



Community Resiliency Indicator System Methods

The Community Resiliency Indicator System was developed by the [San Francisco's Climate and Health Program](#) and is part of [San Francisco's Climate and Health Profile](#). The system includes a selection of 40 indicators and an additive index which is a compilation of all of the indicators.

1. Definition of 'Resiliency'

Our definition of resiliency is "the ability of groups or communities to cope with external stresses and disturbances as a result of social, political, and environmental change".

2. Community Resiliency Indicator System: Objective

The San Francisco Department of Public Health's Climate and Health Program has developed a neighborhood community resiliency indicator system to support public health and city-wide planning and evaluative efforts. The purpose of the indicator system is to assess resilience to climate change stressors in San Francisco using quantitative and qualitative approaches and advance both public and individual interventions that increase the city's collective adaptive capacity.

3. Community Resiliency Indicator System: Methodology

To identify the most significant compounding variables that effect resiliency and vulnerability to climate change-related hazard events, staff reviewed academic literature, national and international resiliency and climate-preparedness plans, and emergency preparedness plans, to compile a comprehensive list of resiliency indicators.

This list was distributed to a Community Resiliency Work Group comprised of SFDPH staff, representatives from other city departments, and community-members. The work group met and ranked indicators by:

- 1) The degree to which the proposed indicator determined a community's resiliency and/or vulnerability.
- 2) The reliability and accessibility of data.
- 3) Does the indicator measure a unique variable that provides a more holistic understanding of resiliency and vulnerability?

The top 40 ranked indicators were divided into the following existing San Francisco Indicator Project categories: Hazard Risk Indicators, Environmental Indicators, Transportation Indicators, Community Indicators, Public Realm Indicators, Housing Indicators, Economy Indicators, Health Indicators, and Demographic Indicators. The indicators and data sources are outlined in Table 1.

4. Community Resiliency Index: Objective

The Community Resiliency Index is a tool to compare the relative resiliency and vulnerability of each San Francisco neighborhood to the health effects of climate change. Using the indicators from the Community Resiliency Indicator System, the Index allows the Climate and Health Program to both target interventions towards the most at-risk communities, and evaluate long-term progress of these communities.

5. Community Resiliency Index: Methodology

All indicators were relatively scaled 0-100 (with 100 being the most resilient).

The score is calculated using the mean and the standard deviation of each indicator where $Z \text{ score} = (\text{Raw Score} - \text{Mean}) / \text{Standard Deviation}$. Category scores were compiled by averaging z-scores for all indicators in the specific category. For example, the Hazard Risk Score is the average of the three indicators in the Hazard Risk Indicator category. The overall Resiliency Score is the average of all indicators regardless of category.

Once category scores and the resiliency score were calculated for each neighborhood, the neighborhoods were ordered from most to least resilient and divided into quintiles. Each neighborhood was designated a number 1 through 5 corresponding to the resiliency quintile (with 1 being the vulnerable to climate treats and 5 being the resilient).

Raw Data Indicators are available at <https://extxfer.sfdph.org/gis/CommunityResiliency>

Community Resiliency Data Field is available at <https://extxfer.sfdph.org/gis/CommunityResiliency/SanFranciscoCommunityResiliencyIndex.xls>

Table 1. Indicators and data sources

Domain	Indicator	Data Source	Raw Data	Community Resiliency Data Field
Hazard Risk Score	Relative, weighted, measure of hazard risk based on the average of all indicators in the Hazard Risk Indicators category.			Haz_Score
Hazard Risk Indicators	Percent of the land-area in the 100-year storm flood plain	San Francisco Sea Level Rise Committee	SanFranciscoBayside48inch1.zip, SanFranciscoPacSide48inch1.zip SanFranciscoFloodPlain48inch.zip	Flood_Per
Hazard Risk Indicators	Percent of the land-area in 'high' or 'very high' heat vulnerability areas	San Francisco Department of Public Health	SanFranciscoExtremeHeat.zip	Heat_Per

Hazard Risk Indicators	Percent of the land-area in a liquefaction or landslide zone.	San Francisco Department of Emergency Management	SanFranciscoLiquefactionLandslide.zip	Liq_Per
Environmental Score	Relative, weighted, measure of environmental resiliency based on the average of all indicators in the Environmental Indicators category.			Env_Score
Environmental Indicators	Percent impervious surface	National Landcover Database	SanFranciscoImpervious_Surface.zip	Imp_Per
Environmental Indicators	Percent tree cover	San Francisco Planning Department	SanFranciscoUrbanTreeCanopy.zip	Tree_Per
Environmental Indicators	Average annual PM2.5 concentration from all sources	Bay Area Air Quality Management District	SanFranciscoAirQuality.zip	PM_Conc
Environmental Indicators	Percent of land-area within .25 miles of a contamination risk.	California State Water Board Local Oversight Program, California Environmental Protection Agency	SanFranciscoContaminatedSites.zip	Tox_Per
Transportation Score	Relative, weighted, measure of transportation resiliency based on the average of all indicators in the Transportation Indicators category.			Trans_Sco
Transportation Indicators	Average minutes of active transportation (walk+bike) per day	San Francisco Metropolitan Transportation Agency	SanFranciscoActiveTransportation.zip	AT_min
Transportation Indicators	Public transit score	San Francisco Metropolitan Transportation Agency	SanFranciscoTransitScore.zip	Trans_Sco
Community Score	Relative, weighted, measure of community resiliency based on the average of all indicators in the Community Indicators category.			Com_Score
Community Indicators	Violent crimes, per 1000 people	San Francisco Police Department	SanFranciscoViolentCrime.zip	Vcrime_Rate
Community Indicators	Voting rates in the 2012 presidential election	San Francisco Department of Elections	SanFranciscoVotingRates.zip	Vot_Rate

Community Indicators	Percent of the population who moved to San Francisco within the last year	ACS 2008 - 2012	SanFranciscoDemographicsACS_2008_2012.zip	NewSF_per
Community Indicators	Percent of the population without United States citizenship	ACS 2008 - 2012	SanFranciscoDemographicsACS_2008_2012.zip	Citz_Per
Community Indicators	Percent of the population living in households without English spoken 'very well'	ACS 2008 - 2012	SanFranciscoDemographicsACS_2008_2012.zip	Eng_Per
Public Realm Score	Relative, weighted, measure of public realm resiliency based on the average of all indicators in the Public Realm Indicators category			PR_Sco
Public Realm Indicators	Food market score	Dun and Bradstreet, San Francisco Department of Public Health	SanFranciscoFoodAccessScore.zip	Food_Score
Public Realm Indicators	Percent of the population over 25 with a high school degree	ACS 2008 - 2012	SanFranciscoDemographicsACS_2008_2012.zip	HS_Per
Public Realm Indicators	Percent of the land-area within a quarter mile of at least 1 pharmacy	California State Board of Pharmacy	SanFranciscoPharmacy.zip	Pharm_Per
Housing Resiliency Score	Relative, weighted, measure of housing resiliency based on the average of all indicators in the Housing Indicators category			House_Score
Housing Indicators	Percent of households with a resident living alone	ACS 2008 - 2012	SanFranciscoDemographicsACS_2008_2012.zip	LivAl_Per
Housing Indicators	Percent of households with a resident over 65 and living alone	ACS 2008 - 2012	SanFranciscoDemographicsACS_2008_2012.zip	EldLivAl_Per
Housing Indicators	Percent of households with 1 or more people per room	ACS 2008 - 2012	SanFranciscoDemographicsACS_2008_2012.zip	OC_Per
Housing Indicators	Residential housing violations, per 1000 people	San Francisco Department of Public Health, San Francisco Department of Building Inspections, San Francisco Fire Department	SanFranciscoHOousingViolations.zip	Viol_Rate

Housing Indicators	Percent of buildings with air conditioning	San Francisco Department of Building Inspections	SanFranciscoAirConditioning.zip	AC_PER
Housing Indicators	Percent of renter households whose gross rent is 50% or more of their household income	ACS 2008 - 2012	SanFranciscoDemographicsACS_2008_2012.zip	Rent_Per
Economy Score	Relative, weighted, measure of economic resiliency based on the average of all indicators in the Economy Indicators category			Ec_Score
Economy Indicators	Percent of the population over 16 that are employed	ACS 2008 - 2012	SanFranciscoDemographicsACS_2008_2012.zip	Emp_Per
Health Score	Relative, weighted, measure of health resiliency based on the average of all indicators in the Health Indicators category			Health_Score
Health Indicators	Shelters and cooling centers within .25 miles, per 1000 people	San Francisco Department of Public Health	SanFranciscoShelterProximity.zip	Shelt_Rate
Health Indicators	Shelters and cooling centers within .25 miles, per 1000 people (daytime population)	San Francisco Department of Public Health	SanFranciscoShelterProximity.zip	SheltDay_Rate
Health Indicators	Percent of population reporting a disability	ACS 2008 - 2012	SanFranciscoHealthFacilities.zip	Dis_Per
Health Indicators	Percent of population within a 30-commute of a hospital or clinic	San Francisco Department of Public Health	SanFranciscoDemographicsACS_2008_2012.zip	
Health Indicators	Preventable hospitalizations	San Francisco Department of Public Health	SanFranciscoPreventableHospitalizations.zip	PrevHos
Demographic Score	Relative, weighted, measure of demographic resiliency based on the average of all indicators in the Demographic Indicators category			Dem_Score
Demographic Indicators	Percent of the population over 85	ACS 2008 - 2012	SanFranciscoDemographicsACS_2008_2012.zip	Over85_Per

Demographic Indicators	Percent of the population over 65	ACS 2008 - 2012	SanFranciscoDemographicsACS_2008_2012.zip	Over65_Per
Demographic Indicators	Percent of the population under 18	ACS 2008 - 2012	SanFranciscoDemographicsACS_2008_2012.zip	Under18_Per
Demographic Indicators	Percent of the population under 5	ACS 2008 - 2012	SanFranciscoDemographicsACS_2008_2012.zip	Under5_Per
Demographic Indicators	Percent of the population non-white	ACS 2008 - 2012	SanFranciscoDemographicsACS_2008_2012.zip	NonWhi_Per
Demographic Indicators	Percent of the population Latino	ACS 2008 - 2012	SanFranciscoDemographicsACS_2008_2012.zip	Lat_Per
Demographic Indicators	Percent of the population Black/African American	ACS 2008 - 2012	SanFranciscoDemographicsACS_2008_2012.zip	Black_Per
Demographic Indicators	Percent of the population Asian	ACS 2008 - 2012	SanFranciscoDemographicsACS_2008_2012.zip	Asian_Per
Demographic Indicators	Percent of households below 200% of the poverty rate	ACS 2008 - 2012	SanFranciscoDemographicsACS_2008_2012.zip	Pov_Per
Demographic Indicators	Population density	ACS 2008 - 2012	SanFranciscoDemographicsACS_2008_2012.zip	PopDens
Demographic Indicators	Daytime density	ACS 2008-2012, Longitudinal Household-Employer Dynamics 2011, San Francisco Unified School District	SanFranciscoDaytimeDensityPop.zip	DayPopDens
Final Resiliency Score	Relative, weighted, measure of resiliency based on the average of all indicators.			Res_Score