Adapting to Rising Tides Community Vulnerability for Current and Future Flood Risk User Guide

SUMMARY

The San Francisco Bay Conservation and Development Commission Adapting to Rising Tides Program developed a dataset to better understand community vulnerability to current and future flooding due to sea level rise and storm surges. This data has been used in the Adapting To Rising Tides Bay Area Sea Level Rise Vulnerability and Assessment project as well as helping inform the implementation of the BCDC Environmental Justice and Social Equity Bay Plan amendment. This document provides more in-depth information about the data inputs and methodology that was used as well as information about how to access the data. For additional descriptions of GIS methods used in ART Bay Area, please see the ART Bay Area Report Appendix: GIS Data and Methods or BCDC's Github Repository. For more information, please contact GIS@bcdc.ca.gov.

The community vulnerability dataset contains four categories of information:

1. Social Vulnerability Indicators

   Certain socioeconomic characteristics may reduce ability to prepare for, respond to, or recover from a hazard event. Census block groups with high concentrations (relative to the nine county Bay Area) of these characteristics are flagged as socially vulnerable, with each block group assigned a rank of highest, high, moderate, and low. Data is currently from American Community Survey (ACS) 2014-2018 5-year estimates but is anticipated to be updated as new ACS 5-year estimates become available.

2. Contamination Vulnerability Indicators

   The presence of contaminated lands and water raises health and environmental justice concerns, which worsen with flooding and sea level rise. A rank of highest, high, moderate, and lower for the severity of contamination in each block group was calculated using data compiled by CalEPA Office of Environmental Health Hazard Assessment (OEHHA) for use in CalEnviroScreen 3.0.

3. Residential Exposure to Sea Level Rise

   Calculated by joining Metropolitan Transportation Commission 2010 residential parcel data with 2017 ART Bay Area Sea Level Rise and Shoreline Analysis data, FEMA 100 and 500 year flood zone data, and San Francisco 100-year precipitation data to generate the number of residential units exposed at each water level summed by block group. This methodology assumes that once a parcel is exposed to any amount of flooding, the entire number of residential units within that

parcel are considered impacted.

4. Complementary Community Vulnerability Screening Tools

Many screening approaches exist to characterize disadvantaged or vulnerable communities. Often in the Bay Area, different designations of disadvantaged/vulnerable communities are located in the same area. It is recommended to use the ART approach in combination with other complementary tools and designations. The following are included in this shapefile as fields for cross-referencing: CalEnviroScreen 3.0 total score, Metropolitan Transportation Commission Community of Concern designation, UC Berkeley Displacement and Gentrification Typologies.

DEVELOPMENT PROCESS

This dataset originated in the 2015 Stronger Housing, Safer Communities project. The project's advisory committee of recognized experts, including community advocates, selected social characteristics which contribute to vulnerability to hazards (flood and seismic), drawing on professional experience, local knowledge, and consultation of academic and federally-sponsored research. Additional attributes ranking the presence of contaminated sites were added to the dataset following input from the working group for the ART Bay Area project, Policies for a Rising Bay project, and BCDC Environmental Justice and Social Equity Bay Plan Amendment. Data and methods should be continually updated as thinking surrounding community and social vulnerability evolves.

COMMUNITY VULNERABILITY INDICATORS AND RANKING

Social vulnerability indicators

Triggering methodology identifies block groups that have a concentration of individuals or households with a particular characteristic that is either in the 70th percentile or 90th percentile. The data for each block group contains the percent of individuals or households with each indicator and the total count of indicators for the two triggering rates. Indicators in each category are weighted equally, when in real life they do not contribute equally to vulnerability. For example, income may contribute more to community vulnerability than the presence of young children, but it is difficult to quantify how much more. The combination of both these characteristics results in higher vulnerability than either one on its own, which is why a total count method is used. The table below provides more information about measures used, sources, and the rates associated with the 70th and 90th percentile for each indicator.

Table 1: Socioeconomic characteristics that may increase vulnerability

Populations or households that are:	Measure	70th pctl rate	90th pctl rate	2014-2018 American Community Survey (ACS) Table Number: Concept	ACS Universe
Renters	% Renter occupied households	56.8%	79.9%	**B25003_003**: Tenure	Occupied housing units

Under 5	% People under 5	7%	10%	**B01001_003+027**: Sex by age	Total population
Very low income	% People under 200% poverty rate; and/or % Households with income less than 50% of Area Median Income	26.6%; 28.5%	45.2%; 44.7%	**C17002_002-007**: Ratio of income to poverty level in the past 12 months; and/or **B19001_X**: Household income in the past 12 months (in 2018 inflation-adjusted dollars) compared to 50% Area Median Income (AMI) by County (B19013_001)	Population for whom poverty status is determined & Households
Not U.S. citizens	% People not U.S. citizens	16.3%	25.2%	**B05002_021**: Place of birth by nativity and citizenship status	Total population
Without a vehicle	% Households without a vehicle	8.6%	22%	**B25044_003+010**: Tenure by vehicles available	Occupied housing units
People with disability	% Households with 1 or more persons with a disability	25.7%	35.7%	**B22010_003+006**: Receipt of food stamps/snap in the past 12 months by disability status for households	Households
Single parent families	% Single parent families	15.9%	28.5%	**B11004_010+016**: Family type by presence and age of related children under 18 years	Families
Communities of Color	% People of Color	74.9%	90.9%	**B03002_004-009+0012**: Hispanic or Latino origin by race	Total population
65 and over living alone	% Households with 1 or more people 65 years and over	11.7%	19.6%	**B11007_003**: Households by presence of people 65 years and over, household size and household type	Households
Limited English proficiency	% Limited English speaking household	10.7%	20.4%	**C16002_004+007+010+013**: Household language by household limited English speaking status	Households
Without a high school degree	% People 25 years and older without a high school degree	13.9%	28.7%	**B15003_002-016**: Educational attainment for the population 25 years and over	Population 25 years and over
Severely housing cost burdened	% Households spending greater than 50% income on housing; renter-occupied and/or owner-occupied	28.4%; 18.8%	44.1%; 31.4%	**B25070_010**: Gross rent as a percentage of household income in the past 12 months & **B25091_011**: Mortgage status by selected monthly owner costs as a percentage of household income in the past 12 months	Renter-occupied housing units & Owner-occupied housing units

Rankings of social vulnerability were assigned by looking at the distributions of the data. Block groups labeled "**Highest social vulnerability**" have:
- 8 or more social vulnerability indicators with rates in the 70th percentile, relative to nine county Bay Area; *and/or*
- 6 or more social vulnerability indicators with rates in the 90th percentile, relative to nine county Bay Area

Block groups labeled "**High social vulnerability**" don't meet criteria in "Highest" category, and have:
- 6-7 indicators in the 70th percentile; *and/or*

  - o   4-5 indicators in the 90th percentile

Block groups labeled "**Moderate social vulnerability"** don't meet criteria in "Highest" and "High" categories, and have:

  - o   4-5 indicators in 70th percentile; *and/or*
  - o   3 indicators in the 90th percentile

Block groups labeled "**Low social vulnerability**" don't meet any of the criteria above, and those labeled "**Not calculated**" contained characteristics that were not estimated in the American Community Survey, due to low population and other factors leading to low survey response.

Use limitations to consider when working with American Community Survey (ACS) data:
ACS estimates are available by geographical unit, in this dataset the block group, and do not represent where people actually live within that block group. Statistical testing to determine significance is recommended to definitively state that values in one block group are different than another block group. Statistical testing was not conducted for every block group in the Bay Area, as this dataset functions as a regional screening tool. ACS data are reported with an *estimate* and a *margin of error*, which represents 90% confidence that the actual value is within that range. In instances where the *margin of error* represents over half the *estimate*, this data should be treated as unreliable. For more information, refer to: ACS Handbook for Data Users (Researchers)

Contamination Vulnerability Indicators

Contamination indicators represent degradation or threats to communities and the natural environment from pollution. The presence of contaminated lands and water raises health and environmental justice concerns, which worsen with flooding and sea level rise. A percentile score for the severity of contamination in each block group was calculated using data compiled by CalEPA Office of Environmental Health Hazard Assessment for use in the Environmental Effects category of CalEnviroScreen 3.0. In CalEnviroScreen calculations, the Environmental Effects component is weighted half when incorporated into the total pollution burden. By looking at the Environmental Effects components isolated from the CalEnviroScreen total score, specific risk to contamination becomes more clear. The five specific types of contamination are:

  - **Hazardous Cleanup Activities** - Land with hazardous substances undergoing cleanup actions, original source data from Dept. Toxic Substances Control and US EPA (Superfund Sites)
  - **Groundwater Threats** - Sites that may impact groundwater and require cleanup, original source data from State Water Resources Control Board
  - **Hazardous Waste Facilities** - Presence of hazardous waste generators and permitted facilities that are involved in the treatment, storage, or disposal of hazardous waste, original source data from DTSC
  - **Impaired Water Bodies** - Water bodies that do not meet water quality standards, listed as impaired under Section 303(d) of the Clean Water Act. Data from State Water Resources Control Board.
  - **Solid Waste Facilities** - Presence of solid waste sites and facilities, original source data from CalRecycle and DTSC

Rankings of social vulnerability were assigned by looking at the distributions of the data. Block groups labeled "**Highest contamination vulnerability**" have:

- 4 or more contamination indicators with rates in the 90th percentile, relative to the state; *and/or*
- Total contamination score above 90th percentile, relative to the state

Block groups labeled "**High contamination vulnerability**" don't meet criteria in "Highest" category, and have:

- 5 indicators in the 70th percentile; *and/or*
- Total contamination score between 80th – 90th percentile

Block groups labeled "**Moderate contamination vulnerability**" don't meet criteria in "Highest" and "High" categories, and have:

- 4 indicators in the 70th percentile; *and/or*
- Total contamination score between 70th – 80th percentile

Block groups labeled "**Lower contamination vulnerability**" don't meet any of the criteria above.

Complementary Tools

Disadvantaged communities have a specific definition in California law. CA Senate Bill 535[1] directs funds from the State's cap-and-trade program to benefit "disadvantaged communities" and tasked CalEPA with the responsibility to develop the method to identify these communities. CalEPA Office of Environmental Health Hazard Assessment (OEHHA) created and updates the CalEnviroScreen tool, which combines pollution burden and population characteristics to generate a percentile score by census tract, relative to other tracts around the state. Funds directed to disadvantaged communities was increased with CA Assembly Bill 1550.[2] CalEnviroScreen3.0 is the most recent version. In addition to the 5 contamination indicators described in the previous section, CalEnviroScreen3.0 includes data about direct exposure to Drinking water contaminants, Diesel PM, PM2.5, Ozone, Pesticides, Traffic, Toxic releases from facilities. Population characteristics used are rates of Asthma, Cardiovascular disease, Low birth-weight infants, Educational attainment, Housing burdened low income households, linguistic isolation, unemployment, poverty.

The Metropolitan Transportation Commission (MTC) is a partner of the ART Program also working at the regional scale. MTC works to prepare Plan Bay Area (PBA), the integrated Sustainable Communities Strategy and Regional Transportation Plan for the San Francisco Bay Area. If implemented, PBA works to reduce greenhouse gas emissions from passenger vehicles through coordinated transportation, housing, and land use planning, as instructed by CA Senate Bill 375 (SB 375).[3] MTC convened a regional equity working group to develop Communities of Concern (CoC), designed to represent where communities may be disadvantaged or exhibit vulnerabilities now, and in response to future growth. The equity analysis of PBA 2040 analyzes the positive and negative impacts of PBA strategies on CoCs, compared with impacts on the remainder of the region. The ART approach includes (and supplements) the same characteristics as CoCs, and CoCs are at the larger geographic unit of census tract.

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[1] De León, Chapter 830, Statutes of 2012
[2] Gomez, Chapter 369, Statutes of 2016
[3] Sustainable Communities Act, Chapter 728, Statutes of 2008

Displacement screening was added to this dataset after the ART Bay Area project working group made clear that it is necessary to consider displacement in early stages of the project—during researching community vulnerability, and not only considered when evaluating the impacts of potential adaptation strategies later in the project. UC Berkeley Center for Community Innovation Regional Early Warning System for Displacement and Gentrification Typologies were developed for use in evaluating gentrification and displacement risks associated with transit-oriented development, relevant to the implementation of SB 375. The typologies and associated mapping tool are supported by case studies of nine communities, developed in collaboration with MTC's Bay Area Regional Prosperity Plan. Regression models were developed identify indicators that can serve as predictors for loss of low income households and gentrification processes, and includes data about the age of buildings, employment density, housing market, and presence of rail station.

The Governor's Office of Planning and Research guide Defining Vulnerable Communities in the Context of Climate Adaptation provides an overview and comparison of more community vulnerability screening approaches.
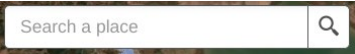
DATA ACCESS

Community Vulnerability data is made available to users in several ways, including a descriptive storymap, interactive web application, and direct download. You can access all these resources at https://www.bcdc.ca.gov/data/community.

WEB APPLICATION USER GUIDE

This section describes simple instructions for how to use the Community Vulnerability web mapping application.
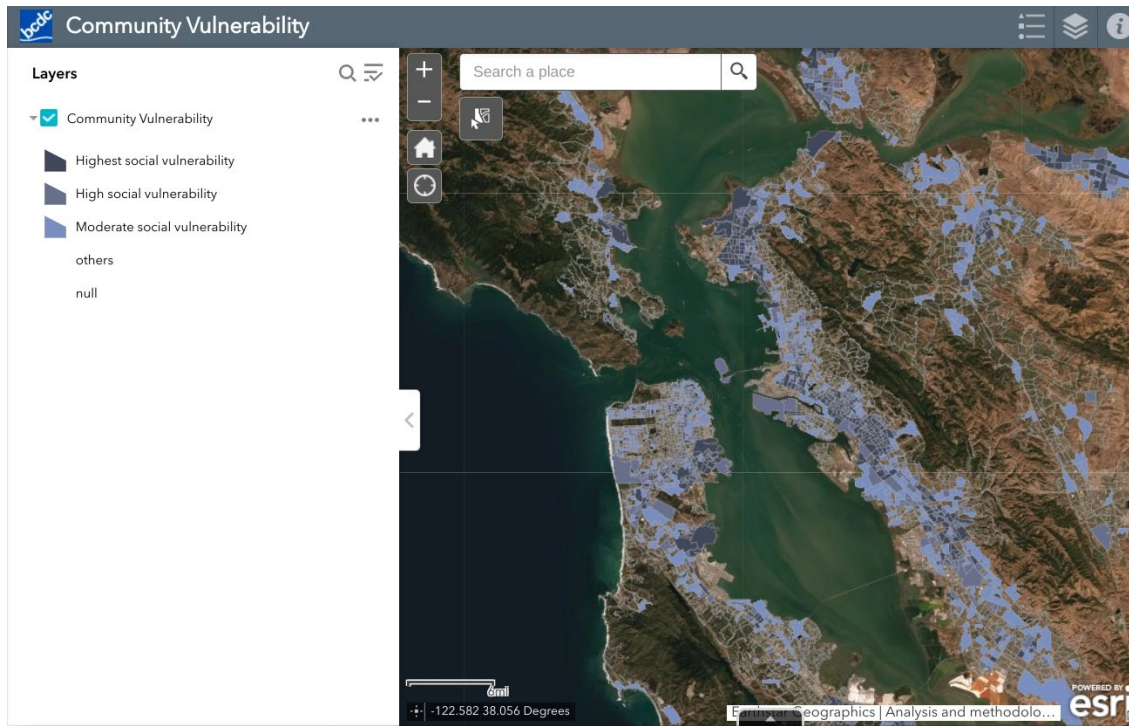
To start exploring the map:

1. Use the 'Search Bar' [Search a place] to type a location or pan and zoom [+/-] to your community or planned project.

2. Click a census block group to see pop-up of social or contamination characteristics of that community.
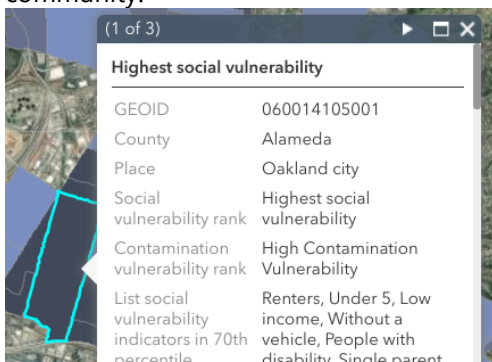
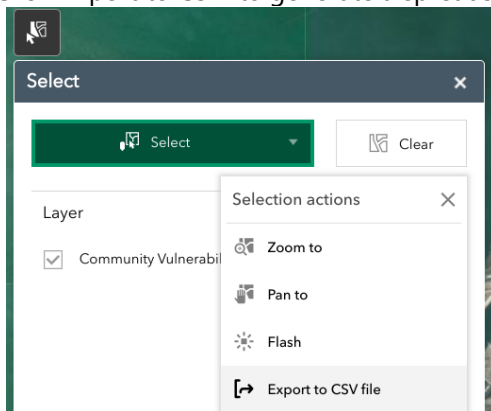3. For multiple block groups, use the 'Select' tool [icon] and click multiple block groups of interest for exporting.
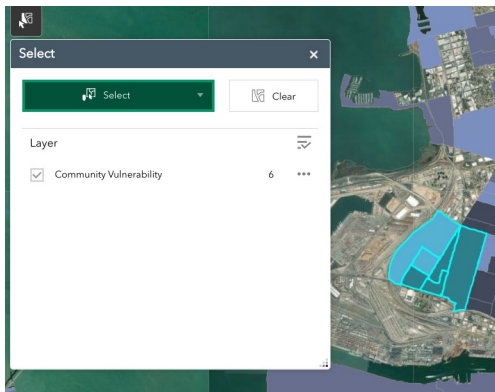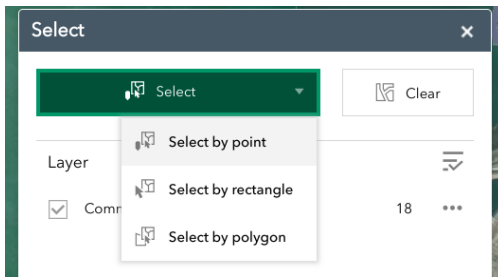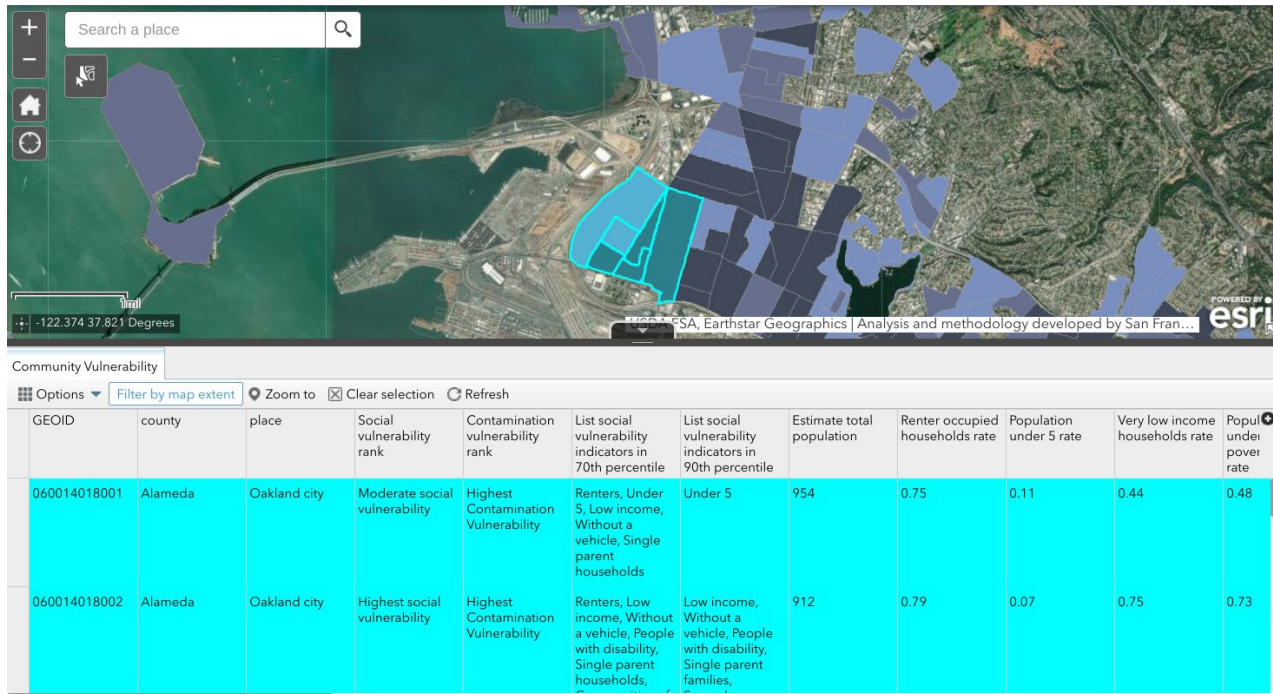
4. Click 'Export to CSV' to generate a spreadsheet of the community characteristics.

5. You can look at a table view of the data by expanding the 'Attribute Table' at the bottom of the screen.

DATA USE AND LIMITATIONS

This data is intended for sea level rise adaptation planning and to inform community outreach and engagement opportunities. This data does not represent legal boundaries, nor does it have any regulatory authority. It is made available "as is" with no liability for how it is used.

Characteristics included are only those with publicly available data that can be consistently compared (quantitatively) across the nine County Bay Area region. Not all characteristics that influence community vulnerability are included in this dataset. Indicators were developed as a regional screening tool to help identify neighborhoods where community members may be at greater risk.

Residential sea level rise exposure was calculated using the most current data available at the time, and exposures to very high levels of sea level rise (which correspond with later time horizons) should be used cautiously as they were not calculated using populations projections. To calculate residential exposure, a key assumption made in this analysis is that once a parcel is exposed to flooding, even marginally, the entire number of residential units in that parcel is considered impacted. This assumption reflects a conservative understanding that flooding has many direct and indirect impacts for a person's ability to enjoy their home. Indirect impacts such as flooding of walkways, foundations, electrical systems may all contribute to an individual or family being displaced. Since there is no data to reflect these indirect impacts, it is assumed that any flooding to a parcel impacts all the people living in it. This assumption works well for small parcels, but for large parcels this assumption serves as a limitation to the analysis. A related but separate limitation of this analysis is the existence of parcel boundaries that extend bayward of the mean higher high water (MHHW) line. These parcel boundaries intersect even small amounts of

flooding despite the fact that no buildings exist in these parts of the parcel and inaccurately indicate impacted residential units. Future efforts should be made to refine parcel boundaries to both current and future developed areas on the shoreline.