UC Berkeley Department of City and Regional Planning

CYPLAN 190 – Advanced Topics in Urban Studies
Module 2: Program Design
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[Presentation]

1. Plan Evaluation

1.1. Summary of Findings

*Figure SEQ Figure * ARABIC 1 Bay Area Region. Blue represents North Bay, Orange is San Francisco County, yellow represents Easy Bay, red represents the San Francisco Peninsula, and green represents South Bay*

The evaluation of the data sources, systems, and tools in the Bay Area Jobs First Collaborative's Regional Plan reveals both strengths and limitations in addressing regional issues like economic disparities, environmental justice, and climate resilience. The plan utilizes several well-established data tools, such as CalEnviroScreen (CES) 4.0 and the Healthy Places Index (HPI) 3.0, which are valuable for identifying disinvested communities through pollution burden and socioeconomic vulnerability assessments. However, the limitations of these tools include fixed geographic boundaries, which does not represent community self-identification.

For demographic, economic, and health analyses, the use of proprietary datasets tools such as Community and Place-Based Data Tool introduces transparency concerns. This tool lacks public documentation, increasing difficulty to assess data accuracy and methodology. Despite these issues, high-quality, publicly available sources–such as the U.S. Census Population Estimates and the American Community Survey–enhance credibility through reliable demographic and economic metrics.

The climate and environmental hazards assessment portion of the plan incorporates advanced modeling data, including data from Cal-Adapts Analytics Engine from California's Fourth Climate Change Assessment and USGS's Coastal Storm Modeling System (CoSMoS), for evaluating extreme heat and coastal flooding risks. While these tools provide a robust scientific basis, some data, such as CMIP5 climate projections, are outdated. Cal-Adapt and other California Climate Change Assessment resources would benefit from updates to CMIP6 to improve relevance. Furthermore, the exclusive use of expert-driven assessments for climate vulnerability, such as the San Francisco Bay Shoreline Vulnerability Index, overlooks valuable local community insights.

In summary, the Regional Plan's data systems are effective, but would benefit from integrating recent datasets, expanding community-defined data sources, and increasing transparency in proprietary tools. By addressing these areas, the plan could improve its adaptability, relevance, and inclusiveness in serving the diverse needs of Bay Area communities.

1.2. Data Systems & Data Sources

The first half of this module focuses on the Bay Area Jobs First Collaborative's Regional Plan Part 1 (the Regional Plan)[1]. This Regional Plan provides a baseline assessment of the nine counties of the Bay Area, through an economic analysis, public health analysis, and analyses of environmental and climate impacts. Below is a review of data sources, systems, and tools used in these assessments.

1.2.1. Identifying Disinvested Communities

Currently used data systems and tools

The Regional Plan defines "disinvested communities" as any area that meets one of the following criteria:

a) Census tracts identified as "disadvantaged" by the California Environmental Protection Agency (CalEPA):
    i. Census tracts representing the highest 25 percent of overall scores in CalEnviroScreen 4.0[2]
    ii. Census tracts that lack overall scores in CalEnviroScreen 4.0 due to data gaps, but represent the highest 5 percent of CalEnviroScreen 4.0 cumulative pollution burden scores
    iii. Census tracts identified in the 2017 DAC designation as disadvantaged, regardless of their scores in CalEnviroScreen 4.0
    iv. Lands under the control of federally recognized Tribes; this criterion excludes Tribes that do not have federal recognition status
b) Census tracts with median household incomes at or below 80 percent of the statewide median income or with the median household incomes at or below the threshold designated as low-income by the Department of Housing and Community Development's list of state income limits adopted pursuant to Section 50093 of the California Health and Safety Code
c) "High poverty areas" and "high unemployment areas," as designated by the California Governor's Office of Business and Economic Development California Competes Tax Credit Program
d) California Native American tribes, as defined by the list maintained by the Native American Heritage Commission

Additionally, as part of the public health analysis portion of the assessment, priority zip codes were identified using the Healthy Places Index, a tool developed by the Public Health Alliance of Southern California[3]. These zip codes represent neighborhoods throughout the nine-county region that are overburdened by pollution and have been systematically denied access to resources. Due to these systemic injustices, these communities have low resilience to climate hazards. The Regional Plan defines priority

[1] California Governor's Office of Planning and Research. *Bay Area Jobs First Collaborative, California Jobs First: Regional Plan Part 1*, 2022.
[2] California Office of Environmental Health Hazard Assessment (OEHHA). *SB 535 List of Disadvantaged Communities (2024) Geodatabase*, 2024. https://oehha.ca.gov/calenviroscreen/sb535
[3] Public Health Alliance of Southern California. *Healthy Places Index*, n.d. https://healthyplacesindex.or

zip codes as those in the bottom 50th percentile of Healthy Places Index (HPI) scores for the state, a proxy for climate vulnerability[4].

Both CalEnviroScreen 4.0 and Healthy Places Index 3.0 are well-established data platforms for visualizing community characteristics across a range of indicators. The pros and cons of utilizing each of these tools is summarized in the table below.

Table 1 Pros and cons of using CalEnviroScreen 4.0 and Healthy Places Index 3.0 for identifying disinvested communities

Data Tool	*Pros*	*Cons*
CalEnviroScreen (CES) 4.0	● Captures cumulative pollution burden and socioeconomic vulnerability ● Provides a range of environmental pollution and exposure indicators ● DAC designation criteria are aligned with relevant California environmental justice legislation	● Only federally recognized Native American Tribes have disadvantaged community (DAC) status ● Communities are defined based on government census tracts, without consideration to how communities and neighborhoods self-identify
Healthy Places Index (HPI) 3.0	● Prioritizes social determinants of health with economic and resource access metrics ● Includes a broader range of health and socioeconomic factors for equity analyses ● All data sources underlying HPI are publicly accessible	● (Relative to CalEnviroScreen) Less emphasis on specific pollution indicators; this may result in missing areas identified solely on socioeconomics, especially tracts not meeting low-income criteria but experiencing high pollution ● Communities are defined based on zip code areas, without consideration to how communities and neighborhoods self-identify

Another potential data system/ tool

The criteria the Regional Plan uses to identify disinvested communities supplements any gaps resulting from index approaches used by CES 4.0 and HPI 3.0. There are two additional criteria related to economic metrics that mitigate the exclusion of communities experiencing unjust conditions. Notably, all Tribes in the Native American Heritage Commission database are given disinvested community status.

[4] A. Ravel, T. Chen, and P. Shah, *Mapping Resilience: A Blueprint for Thriving in the Face of Climate Disasters* (Asian Pacific Environmental Network, 2019).

This database is inclusive of any Tribe that has gone through the Tribal Consultation Process for the Native American Heritage Commission Contact List[5].

However, to understand remaining gaps, we went through the exercise of identifying disinvested communities using the **Centers for Disease Control and Prevention (CDC) Social Vulnerability Index (SVI)**[6]. This tool displays a community's vulnerability to various hazards through examination of 15 social indicators, including poverty, transportation, and housing density.

Unfortunately, the interface for this tool often has lags, the user cannot easily toggle by county. Therefore, we downloaded raw data[7] and reproduced a map for the nine counties in the Bay Area (Figure 2). We set a criterion for establishing whether a census tract is 'disinvested' by setting a threshold of an SVI score of greater than 0.5, as seen in Figure 3. We visually compared Figure 3 against the map of priority zip codes identified using HPI 3.0 (Exhibit 3.41) and a map of Disadvantaged Communities (DAC) in the Bay Area per CES 4.0 (Figure 4). The table below breaks down the total number of census tracts identified as disinvested, based on CalEPA's definition of DACs and our own definition using the CDC SVI.

Table 2 Comparison of disinvested communities identified using CalEnviroScreen 4.0 and the CDC Social Vulnerability Index

Data Tool	*Total number of census tracts identified as 'disinvested'*	*Total population within disinvested census tracts*	*Total area covered by disinvested census tracts (acres)*
CalEnviroScreen (CES) 4.0	146	713,555	317,260
CDC Social Vulnerability Index (SVI)	556	2,41,5777	685,788

[5] California Native American Heritage Commission. *Request for tribal consultation—NAHC contact list regulations*. https://nahc.ca.gov/2021/08/request-for-tribal-consultation-nahc-contact-list-regulations/
[6] Centers for Disease Control and Prevention/ Agency for Toxic Substances and Disease Registry/ Geospatial Research, Analysis, and Services Program. *CDC/ATSDR Social Vulnerability Index*. 2020 California Database. https://www.atsdr.cdc.gov/placeandhealth/svi/data_documentation_download.html. Accessed on November 6, 2024.
[7] Centers for Disease Control and Prevention/Agency for Toxic Substances and Disease Registry. "CDC/ATSDR Social Vulnerability Index (SVI) Interactive Map." Last modified December 1, 2022. https://www.atsdr.cdc.gov/placeandhealth/svi/interactive_map.html.

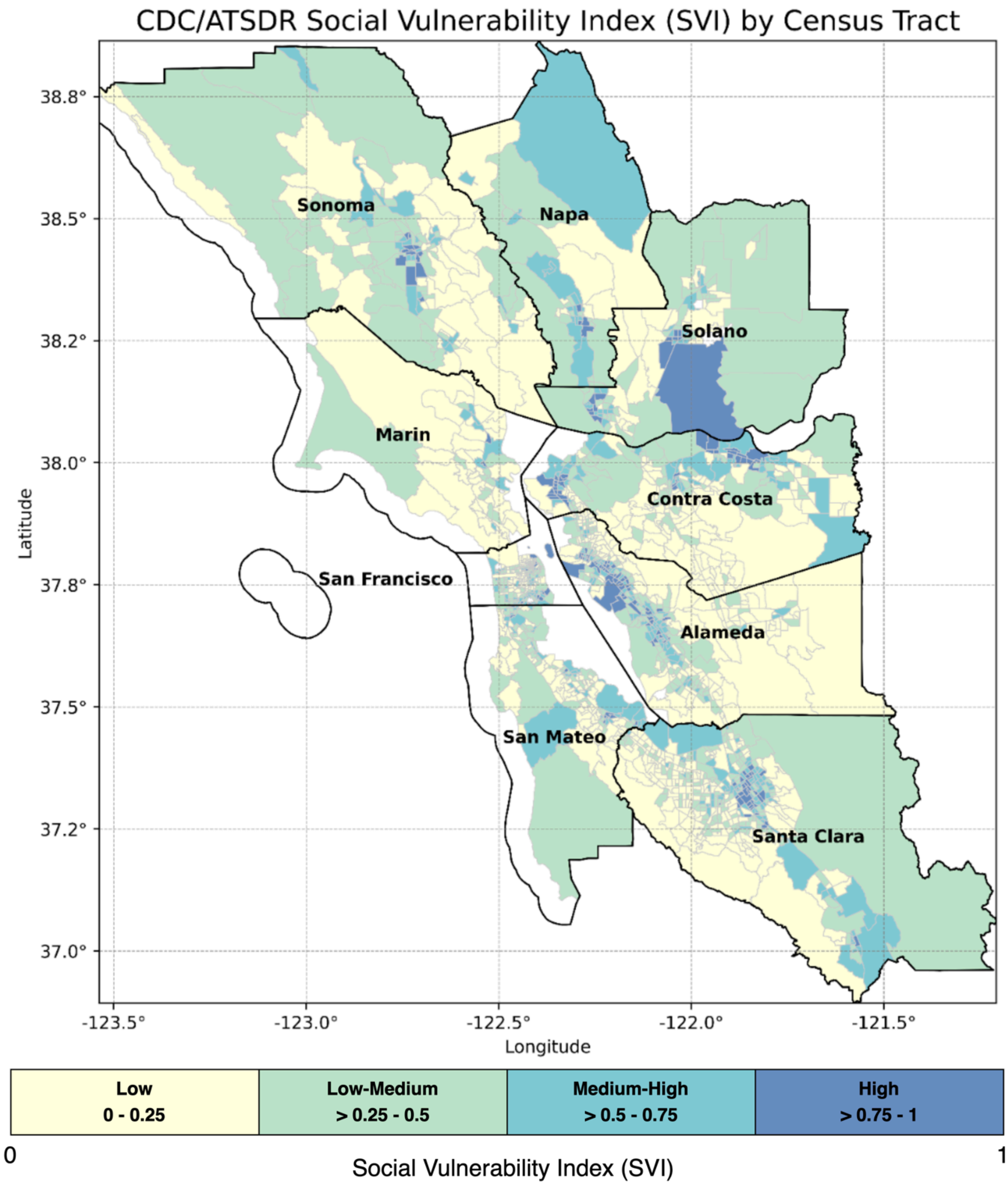


Figure 2 Social Vulnerability Index (SVI) by Census Tract for the Bay Area Counties, 2022. This map visualizes census tracts within the nine-county Bay Area region, colored by percentile rankings on the CDC/ATSDR Social Vulnerability Index (SVI). The SVI aggregates various socioeconomic and demographic factors to assess communities' relative vulnerability to hazardous events, with higher values indicating greater vulnerability.

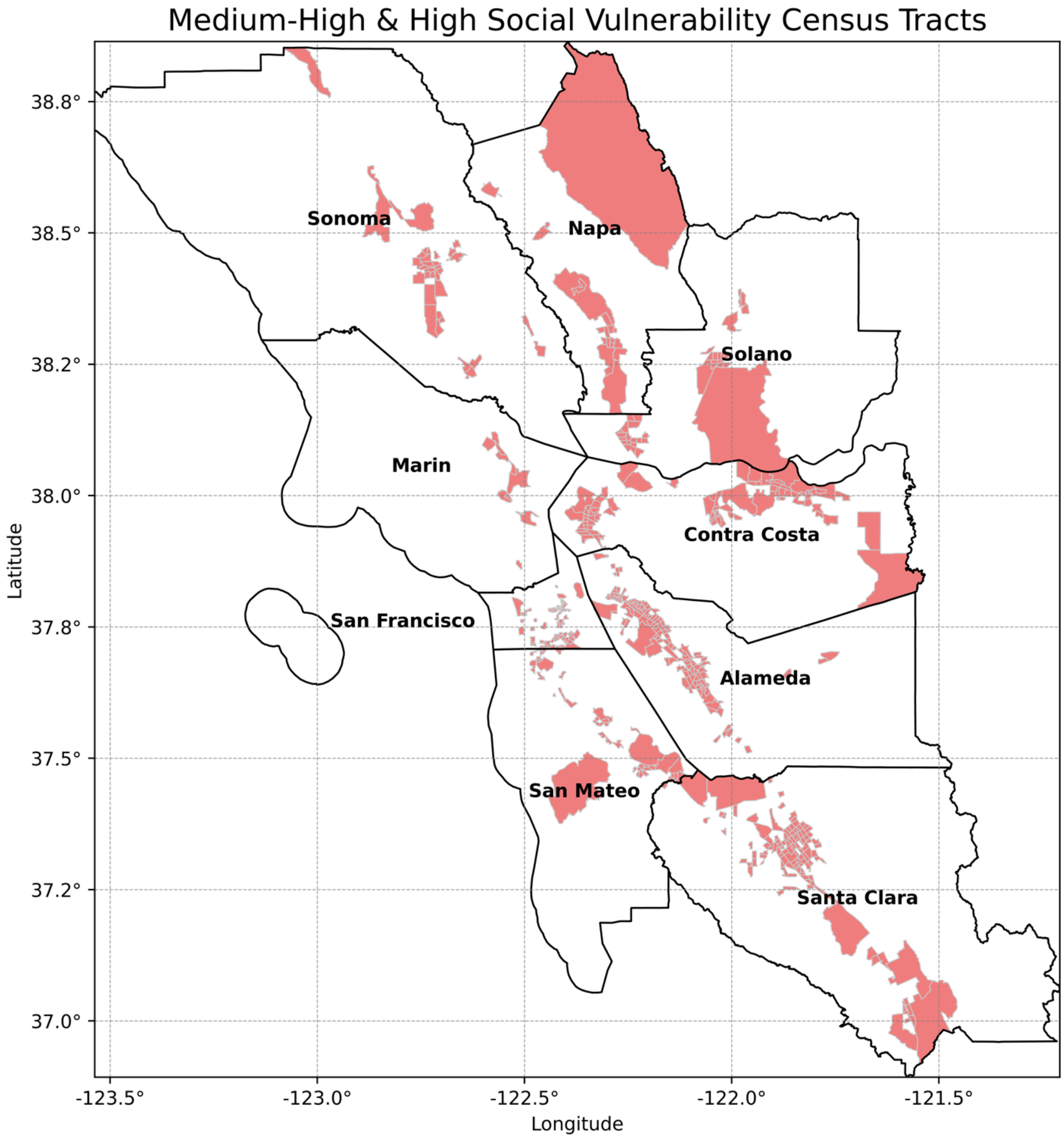
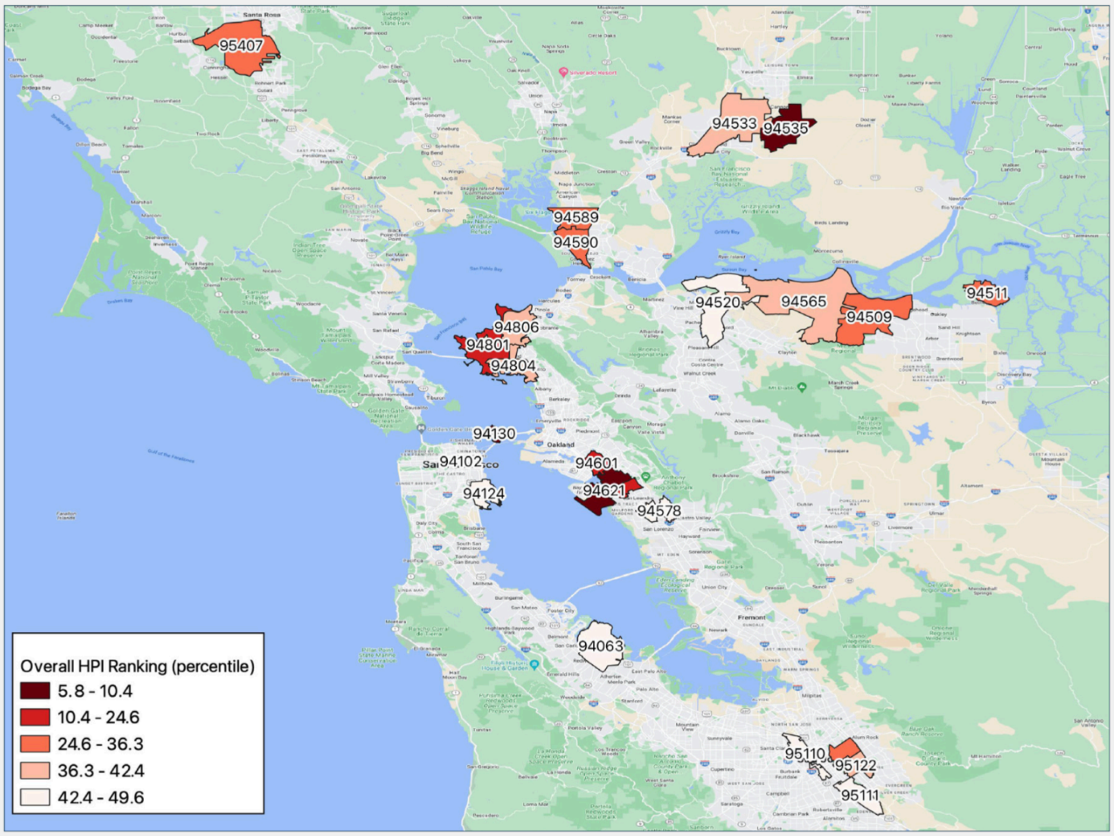


Figure 3 Census tracts with Medium-High and High Social Vulnerability in Bay Area counties, 2022. This map highlights census tracts within the nine-county Bay Area region with Social Vulnerability Index (SVI) scores above 0.5, categorized as medium-high and high vulnerability zones. These areas are identified based on CDC/ATSDR SVI metrics, which assess factors such as socioeconomic status, household composition, race/ethnicity, language, and housing type/transportation access. High SVI scores indicate greater community vulnerability, suggesting that these tracts may require more focused support in emergency preparedness and response efforts.

EXHIBIT 3.41 | Map of priority ZIP code locations



Source: California Healthy Places Index, developed by the Public Health Alliance of Southern California. HealthyPlacesIndex.org.
Map made by the author using QGIS.

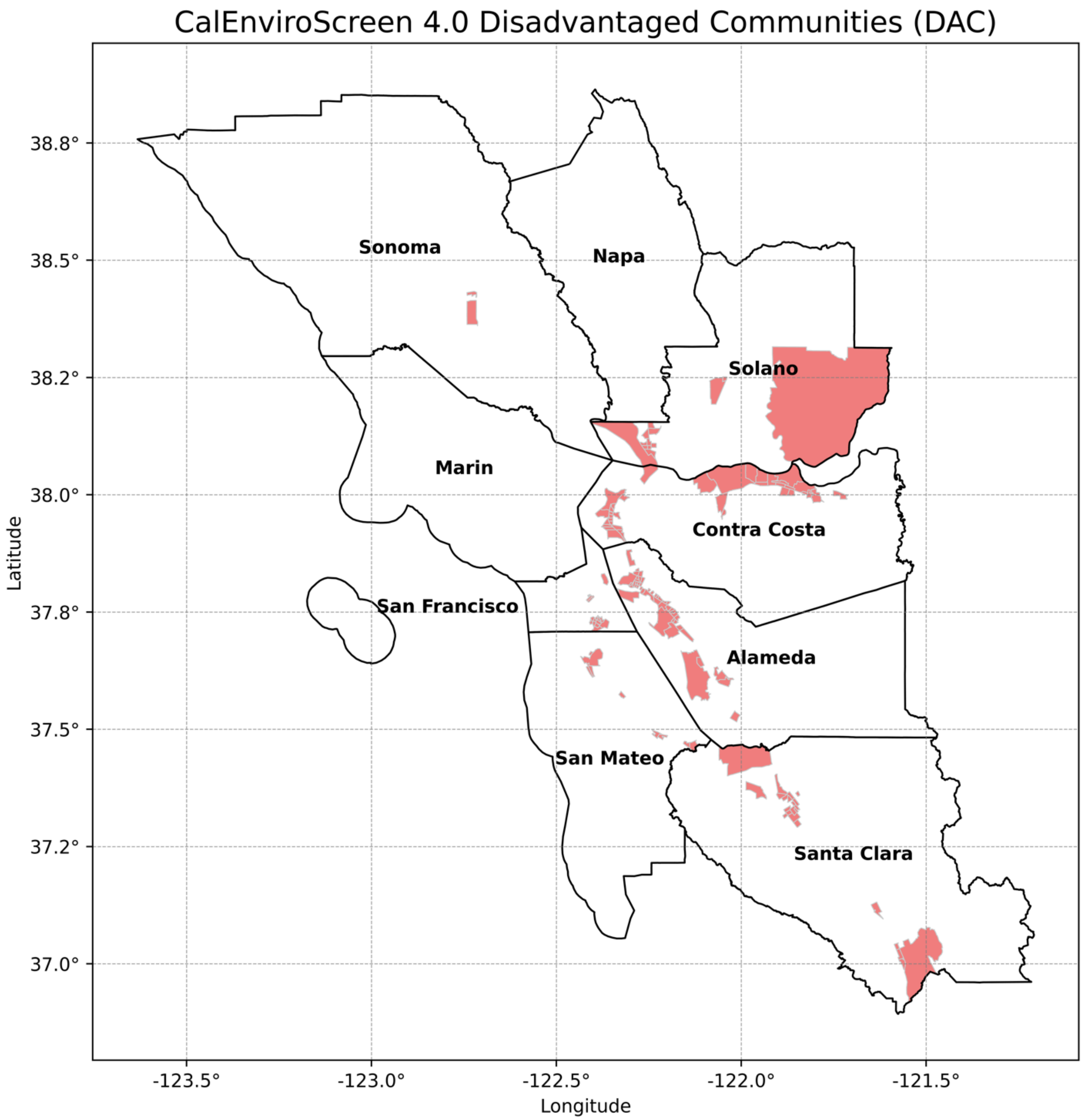


Figure 4 Disadvantaged Community (DAC) census tracts in the Bay Area as determined by CalEnviroScreen 4.0. This map highlights census tracts in the nine-county Bay Area that are designated as disadvantaged communities (DACs) under California Senate Bill 535, based on CalEnviroScreen 4.0 criteria. The tracts shaded in red represent areas with the highest cumulative environmental and social burdens, as determined by indicators such as pollution exposure, population vulnerability, and socioeconomic status.

As demonstrated in Table 2, the CDC SVI identifies a greater number of disinvested communities in terms of total number of census tracts, population, and area, compared to CES 4.0. This discrepancy suggests that the CDC SVI captures different facets of vulnerability that are not accounted within CalEnviroScreen, potentially including communities that experience socioeconomic challenges without the same level of environmental burden. The CDC SVI's broader focus on social factors might contribute to identifying a larger number of vulnerable tracts, particularly in urban and suburban areas. This finding highlights the importance of using multiple tools and data sources to ensure a comprehensive identification of disinvested communities.

The 25 priority zip codes identified using HPI 3.0 (Exhibit 3.41) represents a population of just under 1 million (Exhibit 3.40). If you add this to the 713,555 people in CES 4.0 DACs, the total population is roughly 1.7 million, compared to 2 million per the CDC SVI analysis (Table 2).

1.2.2. Demographic, economic, and public health analysis

Currently used data systems and tools

<u>Demographic analysis</u>

Results from the demographic analysis are included in 3.1 Economy & Economic Development of the Regional Plan. Exhibit 3.1 of the Regional Summary shows an overview of basic demographic information, including a breakdown of the population by sex and median age. These statistics were sourced from the **Community and Place-Based Data Tool**, developed by GISPlanning under a contract from the California Governor's Office Business & Economic Development (GoBiz).

Evaluating the quality of this data was difficult in identifying technical documentation outlining the methodology and data sources underlying this tool. However, based on a blog post by GISPlanning, multiple data sources were incorporated, including proprietary data from Applied Geographic Solutions, National Center for Educational Statistics, Emsi, and DataAxle (formerly InfoGroup USA)[8].

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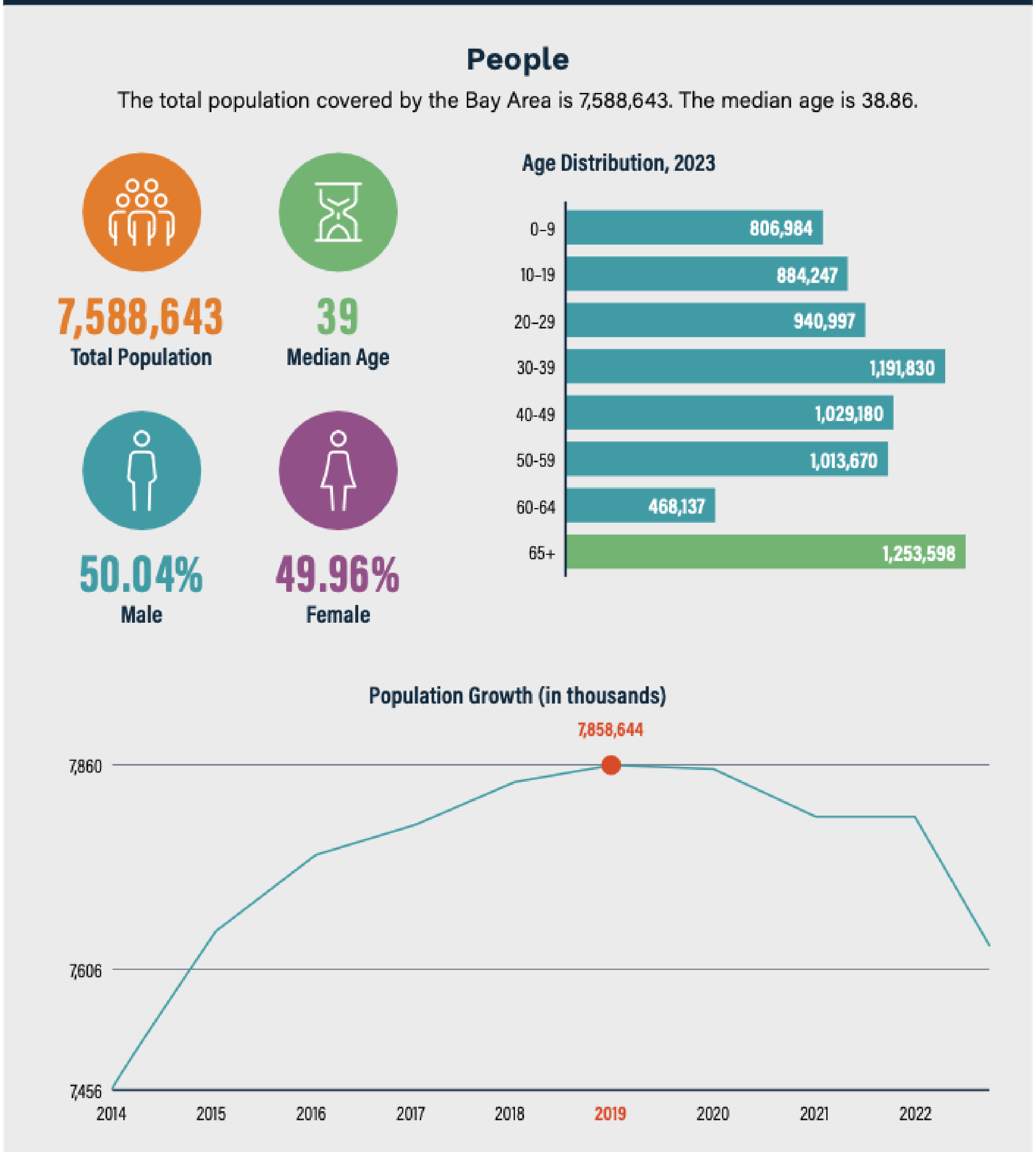
[8] Alissa Sklar, "California Launches Innovative Community & Place-Based Data Tool," *GIS Planning Blog*, May 11, 2022, https://blog.gisplanning.com/california-launches-innovative-community-place-based-data-tool.

EXHIBIT 3.1 | Bay Area population characteristics



Source: Community and Place-Based Data Tool (GIS Planning, n.d.)..

We queried demographic summaries from Community and Place-Based Data Tool for the nine counties in our region, and found that all estimates came from a proprietary source, Applied Geographic Solutions. Using proprietary data for an open-access, government-funded tool has implications for the tool's transparency, and how trusting the user is of the output. This tool is a somewhat "black box" that outputs results without a sense of the inputs or analysis approach.

The demographic analysis also included information from the **U.S. Census Population Division's Annual County Resident Population Estimates by Age, Sex, Race, and Hispanic Origin**. The quality of this data is high, as population estimates are produced using a well-established methodology that includes demographic data from the decennial census, administrative records, and survey data. The Census Bureau applies rigorous quality checks and modeling techniques to ensure accurate estimates, making this dataset a reliable reflection of population distribution by demographic characteristics. The geographic coverage is also complete, and data are released at relatively frequent intervals (annually)[9].

The table below provides a summary of details for each of the data sources and systems described above.

Table 3 Summary of data source, system and tool details for the demographic analysis of the Regional Plan

Data source/system	Data source	Date(s) created	Data quality
Community and Place-Based Data Tool	California Governor's Office Business & Economic Development (GoBiz); GISPlanning	Unknown	Data quality is unknown because proprietary sources were used
Annual County Resident Population Estimates by Age, Sex, Race, and Hispanic Origin	U.S. Census, Population Divisions	2017; 2022	Overall data quality is high

Economic analysis

Results from the economic analysis are described in 3.1 Economy & Economic Development of the Regional Plan. A key data source used in this section of the report is the **Bay Area Recovery Tracker**, which was developed in response to the COVID-19 pandemic. It is informed by the following data sources[10]:

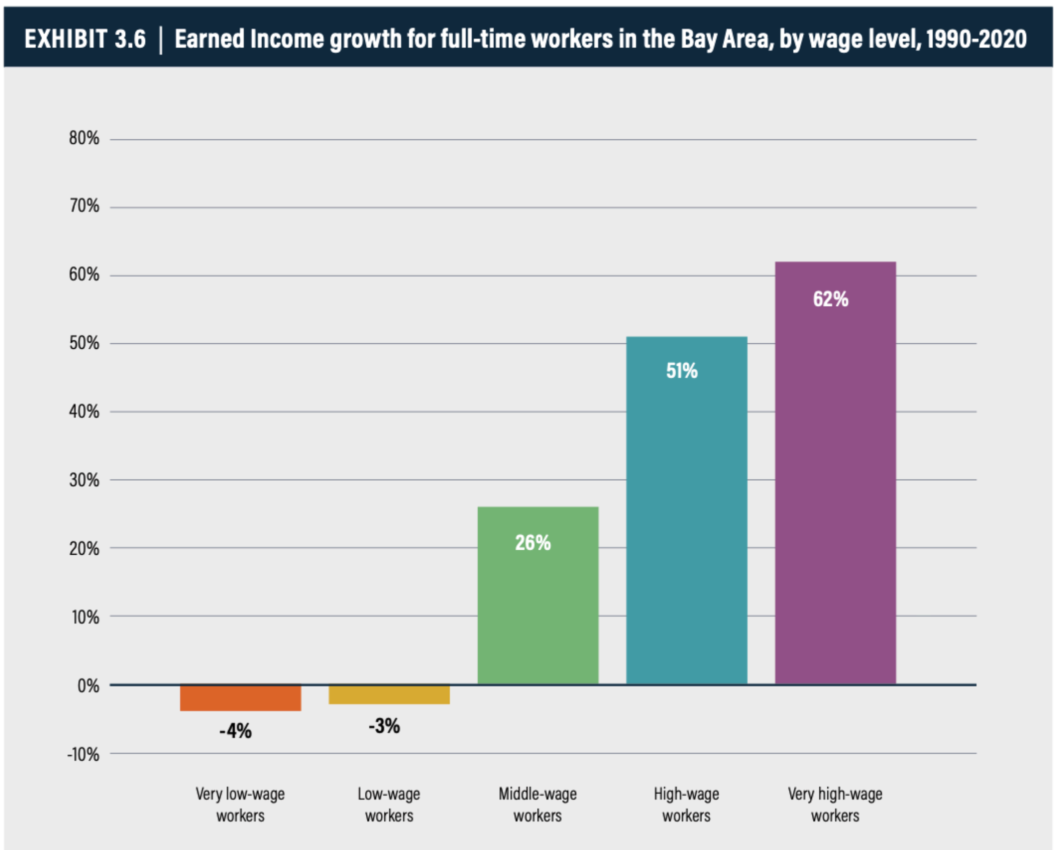
- The Census Household Pulse Survey from August 18, 2020, to October 2, 2023
- The monthly Integrated Public Use Microdata Series (IPUMS) Current Population Survey (CPS) data, which provides social and economic trends in the United States as well as pandemic-related findings
- Open-source data from Bay Area counties on Covid-19 vaccination rates
- The State of California's Employment Development Department data on county-level unemployment rates
- Zillow housing data on typical home values and observed market rate rent for given regions

[9] U.S. Census Bureau, *Methodology for the United States Population Estimates: Vintage 2023*, April 2023, https://www2.census.gov/programs-surveys/popest/technical-documentation/methodology/2020-2023/methods-statement-v2023.pdf.
[10] Bay Area Equity Atlas. "Bay Area Recovery Tracker." Accessed November 6, 2024. https://bayareaequityatlas.org/recovery-tracker.

- The Self-Sufficiency Standard created by the Insight Center's Family Needs Calculator, which measures the base income necessary to afford basic expenses in California
- The 2019, 2020, and 2021 5-year American Community Survey (ACS) IPUMS data

The dashboard for this tool is updated on a quarterly basis and tracks the region's recovery across 15 different indicators. When possible, data is disaggregated by geography, race, income, and gender[11].

The Bay Area Recovery Tracker demonstrates high data quality, integrating reliable and well-established sources that ensure robust accuracy and comprehensive coverage across social, economic, and health metrics. Its design allows for cross-verification, enhancing reliability, while balancing frequently updated data with more in-depth periodic datasets provides both immediacy and nuanced insights. Though there are



Source: The State of Bay Area Workers Data Tool (Rework the Bay, 2021).

minor trade-offs in capturing the latest real-time changes (it is only updated on a quarterly basis), the tool serves as a valuable and thorough tool for monitoring regional recovery with a strong foundation of credibility and detail.

In addition to the Bay Area Recovery Tracker, the report also provided statistics from **The State of Bay Area Workers Data Tool**. Bay Area Equity Atlas was also involved in the development of this tool, along with ReWork the Bay's cross-sector Equity at Work Council and the National Fund for Workforce

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[11] Bay Area Equity Atlas, "Bay Area Recovery Tracker."

Solutions. Additionally, Burning Glass Technologies was brought in as a third-party contractor. An example of the statistics pulled from this tool are shown in Exhibit 3.6 of the report.

Notably, the dashboard for this tool is not working right now and there is no information on whether it will go live again. However, we identified a report summarizing key results and methodology[12]. According to this technical document, two key data sources inform the State of Bay Area Workers Data Tool: the 2018 5-year American Community Survey (ACS) microdata from IPUMS USA and a proprietary occupation-level dataset from Burning Glass Technologies.

The first source (IPUMS) is high quality, offering reliable, detailed demographic and socioeconomic information at multiple geographic levels. The ACS's rigorous sampling and weighting methodology ensure accurate representation of local populations, and IPUMS enhances this with standardized formatting and extensive documentation. The 5-year data provides comprehensive coverage and high completeness across various population subgroups. However, as noted before, the use of proprietary sources obscures the overall quality of the data tool and we cannot speak to the completeness, accuracy, or timeliness of the proprietary data from Burning Glass Technologies.

The table below provides a summary of details for each of the data sources and systems described above.

Table 4 Summary of data sources, systems, and tool used in the economic analysis of the Regional Plan

Data source/system	Data source	Date(s) created	Data quality
Bay Area Recovery Tracker	Bay Area Equity Atlas	Updated on a quarterly basis	Overall data quality is high
The State of Bay Area Workers Data Tool	Bay Area Equity Atlas; ReWork the Bay's cross-sector Equity at Work Council; National Fund for Workforce Solutions; Burning Glass Technologies	2021	While some of the specific data sources have a high data quality, proprietary datasets were also used

<u>Public health analysis</u>

The Regional Plan relied on a single data tool to analyze public health: the Healthy Places Index (HPI) 3.0. This tool is the third iteration of HPI and is developed and maintained by the Public Health Alliance of Southern California. It includes 23 indicators across eight different domains:

1. Economics
2. Education
3. Healthcare access
4. Housing
5. Neighborhood conditions
6. Clean environment
7. Social environment

[12] Abbie Langston, Edward Muña, and Matthew Walsh, *Advancing Workforce Equity in the Bay Area: A Blueprint for Action (Oakland, CA: PolicyLink, 2021)*, https://reworkthebay.org/wp-content/uploads/2021/02/Advancing-Workforce-Equity-in-the-Bay-Area_FINAL_0.pdf

8. Transportation

The developers of HPI 3.0 were very intentional in their process for selecting specific indicators within these domains. Some of the selection criteria included are[13]:

- Indicator data must come from publicly accessible data sources
- Indicator data must be up to date at the geographical level of census tract
- Indicator data must have geographic coverage for all eligible 2010 census tracts

Based on this and additional criteria, data for 23 distinct indicators were pulled from a range of sources, though data from the American Community Survey (ACS) made up half of the individual indicators[14]. These were scaled using Z-Scores and averaged across each of the domains listed above. Although the HPI mapping tool uses 2010 census geographies, much of the data incorporated into HPI scores reflects multiple years and centered around the period between 2015 and 2019.

The data quality of the HPI 3.0 is very high. The tool developers established a well thought out criterion for selecting indicators, that ensured data completeness and accessibility. Additionally, when data was missing, rather than excluding that entire census tract, a nearest (covariate) neighbor algorithm was used.

Additional data

UCLA's *AskCHIS*[15] platform, part of the California Health Interview Survey (CHIS), is a public health data tool that provides access to California's largest state-level health survey. It includes data on demographic characteristics, economic status, and public health metrics at the state, regional, and county levels, with some data available at the zip code level. The tool is designed to assist in analyzing health outcomes, disparities, and social determinants of health across diverse communities. The platform is accessible through an online interface where users can query a range of variables, including population demographics, household income, health behaviors, and insurance coverage. Data can be filtered by age, race and ethnicity, gender, and socioeconomic status, allowing for detailed community assessments. Data outputs are customizable, enabling users to download data summaries, visualizations, and tables for further analysis. The source is user-friendly, and does not require specialized data skills which enables broad access to CHIS data. Since it is prioritizing California, the analysis of community-specific health data is advanced and tailored to the state itself.

The quality of the data is shown in its completeness, geographic resolution, and timeliness. The tool covers over twenty years of data, and includes a comprehensive set of indicators on health behaviors, access to care, and socioeconomic factors. CHIS data is collected annually, ensuring a robust dataset. The data is available at the state and county levels, with select indicators at zip code level. This granularity supports targeted demographics and health analysis in urban and some rural areas.

Though updated annually, the lag between data collection and release limits its responsiveness to current events. Additionally, at finer geographic scales in smaller rural zip codes, data lacks precision due to sampling limitations. Data is also primarily self-reported, which introduces different biases to areas with varying income and health behaviors.

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[13] Neil Maizlish et al., "California Healthy Places Index: Frames Matter," *Public Health Reports* 134, no. 4 (2019): 354–363, https://doi.org/10.1177/0033354919849882.
[14] ibid
[15] UCLA Center for Health Policy Research. *AskCHIS*. https://ask.chis.ucla.edu/.

1.2.3. Climate hazard analysis

The two climate hazards we assessed in Module 1 were extreme heat and coastal flooding due to sea level rise. For consistency, we also focus on these two climate hazards in our review of the Regional Plan.

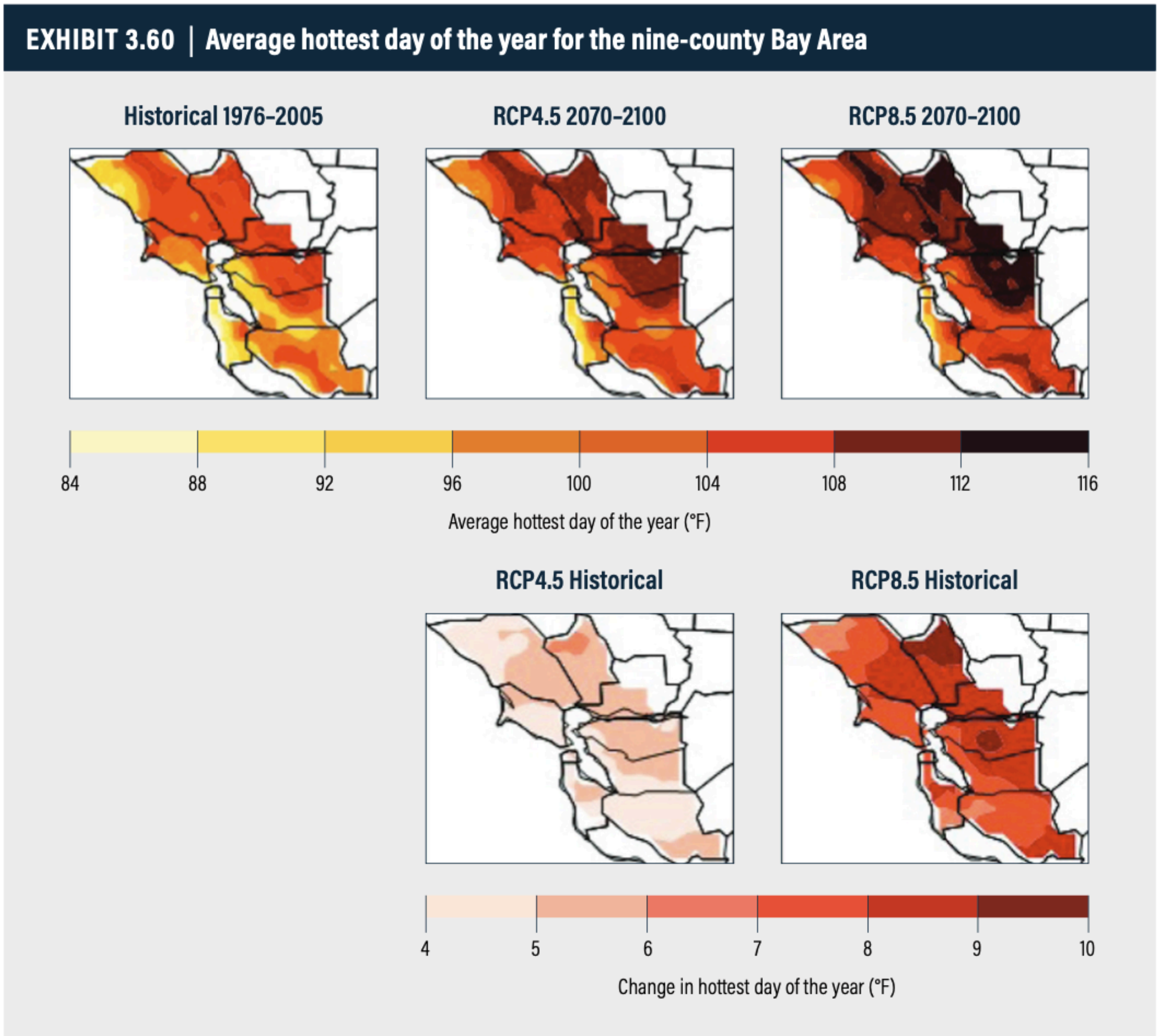
Currently used data sources, systems, and tools

Extreme heat

Section 3.3 of the Regional Plan covers climate and environmental impacts. Insights from **California's Fourth Climate Change Assessment**[16] were leveraged to show projected climate change impacts for extreme heat. For instance, Exhibit 3.60 shows the average hottest day of the year for both a historical period (1976 – 2005) and future scenarios (2070 – 2100) under Representative Concentration Pathways (RCPs) 4.5 and 8.5.

California's Fourth Climate Change Assessment was published in January of 2019 and was prepared by the Governor's Office of Land Use & Climate Innovation, the California Natural Resources Agency, and the California Energy Commission. It reflects downscaled data from the **Coupled Model Intercomparison Project Phase 5 (CMIP5)**, which was the most recent generation of CMIP data in place when the Fourth Assessment was launched. The data from CMIP is based on multiple, robust global climate models (GCMs) driven by first principles of physics and chemistry.

[16] David Ackerly et al., *San Francisco Bay Area Summary Report*, California's Fourth Climate Change Assessment, Report No. SUM-CCCA4-2018-005 (Sacramento: California Governor's Office of Planning and Research, California Natural Resources Agency, and California Energy Commission, 2018), https://www.energy.ca.gov/sites/default/files/2019-11/Reg_Report-SUM-CCCA4-2018-005_SanFranciscoBayArea_ADA.pdf.



Top row: Average hottest day of the year in the historical (1976-2005) period and in the late-21st century (2070-2100) under RCP4.5 and RCP8.5. Bottom row: change (late-21st century minus historical) in the hottest day of the year under RCP4.5 and RCP8.5. Unit is °F. All data are derived from LOCA.

Source: *San Francisco Bay Area Region Report* (California's Fourth Climate Change Assessment). (2018). [Regional Report]. Governor's Office of Planning and Research. https://climateassessment.ca.gov/regions/

GCM projections are at a relatively coarse native resolution, ranging from approximately 100 to 250 km. To capture anomalies at more local scales, downscaling must be conducted. LOCA (Localized Constructed Analogs) downscaling is a statistical technique used to refine coarse climate model data to a finer resolution more suitable for regional or local analysis[17]. This method improves upon traditional downscaling by using historical climate data to establish a more realistic spatial pattern. LOCA downscaling identifies "analogs" in historical records that closely resemble the large-scale patterns of a

[17] David W. Pierce, "What is LOCA?" *LOCA Statistical Downscaling (Localized Constructed Analogs)*, accessed November 6, 2024, https://loca.ucsd.edu/what-is-loca/.

given model output. It then constructs finer-resolution data based on these analogs, capturing localized climate variability more accurately. The resulting data offers high-resolution projections with better representation of extremes and are thus more suitable for regional impact assessment studies[18].

Though output from GCMs have many uncertainties[19], the projections for extreme heat included in the Regional Summary (i.e., Exhibits 3.60 and 3.61) are reflective of state-of-the-art climate modeling science. However, we note that CMIP5 is no longer the most recent iteration of GCM data developed by CMIP. GCMs and data from CMIP6 was first released in 2019, and nearly all of it was published by 2022[20].

The Regional Plan also includes data on extreme heat from the **Cal-Adapt Analytics Engine 2.0**, which was designed with consideration to California's Climate Change Assessment schedule. Because Cal-Adapt 2.0 focuses on California's Fourth Climate Change Assessment, the data underlying this tool is also currently based on out-of-date climate projections. Cal-Adapt was developed by the Geospatial Innovation Facility at the University of California, Berkeley with funding and advisory oversight by the California Energy Commission and the California Strategic Growth Council.

The table below provides a summary of details for each of the data sources and systems used to assess extreme heat, as described above.

Table 5 Summary of data sources, systems, and tools used to describe climate-driven extreme heat impacts in the Regional Plan

Underlying data source	Data source/system	Data source	Date(s) created	Data quality
Downscaled global climate model data (GC) from the Coupled Model Intercomparison Project Phase 5 (CMIP5)	California's Fourth Climate Change Assessment	Governor's Office of Land Use & Climate Innovation; California Natural Resources Agency; California Energy Commission	Report released in January 2019; climate projection data based on CMIP5	Overall quality is high, but data is not representative of the most recent CMIP
	Cal-Adapt 2.0	Geospatial Innovation Facility at the UC Berkeley; California Energy Commission;	First launched in 2011; Cal-Adapt 2.0 was developed and launched as a part of	

[18] David Pierce and Daniel Cayan, *High-Resolution LOCA Downscaled Climate Projections Aim to Better Represent Extreme Weather Events* (La Jolla, CA: Scripps Institution of Oceanography, 2017), https://loca.ucsd.edu/~pierce/LOCA_DPierce_2017-07-08.pdf.
[19] Intergovernmental Panel on Climate Change, Climate Change 2021: The Physical Science Basis. Contribution of Working Group I to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change, ed. V. Masson-Delmotte, P. Zhai, A. Pirani, S.L. Connors, et al. (Cambridge: Cambridge University Press, 2021), https://www.ipcc.ch/report/ar6/wg1/.
[20] European Centre for Medium-Range Weather Forecasts. "CMIP6: Global Climate Projections*." Copernicus Knowledge Base*. Last modified September 18, 2024. https://confluence.ecmwf.int/display/CKB/CMIP6%3A+Global+climate+projections.

		California Strategic Growth Council	California's Fourth Climate Change Assessment	

Flood & Sea Level Rise

To assess climate risks due to flooding and sea level rise, the Regional Report relied on data from the **Coastal Storm Modeling System (CoSMoS)**. CoSMoS is a dynamic modeling approach that was developed by the United States Geological Survey (USGS). CoSMoS enables detailed projections of coastal flooding by integrating future sea-level rise and storm impacts with long-term coastal evolution, such as beach changes and cliff or bluff retreat, across extensive areas (hundreds of kilometers)[21]. It models the full range of coastal storm dynamics—tides, waves, and storm surge—and scales these down to localized flood projections, making it suitable for regional-level coastal planning and decision-making. Additionally, instead of relying solely on historical storm data, CoSMoS utilizes wind and pressure inputs from global climate models to simulate coastal storms under the evolving climate conditions of the 21st century[22]. With consideration to all of this, we rate the overall quality of CoSMoS data as high; the model is based on first principles, and data is scaled and corrected using state-of-the art data science techniques.

There are multiple ways to view and interact with CoSMoS data. The first is using **the Hazard Exposure Reporting and Analytics (HERA)** platform, and specifically the Impact of Sea Level Rise and Storms on Coastal Flooding Hazards mapping tool. For instance, Exhibit 3.69 of the report shows the percentage of total employees within each county that will be vulnerable to 4.9 feet of sea level rise with annual storm frequency. This analysis was conducted using the hazard zones defined by CoSMoS and employee data from the Data Axle Employer Database, a proprietary dataset. Businesses are described using the North American Industry Classification System (NAICS). Businesses were categorized into the groups shown in Exhibit 3.69[23].

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[21] U.S. Geological Survey. "Coastal Storm Modeling System (CoSMoS)." Last modified November 21, 2021. https://www.usgs.gov/centers/pcmsc/science/coastal-storm-modeling-system-cosmos.
[22] Ibid
[23] U.S. Geological Survey. "Data Methods Overview." *Hazards Exposure Reporting and Analytics (HERA)*. Accessed November 6, 2024. https://www.usgs.gov/apps/hera/docs/about/index.html?topic=data-methods-overview.

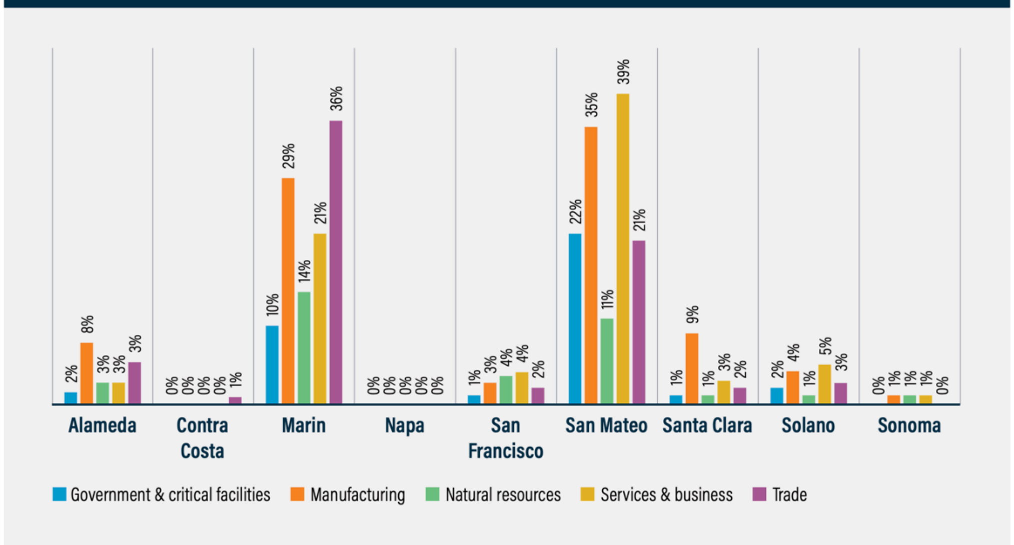


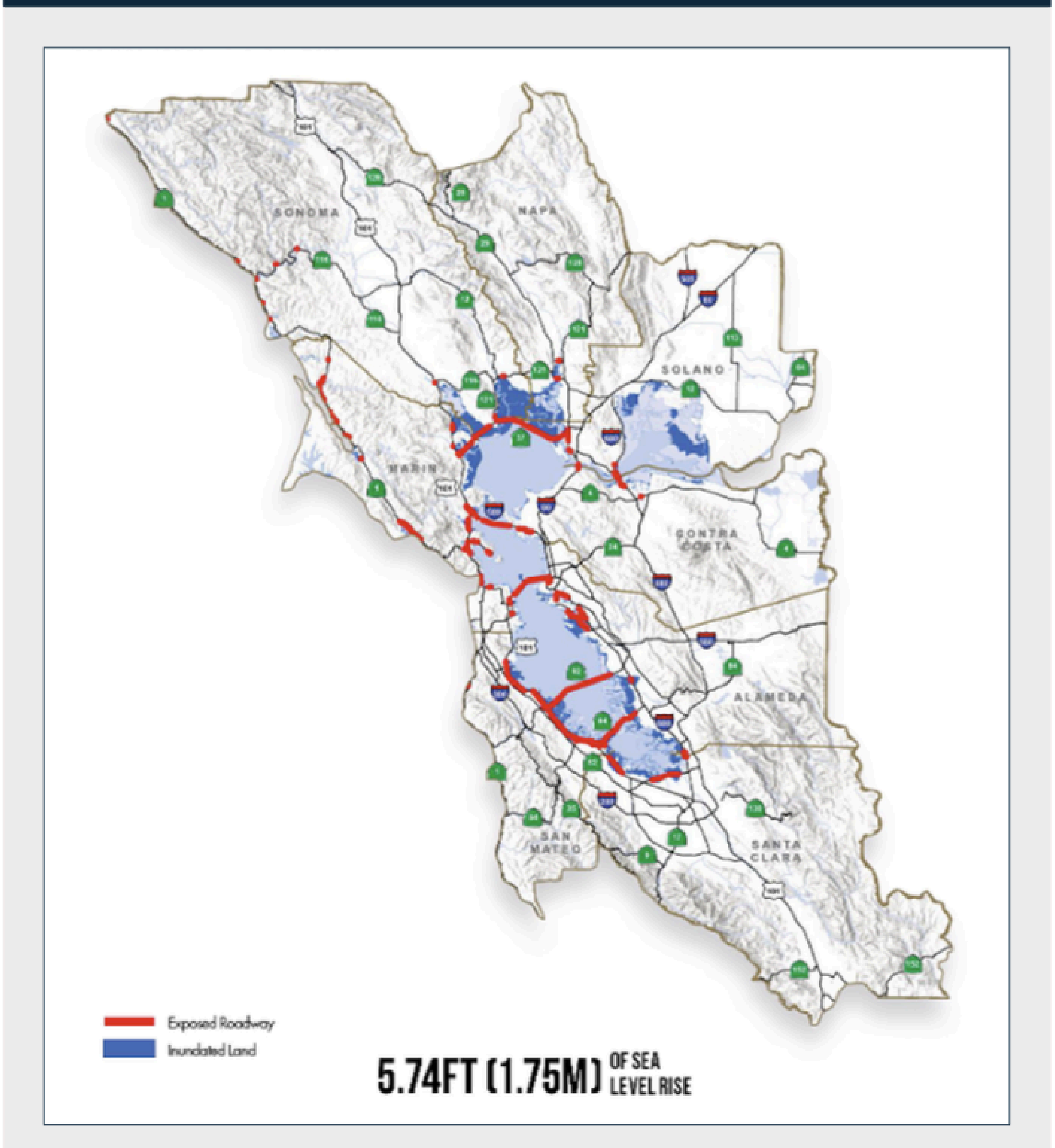
EXHIBIT 3.69 | Percent of total employees within each county that will be vulnerable to 4.9 feet of sea level rise with annual storm frequency, by sector

Source: USGS HERA Coastal Flooding Tool.

Additionally, Exhibit 3.71 demonstrates the impact of sea level rise on the state highway system. This map was produced by California Department of Transportation (CalTrans), as part of the **CalTrans Vulnerability Assessment for District 4**[24] but the underlying sea level projections are from CoSMoS.

[24] California Department of Transportation. *District 4 Technical Report: 2019 Climate Change Vulnerability Assessments*. 2019. https://dot.ca.gov/-/media/dot-media/programs/transportation-planning/documents/2019-climate-change-vulnerability-assessments/ada-remediated/d4-technical-report-a11y.pdf.

EXHIBIT 3.71 | Sea level rise impacts to the Caltrans state highway system with 5.74 feet of SLR



Caltrans Transportation Asset Vulnerability Study, District 4, Caltrans No. 74A0737. Sea level rise and storm surge data provided by the U.S. Geological Survey from the Coastal Storm Modeling System (CoSMoS). GIS data from CoSMoS can be viewed and downloaded from the Our Coast Our Future interactive map available here: http://data.pointblue.org/apps/ocof/cms

Source: Caltrans Vulnerability Assessment for District 4 (Caltrans, 2018).

As shown in the caption of Exhibit 3.71, CoSMoS GIS data can theoretically be viewed and downloaded using the **Our Coast, Our Future Hazard Map**. Our Coast, Our Future is a partnership between Point Blue Conservation Science and USGS, and was developed collaboratively with local, state, and federal stakeholders. However, the page for this tool is down right now.

The table below provides a summary of details for each of the data sources and systems described above.

Table 6 Summary of data sources, systems, and tool used to describe climate-driven sea level and flood risks in the Regional Plan

Data tool	**Underlying data source(s)**	**Tool developers**	**Date(s) created**	**Data quality**
Hazard Exposure Reporting and Analytics (HERA) - Impact of Sea Level Rise and Storms on Coastal Flooding Hazards	Coastal Storm Modeling System (CoSMoS) Data Axle Employer Database	United States Geological Survey (USGS)	Launched in 2020	While some of the specific data sources have high data quality, proprietary datasets were also used
Our Coast, Our Future (OCOF) Hazard Map	Coastal Storm Modeling System (CoSMoS)	Our Coast, Our Future (OCOF)	First launched in 2011 and has gone through multiple iterations	While the quality of underlying data from CoSMoS is high, the tool is currently down right now

Additional data

<u>Suggested Data Source #1 – San Francisco Bay Shoreline Vulnerability Index (SVI)</u>

The first additional data source we recommend is the San Francisco Bay Shoreline Vulnerability Index (SVI)[25]. This index is a measure of shoreline vulnerability to erosion and/or overtopping due to extreme tides, waves, storm surges, and sea level rise[26]. It uses the following six characteristics to determine the shoreline vulnerability for the primary shoreline (defined as the first elevated shoreline facing the Bay):

1. Vulnerability of shoreline type of flooding and sea level rise
2. Adaptability to sea level rise by shoreline type
3. Presence of fortification
4. Presence of frontage and/or secondary shoreline protection
5. Elevation
6. Wave energy

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[25] California Natural Resources Agency. “Shoreline Vulnerability Index (BCDC, 2021).” Last modified September 8, 2024. https://gis.data.ca.gov/datasets/BCDC::shoreline-vulnerability-index-bcdc-2021/explore?location=37.796986%2C-122.314236%2C14.37.

[26] Adapting to Rising Tides Program. *Shoreline Vulnerability Index for San Francisco Bay: Methodology Report*. San Francisco Bay Conservation and Development Commission, 2021. https://www.adaptingtorisingtides.org/wp-content/uploads/2021/07/ShorelineVulnerabilityIndex_Methodology_2021.pdf.

Each characteristic is weighted based on its relative importance to the shoreline's flood vulnerability. This tool was developed by the San Francisco Bay Area Conservation and Development Commission (BCDC) in collaboration with Silvestrum Climate Associates.

The SVI for the San Francisco Bay Area demonstrates medium to high data quality, integrating accurate, high-resolution spatial data from Bay Shore Inventory (which was developed by San Francisco Estuary Institute) and expert-driven assessments. The Bay Shore Inventory is a database of 100-foot segments of elevated bay shore features for all nine counties. Each segment is classified as levees, berms, embankments, transportation structures, wetlands, natural shoreline, channel openings, and water control structures[27].

Characteristics 1–4 were gathered by administering a survey to expert practitioners in the field and then statistically analyzing their responses. The survey pool included engineers, planners, county managers, restoration scientists, and transportation analysts. But, as the methodology notes, it was limited to "expert" or professional opinions.

With vertical accuracy within 5 cm, the foundational data is reliable and reviewed by local agencies across all nine Bay Area counties, covering key characteristics such as elevation, fortification, and frontage. While some attributes, like ownership and maintenance, are not uniformly complete, the SVI's methodological rigor, combining local expertise and established vulnerability metrics, enhances its reliability for flood risk assessment. Though periodic updates are recommended to maintain relevance as shoreline conditions evolve, we rank the quality of this data tool as high.

The addition of information from SVI to the Regional Plan for the Bay Area could serve to complement the existing assessment of sea level rise on road networks. While USGS's Coastal Storm Modeling System (CoSMoS) provides an estimate of hazard level due to storm surges and sea-level rise, it does not consider the presence of fortifications or frontages. It may also be useful to combine CoSMoS with the information from SVI (i.e., overlay SVI scores onto CoSMoS-defined hazard zones).

<u>Suggested Data Source #2 – California Heat Assessment Tool (°CHAT)</u>

The second additional source that we recommend is the California Heat Assessment Tool (°CHAT). This interactive platform was developed by Four Twenty-Seven, Inc. in partnership with Argos Analytics, Habitat Seven, and the Public Health Institute, and was funded by the California Natural Resources Agency as part of development of the state's Fourth Climate Change Assessment[28].

°CHAT provides a nuanced approach to identifying and projecting Heat Health Events (HHEs) in California, considering both historical and future climate impacts on public health. °CHAT defines an HHE as any heat event that negatively affects public health and uses thresholds unique to each local area, reflecting historical sensitivity to heat. To establish these thresholds, the tool uses a distributed lag non-linear model (DLNM) with data from 1984 to 2013, including temperature and vapor pressure metrics from the PRISM Climate Group, paired with emergency department visit records (2005-2013) during summer months[29].

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[27] Adapting to Rising Tides Program, *Shoreline Vulnerability Index for San Francisco Bay: Methodology Report*, 2021
[28] California Heat Assessment Tool. "About." Accessed November 6, 2024. https://www.cal-heat.org/about.
[29] ibid

Future projections in °CHAT are based on LOCA downscaled models capturing daily humidity and temperature changes at a 6-kilometer resolution through 2099[30]. This enables °CHAT to show how the frequency, duration, and characteristics of HHEs may evolve across percentile-based ranges, accommodating uncertainties. °CHAT is a valuable tool for visualizing and preparing for complex, localized heat risks across California as climate change progresses. While plots 3.60 and 3.61 show projected changes in average hottest day of the year and annual average maximum temperatures, °CHAT emphasizes the health impacts of heat through locally adapted thresholds, additional climate factors, and percentile-based projections of HHE frequency and severity[31].

Overall, °CHAT has high data quality, with strengths in accuracy and reliability. It uses high-resolution PRISM climate data and emergency department records from OSHPD, employing a robust statistical model to link heat exposure to health outcomes. The tool's data completeness is medium to high, integrating essential variables like temperature, humidity, and health impacts, though it lacks recent health data (post-2013) and comprehensive year-round data. Timeliness is medium, as the projections are based on older datasets.

The table below provides a summary of characteristics for the two additional data tools we are suggesting to complement the existing climate hazards assessment of the Regional Plan.

Table 7 Summary of additional data sources, systems, and tool that could be used to complement the existing climate hazards impact assessment in the Regional Plan

Data tool	**Underlying data source(s)**	**Tool developers**	**Date(s) created**	**Data quality**
San Francisco Bay Shoreline Vulnerability Index (SVI)	Bay Shore Inventory (San Francisco Estuary Institute) and expert-driven assessments (gathered through surveys)	San Francisco Bay Area Conservation and Development Commission (BCDC); Silvestrum Climate Associates	Launched in 2021; last updated in 2024[32]	Overall quality of the data is high, though the survey administered to identify shoreline characteristics was limited to experts
California Heat Assessment Tool (°CHAT)	Climate projections based on a subset of the Localized Constructed Analogs (LOCA) downscaled projections Additional sources include:	Four Twenty-Seven, Inc.; Argos Analytics; Habitat Seven; Public Health Institute Funding from the California Natural	Launched in 2018[33]	Overall quality of the data is high, though it lacks recent health data (post-2013) and comprehensive year-round data

[30] David W. Pierce, Daniel R. Cayan, and Bridget L. Thrasher, "Statistical Downscaling Using Localized Constructed Analogs (LOCA)," Journal of Hydrometeorology 15, no. 6 (2014): 2558–2585, https://doi.org/10.1175/JHM-D-14-0082.1.
[31] California Heat Assessment Tool, "About." https://www.cal-heat.org/about
[32] California Natural Resources Agency. "Shoreline Vulnerability Index (BCDC, 2021)." Last modified October 14, 2024. https://data.cnra.ca.gov/dataset/shoreline-vulnerability-index-bcdc-2021.
[33] California Natural Resources Agency. "California Releases New Climate Science, Planning Tools to Prepare for Climate Change Impacts." Press release, August 27, 2018.

	Data from PRISM Climate Group Emergency department (ED) data from the California Office of Statewide Health and Planning (OSHPD) for the years 2005-2013	Resources Agency (CNRA)		

Policy Considerations

Based on our review of the data tools and systems used in Section 3.3 Climate & Environmental Impacts of the Regional Plan, and with consideration to the additional data tools described in the preceding section, we can offer the following insight to policymakers:

- Oftentimes, a key dataset informs multiple data tools and dashboards. For example, downscaled global climate model data from the Coupled Model Intercomparison Project Phase 5 (CMIP5) was used in the development of all activities related to California's Fourth Climate Change Assessment; this includes the Regional Climate Change Assessment Report for the Bay Area and Cal-Adapt 2.0. If this key dataset is out of date (as is the case with CMIP5), then all the resultant resources are also out of date.
- Related to the point above, it is sometimes the case that multiple tools are developed to view and download the same dataset. For example, both the USGS Hazard Exposure Reporting and Analytics (HERA) Coastal Flooding Tool and the Our Coast, Our Future (OCOF) Hazard Map should both theoretically display data from the Coastal Storm Modeling System (CoSMoS). However, there is no documentation on how these two tools differ and the latter of these tools is not working. This indicates that a greater degree of inter- and intra-governmental communication may need to occur to ensure that tool development efforts are coordinated, and in reference to each other.
- One of the underlying datasets for the USGS HERA was proprietary. Though the use of proprietary datasets was much more prevalent in the demographic and economic analysis portions of the Regional Plan, we still note this usage. It is our view that data collected via direct community outreach and/or through publicly available datasets is more conducive to tool transparency.
- Lastly, none of the described data tools for the Climate & Environmental Impacts section incorporate local knowledge from direct community outreach. For example, as part of the development process for the San Francisco Bay Shoreline Vulnerability Index (SVI), surveys were disseminated to professional experts (e.g., engineers, planners, county managers, restoration scientists, and transportation analysts). While this approach ensures that the tool is technically sound, it does not consider assets that are valuable to community members.

1.3. Community Engagement

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https://resources.ca.gov/CNRALegacyFiles/wp-content/uploads/2018/08/CA-Releases-Fourth-Climate-Change-Assessment-8-27-18.pdf.

1.3.1. Currently used engagement strategies

The Bay Area Jobs First Collaborative Regional Plan uses a structured hierarchical organization of stakeholders that organizes the decision-making and operations of the plan, in addition to creating opportunities for engagement for the broader community. As visualized in Exhibit 1.1, All Home and Bay Area Good Jobs Partnership for Equity (BAGJPE) are the organizations that oversee collaboration among various stakeholders to inform the regional planning process. They oversee and facilitate stakeholder meetings with community groups including local governments, businesses, labor organizations, and community groups across all Bay Area counties. These meetings give insight to the region's economic challenges, local priorities, and sector-specific needs in addressing transitions and strategies to improve employment opportunities. Additionally, the Collaborative organizes workgroups and focus areas that unite sector experts and community advocates to synthesize solutions on key issues to be addressed by the Jobs First Plan. This can include economic analysis, workforce development strategies, climate resilience, and even methods of community engagement itself. Sector-specific needs and data about respective work forces are collected from these methods and are used to inform development strategies and ensure relevance and effectiveness.

EXHIBIT 1.1 | Bay Area Jobs First Collaborative governance structure

Source: Bay Area Jobs First Collaborative (BAJFC), 2023.

Another point of leverage and involvement for different stakeholders include the Steering Committee, which is made up of 21 members with diversity in perspectives and voices coming from multiple sectors like workforce development, economic planning, community advocacy, and labor. These individuals are specifically selected for expertise in their discipline as it relates to economic resilience and equitable growth, ensuring their informed guidance for the project.

The Sub-Regional Tables of stakeholders, groups of representatives for each county, further create opportunities for community engagement, with a focus on specific geographic areas within the Bay Area. Co-conveners like labor councils and community organizations host localized discussions among stakeholders to collect community-specific info on job access, housing, climate resilience, childcare, and localized economic conditions. The space for a diverse representation in voices and collection of region-specific information helps tailor development plans to be unique to meet local needs and ensures that especially smaller / disinvested communities are not overlooked.

Lastly, the Research, Planning, and Community Engagement Committee, composed of Sub-Regional Table co-conveners, partnered research organizations, and additional community stakeholders, conducts surveys and needs assessments for relevant needs including childcare services, workforce training and development, and accessibility to job resources. This helps planners receive feedback on discrepancies in services and accessibility among communities and further nuance their understanding of challenges that DCs face. These data points will be used to bridge gaps and improve the quality of public services, thus supporting community members in relevant high-need areas.

1.3.2. Additional data points

From a demographic standpoint, collecting data on the youth and elderly dependency ratios within a household could offer a more holistic understanding of economic and individual pressures on working-age populations. More information about the balance between the economically active and dependent parts of the population, will help inform policy with a more nuanced understanding of the impacts on family structures, public services, and economic stability. Additionally, the region should ensure that their data collection includes cultural connectivity and community services. Creating spaces for productive conversations and learning (i.e cultural centers, language-specific resources) will help create data points that will make the Regional Plan be more culturally sensitive and inclusive, addressing the unique needs of different community groups. These engagement strategies with plan stakeholders and these communities will better inform policies for more equitable and effective resource allocation and social integration.

Economically speaking, collecting information on informal economy participation will give insight on unregistered or “under-the-table” activities such as freelance home repairs, childcare, or street vending that DACs are more likely to participate in. Despite their contribution to local economies, they are often overlooked in formal city economy reports, masking true economic conditions and needs. Thus, more comprehensive surveys and conversations with these communities can help collect additional data points on the informal job markets they participate in and inform the economic development and transition proposed by the Regional Plan. Additionally, the planning committee should ensure that community outreach collects data points that give insight to household allocation of their income toward essential expenses like energy, housing, transportation, and food. This will uncover economic strains and vulnerabilities on disinvested groups and inform strategies that relate to new job market creations and liveable wages.

To better understand the state of public health in disinvested communities, it’s vital to collect information on the most prominent of environmental health concerns, especially those that have impacted them disproportionately compared to other nearby communities in the region. This includes getting anecdotes from community members about their lived experiences in their neighborhoods at town halls and community meetings (i.e waste, unpleasant smells that could be derived from toxic sources, noise pollution) and juxtaposing to environmental justice data collected by third-party sources. Additionally, evaluating the quality and availability of health services in the regions of these communities, including discrepancies in healthcare proximity, access, and connectivity due to internet availability or gaps in digital literacy, would reveal improvement points for healthcare access and inform policies to improve health equity.

To further nuance understanding of disinvested communities with respect to climate hazard vulnerability and resilience, having conversations with community members about household preparedness would allow effective resource allocation and improvement strategies like awareness campaigns that would increase climate resilience. Indicators would include the extent to which community members understand and are both physically, mentally, and economically prepared for climate-related emergencies (especially floods and extreme heat in the Bay Area). Understanding varying levels of preparedness in disinvested communities is crucial to transitioning and developing the economy of the region in an equitable manner that accommodates for the different vulnerabilities of the population.

2. Program Design

2.1. Program Goals

Extreme heat resilience for disadvantaged communities in the Bay Area is often bounded by outdated or insufficient housing. Therefore, the proposed program aims to address disparities in these communities through improving energy efficiency and accessibility to reliable HVAC systems. The program seeks to prevent high energy costs from being a disproportionate barrier on disadvantaged communities by promoting renovations and improved home weatherization. Outreach efforts would engage community groups, incentivize participation in home-energy audits, and assess public spaces for heat relief. Through these initiatives, the program aims to be a comprehensive strategy to increase the amount of disinvested community homes that have reliable HVAC systems by 25% by November 2025.

2.2. Theory of Change

2.2.1. Inputs

Leveraging multiple resources to ensure thorough data collection and understanding of DAC-specific needs, the program will entail the aid of environmental personnel, community groups, and data tools to target specific disadvantaged communities.

<u>Staffing and Training</u>
A dedicated team of field staff would be necessary for conducting targeted outreach and home assessments within communities. This includes hiring data collectors skilled in energy efficiency assessments, HVAC system functionalities, and building infrastructure evaluation. For consistency, the staff would be trained on standardized data collection methods and equipped with mobile survey technology. Therefore, standardized test training and equipment would be necessary for field staff. This will be crucial for DACs' engagement, where language and trust barriers exist. Face-to-face contact with trained personnel would ensure a consistent feedback loop for DACs.

Specifically, some staff are required for survey collections. Majority of the labor force demographics are communities of color–such as 71.5% Latinx in Alameda County[34]–so having multilingual staff members is essential for ensuring accurate representation and accessibility to the program. Other expectations of trained personnel include participation in call-lines for aiding the survey process, categorizing data collection, and hosting accessible workshops on energy-efficiency.

<u>Community Group Engagement</u>

Partnerships within the community are significant for ensuring an accurate representation of disadvantaged communities, and would increase outreach for co-hosted community workshops on energy efficiency. Establishing trust through local organizations, community centers, and advocacy groups will help extend trust to municipal agencies for access to public spaces necessary for workshops. To incentivize participation, workshop attendees would receive gift cards or vouchers, making engagement more accessible for economically-burdened households. Thus, partnership with sponsors and funding are important for this program as well.

Community engagement will also increase understanding of which areas are more at-risk of extreme heat. Though the program will incorporate data tools for spatial analysis of these communities, speaking directly with community groups increases accuracy of correctly targeting homes that require HVAC system upgrades and aid.

Access to social media, community websites, and email newsletters are important for the program's distribution and communication with pushing out surveys, workshops, and assessments.

<u>Data Tools:</u>

- Using CalEnviroScreen 4.0 and Healthy Places Index (HPI) 3.0 will identify specific DACs based on population burden, socioeconomic vulnerability, and health risks. By outlining high-pollution and low-income areas, the program will target essential communities for intervention. For

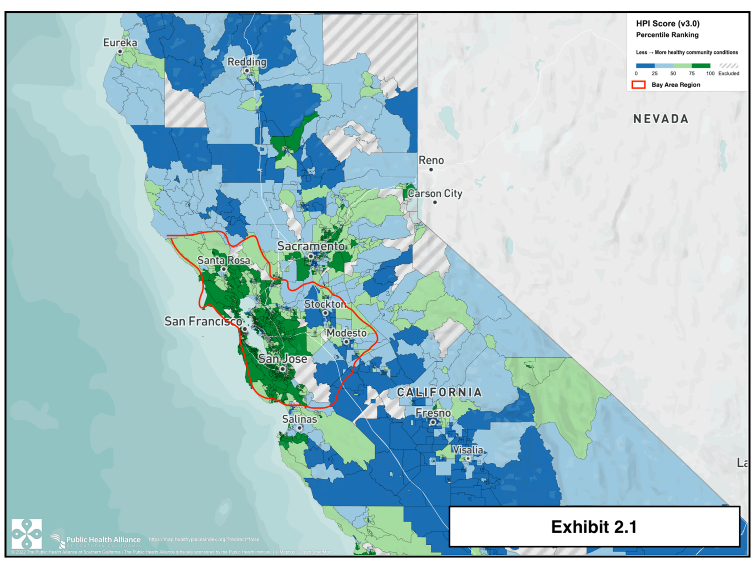

Exhibit 2.1

[34] U.S. Census Bureau, "EMPLOYMENT STATUS," 2021. *American Community Survey, ACS 1-Year Estimates Subject Tables, Table S2301*, 2021, https://data.census.gov/table/ACSST1Y2021.S2301?t=Employment&g=050XX00US06001.

instance, within the Bay Area region, areas in the bottom 50th percentile of HPI are flagged as high climate-risk areas[35]. These areas, such as Stockton in Exhibit 2.1, align with the profile highlighted by these tools to outreach for the program.

- GIS-based mapping tools, such as ArcGIS Online, will be used for spatial analysis to overlay DAC locations with infrastructure data. With this, the program will visualize heat-vulnerable buildings and areas with inadequate HVAC access. In addition, this will render data that is collected through the field assessments of targeted homes the program aims to hold.

2.2.2. Outputs

In order to address the range of communities for the collection of HVAC and weatherization data, the program will host three methods of information gathering that prioritize breaking trust barriers and incentivization for financial burdens.

Surveys

Surveys are significant methods of communication for data collection to avoid financial and time barriers to participation. According to the American Community Survey (ACS) conducted by U.S. Census Bureau, data within Alameda County has shown that 60% of adults aged 30-55 in these communities work full-time[36]. Therefore, surveys will allow these residents to participate at their own convenience. These surveys will include questions about HVAC presence, energy usage, and monthly energy costs. This approach provides a scalable, low-cost method to gather information while minimizing time burdens. The program aims to reach a minimum 30% response rate among surveyed households within DACs, targeting at least 500 households.

Outlined in these surveys will be development about energy usage through questionnaires on monthly energy costs, seasonal fluctuations, and proportion of household income spent on energy. Questions about HVAC access and functionality are important to knowing which households have a HVAC system in-place, and the frequency of its use and maintenance. In order to maintain accessibility and avoid breaking trust, surveys will also be qualitative questions about feeling of indoor temperature rather than infrastructure-based questions that could be surveyed at field inspections instead. Demographic background will be the foreground of the surveys to conclude which households are being most impacted by climate-induced heat.

The survey will be a continuous 6-week one to ensure the program meets the minimum response goals. To encourage further participation, the program will provide a gift card giveaway to households that participate and complete the survey. In order to ensure a consistent feedback loop, the program will also conduct follow-ups on the surveys after program completion to ensure households at high-risk are being monitored for any additional aid.

Community Workshops

In-person workshops in easily accessible community centers allow for in-depth discussions with disadvantaged community members on their experiences with extreme heat and HVAC access.

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[35] Public Health Alliance of Southern California. n.d. Healthy Places Index. https://map.healthyplacesindex.org/?redirect=false.

[36] U.S. Census Bureau, "EMPLOYMENT STATUS," 2021. *American Community Survey, ACS 1-Year Estimates Subject Tables, Table S2301*, 2021, https://data.census.gov/table/ACSST1Y2021.S2301?t=Employment&g=050XX00US06001.

Workshops will be scheduled during evenings and weekends to accommodate working schedules and ensure broad participation, since 57.1% of DAC head-of-households are both working full-time[37]. The program will hold a minimum of ten workshops across various disadvantaged communities, aiming for 20-30 participants per workshop. These workshops will be held every two weeks to ensure time for participant registration. Topics at the workshops will include HVAC usage, energy bills, and building challenges related to heat retention, facilitating a collaborative environment where residents can voice their needs directly. There will be energy-saving techniques, HVAC system information, and financial assistance programs discussed. Partnerships with local organizations will ensure that workshops are culturally relevant and adequately promoted.

This aspect of the program aims to build climate resilience in DACs through educating residents about energy-saving practices, providing information on available HVAC support programs, and gathering input to advocate for policy changes that reduce energy burdens. Through a pre-workshop survey during the two-week registration prior to the workshop, residents will voice their current energy behavior. Thus allowing for the program to tailor the workshop to meet specific community needs. Given that in communities like Stockton, where 44.6% of residents are living below poverty level[38], holding these workshops in public locations like community centers and libraries will relieve financial burdens that come with attending.

With every community, there will be a follow-up session three months after where residents can discuss their challenges and needs related to extreme heat and energy costs after the program. Insights will be documented and categorized to identify common themes and needs within the community. To incentivize participation, the program will cater the workshops to provide lunch for the community as well as donate energy-saving kits with emergency lamps and LED bulbs that many residents may not have the luxury to spend.

<u>Field Assessments of Built Environment</u>
To gain a direct, detailed understanding of the physical infrastructure, field teams will conduct home energy audits in selected DAC households that spend over $250 on monthly energy costs, and other DAC households that spend $50 to $100 on energy-based costs. In Alameda County, these high-cost margins make up 40% of residents[39], and assessing these communities would give insight into the different ways residents spend on energy-costs. Other target homes include at least 100 homes that focus on older housing stock, as U.S. Department of Energy highlights how low-income residents spend more on energy burdens given that their houses are older[40].

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[37] U.S. Census Bureau, U.S. Department of Commerce, "Employment Characteristics of Families," 2023. *American Community Survey, ACS 1-Year Estimates Subject Tables, Table S2302*, 2023, https://data.census.gov/table/ACSST1Y2023.S2302?t=Employment&g=050XX00US06001.

[38] U.S. Census Bureau, "Poverty Status in the Past 12 Months," 2022. *American Community Survey, ACS 5-Year Estimates Subject Tables, Table S1701*, 2022, https://data.census.gov/table/ACSST5Y2022.S1701?t=Income and Poverty&g=1400000US06077000100,06077000300,06077003209.

[39] U.S. Census Bureau, U.S. Department of Commerce, "Monthly Electricity Costs," 2023. *American Community Survey, ACS 1-Year Estimates Detailed Tables, Table B25132*, 2023, https://data.census.gov/table/ACSDT1Y2023.B25132?t=Housing:Insurance, Utilities, and Other Fees&g=050XX00US06001.

[40] U.S. Department of Energy, Office of Energy Efficiency and Renewable Energy. *Low-Income Community Energy Solutions.* https://www.energy.gov/eere/slsc/low-income-community-energy-solutions.

Assessments include checking for HVAC systems, assessing insulation quality, and measuring energy inefficiencies. For accuracy, field staff will use standardized inspection checklists on HVAC systems and thermal imaging devices to identify areas of heat loss. During the audit process, field staff will prioritize educating residents rather than primarily testing the homes in order to break trust barriers.

2.2.3. Outcomes

There are four main outcomes that the program aims to achieve, in order to accomplish the overall goal of increasing reliable HVAC systems in homes by 25% within the following year.

1. *Quantify energy burden data for DACs*
   Gather data that shows that at least 30% of DAC households spend over 10% of their income on energy costs. This would be helpful for local policymakers to make data-informed decisions on which organizations to fund and target for the need of energy assistance programs in DACs.

2. *Identify key building-efficiency issues in DACs*
   Document at least three common infrastructure deficiencies–such as insufficient insulation, unsealed windows, and/or outdated HVAC systems) across 100 DAC homes. Data from this documentation will support grant proposals and funding allocation for building upgrades and weatherization within DACs.

3. *Increase community engagement in data contribution*
   Achieve participation from at least 50% of DAC households in targeted areas, ensuring that data represents a diverse and comprehensive sample of the community. Thus, fostering ongoing resident engagement to validate data relevance for shaping local climate resilience initiatives.

4. *Allocate comprehensive data on HVAC accessibility in DACs*
   Produce a data-backed report to highlight specific needs and climate vulnerabilities of DACs in order to secure at least two funding programs for HVAC installations, weatherization, or energy assistance initiatives by 2025.

2.3. Data Analysis & Interpretation

2.3.1. Analysis Method

To analyze the collected data, statistical tools like R or Python's pandas will be used to examine survey responses related to energy usage, HVAC access, housing conditions, and demographic information. This analysis will focus on identifying patterns in energy cost burdens and HVAC accessibility within disadvantaged communities (DACs), using correlation coefficients to map trends. Data visualization libraries, such as matplotlib or Plotly, will aid in presenting these findings. Once data is de-anonymized and filtered, visualizations can be made publicly accessible on websites for community reference. To predict future trends, logistic regression models may be employed, helping to forecast challenges as temperatures increase. Using regression models we can show future predictions for outcomes like heat related medical issues with a best possible scenario and a worst possible scenario. Modeling this can show an estimate for the impact that some sort of policy will have on different DACs as well as provide a margin for error.

GIS software will be utilized to overlay preexisting data like CalEnviroScreen and Healthy Places Index (HPI) data with the collected data, enabling identification of high-risk areas and correlation of specific housing vulnerabilities with geographical factors. Logic checks will be applied to survey responses to ensure data consistency; for instance, monthly energy costs will be compared to household income and HVAC usage reports to flag any inconsistencies, which may indicate misunderstandings or misreporting. Data points will also be weighted based on credibility, considering factors such as response time (where quicker responses may carry a higher error risk), geographic proximity to high-risk areas, and alignment with past responses. Data from community organizations involved in workshops will carry additional credibility due to established trust, and all findings will be compared with past data trends to enhance forecast accuracy through regression analyses.

The newly collected data will contribute to a comprehensive regional profile, detailing the energy needs and vulnerabilities of DACs. Survey and workshop responses will reveal specific needs, desires, and challenges within these communities, guiding resource allocation and policy development. Additionally, insights from home audits and workshop feedback will inform the design of HVAC upgrades and weatherization programs tailored to the identified needs, ensuring the program effectively meets community requirements.

2.4. Data Policy Considerations

Using these additional data points, policymakers must consider the opportunities and concerns that may arise upon creating policies that satisfy the needs, desires, and concerns of DAC's. In doing so, the following considerations should be addressed.

Opportunities

<u>Resource Allocation</u>

Analyzing the collected data from surveys, community workshops, and field assessments can allow policymakers to gain stronger insight regarding the allocation of resources to regions and households most in need. For instance, utilizing survey data in connection with GIS overlays may help with the identification of areas that are socioeconomically and/or environmentally hampered. Mapping other important factors such as energy usage, HVAC access, and more can ensure that precise and effective programs are set in place. Thus, policymakers can ensure to direct further resources towards these areas in need.

<u>Policy Advocacy</u>

Utilizing strategies including community workshops and surveys, policymakers can directly learn about the specific challenges experienced by members of DACs. Collecting data regarding HVAC systems, energy costs, and housing quality, policymakers can gain ideas concerning these issues and advocate for policies that may work to resolve these issues. Furthermore, the collection of such data can help to cultivate policies that are specific to resolving such issues.

<u>Planning for the Future</u>

With collected data from the proposed plan, policymakers can analyze and note patterns relating to given challenges and forecast future trends and impacts. Along with utilizing data tools (particularly mapping tools that analyze predicted outcomes), policymakers can make decisions that inform long-term infrastructure and policy decisions to help DACs.

Concerns

Protection of Privacy and Public Trust

Through the collection of data from facilitated surveys and community workshops, concerns may arise over privacy and the collection and usage of personal data. To maintain a strong relationship between DACs and policymakers, it is crucial to ensure that personal data is protected, and strict protocols are in place to prevent misuse of data or breaches of privacy. Failure to do so may lead to the loss of trust by the general public, and may even lead to legal troubles. To further ensure that public trust is maintained, it is important to maintain transparency with data collection and inform communities about how their data is being used. If all is done correctly, then their cooperation should benefit the policy making process and help to build stronger relationships between the public and policymakers.

Accuracy and Bias

In order to create the most effective and efficient policies, it is crucial to ensure that the collected data is highly reliable. Failure to do so may lead to incorrect conclusions, false assumptions of data, and purposeless plans for policy making, which may impact the effectiveness of any proposed policies. Furthermore, it is important to garner data from accurate representations of impacted communities to guarantee that policies are enforced towards relevant populations.

Real-World Variables

It is important for policymakers to consider on-the-ground community experiences and real-world-variables along with their data analytics. While their collection of data may offer valuable foresight, they may not account for external factors, such as changing community dynamics (ex. gentrification), environmental impacts (ex. natural disasters), and so forth.

Bibliography

Ackerly, David, et al. San Francisco Bay Area Summary Report, California's Fourth Climate Change Assessment, Report No. SUM-CCCA4-2018-005. Sacramento: California Governor's Office of Planning and Research, California Natural Resources Agency, and California Energy Commission, 2018. https://www.energy.ca.gov/sites/default/files/2019-11/Reg_Report-SUM-CCCA4-2018-005_SanFranciscoBayArea_ADA.pdf.

Adapting to Rising Tides Program. Shoreline Vulnerability Index for San Francisco Bay: Methodology Report. San Francisco Bay Conservation and Development Commission, 2021. https://www.adaptingtorisingtides.org/wp-content/uploads/2021/07/ShorelineVulnerabilityIndex_Methodology_2021.pdf.

Bay Area Equity Atlas. "Bay Area Recovery Tracker." Accessed November 6, 2024. https://bayareaequityatlas.org/recovery-tracker.

California Department of Transportation. District 4 Technical Report: 2019 Climate Change Vulnerability Assessments. 2019. https://dot.ca.gov/-/media/dot-media/programs/transportation-planning/documents/2019-climate-change-vulnerability-assessments/ada-remediated/d4-technical-report-a11y.pdf.

California Heat Assessment Tool. "About." Accessed November 6, 2024. https://www.cal-heat.org/about.

California Natural Resources Agency. "California Releases New Climate Science, Planning Tools to Prepare for Climate Change Impacts." Press release, August 27, 2018. https://resources.ca.gov/CNRALegacyFiles/wp-content/uploads/2018/08/CA-Releases-Fourth-Climate-Change-Assessment-8-27-18.pdf.

California Natural Resources Agency. "Shoreline Vulnerability Index (BCDC, 2021)." Last modified October 14, 2024. https://data.cnra.ca.gov/dataset/shoreline-vulnerability-index-bcdc-2021.

Centers for Disease Control and Prevention/Agency for Toxic Substances and Disease Registry. "CDC/ATSDR Social Vulnerability Index (SVI) Interactive Map." Last modified December 1, 2022. https://www.atsdr.cdc.gov/placeandhealth/svi/interactive_map.html.

European Centre for Medium-Range Weather Forecasts. "CMIP6: Global Climate Projections." Copernicus Knowledge Base. Last modified September 18, 2024. https://confluence.ecmwf.int/display/CKB/CMIP6%3A+Global+climate+projections.

Governor's Office of Planning and Research, Bay Area Jobs First Collaborative. California Jobs First: Regional Plan Part 1. 2022.

Intergovernmental Panel on Climate Change. Climate Change 2021: The Physical Science Basis. Contribution of Working Group I to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change, edited by V. Masson-Delmotte, P. Zhai, A. Pirani, S.L. Connors, et al. Cambridge: Cambridge University Press, 2021. https://www.ipcc.ch/report/ar6/wg1/.

Langston, Abbie, Edward Muña, and Matthew Walsh. Advancing Workforce Equity in the Bay Area: A Blueprint for Action. Oakland, CA: PolicyLink, 2021. https://reworkthebay.org/wp-content/uploads/2021/02/Advancing-Workforce-Equity-in-the-Bay-Area_FINAL_0.pdf.

Maizlish, Neil, et al. "California Healthy Places Index: Frames Matter." Public Health Reports 134, no. 4 (2019): 354–363. https://doi.org/10.1177/0033354919849882.

Pierce, David W., Daniel R. Cayan, and Bridget L. Thrasher. "Statistical Downscaling Using Localized Constructed Analogs (LOCA)." Journal of Hydrometeorology 15, no. 6 (2014): 2558–2585. https://doi.org/10.1175/JHM-D-14-0082.1.

Pierce, David W., and Daniel Cayan. High-Resolution LOCA Downscaled Climate Projections Aim to Better Represent Extreme Weather Events. La Jolla, CA: Scripps Institution of Oceanography, 2017. https://loca.ucsd.edu/~pierce/LOCA_DPierce_2017-07-08.pdf.

Public Health Alliance of Southern California. n.d. Healthy Places Index. https://map.healthyplacesindex.org/?redirect=false.

Health Alliance of Southern California. Healthy Places Index. Accessed November 6, 2024. https://healthyplacesindex.org.

Sklar, Alissa. "California Launches Innovative Community & Place-Based Data Tool." GIS Planning Blog, May 11, 2022. https://blog.gisplanning.com/california-launches-innovative-community-place-based-data-tool.

UCLA Center for Health Policy Research. *AskCHIS*. https://ask.chis.ucla.edu/.

U.S. Census Bureau, U.S. Department of Commerce, "Employment Characteristics of Families," 2023. *American Community Survey, ACS 1-Year Estimates Subject Tables, Table S2302*, 2023, https://data.census.gov/table/ACSST1Y2023.S2302?t=Employment&g=050XX00US06001.

U.S. Census Bureau, "EMPLOYMENT STATUS," 2021. *American Community Survey, ACS 1-Year Estimates Subject Tables, Table S2301*, 2021, https://data.census.gov/table/ACSST1Y2021.S2301?t=Employment&g=050XX00US06001.

U.S. Census Bureau. Methodology for the United States Population Estimates: Vintage 2023. April 2023. https://www2.census.gov/programs-surveys/popest/technical-documentation/methodology/2020-2023/methods-statement-v2023.pdf.

U.S. Census Bureau, U.S. Department of Commerce, "Monthly Electricity Costs," 2023. *American Community Survey, ACS 1-Year Estimates Detailed Tables, Table B25132*, 2023, https://data.census.gov/table/ACSDT1Y2023.B25132?t=Housing:Insurance, Utilities, and Other Fees&g=050XX00US06001.

U.S. Census Bureau, "Poverty Status in the Past 12 Months," 2022. *American Community Survey, ACS 5-Year Estimates Subject Tables, Table S1701*, 2022, https://data.census.gov/table/ACSST5Y2022.S1701?t=Income and Poverty&g=1400000US06077000100,06077000300,06077003209.

U.S. Department of Energy, Office of Energy Efficiency and Renewable Energy. *Low-Income Community Energy Solutions*. https://www.energy.gov/eere/slsc/low-income-community-energy-solutions.

U.S. Geological Survey. "Coastal Storm Modeling System (CoSMoS)." Last modified November 21, 2021. https://www.usgs.gov/centers/pcmsc/science/coastal-storm-modeling-system-cosmos.

U.S. Geological Survey. "Data Methods Overview." Hazards Exposure Reporting and Analytics (HERA). Accessed November 6, 2024. https://www.usgs.gov/apps/hera/docs/about/index.html?topic=data-methods-overview.