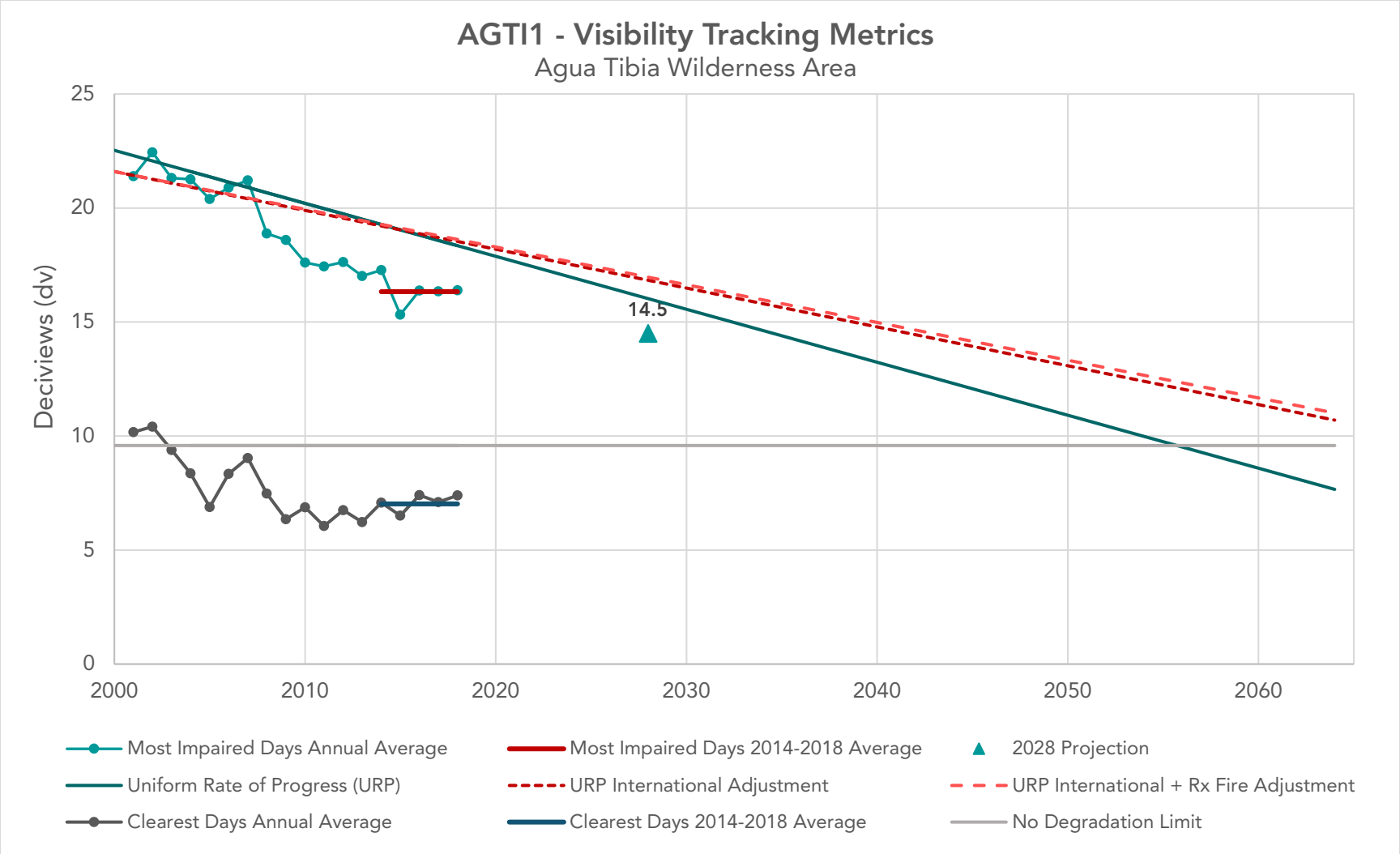
Figure C-138: Visibility Tracking Metrics and Projections for Agua Tibia Wilderness Area



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