

# Climate Analysis

This chapter provides an overview of key climate and environmental issues in the region and the related impacts on people and communities. Included are insights into anticipated climate impacts and potential sources of resilience. The analyses below: 1) review the sources of environmental pollutants and contaminants, 2) assess the burden of these pollutants and contaminants on communities throughout the region, and 3) describe how existing environmental inequities intersect with the projected impacts of climate change. Highlighted throughout this chapter are the drivers and impacts of the two major climate-related risks the area faces: sea level rise on the coast and wildfire in inland areas. Also addressed are environmental issues related to current and former industries including energy generation, forestry, and agricultural production. The chapter concludes with a discussion of environmental activism and leadership in the region.

## Key Takeaways

- ◆ **Critical environmental risk factors** across the region include the potential for ground- or surface-water contamination, wildfires, and lead exposure to young children. While the region enjoys better air quality than the rest of the state, its largest industrial emitters are located in low-income areas.
- ◆ **Sea level rise** is a critical climate impact for the region, which has the longest coastline of any California Jobs First region. Humboldt Bay is one of the highest risk areas on the California coast and yet is slated for more redevelopment activities elsewhere in the region, at the time of writing.
- ◆ **Wildfire** is a major driver of economic losses and has been a public health disaster for inland communities. Moreover, communities with incomes well below the state median feel its worst impacts. In recent years, Lake County, in particular, has suffered the worst of these, but Del Norte and Humboldt have the highest risk projections in the region. Wildfire thus constitutes a critical risk to industries in the Working Lands sector.
- ◆ **Investment in infrastructure** for water delivery and waste disposal is a crucial environmental justice issue for the region.
- ◆ Jurisdictions in the region have **significant data gaps** concerning GHG emissions (e.g., only one outdated GHG inventory was available for the region). Jurisdictions should prioritize creating GHG emissions inventories to better direct clean energy projects and other emissions-reduction efforts.

### Key Metrics<sup>46</sup>

- ◆ **Percent of waterways impaired and number of groundwater threats present in the region:** Track the extent of water pollution and groundwater contamination to prioritize areas for remediation and protection.
- ◆ **Dollars invested in water infrastructure improvements in disinvested communities and those hosting waste sites:** Monitor investments in water systems to ensure equitable access to safe, clean water and measure progress in addressing disparities.
- ◆ **Number and scale of climate adaptation initiatives along the coast, especially in Crescent City, Humboldt Bay, and the Mendocino Coast:** Assess the region's preparedness for sea-level rise and other coastal impacts by tracking the implementation of adaptation measures.
- ◆ **Greenhouse gas emissions by sector and per capita:** Measure the region's contribution to climate change and identify high-emitting sectors for targeted emissions-reduction strategies.

## Environmental Risks for Communities

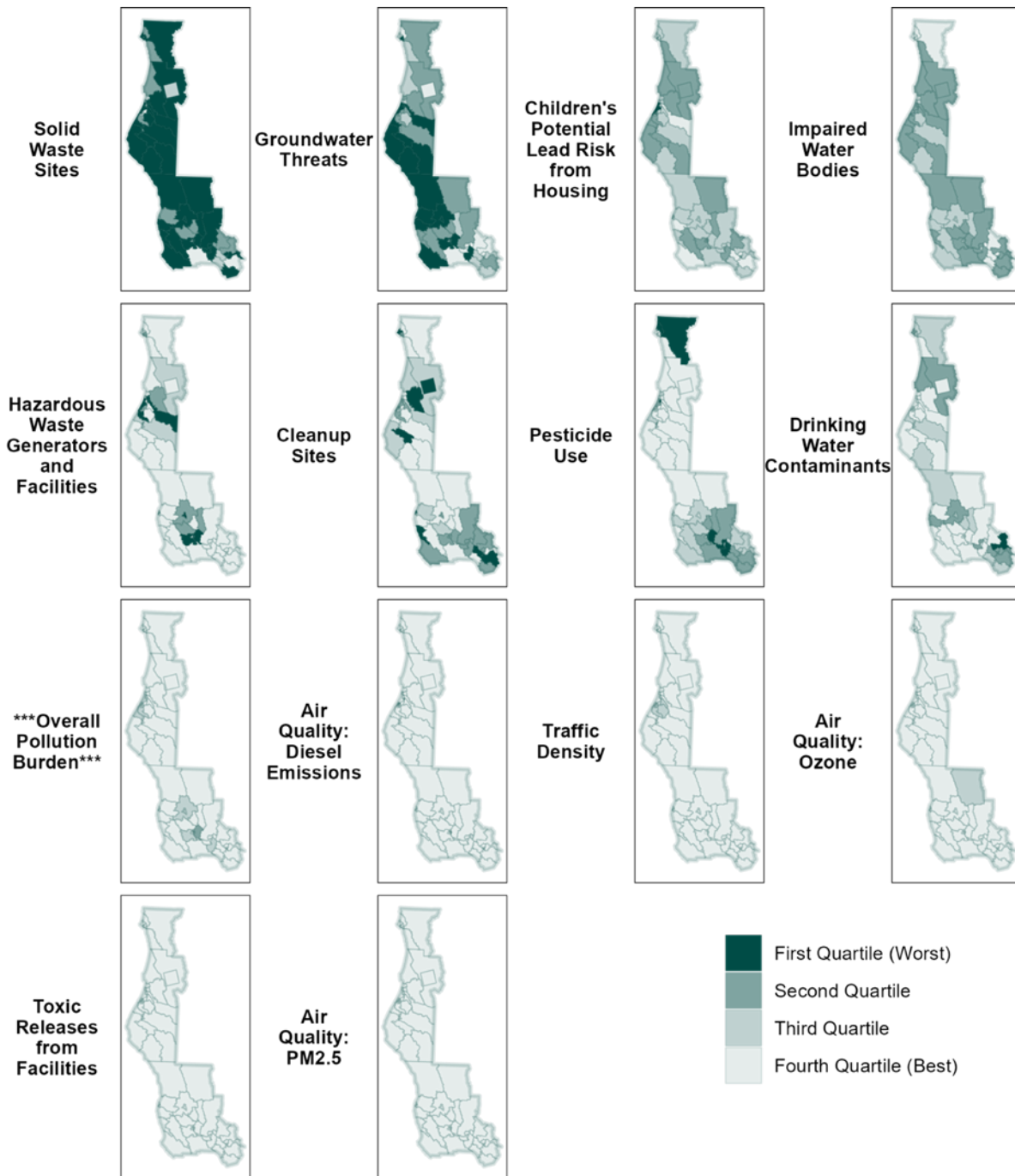
This section provides an overview of the burden of air and water pollution, toxic and hazardous waste, major sources of greenhouse gas (GHG) emissions, and the impacts of all these on diverse and/or disinvested communities.

The region's overall pollution burden is low compared to other regions in the state (see "Overall Pollution Burden" in Figure 4.1). Nevertheless, certain types of pollutants or environmental risks are elevated, and communities in the region face differential risks, including (among others): 1) water resource impacts from a variety of sources (e.g., drinking water and fish contamination), including solid waste sites, nonpoint-source groundwater pollution, hazardous waste generators, and cleanup sites and 2) lead poisoning of children. And, despite low levels of human-caused air pollution, wildfires continue to pose a critical risk to air quality, health, and prosperity within the region.



<sup>46</sup> Data sources for select metrics have yet to be identified by RRRISE.

Figure 4.1 CalEnviroScreen 4.0 Indicators (2023)



Note. Data sourced from CalEnviroScreen 4.0. Each census tract is ranked compared to all other census tracts in the state. Those in the first quartile (dark emerald) are among the worst 25% of census tracts within the state, whereas those in the fourth quartile are among the best 25%.

## Water Quality and Hazardous Waste Sites

Although most of the region has levels of drinking water contamination (“Drinking Water Contaminants” in Figure 4.1) comparable to state trends, the region’s water bodies (“Impaired Water Bodies” in Figure 4.1) are more likely to be polluted than those used to compute statewide trends, indicating the seriousness of the potential threat to drinking water quality within the region. In particular, runoff and surface materials picked up and carried by moving bodies constitute a critical

source of water pollution in the region, and so agricultural activities, erosion from timber harvesting, construction, and roadways can all contribute to surface pollution that ultimately accumulates in water bodies.

The region's substantial cannabis industry has also had an impact on the local environment. Water contamination, streamflow reductions due to water diversions, and poisoning of wildlife have been linked to the region's cannabis producers (Carah et al., 2015). Additionally, hundreds of sites in the region, including cleanup sites and underground storage tanks, are potentially putting groundwater sources and water quality at risk. Nonetheless, at present, most of the region has above-average groundwater threat levels compared to state trends.

Across the region, over 36,000 miles of rivers and streams are considered impaired due to pollutants (CalEnviroscreen 4.0). Fifty-eight river and stream locations have tested positively for at least one pollutant that is over the safe threshold mandated by the California Water Boards. Of the recorded locations, 67% have sedimentation listed as a pollutant, 66% have heightened water temperature, and 45% have aluminum. Other listed pollutants include indicator bacteria, mercury, copper, and dissolved oxygen. Sediment can create shallower waterways, increasing the risk of flooding, harming ecosystems and habitats, reducing water clarity, and increasing the cost of drinking water processing, among other serious impacts. Increasing water temperatures in streams and rivers impact wildlife and can lead to reduced biodiversity. Aluminum is a naturally occurring element in nature, but large amounts in high doses can lead to adverse health effects.<sup>47</sup>

Contaminated surface waters<sup>48</sup> pose a particular risk to public health as the region's drinking water comes primarily from these sources. High levels of pollutants such as mercury can lead to fishing advisories, potentially impacting recreational activities and fishing-related industries and constituting threats to priority sectors (discussed below). Among the many lakes, reservoirs, harbors, and estuaries in the region, eight bodies of water comprising over 63,000 acres are listed as polluted; three-quarters of these water bodies are contaminated by mercury, which increases mercury levels in fish. This contamination can lead to advisories for eating fish caught locally and so interrupt fishing-related recreation and economic activities, such as tourism. Further, many of the region's indigenous cultures depend on fishing and are thus disproportionately threatened by this type of contamination. Rivers and streams are primarily impacted by elevated levels of sediment and aluminum. Accumulated sediment can result in shallow water bodies, increasing the risk of flooding, and elevated levels can increase the cost of processing drinking water from these sources.

Over 11 miles of coastal and bay shoreline across 16 beaches in Humboldt and Mendocino Counties are considered to be impaired (see Figure 4.2). No coastline in Del Norte County is listed as impaired, as of this report. Each of these locations has been found to be polluted by indicator bacteria, which are surrogates used to measure the potential presence of fecal material and pathogens in waterways. As the source of most indicator bacteria is feces or other types of waste produced by humans and warm-blooded animals (e.g., birds and mammals), indicator bacteria contaminate food sources caught or collected from contaminated waters and can then lead to illness in humans and pets.<sup>49</sup>

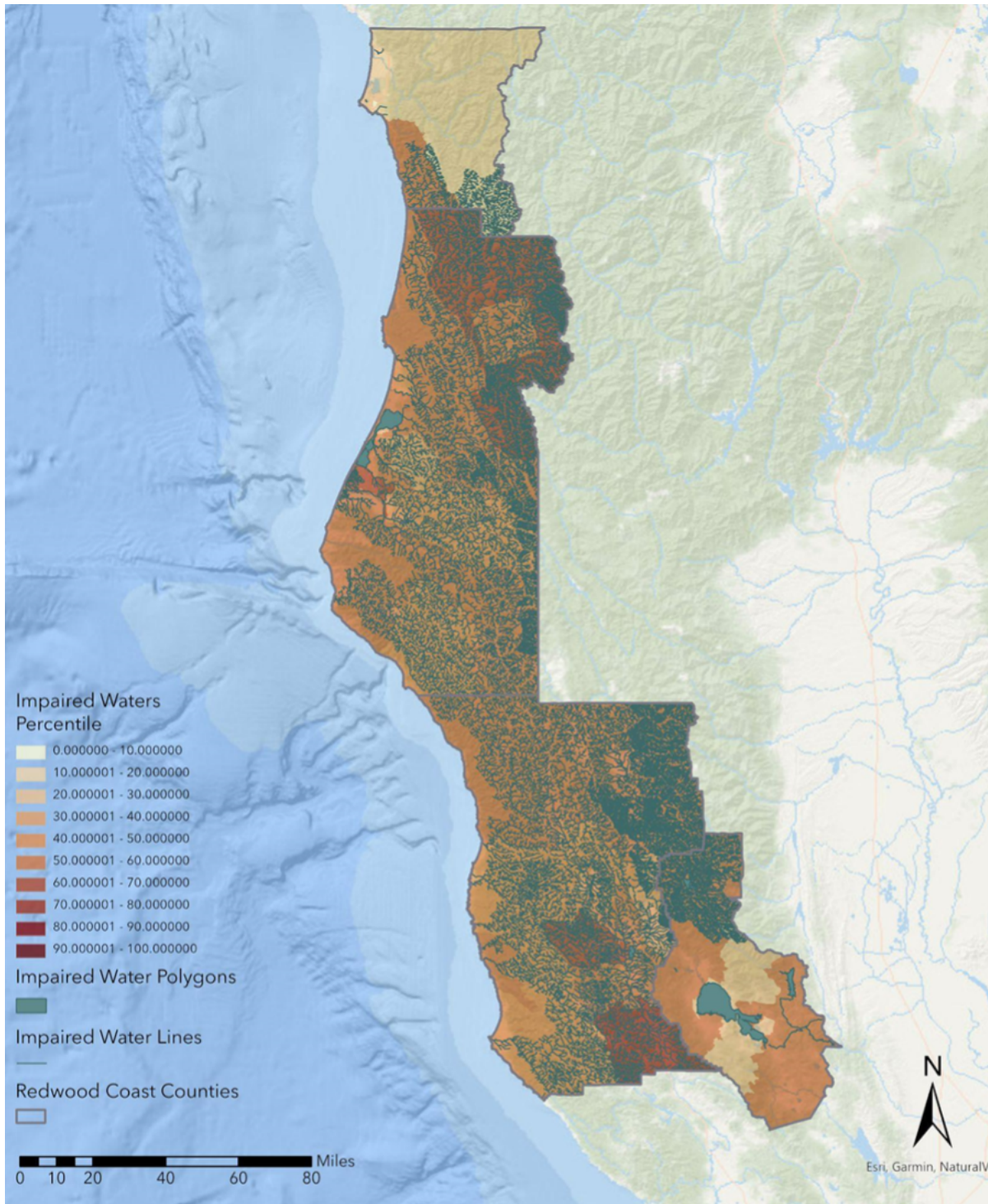
<sup>47</sup> [https://www.waterboards.ca.gov/northcoast/water\\_issues/programs/](https://www.waterboards.ca.gov/northcoast/water_issues/programs/)

<sup>48</sup> Impaired groundwater can affect drinking water and soil and lead to adverse health impacts. The State Water Resources Control Board (SWRCB) hosts a GeoTracker Database that oversees and tracks projects at cleanup sites that can affect purity of groundwater. It also hosts the California Integrated Water Quality System Project, which tracks information about environmental impacts, manages permits, tracks inspections, and manages enforcement activities.

<sup>49</sup> [REF]

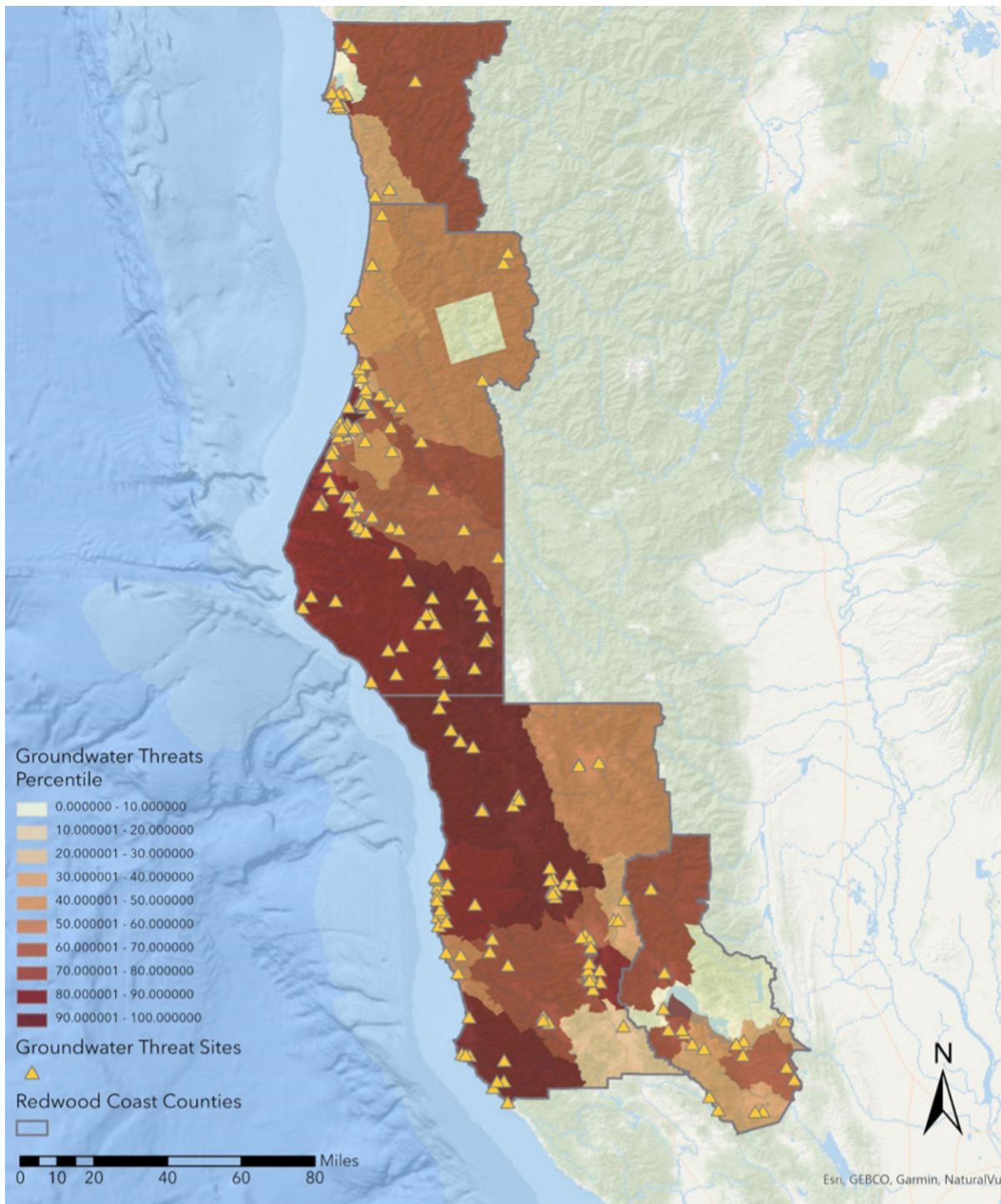


Figure 4.2 Impaired Waterways Map



Source: CalEnviroScreen Indicator Maps: Groundwater Threats, requested July 2023.

Figure 4.3 Groundwater Threats



Source: CalEnviroScreen Indicator Maps: Groundwater Threats, requested July 2023.



## Hazardous Waste

Although the region's numbers of hazardous waste generators and facilities are fewer than statewide trends, populated areas surrounding Ukiah and near Humboldt Bay appear to have higher levels of these than other areas of the region. While most regional areas have fewer hazardous waste generators compared to similar areas in the state, the region's severe wildfires constitute a particular hazard, increasing risk of exposure to contaminants for first responders and members of the public. While overall Cleanup Sites are less common region-wide, the location of such sites is uneven, with most located in lower income areas. Those living near these sites are at greater risk of harm. Areas around Eureka and east on the 36 corridor, and neighborhoods near Ukiah are particularly vulnerable. See Figure 4.3 above.

Approximately 270 locations across the region have led to common soil and groundwater pollutant leaks and so have threatened the safety of drinking water or exposed people to contaminated soil and air. Of these sites, 30% are land disposal sites, 40% are Cleanup Program sites, and the remaining sites consist of leaking underground storage tanks (LUSTs) and military cleanup sites. Common groundwater pollutants are gasoline and diesel fuels near gas stations, as well as substances like pesticides and heavy metals that leak from landfills or burn sites. Land and groundwater that has been contaminated can take years or decades to clean up, leading to water shut-offs, mandatory bottled water deliveries to impacted communities, and public health concerns should exposure go undetected.

## Air Pollution

The Redwood Coast region has five mandatory air pollution reporting facilities.<sup>50</sup> These are all located in census tracts with a median household income (MHI) far below the state's median household income of \$84,097 and the national median of \$69,000. Two of these facilities are within the Humboldt Bay region and may be at risk of sea level rise or flooding events, possibly leading to pollution of the Bay and ocean waters that could pose a risk to ecosystems and public health. Two of these facilities are located on tracts with MHI's below \$40,000.

Among non-natural sources, waste disposal and farming operations are the largest emitters of organic gasses. Industry, namely mineral processes, is the largest stationary source of particulate matter. Dust blown from unpaved rural roads constitutes another major source of particulate matter; this is to be expected in rural areas and can be mitigated through paving. Residential use of wood fires for heating and managed burns are also major contributors to overall air pollution. The use of natural gas for heating and cooking is one of the largest areawide pollution sources in the region, suggesting that the region could therefore benefit from residential energy retrofits.

Within the region, wildfires are by far the single most significant contributor to overall air pollution. Of non-natural sources, the dust stirred up along the region's rural unpaved roads contribute substantially to particulate matter emissions. Residential fuel use (particularly wood fires) as well as managed burns are also major contributors to overall air pollution. While indicators of overall air pollution are low relative to state trends, wildfires are a more critical risk for the region compared to

<sup>50</sup> *Major source facilities* are facilities that emit, or have the potential to emit, 100 tons per year or more of any air pollutant, 10 tons per year of any single hazardous air pollutant (HAP), or 25 tons per year of any combination of HAPs. These are considered major sources of pollution and must therefore obtain a Title V permit to operate. Facilities with Title V permits must submit annual compliance certifications and semi-annual monitoring reports to the NCUAQMD detailing the facility's compliance with permit conditions, emission limits, and other applicable air quality regulations.

the state as a whole. Wildfire smoke has been shown to cause respiratory illnesses among sensitive populations and outdoor workers. Moreover, it limits the tourism and recreation industry that fuels many local economies in the summer months.

### Lead Exposure in Children

Exposure to lead through lead-based paint in older housing is the most significant source of lead poisoning in children. Children’s estimated risk of exposure to lead from housing is elevated in many areas of the region, particularly in the Humboldt Bay area and the more urbanized areas of Del Norte and Mendocino Counties. Moreover, children five and younger in Humboldt and Lake Counties have been found to have elevated blood lead levels compared to the state average (6.7% and 3.3%, respectively, compared to 1.9% statewide).

## Greenhouse Gas (GHG) Emissions

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### Data Limitations

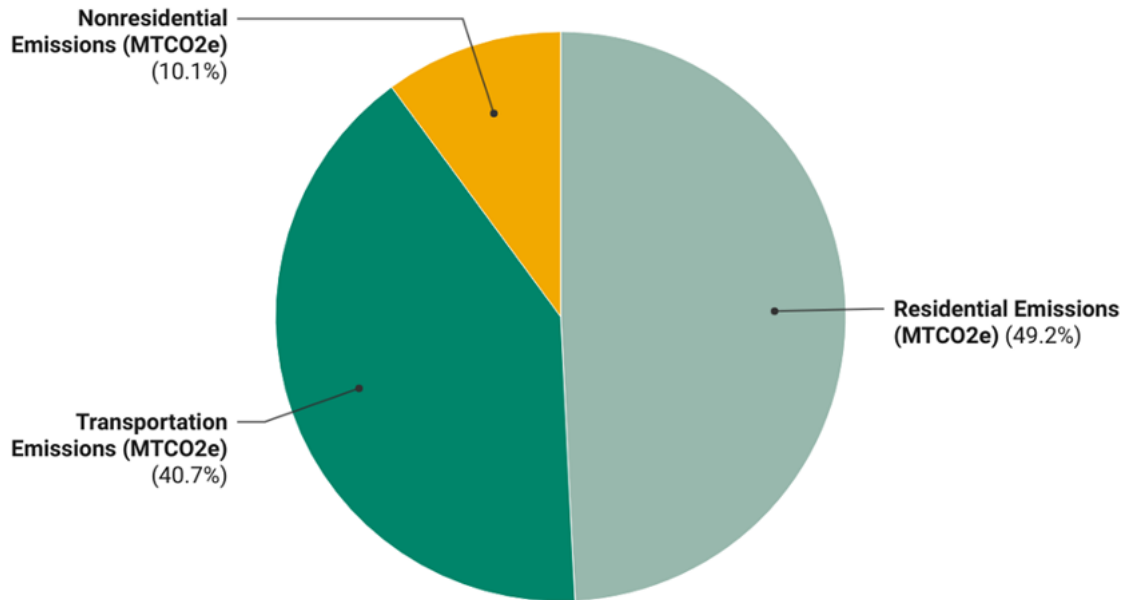
As a community-level GHG emissions inventory was available for Humboldt County only and was more than five years old, the data it contained was scaled using demographic changes and emission trends to obtain an estimate of 2020’s emissions. Due to the limitations of this methodology, only findings related to emissions from the Residential, Nonresidential, and transportation sectors are discussed below. Local emissions from the Solid Waste and Water and Wastewater sectors can increase emission totals by varying proportions depending on the presence of treatment plants, landfills, and other sites that emit GHG within a jurisdiction’s boundary. These sectors have been omitted from the following analysis due to restraints on normalizing these values.

GHG emission estimates for Del Norte, Lake, and Mendocino Counties were available through Google Environmental Insights Explorer (Google EIE). The methodology used by Google EIE differs from that used by the Sierra Business Council and from that of most consulting firms performing local and regional emissions inventories.<sup>51</sup> Given the lack of available GHG inventories in the Redwood Coast CERF region, utilizing Google EIE provided estimates of regional emission totals and allowed by-sector identification of estimated emission sources. However, due to extensive reliance on estimates in the analysis, the county and regional totals shown below are not exact. Further, the calculation methods and tools used do not align with GHG emission inventory best practices. Therefore, all GHG emissions shown in Figure 4.4 are provided for illustrative purposes only. It is highly recommended that jurisdictions complete comprehensive emissions inventories in order to properly engage in climate action planning. For jurisdictions interested in having a GHG inventory developed, resources are available from CARB, ICLEI, Redwood Coast Energy Authority, and the Schatz Energy Research Center.

<sup>51</sup> Google EIE methodology can be found [here](#).



Figure 4.4 Emissions by Sector



*Chart: Sierra Business Council  
Source: Local Greenhouse Gas Inventories where available (scaled to 2020 when necessary, Google Environment Insights. Created with Datawrapper)*

In California, the Transportation sector is the largest contributor to GHG emissions, and many rural California regions mirror this trend. While the Redwood Coast regional analysis shows the residential sector as the largest contributor to GHG emissions, it should be noted that emissions data from Google EIE tend to show lower proportions of emissions from transportation than do standard-method GHG emission inventories.

Transportation is still heavily reliant on the burning of fossil fuels (e.g., gasoline and diesel), which release large amounts of greenhouse gases to the atmosphere. In rural areas like the Redwood Region, it is unsurprising that the transportation sector is the source of the vast majority of emissions due to residents' needing to travel further distances to town centers for work and to reach such providers of typical services as schools, grocery stores, and healthcare providers. Rural areas with economies based on natural and working land industries may see even larger percentages of emissions associated with the transportation sector due to the increased use of off-road vehicles and equipment (e.g., farm machinery). Rural regions are also slower to adopt new technologies like electric vehicles (EVs); this may be due in part to local resistance, but is more likely attributable to the lack of EV infrastructure and funding to support a transition, as well as residents' individual cost barriers and cultural resistance to change.

Residential building is typically the second-largest GHG-emission sector in rural regions, owing to their reliance on natural gas and propane as primary fuel sources for home heating. As California begins to mandate cleaner energy sources and a transition to electrification, the region must have access to energy efficiency resources, clean energy workforce development, and funding

opportunities. Additionally, the region’s larger energy providers must be able to provide a reliable transmission and distribution infrastructure to ensure that power outages will not disproportionately affect rural communities, where extreme weather conditions have led to the present-day reliance on natural gas and propane for heating and cooking.

### Significant Stationary Sources of GHG Emissions

The California Air Resources Board (CARB) requires facilities emitting 10,000 or more metric tons of carbon dioxide equivalent (MTCO<sub>2</sub>e) to submit annual reports. Only Lake and Humboldt Counties have facilities that meet or exceed these mandatory reporting thresholds for 2020 (see Figure 4.5).<sup>52</sup>

Figure 4.5 CARB Mandatory Reporting Facilities in the Redwood Region (2020)

County	City	Source Name	Emissions (MTCO <sub>2</sub> e)	Year	NAICS	Sector
Lake	Middletown	Calpine - Geysers Power Company, LLC - Geothermal	210,004	2020	221116	Electricity Generation
Humboldt	Samoa	DG Fairhaven Power LLC	16,128	2020	221117	Electricity Generation
Humboldt	Scotia	Humboldt Sawmill Company	295,562	2020	221116	Cogeneration
Humboldt	Eureka	PG&E Humboldt Bay Generating Station	227,214	2020	221112	Electricity Generation
Humboldt	Arcata	The Sun Valley Group	11,532	2020	111,422	Other Combustion Source

Major gaps exist in data related to the region’s greenhouse gas emission, highlighting the need for the region to conduct a comprehensive emissions inventory to enable data-informed emissions planning purposes. Available data show that residential energy use, followed by transportation, are the two largest anthropogenic emitters of GHGs in the Redwood Region. However, the largest overall source of GHG in the region is likely to be wildfires. Among the target sectors, data from the Industry Cluster and Labor Market Analysis suggest that, relative to economic value added, the Working Lands and Blue Economy industries have the highest output of greenhouse gas emissions among the RRRISE target industry sectors.

<sup>52</sup> GHG emissions data for facilities emitting over 25,000 metric tons of CO<sub>2</sub> equivalents are subject to independent third-party verification by a CARB-accredited verifier. The following facilities were identified using [CARB’s Pollution Mapping Tool](#)

**Figure 4.6 Major Sources of GHG Emissions, Air, Water, and Hazardous Waste From Potential Growth Clusters, Emissions (kg) per Job**

	Commercial RCRA Defined Hazardous Waste (kg)	Criteria and Hazardous Air Emissions (kg)	Greenhouse Gases (kg)	Point Source Releases to Water (kg)	
Performing Arts, Spectator Sports, and ... (711)	0	1	94	0	Arts, Culture, & Tourism
Museums, Historical Sites, and Similar ... (712)	7	4	557	0	
Miscellaneous Store Retailers (453)	0	5	179	0	Other NAICS: Retail Trade (44-45)
Electronics and Appliance Stores (443)	0	8	280	0	
Nonstore Retailers (454)	0	28	255	0	
Motor Vehicle and Parts Dealers (441)	1	43	1,708	0	
Food and Beverage Stores (445)	0	14	429	0	
Social Assistance (624)	0	1	177	0	Health & Caregiving
Hospitals (622)	2	16	2,034	0	
Rental and Leasing Services (532)	4	15	4,127	0	Other NAICS: Real Estate and Rental and Lea... (53)
Leather and Allied Product Manufacturin... (316)	0	8	1,428	0	Agriculture and Blue Economy
Fishing, Hunting and Trapping (114)		0	5,561	1	
Animal Production and Aquaculture (112)	0	4,992	61,734	77	
Beverage and Tobacco Product Manufactur... (312)	10	134	5,512	2	
Support Activities for Agriculture and ... (115)	0	66	1,829	0	Wood Products
Furniture and Related Product Manufactu... (337)	38	43	2,735	0	
Wood Product Manufacturing (321)	89	927	22,985	70	
Apparel Manufacturing (315)		1	624	1	Other NAICS: Manufacturing (31-33)
Printing and Related Support Activities (323)	118	33	7,839	1	
Chemical Manufacturing (325)	35,612	1,030	355,607	462	
Administrative Government (9B)	8	52	10,972	1	Government
Construction (23)	7	239	10,279	20	Renewable & Resilient Energy, Enabling Industries
Waste Management and Remediation Servic... (562)	8,511	783	46,604	27	Other NAICS: Administrative and Support and... (56)

4th Quartile (Lowest Emitting)
  3rd Quartile
  2nd Quartile
  1st Quartile (Highest Emitting)

Note. Data sourced from IMPLAN.

## Current and Anticipated Impacts of Climate Change on the Redwood Coast

Analysis of the impacts of climate change on the Redwood Coast was based on evaluation of the following climate indicators to enable future projections:

- 1. Annual Cooling Degree Days:** Annual Cooling Degree Days represents the sum of the number of degrees that each day's average temperature is above 65°F (18°C) over the course of a year. The measure is used to estimate the energy demand required for cooling buildings and is an indicator of the degree of cooling needed in a given location based on temperature.
- 2. Extreme Heat Days** are an indicator used to measure the annual number of days when a county's daily maximum temperature surpasses a specific threshold, which is typically set at the 98th percentile temperature for that county based on historical data (meaning that the threshold

temperature was exceeded on only 2% of days during a historical baseline period). Comparing the number of extreme heat days in a given year or period to that of the historical baseline allows the effect of climate change on the frequency and severity of extreme heat events in a region to be assessed.

3. **Warm Nights** refer to the annual number of nights when the minimum temperature remains above a predetermined threshold, usually the 98th percentile for the county based on historical data. Even in regions with cooler nights and even in summer, tracking changes in nighttime temperatures is crucial for understanding the potential impacts of climate change on the economy and on public health planning.
4. **Annual Average Precipitation:** Measured in inches, this indicator measures the average precipitation per year at the county level; precipitation is measured as liquid or solid water and is averaged over the county's area.
5. **Area Burned:** Measured in hectares, this indicator measures how many acres will burn due to wildfire. This indicator cannot predict where a fire is likely to occur but can enable an overall assessment of how wildfire will affect the local economy, public health, and the health of local ecosystems.

## Heat

Recent high-impact wildfires and droughts have been linked to extremes in the Evaporation Demand Drought Index (EDDI).<sup>53</sup> The likelihood of extreme wildfire is based on two-week periods of elevated evaporative demand during the summer and autumn. When the two-week EDDI is above the 95th percentile, it can be used as a proxy for high fire danger days. For the Redwood Region, the historical baseline is approximately five days per season that have a two-week EDDI above the 95th percentile. All models for both the near future and the mid-century show an increase in extreme EDDI days, indicating more high fire danger days. The mid-century model shows a consistent increase of over 400% (nearly five times the historical baseline) across the entire region, with Del Norte and Humboldt having more extreme EDDI days than the more southern counties in the region.

## Wildfires

These factors are expected to increase atmospheric evaporation, leading to drier conditions and increased wildfire risk. Across the region, summertime high fire-risk days and total wildfire area burned are expected to increase markedly by midcentury, exacerbating an already heightened risk to health, life, and property. Total wildfire burn area is expected to rise between 29% in Lake County and to increase as much as 213% in Del Norte County. Statewide, wildfires were the second largest contributor to GHG emissions in 2020, offsetting previous efforts to reduce GHG emissions (Jerrett et al., 2022).

## Sea Level Rise

Coastal communities in Del Norte, Humboldt, and Mendocino counties are projected to experience varying impacts of sea level rise. Coastlines such as areas around Crescent City that have low slopes are particularly vulnerable, where even a small level of sea level rise can result in a substantial loss of shoreline. Crescent City will likely see a sea level rise of up to six inches by 2050. Even with extensive global GHG emissions reduction, most projections view the rise through 2050 as inevitable due to legacy emissions. Consequently, beaches with low gradients, like Crescent Beach, could see nearly 100 feet of shoreline lost to sea level rise by 2060.<sup>54</sup>

<sup>53</sup> *Evaporative demand* can be thought of as how “thirsty” the atmosphere is and how much moisture evaporates over a period of time. Increasing air temperature is the leading cause of increased evaporative demand for inland regions, whereas humidity has more of an overall influence on coastal regions (Sierra Business Council).

<sup>54</sup> It is typically assumed that one inch of sea level rise will cause about 100 inches of shoreline loss, depending on beach slope; <https://science.nasa.gov/earth/climate-change/cant-see-sea-level-rise-youre-looking-in-the-wrong-place/>

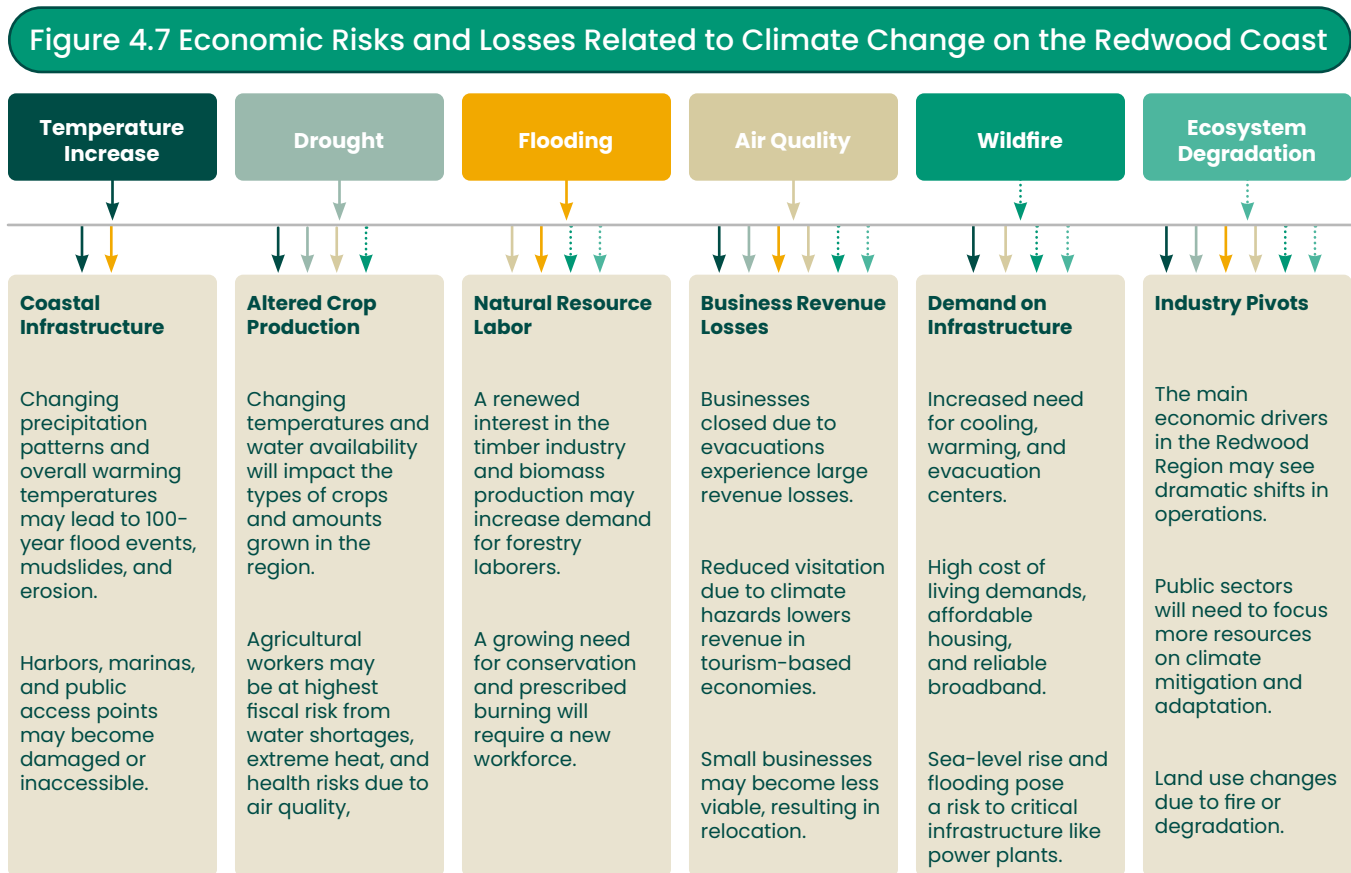


The land around Humboldt Bay is subsiding (sinking), possibly amplifying the relative rate of sea level rise in the area. The North Spit is expected to experience the most significant sea level rise in the Redwood Coast region and is considered one of the most high-risk tidal ranges along the West Coast. The coastal dune habitat along the North Spit could increase coastal resilience in the region if it is restored and maintained. On Mendocino’s shores, Arena Cove can expect to see up to a foot of sea level rise by 2050, possibly leading to a loss of shoreline near the Point Arena Pier and causing erosion along the sea cliffs. Loss of shoreline in the Arena Cove area would lead to limited public and commercial access, and the Mendocino coastline with its gentle slopes could see over 100 feet of shoreline lost by 2060.

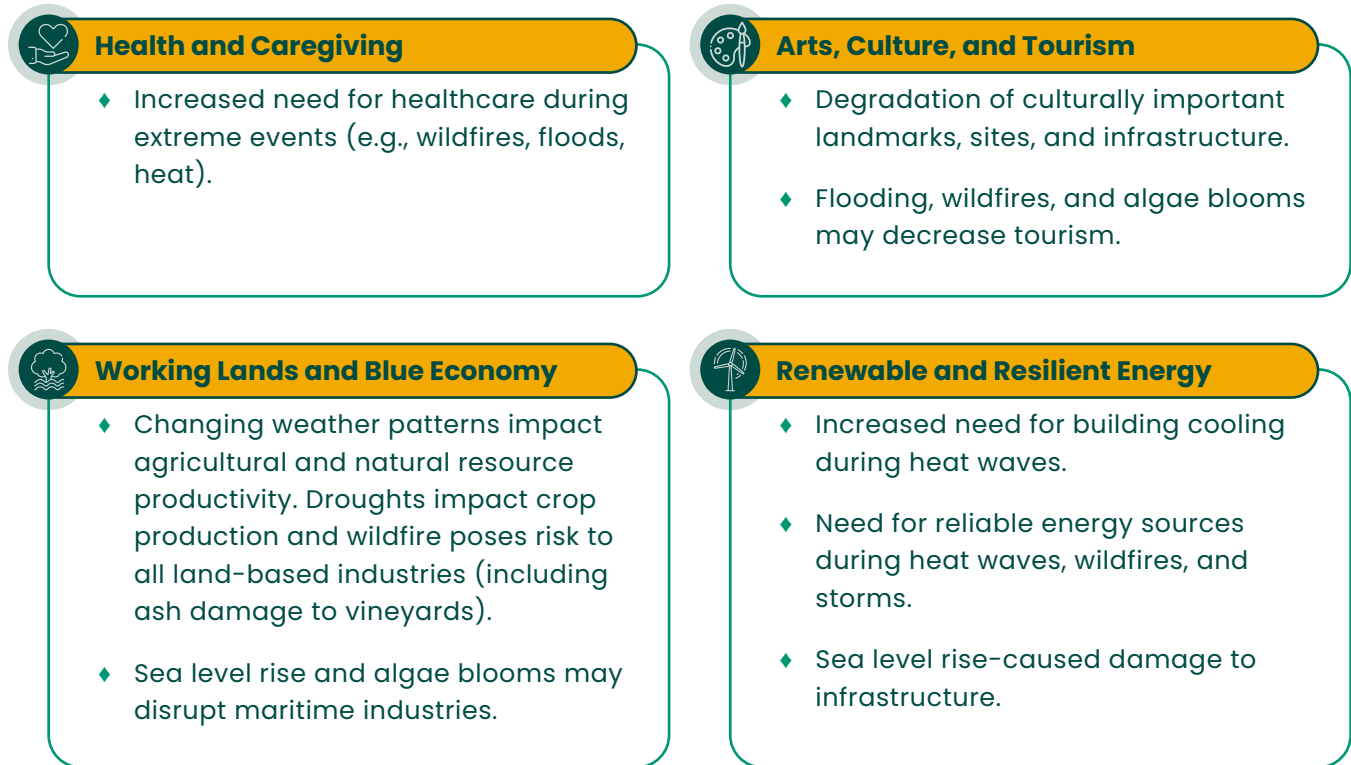
### Landslides

An intensity of rainfall during wet seasons will increase the likelihood of flooding and landslides within the region. Landslides threaten residents and housing, as well as critical infrastructure, including but not limited to transportation networks, water and sanitation systems, and communication networks. Landslides can negatively affect the habitats of local wildlife. For example, elevated sediment deposits due to landslides may accumulate in streams or rivers. These deposits can degrade spawning habitats for fish and reduce the diversity of their food source (California Energy Commission et al., n.d.), a potential threat to the Working Lands and Blue Economy sector.

Figure 4.8 below provides a summary of the effects climate change can have on the region over the near to long term.



Additional impacts on the region’s targeted industries include:



## Impacts on Disinvested Communities

Redwood Region communities are especially vulnerable to climate change due to geography and environment, lack of resources and essential services, and underrepresentation of at-risk populations. These sparsely populated communities tend to be defined by low-tech, outdoor and service-based jobs, and traditional values, where people of color, people with disabilities, and families in poverty are present but often exist as hidden populations. These data constraints have led to less state and federal funding (disinvestment) and greater disparities in levels of climate change adaptation planning.

The populations shown in Figure 4.9 may see the most impacts from climate change hazards. Young children, seniors, and people with disabilities are at higher risk of physical impacts from climate change due to their reduced physical and (in some cases) mental capacities, owing to age, illness, or isolation; many may be reliant on caregivers and medical equipment. Power outages can cause great physical stress on communities reliant on air conditioning, refrigeration of medicines, electrically powered medical equipment, and other powered products. Additionally, these groups are less likely to be able to evacuate without assistance.<sup>55</sup>

People experiencing poverty and those unable to work are more likely to face economic barriers to climate adaptation from, for example, inadequate shelter or lack of mobility during extreme weather events. Growing populations of under-resourced groups in the Redwood Region can lead to lowered community resilience, an increased need for climate planning, and increased social services.

<sup>55</sup> <https://www.epa.gov/climateimpacts/climate-change-and-human-health-whos-most-risk>

Most of the impacts felt by climate hazards will be similar across vulnerable populations (see Figure 4.8).

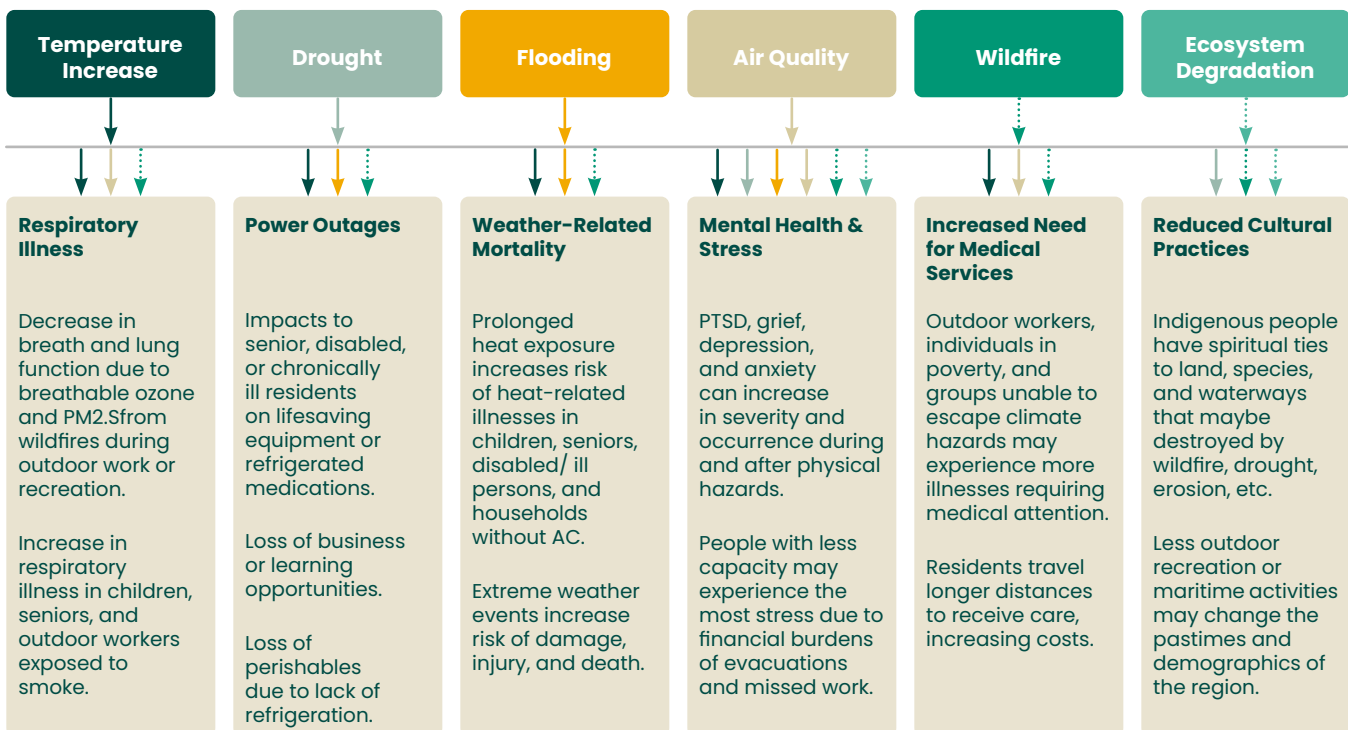
**Figure 4.8 Populations at Risk of Adverse Impacts from Climate Change**

Population	Number of People	Percent of Total Population	Critical Risks
Under 5	17,421	5.4%	Extreme heat, air quality
Over 65	65,563	32.9%	Extreme heat, air quality, reduced evacuation ability
People of color	79,956	24.7%	Extreme heat, air quality
People in poverty	56,819	17.8%	Extreme heat, air quality, reduced evacuation ability, water shortages (i.e., dry wells), extreme precipitation events
Nonworking people (aged 16-64)	58,611	29.4%	Extreme heat, air quality, reduced evacuation ability, water shortages (i.e., dry wells)
Households with no car	8,104	6.6%	Extreme heat, air quality, reduced evacuation ability, water shortages (i.e., dry wells), extreme precipitation events
People with disabilities	58,697	18.4%	Extreme heat, air quality, reduced evacuation ability, power outages
People without health insurance	25,042	7.9%	Extreme heat, air quality

*Various Total Populations were used based on population type. For example, the percent of households with no car is based on the total number of households in the Redwood Coast Region and not the total population.*

*Table: Sierra Business Council. Source: US Department of Commerce. 2022. Census Bureau, American Community Survey Office, Washington, D.C. Created with Datawrapper.*

**Figure 4.9 Climate Impacts on Vulnerable Populations**



Tribal populations within the region disproportionately face several climate-related threats, including food and water insecurity, limited access to traditional foods, and loss of culturally vital plant, fungi, and wildlife (Bull Bennett, et al.). Impacts on freshwater resources are a particular concern for Tribal communities that depend on them for drinking water, fisheries, and cultural activities. In addition, climate impacts to culturally significant species and habitats can detrimentally affect social and cultural components to Tribal communities (California Energy Commission et al., n.d.).

## Environmental Leadership in the Region

The Redwood Region’s original inhabitants have a long history over many millennia of living resiliently and sustainably in the lands and on the coastlines of the Redwood Region. As noted elsewhere in this report, many of the region’s Tribes are now regional leaders in innovative environmental restoration and resilient living. In addition, both Tribal and non-Tribal leaders are working to re-integrate “traditional ecological knowledge” into environmental management practices that are often based solely in Western models of science and ecological understanding. The environmental leadership provided by the Redwood Region’s Tribes has been transformative, showcasing the power of integrating indigenous knowledge and values into today’s restoration and conservation efforts.

The Klamath River Restoration Agreement, a historic accord signed in 2010 by the Yurok, Karuk, and Klamath Tribes and federal and state agencies, has succeeded in removing four dams on the Klamath River. The project is working to restore salmon runs, improve water quality, and further showcase the Tribes’ commitment to watershed and bioregional health. The Yurok Tribe has also been a leader in sustainable forestry practices, developing a forest management plan that prioritizes the long-term health of their ancestral lands while providing economic opportunities for the Tribe (*Environmental Department, Yurok Tribe, n.d.*). The Hoopa Valley Tribe has implemented a carbon sequestration project, utilizing their forestlands to absorb and store atmospheric carbon dioxide (*Hoopa Valley Land Management, Tribal EPA/Realty, n.d.*). Scotts Valley Tribe is currently developing an innovative biomass to energy project, among other renewable energy and sustainability initiatives.

Tribes have been instrumental in promoting environmental education and cultural preservation. The Round Valley Indian Tribes have established the Eel River restoration project, which engages Tribal youth in hands-on environmental restoration work while teaching them about their cultural heritage (*Education – ERRP, n.d.*). The Yurok have been at the forefront of efforts to reintroduce the critically endangered California condor to the Redwood Region, with the first birds released in 2022 as part of the Yurok Condor Restoration Program.<sup>56</sup>

The Blue Lake Rancheria (BLR), a federally recognized Tribe in Humboldt County, has emerged as a leader in renewable energy and community resilience through its development of the Blue Lake Rancheria community-scale microgrid. The microgrid, which was commissioned in 2017, is a state-of-the-art, low-carbon energy system that integrates solar photovoltaic (PV) panels, battery storage, and advanced control systems to provide reliable, sustainable power to the Tribe’s critical infrastructure (*Blue Lake Rancheria Microgrid – Schatz Energy Research Center, n.d.*).

In addition to the region’s indigenous populations, the region also has a post-settlement history of environmental leadership and activism—stemming in no small part from the region’s natural beauty, which has inspired generations of individuals and organizations located there to champion

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conservation efforts. From the early days of the Save the Redwoods League to the “back-to-the-landers” movement in the 1960s and 1970s, which saw an influx of environmentally conscious individuals seeking to live off the grid and in harmony with nature, to the present-day initiatives aimed at protecting the region’s unique biodiversity, the Redwood Region has been at the forefront of progressive environmental stewardship.

Several notable organizations have played pivotal roles in shaping the environmental landscape of the Redwood Region. In Humboldt County, the Environmental Protection Information Center (EPIC), founded in 1977, has been a stalwart defender of the region’s ancient forests, working tirelessly to protect old-growth redwoods and advocate for sustainable forestry practices (EPIC: *Environmental Protection Information Center*, n.d.). Similarly, the North Coast Environmental Center, established in 1971, has been instrumental in promoting environmental education, monitoring water quality, and engaging in conservation efforts throughout the region (*History | NEC*, n.d.). These organizations, along with numerous other grassroots groups and community-based organizations (CBOs), have been integral to the preservation of the Redwood Region’s natural heritage.

Lake County has been a leader in sustainable agriculture, with a thriving organic farming community and innovative programs like Lake County Farmers’ Finest, which promotes locally grown produce and supports small-scale farmers (*Lake County Farmers’ Finest*, n.d.). Mendocino County has a long history of environmental activism, with organizations like the Mendocino Land Trust working to protect the county’s unique coastal and inland ecosystems through land conservation, habitat restoration, and public access initiatives. Additionally, the county has been a leader in the development of sustainable forestry practices, with the Mendocino Redwood Company implementing selective harvesting and restoration forestry techniques that prioritize the long-term health of the forest ecosystem (*Our Story | Humboldt Sawmill*, n.d.).

The Redwood Region has benefited from the presence of educational institutions that prioritize environmental studies and sustainability. College of the Redwoods (CR), Mendocino College (MCC), and Cal Poly Humboldt (CPH) have all developed robust programs and initiatives focused on environmental education (science, engineering, planning and policy, etc.), research, and community engagement. From cutting-edge research in such areas as sustainable forestry and clean energy to innovative community outreach programs, these educational institutions continue to play a crucial role in shaping the future of environmental leadership in the Redwood Region (*Environmental Science & Management*, n.d.).

