



2019

San Diego's Climate Equity

INDEX REPORT



Our vision is to be a sustainable and resilient city with opportunity in every community.

City of San Diego Sustainability
Department Vision Statement

Table of Contents

Executive Summary	3
Background	7
Methodology	9
Findings	14
Recommendations	16
Acknowledgements	18
APPENDIX A:	19
APPENDIX B:	20

Executive Summary

Historically in San Diego, as in most cities, some communities have been afforded greater access to opportunity than others over many years of growth and development. The City of San Diego's 2015 Climate Action Plan (CAP) established an opportunity to address environmental justice and social equity concerns - collectively referred to as climate equity - when addressing climate change. This direction, and the CAP overall, supports the City's General Plan which provides policies to pursue environmental justice in the planning process through greater community participation. It also establishes the need to prioritize and allocate citywide resources which provide public facilities and services to communities in need, and to improve mobility options and accessibility for the non-driving elderly, disabled, low-income, and other members of the population. The City has identified these communities as Communities of Concern.

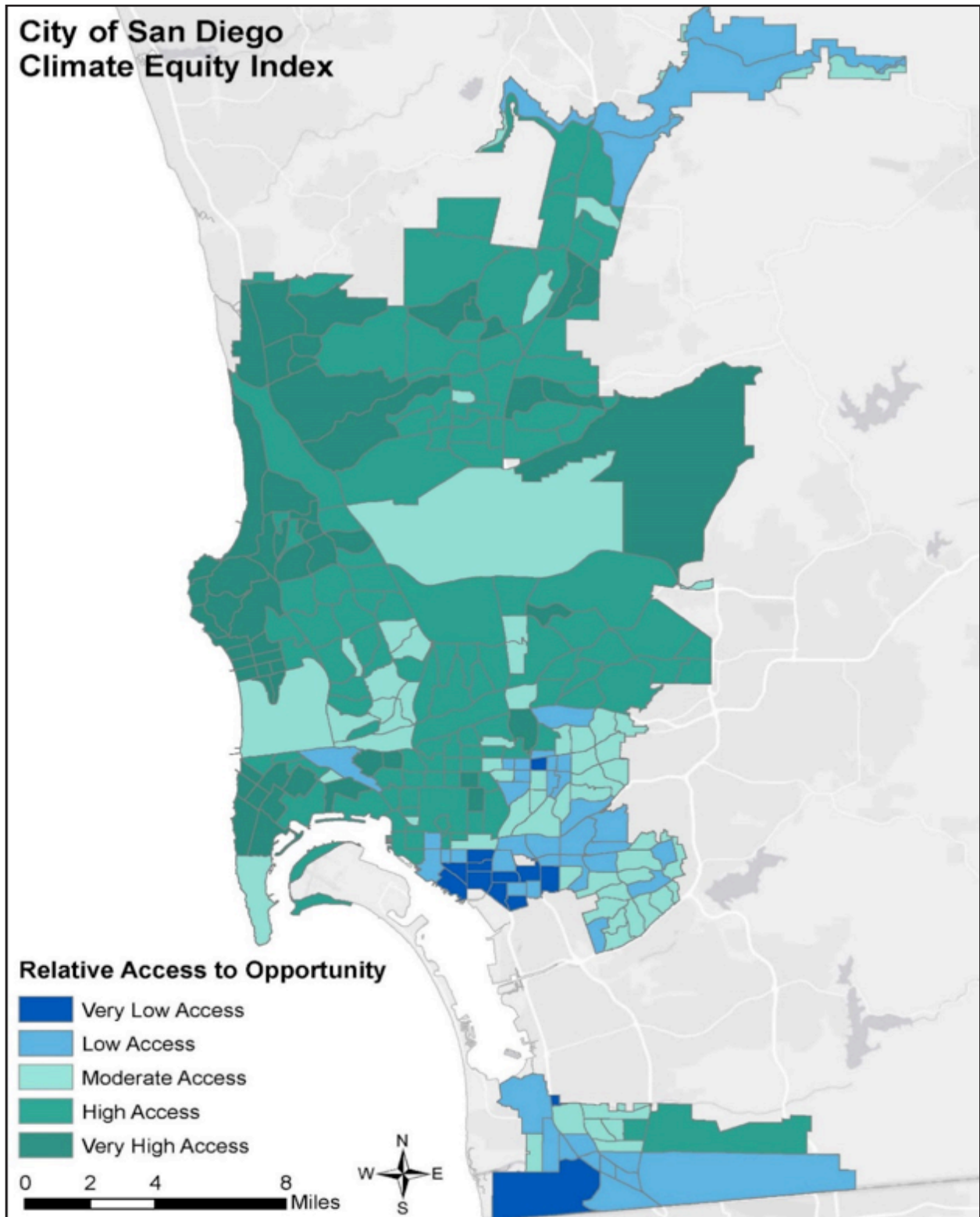
To better understand our Communities of Concern, and to establish benchmarks and metrics to serve as a citywide assessment of climate equity, the City's Sustainability Department and the University of San Diego Energy Policy Initiatives Center (EPIC) created the first-of-its-kind Climate Equity Index (CEI). San Diego's CEI assessed all 297 census tracts that intersect with the City and developed standardized indicators to calculate a CEI score from 0-100 for each tract that can be compared to the score of other tracts.

Critical to this effort was collaboration with community stakeholders. To this end, the City worked with community-based organizations to form an Equity Stakeholder Working Group. Thirty-five indicators were selected to measure equity across the City based on input from the working group and research on nationwide best practices. Based on this assessment, the average CEI score for the City was determined to be 61. Census tracts that scored below the average are considered to have less access to opportunity than the tracts that scored above the average. In total, 172 census tracts scored at or above the average,



indicating high to very high access to opportunity, while 125 tracts scored below average with very low, low or moderate access to opportunity. This is represented in Figure 1 below.

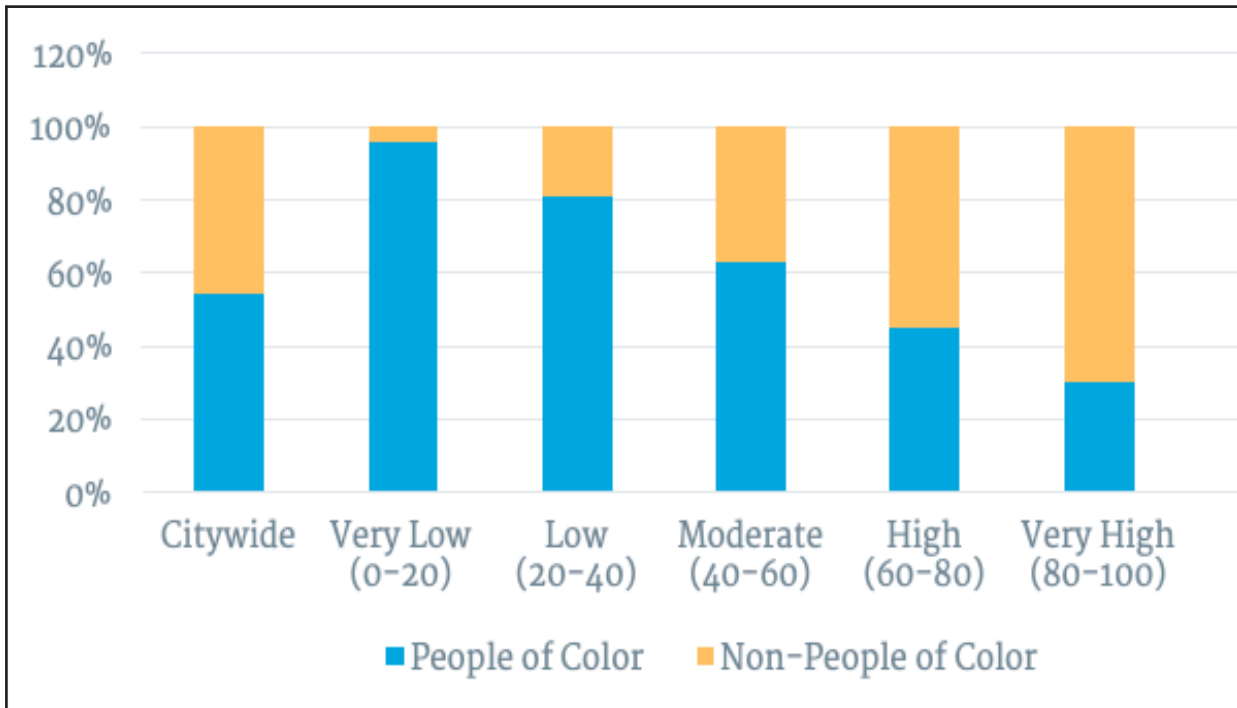
Figure 1. Climate Equity Index Scores Across the City of San Diego



Energy Policy Initiatives Center, USD
12/09/2019

The CEI also highlights racial inequities within the City as a disproportionate number of people of color are concentrated in census tracts with very low to moderate access to opportunity. Seventy-three percent of residents within these census tracts identify as people of color, compared to 40% of residents in tracts with high to very high access to opportunity. Overall 54% of the population of the City identify as people of color. Figure 2 shows the percentage of people of color per census tract category as identified in the CEI.

Figure 2. Percent of People of Color by Census Tract Performance



Thirteen census tracts were identified as having very low access to opportunity in which 96% identify as people of color. These tracts are in the neighborhoods of Barrio Logan, Lincoln Park, Nestor, the Tijuana River Valley, Logan Heights, Palm City, Mountain View, Stockton, Grant Hill, Southcrest, Teralta East and Shelltown.

Forty-eight census tracts were identified as having low access to opportunity, with an average of 81% identifying as people of color. Sixty-four tracts were identified as having moderate access to opportunity, with an average of 63% of their population identifying as people of color.

While race was not identified as an indicator within the CEI, the index highlights racial inequities the City can address through work to combat climate change and efforts to address climate equity.

After analyzing the results of the CEI assessment, including feedback from the Equity Stakeholder Working Group, City staff recommends the following actions:

RECOMMENDATION 1: Seek grant funding opportunities to support community engagement and invest in areas with very low to moderate access to opportunity.

RECOMMENDATION 2: Conduct public engagement efforts, in partnership with community-based organizations, in census tracts with very low access to opportunity.

RECOMMENDATION 3: Explore the feasibility of establishing a sustainability ambassador program in areas with a very low to moderate access to opportunity to improve participation in City planning.

RECOMMENDATION 4: Determine mechanisms to incorporate climate equity into City programs and projects.

RECOMMENDATION 5: Refresh data within San Diego's Climate Equity Index every five years.

Taking these recommended actions will ensure the City is moving in the right direction to address climate equity when implementing the CAP and is considering the needs of all residents when planning for San Diego's future.



Background

THE CLIMATE ACTION PLAN AND COMMUNITIES OF CONCERN

On Dec. 5, 2015, the City of San Diego adopted its Climate Action Plan (CAP), setting forth five strategies that could achieve the goal of reducing greenhouse gas (GHG) emissions 50% by 2035. As stated within the document, “the benefits of the CAP are intended to be shared equally, fairly and with lack of prejudice among all persons citywide.” The City recognizes the importance of ensuring all San Diegans receive the opportunities associated with the implementation of the CAP.

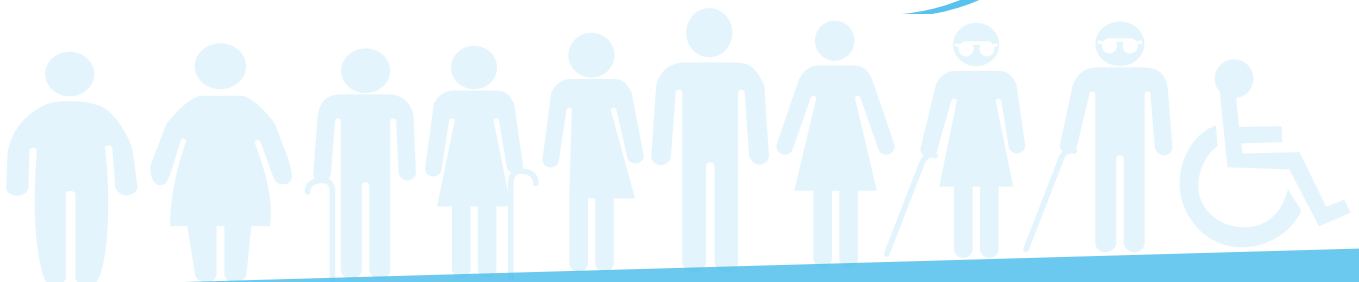
Using the term “disadvantaged communities,” the CAP referred to what the City now calls Communities of Concern, those within census tracts in the top 30th percentile of the California Office of Environmental Health Hazard Assessment’s CalEnviroScreen 3.0 (CalEnviroScreen) tool, census blocks eligible for Community Development Block Grants, and areas within a half-mile radius of affordable housing. A map of San Diego’s Communities of Concern is included in Appendix A.

Additionally, the City’s General Plan, which the CAP serves as mitigation to, includes policies that prioritize and allocate citywide resources to provide public facilities and services that improve mobility options and accessibility for the non-driving elderly, disabled, low-income, and other members of the population. City staff takes this as a directive to ensure we prioritize Communities of Concern when looking at investing in CAP projects and programs.

CLIMATE EQUITY

To address environmental justice and social equity, the City recognizes these two concepts are incorporated in the term “climate equity”. The City worked with community-based organizations (CBOs) to define climate equity as efforts addressing historical inequities suffered by people of color, allowing everyone to fairly share the same benefits and burdens from climate solutions and attain full and equal access to opportunities regardless of one’s background and identity.

Climate Equity: *addressing historical inequities suffered by people of color, allowing everyone to fairly share the same benefits and burdens from climate solutions and attain full and equal access to opportunities regardless of one’s background and identity.*



Throughout the nation, vulnerable populations are hit hardest by climate change.¹ As the City continues to plan to address those impacts it is imperative that decision-making tools are created and utilized to respond more effectively in communities that need it most.

To attain climate equity, the City recognizes the need to acknowledge where disparities exist and identify ways to redress those disparities. The City developed the CEI, along with stakeholders representing San Diego's Communities of Concern, to provide a data-backed method to understand the inequities experienced by these communities.

STAKEHOLDER ENGAGEMENT

The first step to addressing climate equity is to include Communities of Concern in the decision-making process. To do so, the City has established an informal Climate Equity Stakeholder Working Group to provide feedback and input on decisions for how the CEI was developed. This group may reconvene beyond the completion of the CEI to provide input on overall CAP implementation. The stakeholder group was integral in advising the City on the working definition of climate equity, provided input on how to measure climate equity and helped develop the recommendations in this report.

The Equity Stakeholder Working Group is comprised of 23 CBOs that serve San Diego's identified Communities of Concern. A list of the Equity Stakeholder Working Group members is available in the Acknowledgements section of this report.

CLIMATE EQUITY INDEX

San Diego's Climate Equity Index (CEI) was developed to measure the level of access to opportunity residents have within a census tract, and assess the degree of potential impact from climate change to these areas. For example, some census tracts have a higher level of access to opportunity as a result of greater access to public transit stops and pedestrian amenities, such as sidewalks and streetlights, or they spend a lower percentage of their income on housing, energy and transportation costs. These populations face relatively fewer barriers to commute to school or work or to invest in newer energy conservation technologies.

The CAP committed City staff to develop the methodology for reporting on equity². To fulfill that commitment, the CEI identifies the level of access to opportunity for residents and provides a tool to measure inequity, allowing the City to prioritize areas with the least access to opportunity and begin dismantling historic barriers that have caused disparities in Communities of Concern. The CEI can also be a tool to identify other areas that should be included in the Communities of Concern definition.

¹ Making Equity Real in Climate Adaption and Community Resilience Policies and Programs: A Guidebook (2019)

² City of San Diego Climate Action Plan (2015), Pg. 43

Methodology

INDICATORS

City staff researched nationwide best practices, reviewed available sources of data, and obtained input from the Equity Stakeholder Working Group to measure equity across the City. A total of 35 indicators were selected for the CEI. In deciding on the final list of indicators, the City worked with the Equity Stakeholder Working Group and assessed each indicator with the following guidelines:

Equity Focus - data identifies and represents equity issues within the City

Climate Focus - data has a close connection to the City's Climate Action Plan

Clear Connection - the relationship between the indicator and climate equity is clearly understood

Data Integrity - quality data is available from reliable and trustworthy sources

Data Update Frequency - the frequency of data updates should permit regular, future updates to the CEI and allow for indicators to be tracked over time

All indicators fall into one of five broader categories: environmental, socioeconomic, housing, mobility and health. The indicators that pertain to each category are identified in Table 1, in no particular order, along with a description of what was measured for each. For further discussion of individual indicators, refer to Appendix B.

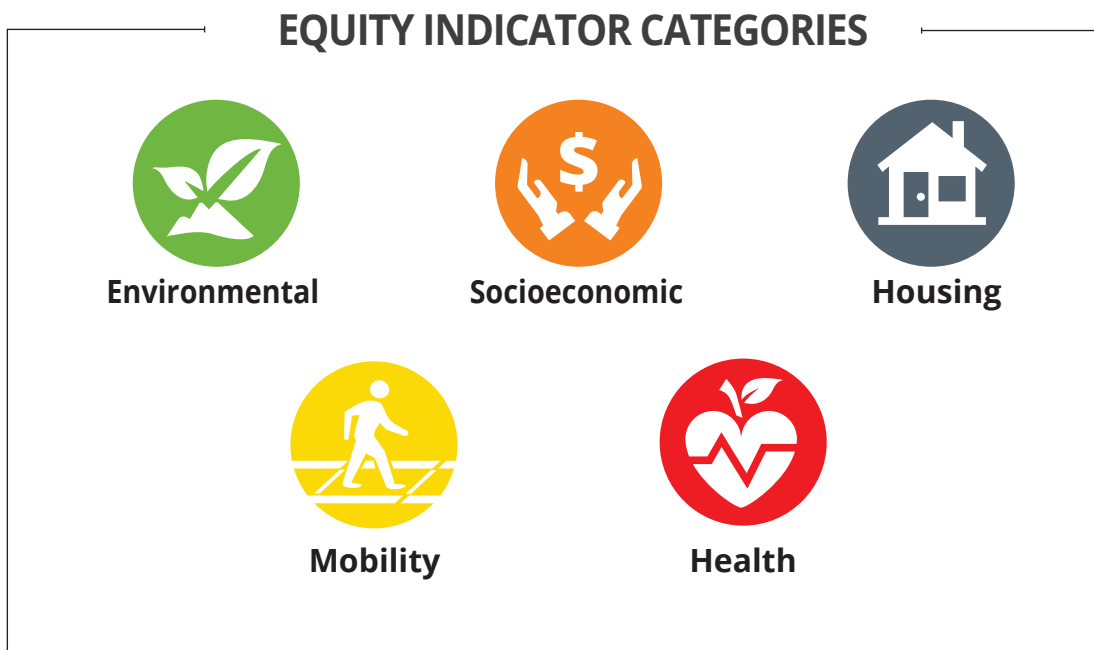







Table 1. Climate Equity Index Indicators

Indicator	Description
 ENVIRONMENTAL INDICATORS	
Flood Risk*	<i>Percent of census tract within the 100-year flood plain and/or predicted to experience inundation during a 100-year storm surge event given a 2-meter rise in sea level</i>
Fire Risk*	<i>Percent of the census tract classified under the very high fire hazard severity zone</i>
Tree Coverage*	<i>Percent of tree canopy coverage</i>
Urban Heat Island Index	<i>Increase in temperature due to urban heat island (UHI) effect</i>
Proximity to Community Recreation Areas*	<i>Number of recreation areas (parks, open space, beaches, libraries and recreation centers) within 1/2 mile of populated neighborhoods</i>
Proximity to Waste Sites*	<i>Average distance to the nearest waste site (includes hazardous waste generators and facilities, facilities with documented toxic releases, solid waste sites and facilities, and cleanup sites)</i>
Pesticide Use	<i>Total pounds of selected pesticides used in production-agriculture per square mile as calculated by CalEnviroScreen 3.0</i>
Drinking Water Contaminants	<i>Average concentration of contaminants within drinking water systems as calculated by CalEnviroScreen 3.0</i>
Groundwater Threats	<i>CalEnviroScreen 3.0 groundwater threat scores for census tracts based on type of pollution site and location to populated neighborhoods</i>
Impaired Water Bodies	<i>Number of pollutants across all water bodies designated as impaired within the census tract as calculated by CalEnviroScreen</i>
 HEALTH INDICATORS	
Asthma Rates*	<i>Rate of emergency department visits due to asthma</i>
Cancer Fatalities*	<i>Percent of total deaths that are cancer-related</i>
Healthy Food Access*	<i>Percent of population with low access to healthy food (> 1/2 mile for urban census tracts and >10 miles for rural census tracts)</i>
Low Infant Birth Weight	<i>Percent of full term births (37 weeks of gestation) with a birthweight less than 2,500 grams</i>
Heart Attack Fatalities*	<i>Percent of total deaths that are heart attack-related</i>
 HOUSING INDICATORS	
Housing Cost Burden	<i>Median housing cost as a percent of median income</i>
Overcrowdedness	<i>Percent of housing units with greater than 1.00 occupants per room</i>

 MOBILITY INDICATORS	
Pedestrian Access*	<i>A combination of average Walk Score, miles of sidewalk, number of streetlights and pedestrian-vehicle collisions</i>
Commute Burden*	<i>Percent of population with commute time over the regional average (30 minutes for commuting by car and 45 minutes for commuting by mass transit)</i>
Transportation Cost Burden	<i>Median household transportation cost as a percentage of median household income</i>
Disability	<i>Percent of population with a disability</i>
Street conditions*	<i>Weighted average Overall Condition Index (OCI) score</i>
Bikeability*	<i>Weighted average Bike Score</i>
Access to Public Transit*	<i>Average distance to the nearest transit stop</i>
Traffic Density	<i>Traffic volume divided by total road length as calculated by CalEnviroScreen 3.0</i>
Electric Vehicle Charging Infrastructure*	<i>Number of publicly available charging stations (includes Level 2 and DC fast chargers)</i>

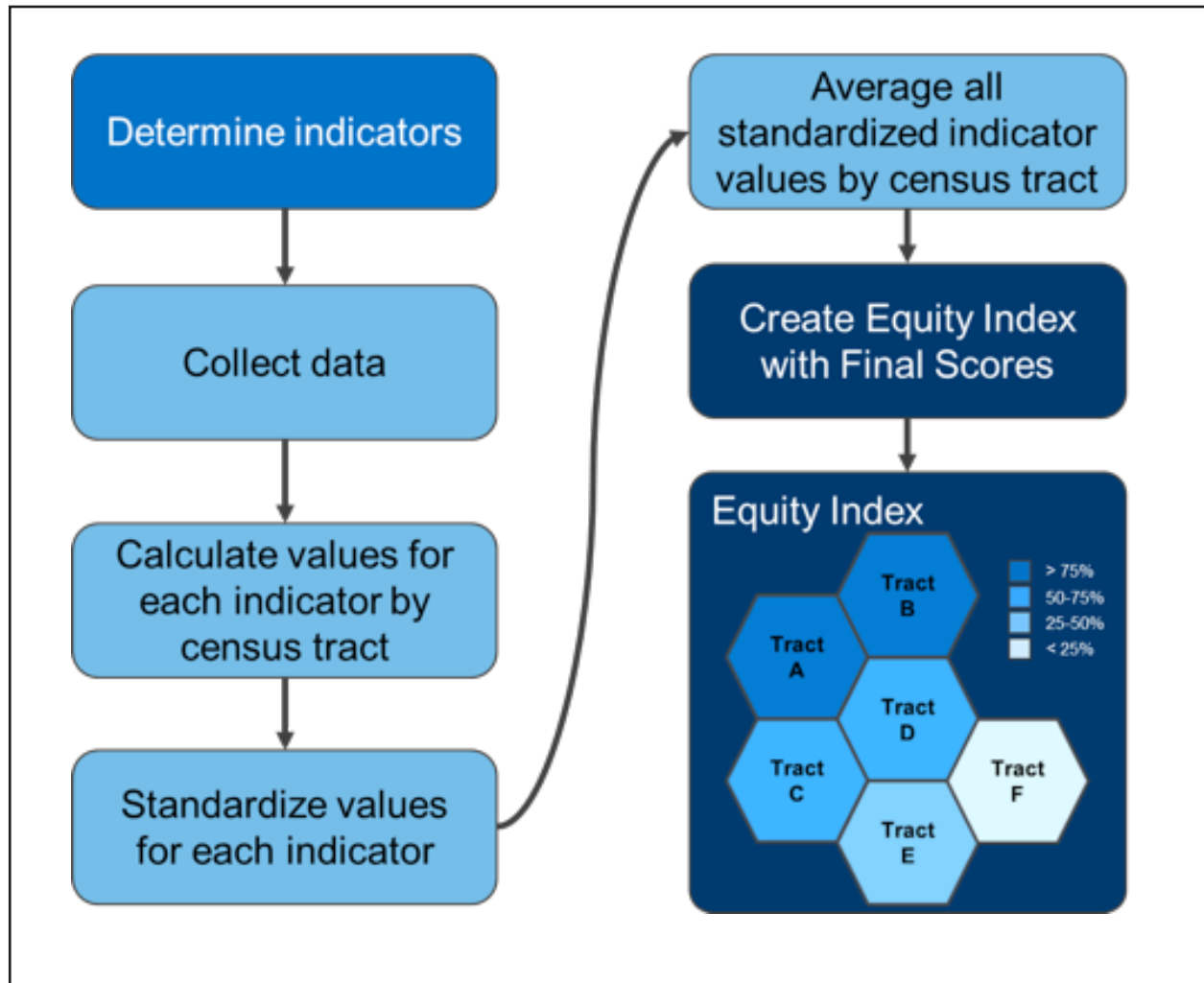
 SOCIOECONOMIC INDICATORS	
Unemployment	<i>Unemployment rate (percent of population unemployed)</i>
Educational Attainment	<i>Percent of population over age 25 with less than a high school education</i>
Linguistic Isolation	<i>Percent of households that are limited English-speaking households</i>
Digital Access	<i>Percent of households without internet access</i>
Median Income	<i>Estimated median household income in the past 12 months</i>
Poverty Rate	<i>Percent of population with income below 300% of the federal poverty level</i>
Change in Income*	<i>Five-year annual percent change in median household income</i>
Energy Cost Burden*	<i>Three-year average annual cost of energy as a percent of the median household income</i>
Solar Photovoltaic Systems*	<i>Number of solar photovoltaic systems per capita</i>

*Denotes data needing additional calculation to aggregate at the census tract level.

INDEX CALCULATION

The CEI is based on census tracts, the smallest geographical area for which most indicator data is available or can be reasonably derived from a larger area. Every tract receives a value for each of the 35 indicators and these values are then used to determine its CEI score. General methods for this process are identified in Figure 3 and are further detailed in Appendix B.

Figure 3. General Climate Equity Index Methods



Data was collected at the census tract level, where available. Data not aggregated at the census tract level required additional calculations (see Appendix B for further details) and are noted in Table 1 above with an asterisk (*).

Next, all indicator values were standardized into z-scores, maintaining the relative difference in scores across census tracts while allowing for calculations across indicators. Final CEI scores were obtained by averaging all z-scores for a particular census tract and then indexing those scores to a value between 0-100 for easier interpretation of the results.

LIMITATIONS

While the CEI highlights areas of concern for the City to focus on when addressing climate equity, there are some limitations that need to be acknowledged.

GEOPOLITICAL BOUNDARIES

Ideally, CEI scores would be calculated at the smaller, more localized census block level. Census tracts contain multiple census blocks. However, currently available data restricts the geographic scale to the census tract level, therefore, the CEI scores represent data at the census tract level. Assigning fixed geographic boundaries permits CEI scores to be compared to the demographics of each tract; however, the benefits and/or burdens experienced are not always bound to these specific geographic areas. For instance, facilities and amenities offered in one census tract may be easily accessible to residents in neighboring census tracts. Conversely, if a hazardous waste site is located on the border of one tract, the potential pollution burden will be shared with the other tracts it borders even if the facility does not operate within them.

Census tract boundaries do not adhere to jurisdictional boundaries or other planning boundaries used by the City, as in Community Plan Areas for example. There are also multiple census tracts shared between the City of San Diego and one or more neighboring jurisdictions. Since most data were collected at the census tract level, CEI scores for these tracts reflect conditions across the entire tract, not just the portion located within the City.

DATA AVAILABILITY

There are several limitations that involve data availability that either restrict the potential for regular updates going forward or prevent the inclusion of certain indicators into the CEI. In assessing the City's tree canopy coverage, for example, there is currently no planned update to the 2014 data used to calculate CEI scores. Still, the stakeholder group felt this was an extremely important indicator since it is directly tied to the CAP. The CEI relies on other indicators that receive updates irregularly and may cause some uncertainty. This can potentially limit the ability of regular CEI updates to track how indicators, like tree canopy, change over time.

Some indicators proposed in discussion with the Equity Stakeholder Working Group were not included in this analysis due to a lack of data. For instance, air quality was suggested as a health indicator. While some regional data are available, there is currently no accurate way to assess air quality on a census tract level across the City. While the City acknowledges the importance of monitoring air quality, the current data available does not lend itself to be used for a citywide assessment and therefore was not included in the CEI.

While the City acknowledges these limitations, it maintains confidence in the CEI to accurately measure climate equity within the City of San Diego. As better data becomes available for our citywide assessment, City staff will work with the Equity Stakeholder Working Group to determine if additional indicators should be included in the CEI and assess any future need to adapt methods.

Findings

Figure 1 highlights the results of the CEI. Each of the 297 census tracts within the City has been assigned a score between 0 and 100, based on how each tract scores across all indicators. Scores illustrate the relative difference between census tracts, with the census tract performing the best across all indicators scoring the highest (100) and the tract performing least best across all indicators the lowest (0). Scores for other census tracts are scaled to demonstrate their performance relative to the highest and lowest scoring tracts.

Five categories were developed to represent CEI scores and better identify the relative differences in access to opportunities among census tracts.

CEI score of 0-20:
very low access to opportunity

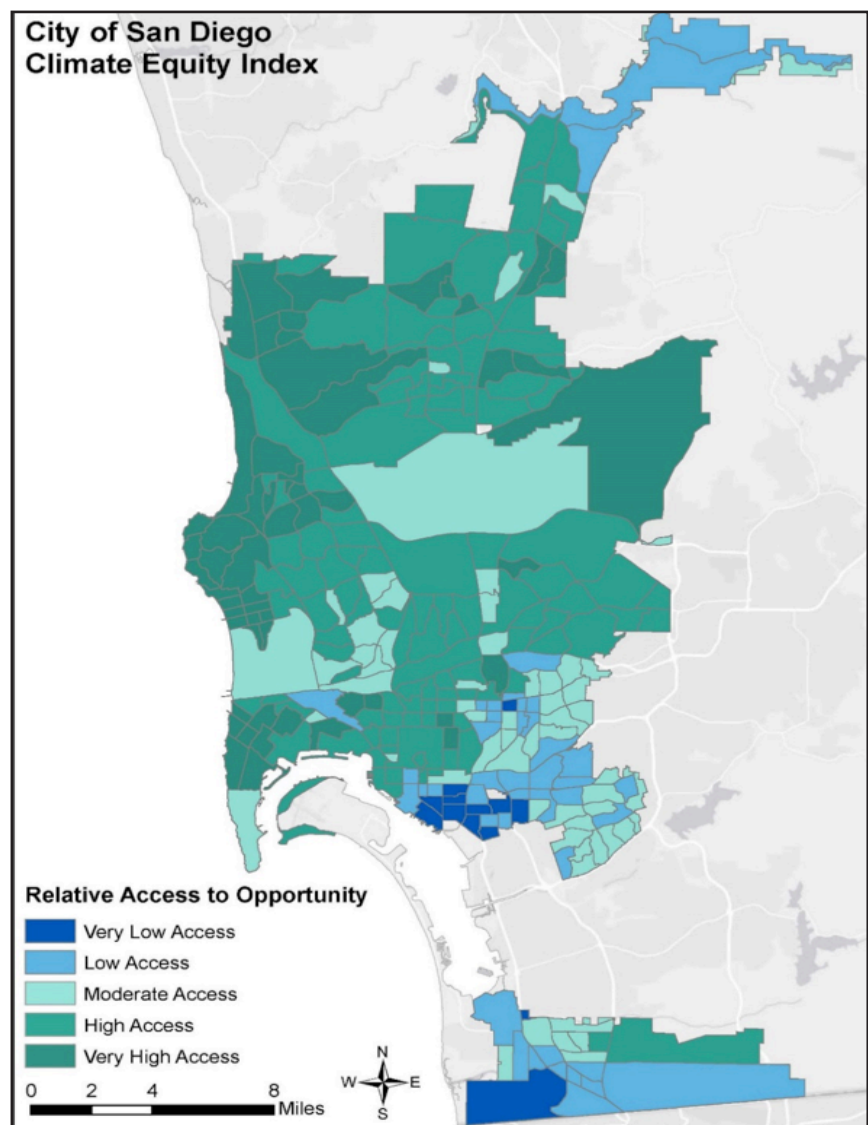
CEI score of 20-40:
low access to opportunity

CEI score of 40-60:
moderate access to opportunity

CEI score of 60-80:
high access to opportunity

CEI score of 80-100:
very high access to opportunity

Figure 1. Climate Equity Index Scores Across the City of San Diego



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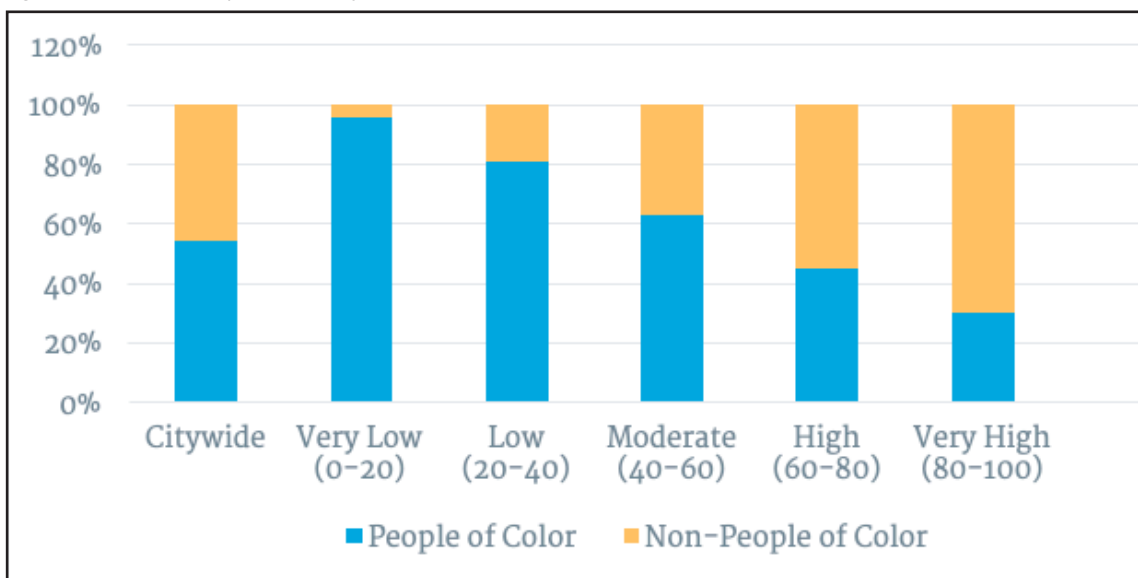
The average CEI score across the City is 61, with a standard deviation of 21. A majority of the City's tracts (172 or 58%) scored at or above the average, demonstrating high to very high access to opportunity. Relative to other tracts in the City, San Diegans living within these tracts face fewer barriers to improve their

quality of life and enjoy a higher access to opportunities to improve their lifestyle. However, this still leaves many San Diegans facing higher barriers and with less opportunity.

There are 125 census tracts within the City that show very low to moderate access to opportunity. Below are a few demographic key points.³

- ┌ Census tracts with a below average CEI score represent 42% of the total population in all census tracts included in the analysis.
- ┌ The 13 census tracts with the least access to opportunity are in the neighborhoods of Barrio Logan, Lincoln Park, Nestor, the Tijuana River Valley, Logan Heights, Palm City, Mountain View, Stockton, Grant Hill, Southcrest, Teralta East and Shelltown.
- ┌ The data show that there is a disproportionate amount of people of color in our below average tracts, as shown in Figure 2.

Figure 2. Percent of People of Color by Census Tract Performance



- The average percent of people of color in all the San Diego census tracts is 54%. In census tracts below average, the percent of people of color is 73%.
- Within the 13 census tracts with very low access to opportunity, 96% of residents identify as people of color.
- Within the 48 census tracts with low access to opportunity, 81% identify as people of color.
- Within the 64 tracts with moderate access to opportunity, 63% identify as people of color.
- Within the 116 tracts with high access to opportunity, 45% identify as people of color.
- Within the 56 tracts with very high access to opportunity, 31% identify as people of color.

³ Demographic data is based on the U.S. Census Bureau's 2017 American Community Survey 5-year estimate. For census tracts that are shared between the City and another jurisdiction, demographic data represents the entire census tract, not just the portion within the City of San Diego.

Recommendations

Implementation of the CAP affords the City of San Diego the chance to increase access to opportunity in Communities of Concern and become a leader in addressing climate equity. Progress is possible and the City is taking its first major step in acknowledging concerns and moving forward with bold actions to address climate equity.

This multi-faceted task is a relatively new discipline for municipalities and governments to tackle. While there are some examples of success across the nation, due to the diverse nature of our communities, any approach the City takes to address climate equity will require unique solutions developed in close coordination with our communities. Staff recommends the following actions to begin addressing climate equity in the City.

RECOMMENDATION 1: SEEK GRANT FUNDING OPPORTUNITIES TO SUPPORT COMMUNITY ENGAGEMENT AND INVEST IN AREAS WITH VERY LOW TO MODERATE ACCESS TO OPPORTUNITY

Effective outreach and engagement in our Communities of Concern require resources and innovative, non-traditional methods. The City should seek out grants and other funding opportunities that support our efforts, as well as those by stakeholder organizations, that focus on activating, organizing and engaging residents within the communities with very low to moderate access to opportunities. The City can partner with community groups to identify and apply for grants that support our mission of engaging communities and empowering them when it comes to CAP projects and programs that could benefit our Communities of Concern.

RECOMMENDATION 2: CONDUCT PUBLIC ENGAGEMENT EFFORTS, IN PARTNERSHIP WITH COMMUNITY-BASED ORGANIZATIONS, IN CENSUS TRACTS WITH VERY LOW ACCESS TO OPPORTUNITY

The solutions to reducing the City's GHG emissions in Communities of Concern should be done in consultation with stakeholders. Steps should be taken by City staff to prioritize public engagement activities in census tracts with very low access to opportunity. Due to the diversity of backgrounds and demographics, the City should consider partnering with CBOs that currently work in and have relationships with community members that reside in these census tracts.

Engagement should center around education on the City's CAP goals and climate equity, and seek input from residents on projects that help address climate change and reduce GHG emissions.

RECOMMENDATION 3: EXPLORE THE FEASIBILITY OF ESTABLISHING A SUSTAINABILITY AMBASSADOR PROGRAM IN AREAS WITH VERY LOW TO MODERATE ACCESS TO OPPORTUNITY

One way to strengthen our communities and provide equal access is to invest in cultivating community leaders and empowering them to become sustainability ambassadors. Partnering with CBOs and local universities, the City can look to establish a Sustainability Ambassador program, empowering residents by demonstrating the importance of sustainability and climate equity, and providing them with the tools to effect change and educate their fellow community members. This would also improve the relationship between the City and our diverse communities.

RECOMMENDATION 4: DETERMINE MECHANISMS TO INCORPORATE CLIMATE EQUITY INTO CITY PROGRAMS AND PROJECTS

The City should move forward in a coordinated effort to address climate equity, as it intersects with various City Departments. A policy can be developed to provide guidance on how best to incorporate climate equity into City operations and ensure every department is prioritizing Communities of Concern.

The City can also assess other mechanisms to help dismantle barriers our communities face to become more civically engaged and to become a part of the decision-making process, internally and, where applicable, with other agencies within the City. This process should also identify and include specific mechanisms to intergrate climate equity into resiliency and adaptation plans and future climate action planning updates.

RECOMMENDATION 5: REFRESH DATA WITHIN SAN DIEGO'S CLIMATE EQUITY INDEX EVERY FIVE YEARS

The City continues its commitment to include a progress report on the CAP to update the public on the actions taken to address climate equity. To ensure the City is moving in the right direction, a data refresh of the CEI should also be done every five years to measure progress in achieving climate equity goals and potentially revisit based on new information.



Acknowledgments

The following organizations comprised the City's informal Equity Stakeholder Working Group. We thank every organization for their involvement and contribution of time and input in establishing the City's Climate Equity Index.

Alliance San Diego

Bayside Community Center

Business For Good

Casa Familiar

Center for Sustainable Energy

Circulate San Diego

City Heights CDC

Climate Action Campaign

Environmental Health Coalition

GRID Alternatives

Groundworks San Diego

I Am My Brother's Keeper CDC

Mid-City CAN

Nile Sisters Development Initiative

Partnership for the Advancement of New Americans (PANA)

Project New Village

RISE San Diego

San Diego 350

San Diego EDC

San Diego Housing Federation

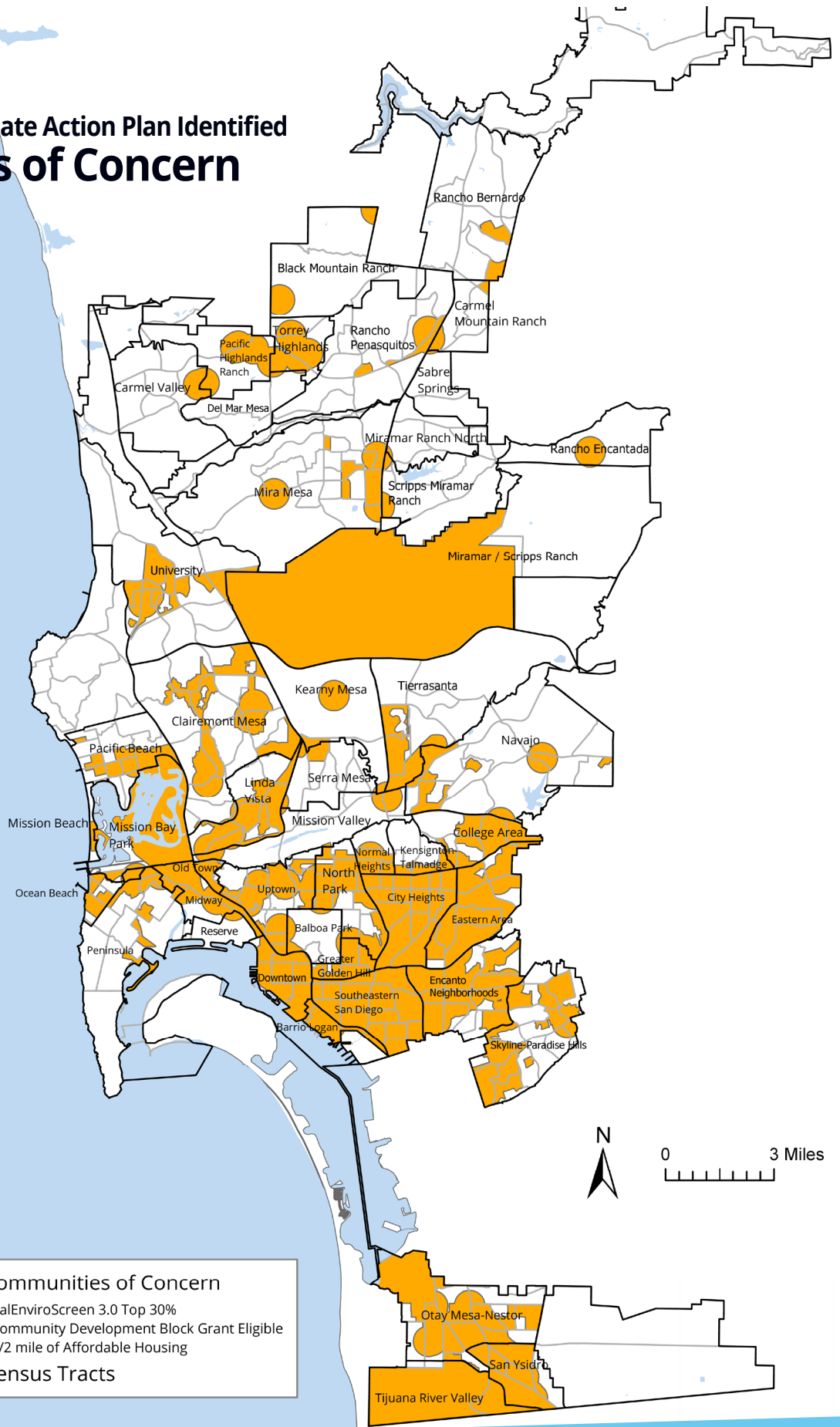
The Greenlining Institute

The San Diego Foundation

Urban Collaborative Project

APPENDIX A

City of San Diego's Climate Action Plan Identified Communities of Concern



 Communities of Concern
- CalEnviroScreen 3.0 Top 30%
- Community Development Block Grant Eligible
- 1/2 mile of Affordable Housing
 Census Tracts

APPENDIX B

City of San Diego Climate Equity Index Methods

November 2019

Prepared for the City of San Diego

Prepared by the Energy Policy Initiatives Center



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About EPIC

The Energy Policy Initiatives Center (EPIC) is a non-profit research center of the USD School of Law that studies energy policy issues affecting California and the San Diego region. EPIC's mission is to increase awareness and understanding of energy- and climate-related policy issues by conducting research and analysis to inform decision makers and educating law students.

For more information, please visit the EPIC website at www.sandiego.edu/epic.

Disclaimer

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TABLE OF CONTENTS

1 | [Introduction](#)..... 2

2 | [General Methods](#)..... 2

2.1 [Data Collection](#) 2

2.2 [Calculating Individual Indicator Values](#) 3

2.3 [Standardizing Indicators](#) 3

2.4 [Calculating CEI Scores](#) 4

3 | [Indicators](#)..... 5

3.1 [Environmental Indicators](#)..... 5

 3.1.1 [Flood Risk](#).....5

 3.1.2 [Fire Risk](#).....6

 3.1.3 [Tree Coverage](#).....6

 3.1.4 [Urban Heat Island Index](#)7

 3.1.5 [Proximity to Community Recreation Areas](#)7

 3.1.6 [Proximity to Waste Sites](#).....8

 3.1.7 [Pesticide Use](#).....8

 3.1.8 [Drinking Water Contaminants](#)9

 3.1.9 [Groundwater Threats](#)9

 3.1.10 [Impaired Water Bodies](#).....9

3.2 [Socioeconomic Indicators](#) 10

 3.2.1 [Unemployment](#).....10

 3.2.2 [Educational Attainment](#).....10

 3.2.3 [Linguistic Isolation](#)11

 3.2.4 [Digital Access](#)11

 3.2.5 [Median Income](#).....11

 3.2.6 [Poverty Rate](#)12

 3.2.7 [Change in Income](#)12

 3.2.8 [Energy Cost Burden](#)13

 3.2.9 [Solar Photovoltaic Systems](#).....13

3.3 [Housing Indicators](#) 14

 3.3.1 [Housing Cost Burden](#)14

 3.3.2 [Overcrowdedness](#).....15

3.4 [Mobility Indicators](#)..... 15

 3.4.1 [Pedestrian Access](#)15

 3.4.2 [Commute Burden](#)16

 3.4.3 [Transportation Cost Burden](#)16

 3.4.4 [Disability](#)17

 3.4.5 [Street Conditions](#).....17

 3.4.6 [Bikeability](#)18

 3.4.7 [Access to Public Transit](#)18

 3.4.8 [Traffic Density](#).....18

 3.4.9 [Electric Vehicle Charging Infrastructure](#)19

3.5 [Health Indicators](#) 19

 3.5.1 [Asthma Rates](#).....19

 3.5.2 [Cancer Fatalities](#)20

 3.5.3 [Healthy Food Access](#).....20

 3.5.4 [Low Infant Birth Weight](#)21

 3.5.5 [Heart Attack Fatalities](#)21

[References](#)..... 22

INTRODUCTION

This report provides a summary of the methods and indicators used to calculate the Climate Equity Index (CEI) for the City of San Diego (City).

Section 2 provides discussion on the methods used for the analysis. Section 3 provides discussion on each of the 35 indicators used in the analysis including: what was measured, data source(s) used, indicator specific methods, and potential limitations.

GENERAL METHODS

The CEI is based at the census tract level, where each tract receives a value for each indicator and its 35 indicator values are then used to determine its CEI score. General methods for this process are identified in [Figure 1](#).

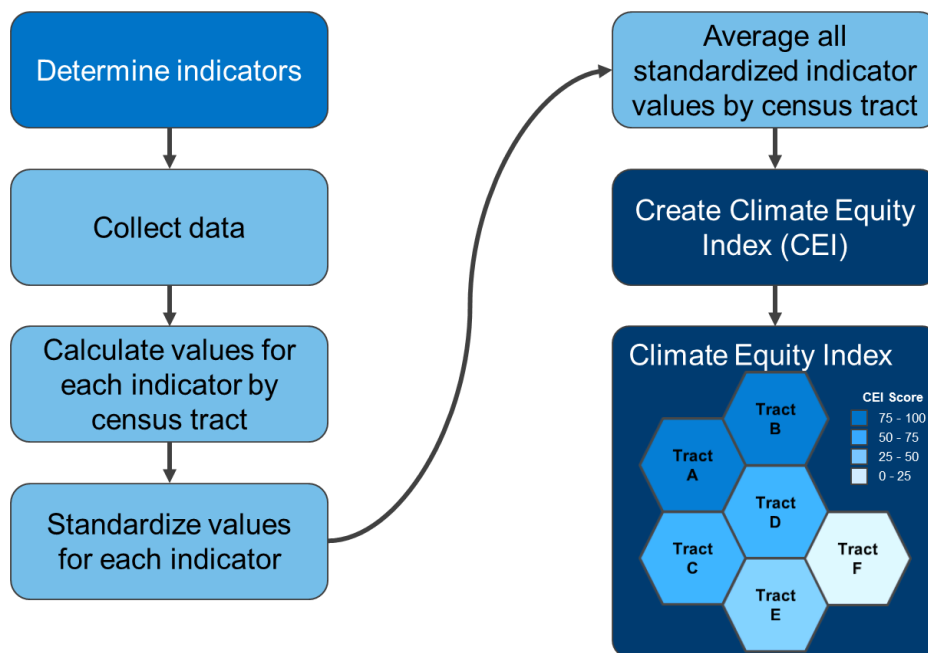


Figure 1. General Climate Equity Index Methods

Indicators were identified through discussion with City staff and the Equity Stakeholder Working Group (ESWG). The following sections detail the methods identified in [Figure 1](#) to calculate CEI scores.

Data Collection

Data were collected for all indicators based on certain criteria to maintain the integrity of the CEI. Key criteria include:

- Data should be available at the census tract level for the entire City of San Diego or in a manner that can be transformed to the census tract level;
- Data should meaningfully represent its corresponding indicator in the context of the CEI; and
- Data should be current with an emphasis on sources that are frequently updated or planned to be updated.

Some indicators were identified by the City and ESWG that did not meet one or more of the criteria above (e.g., air quality); these indicators were not included in the CEI with the understanding that they may be included at a later date should better data become available.

Calculating Individual Indicator Values

Once data were collected for indicators, aggregate indicator values were calculated for each census tract. For some indicators, the data collected were available at the census tract level and required few or no further modifications. For instance, data collected from the U.S. Census Bureau’s American Community Survey (ACS) is provided at the census tract level. This includes many of the socioeconomic indicators such as median income, unemployment rate, and digital access. For indicators where data was not available by census tract, additional calculations were necessary to determine values for each tract. More details on indicator specific calculations are provided in Section 3 of this report.

Standardizing Indicators

Once values were calculated for each indicator at the census tract level, they were standardized so that indicators could be compared to one another. The reason for standardizing the indicators is that they are each measured in different units. For instance, median income is measured in dollars per household and fire risk is measured in percent area. By standardizing, the indicators are converted to a common scoring system that allows for an “apples to apples” comparison and permits calculations necessary to aggregate indicators into an overall CEI score (Figure 2).

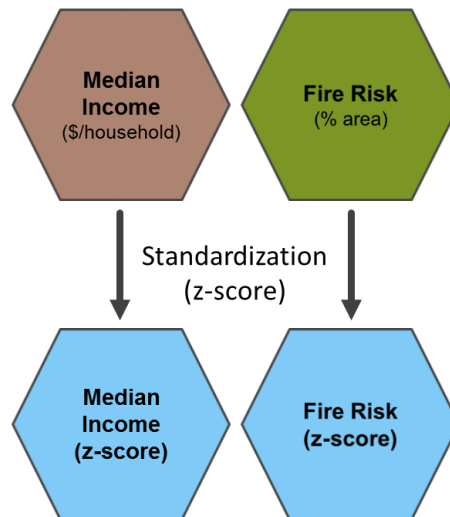


Figure 2. Standardization of Indicators

Indicators were standardized using z-scores. A z-score is a statistical measure that identifies how many standard deviations a value is from the mean. In other words, how far a given value is from the average. Z-scores maintain the magnitude in differences between values and acts as a common metric between datasets with different units. Z-scores were calculated for each census tract indicator value using Equation 1.

Equation 1. Z-score Formula

$$z_{ij} = \frac{x_{ij} - \mu_i}{\sigma_i}$$

Where,

x_{ij} = value for indicator i for census tract j

μ_i = average for indicator i

σ_i = standard deviation for indicator i

Calculating CEI Scores

Once z-scores were calculated for all census tracts across all indicators, indicators could be combined into a single census tract value. This was done by averaging all z-scores for each census tract (Figure 3). Z-scores were averaged instead of summed to avoid penalizing census tracts that may have had data missing for one or more indicator.

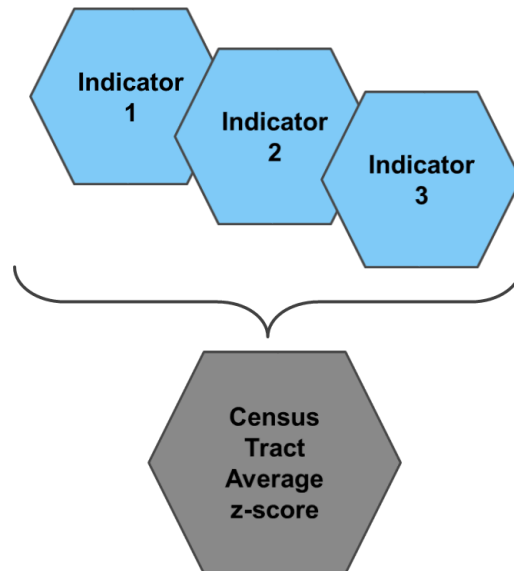


Figure 3. Average Census Tract Z-score

Average z-scores were indexed to a scale of 0-100 (the Climate Equity Index) for easier interpretation. This indexing was done using Equation 2.

Equation 2. Z-score Formula

$$Score_j = \frac{(index_{max} - index_{min})}{(z_{max} - z_{min})} * (z_j - z_{min}) + index_{min}$$

Where,

- $Score_j$ = CEI score for census tract j
- $index_{max}$ = maximum possible index value (100)
- $index_{min}$ = minimum possible index value (0)
- z_{max} = maximum value for all average z-scores
- z_{min} = minimum value for all average z-scores
- z_j = mean z-score for census tract j

To prevent outliers from skewing results, average z-scores greater than three standard deviations from the mean were removed from indexing calculations and automatically assigned either the highest (100) or lowest (0) index value depending on its relationship to the mean.

Indexed scores illustrate the relative difference between census tracts, with the census tract performing the best across all indicators scoring the highest (100) and the tract performing the lowest, the worst (0). Scores for other census tracts are scaled to demonstrate their performance relative to the highest and

lowest scoring tracts. **Figure 4** is an illustrative example of how CEI scores can be mapped across census tracts.

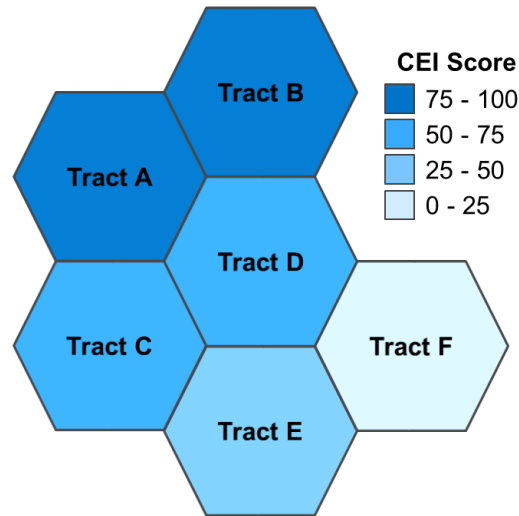


Figure 4. Illustration of CEI Scored Census Tracts

INDICATORS

Environmental Indicators

The following sections detail the data sources and indicator-specific methods used in calculating CEI scores for the following ten (10) environmental indicators:

- Flood Risk;
- Fire Risk;
- Tree Coverage;
- Urban Heat Island Index;
- Proximity to Community Recreation Areas;
- Proximity to Waste Sites;
- Pesticide Use;
- Drinking Water Contaminants;
- Groundwater Threats; and
- Impaired Water Bodies.

Flood Risk

The flood risk indicator measures the percent area of each census tract that falls within the 100-year flood plain and/or is predicted to experience inundation during a 100-year storm surge event given a 2 meter rise in sea level. The floodplain dataset was last updated in June of 2019 and the sea level rise (SLR) dataset was updated in May of 2018. While both datasets are expected to be updated in the future, it is unclear when those updates will occur.

Indicator Specific Methods

The floodplain and sea level rise shapefiles were combined using ArcGIS software to determine all areas across the City that are within the 100-year flood plain and/or are expected to experience inundation during a 100-year storm event given a 2 meter rise in sea level. This new shapefile was intersected with a census tract boundary layer to identify those same areas by census tract. ArcGIS was then used to calculate the total area within each census tract with a qualifying flood risk as a percent of the total census tract area.

Data Source(s)

SanGIS, Federal Emergency Management Agency (FEMA), County of San Diego, Dept. of Public Works, Flood Control Engineering (2019). [Flood Plain](#). Shapefile

Barnard PL., Erikson LH, Foxgrover AC, Limber PW, O'Neill AC, and Vitousek S. (2018). [Coastal Storm Modeling System \(CoSMoS\) for Southern California, v3.0, Phase 2 \(ver. 1g, May 2018\)](#). U.S. Geological Survey data release. Shapefile

SANDAG, U.S. Census Bureau (2014). [Census Tracts 2010](#). Shapefile

Fire Risk

The fire risk indicator measures the percent area of each census tract that falls within zones identified as very high fire severity by the California Department of Forestry and Fire Prevention (CAL FIRE). While the fire hazard severity zone (FHSZ) shapefile provided by the City is the current map being utilized by the City, it is unclear when it was most recently updated and no future update date was provided. FHSZs are not expected to significantly change in the near term and using the same data for CEI updates may be acceptable. This assumption will need to be reevaluated with any future CEI update.

Indicator Specific Methods

The FHSZ shapefile was intersected with a census tract boundary layer to identify those areas in each census tract that are within a very high fire severity zone. Calculations were then done to determine the percent of each census tract that falls within these zones.

Data Source(s)

City of San Diego, CAL FIRE (n.d.). *Fire Hazard Severity Zone Local Responsibility Area (FHSZ LRA)*. Shapefile. Provided by City staff.

SANDAG, U.S. Census Bureau (2014). [Census Tracts 2010](#). Shapefile

Tree Coverage

The tree coverage indicator measures the percent tree canopy coverage for each census tract across all land use categories identified in a 2014 Light Detection and Ranging (LiDAR) analysis for the City of San Diego. Results of the 2014 LiDAR analysis were made available in 2017. Currently, there is no plan to update the data with a second LiDAR study. This may limit the ability of future CEI updates to track progress for this indicator and updated CEI scores may not accurately capture City efforts to increase tree canopy within census tracts.

Indicator Specific Methods

The tree canopy raster dataset contains grid cells that cover the City of San Diego, with each identified as one of seven different land cover categories (tree canopy, bush/shrub, buildings, roads, bare earth, other paved surfaces, or water). The raster file was converted to a shapefile and intersected with the census tract boundary layer with individual polygons representing each land cover category for each census tract. Consistent with how the University of Vermont estimated tree coverage for the entire City, the total coverage for each census tract was derived by dividing the area of each tract categorized as tree canopy by the total area for all land cover types less water.

Data Source(s)

University of Vermont Spatial Analysis Laboratory, City of San Diego (2017). [TreeCanopy 2014 SanDiego](#). Raster Dataset

SANDAG, U.S. Census Bureau (2014). [Census Tracts 2010](#). Shapefile

Urban Heat Island Index

The urban heat island index indicator measures the positive temperature differential (in degree hours per day) between urban census tracts and reference points in rural, upwind reference points. The indicator uses results from the California Environmental Protection Agency's (CalEPA) Urban Heat Island Index (UHII), which measures temperature at two meters above ground level, where people experience heat. The UHII was last updated in 2015 and it is uncertain if and when the data will be updated. This may limit the ability of future CEI updates to include any increases and/or decreases in urban heat island impacts across City census tracts.

Indicator Specific Methods

Data for this indicator were provided at the census tract level through the UHII. No additional calculations or adjustments outside of what was done for the UHII were done for purposes of the CEI.

Data Source(s)

CA Environmental Protection Agency (2015). [Urban Heat Island Index for California](#). Shapefile

SANDAG, U.S. Census Bureau (2014). [Census Tracts 2010](#). Shapefile

Proximity to Community Recreation Areas

The proximity to community recreation areas indicator measures the number of recreation areas (parks, open space, beaches, libraries, and recreation centers) within ½ mile of populated neighborhoods. Location data for this indicator were provided by City staff or collected from SanGIS. For all community recreation area datasets, the most recent year of data is 2018. It is expected that all will undergo frequent updates; however, it is unclear how often and when those updates will occur. Each of these datasets are not expected to significantly change in the near term and using the same data for CEI updates may be acceptable. This assumption will need to be reevaluated with any future CEI update. Future updates may involve working with City staff to identify changes and make necessary updates to the original datasets used here.

Indicator Specific Methods

Multiple shapefiles were collected for this indicator either from the City or downloaded directly from SanGIS, SANDAG's online data portal. All layers were combined into a single shapefile and a ½ mile buffer was applied to each recreation area (park, open space, public beach, library, and recreation centers). This buffered layer was spatially joined with a census tract boundary layer and the number of buffered community recreation areas that overlap (either wholly or partially) with each census tract were summed to estimate the indicator value.

Data Source(s)

City of San Diego (2019). [Recreation Center Locations](#). Shapefile

City of San Diego (2019). [Library Locations](#). Shapefile

SANDAG, County of San Diego, City of San Diego, City of Carlsbad, City of Chula Vista, City of Coronado, City of Del Mar, City of El Cajon, City of Encinitas, City of Escondido, City of Imperial Beach, City of La Mesa, City of Lemon Grove, National City, City of Oceanside, City of Poway, City of San Marcos, City of Santee, City of Vista, San Diego Port District, State Parks (2019). [Parks](#). Shapefile

U.S. Census Bureau (n.d.). [2017 ACS 5-year estimates](#). Total Population (B01003). CSV

SANDAG, U.S. Census Bureau (2014). [Census Tracts 2010](#). Shapefile

Proximity to Waste Sites

The proximity to waste sites indicator measures the average distance to the nearest waste site, which includes: hazardous waste generators and facilities, facilities with documented toxic releases, solid waste sites and facilities, and Cal EPA identified cleanup sites. Location data for this indicator were collected directly from CalEnviroScreen. Data from the most recent CalEnviroScreen update (version 3.0, 2017) represent conditions in 2016, with the exception of facilities with documented toxic releases. This component includes data from 2012-2014. The CalEnviroScreen tool is expected to undergo future updates; however the frequency of those updates is unclear and may not align with CEI updates. Publicly available datasets may be used to update this indicator in line with methods used in the current version of CalEnviroScreen for future CEI updates.

Indicator Specific Methods

Data for this indicator were gathered at the census tract level from CalEnviroScreen 3.0. A shapefile was created that integrates the location of waste sites (hazardous waste generators and facilities, facilities with documented toxic releases, solid waste sites and facilities, and Cal EPA identified cleanup sites) used for multiple CalEnviroScreen indicators. Next, the average distance to the nearest waste site was estimated across each census tract. A weighted average distance for each tract was calculated by weighting the average distance of populated neighborhoods by its population.

Data Source(s)

California Environmental Protection Agency (Cal EPA) Office of Environmental Health Hazard Assessment (OEHHA) (2017). [CalEnviroScreen 3.0](#). Shapefile

SANDAG, U.S. Census Bureau (2014). [Census Tracts 2010](#). Shapefile

Pesticide Use

The pesticide use indicator measures the total pounds per square mile (lb/mi²) of 70 Cal EPA selected pesticides used in production-agriculture. Values for this indicator were collected directly from CalEnviroScreen 3.0. CalEnviroScreen data was last updated in 2017 and data relevant to this indicator use a three-year average from 2012-2014. The CalEnviroScreen tool is expected to undergo future updates; however the frequency of those updates is unclear and may not align with CEI updates. Publicly available datasets may be used to update this indicator in line with methods used in the current version of CalEnviroScreen for future CEI updates.

Indicator Specific Methods

Data for this indicator were gathered at the census tract level from CalEnviroScreen 3.0. No additional calculations or adjustments outside of what was done for CalEnviroScreen were done for purposes of the CEI.

Data Source(s)

California Environmental Protection Agency (Cal EPA) Office of Environmental Health Hazard Assessment (OEHHA) (2017). [CalEnviroScreen 3.0](#). Shapefile

Drinking Water Contaminants

The drinking water contaminants indicator measures the average concentration of contaminants within drinking water systems in each census tract. Values for this indicator were collected directly from CalEnviroScreen 3.0. CalEnviroScreen data was last updated in 2017 and data relevant to this indicator include the average concentration of drinking water contaminants over one complete compliance cycle (2005-2013). The CalEnviroScreen tool is expected to undergo future updates; however the frequency of those updates is unclear and may not align with CEI updates. Publicly available datasets may be used to update this indicator in line with methods used in the current version of CalEnviroScreen for future CEI updates.

Indicator Specific Methods

Data for this indicator were gathered at the census tract level from CalEnviroScreen 3.0. No additional calculations or adjustments outside of what was done for CalEnviroScreen were done for purposes of the CEI.

Data Source(s)

California Environmental Protection Agency (Cal EPA) Office of Environmental Health Hazard Assessment (OEHHA) (2017). [CalEnviroScreen 3.0](#). Shapefile

Groundwater Threats

The groundwater threats indicator measures CalEnviroScreen groundwater threat scores for census tracts based on type of pollution site and its location to populated neighborhoods. Potential threats to groundwater include the storage and disposal of hazardous waste in storage tanks either above or underground at commercial, industrial, and/or military sites. Values for this indicator were collected directly from CalEnviroScreen 3.0. CalEnviroScreen data was last updated in 2017 and data used in the analysis relevant to this indicator are from 2016. The CalEnviroScreen tool is expected to undergo future updates; however the frequency of those updates is unclear and may not align with CEI updates. Publicly available datasets may be used to update this indicator in line with methods used in the current version of CalEnviroScreen for future CEI updates.

Indicator Specific Methods

Data for this indicator were gathered at the census tract level from CalEnviroScreen 3.0. No additional calculations or adjustments outside of what was done for CalEnviroScreen were done for purposes of the CEI.

Data Source(s)

California Environmental Protection Agency (Cal EPA) Office of Environmental Health Hazard Assessment (OEHHA) (2017). [CalEnviroScreen 3.0](#). Shapefile

Impaired Water Bodies

The impaired water bodies indicator measures the number of pollutants across all water bodies designated as impaired within each census tract as calculated by CalEnviroScreen 3.0. CalEnviroScreen

data was last updated in 2017 and data used in the analysis relevant to this indicator are from 2012. The CalEnviroScreen tool is expected to undergo future updates; however the frequency of those updates is unclear and may not align with CEI updates. Publicly available datasets may be used to update this indicator in line with methods used in the current version of CalEnviroScreen for future CEI updates.

Indicator Specific Methods

Data for this indicator were gathered at the census tract level from CalEnviroScreen 3.0. No additional calculations or adjustments outside of what was done for CalEnviroScreen were done for purposes of the CEI.

Data Source(s)

California Environmental Protection Agency (Cal EPA) Office of Environmental Health Hazard Assessment (OEHHA) (2017). [CalEnviroScreen 3.0](#). Shapefile

Socioeconomic Indicators

The following sections detail the data sources and indicator-specific methods used in calculating CEI scores for the following nine (9) socioeconomic indicators:

- Unemployment;
- Educational Attainment;
- Linguistic Isolation;
- Digital Access;
- Median Income;
- Poverty Rate;
- Change in Income;
- Energy Cost Burden; and
- Solar Photovoltaic Systems.

Unemployment

The unemployment rate indicator measures the percent of the population within each census tract that is over the age of 16 and unemployed. Unemployment data are collected from the American Community Survey (ACS), which is updated annually. The 2013-2017 five-year average is applied in this analysis.

Indicator Specific Methods

Data for this indicator were gathered at the census tract level from American Fact Finder, the online ACS data portal. No additional calculations or adjustments were needed to convert data.

Data Source(s)

U.S. Census Bureau (n.d.). [2017 ACS 5-year estimates](#). Employment Status (S2301). CSV

Educational Attainment

The educational attainment indicator measures the percent of the population within each census tract that is over the age of 25 and has less than a high school education. Educational attainment data are collected from the ACS, which is updated annually. The 2013-2017 five-year average is applied in this analysis.

Indicator Specific Methods

Data for this indicator were gathered at the census tract level from American Fact Finder. To calculate the percent of the population over the age of 25 with less than a high school education, the number of individuals with below a high school education were divided by the sum of those with below and those with above a high school education.

Data Source(s)

U.S. Census Bureau (n.d.). [2017 ACS 5-year estimates](#). Educational Attainment for the Population 25 Years and Over (B15003). CSV

Linguistic Isolation

The linguistic isolation indicator measures the percent of limited-English speaking households within each census tract based on all primary language groups identified in the American Community Survey. The ACS identifies limited-English speaking households for the following language groups: Spanish, Asian and Pacific Island languages, other Indo-European languages, and other languages. Linguistic isolation data are collected from the ACS, which is updated annually. The 2013-2017 five-year average is applied in this analysis.

Indicator Specific Methods

Data for this indicator were gathered at the census tract level from American Fact Finder, the online ACS data portal. No additional calculations or adjustments were needed to convert data.

Data Source(s)

U.S. Census Bureau (n.d.). [2017 ACS 5-year estimates](#). Limited English Speaking Households (S1602). CSV

Digital Access

The digital access indicator measures the percent of households without internet access within each census tract. Those considered to have internet access include both households with an active internet subscription and those without, but are still provided internet (e.g., student dorms where the university maintains the internet subscription). Digital access data are collected from the ACS, which is updated annually. The 2013-2017 five-year average is applied in this analysis.

Indicator Specific Methods

Data for this indicator were gathered at the census tract level from American Fact Finder, the online ACS data portal. Data is provided that identifies those with internet access (either with or without their own subscription) and those without access. To calculate the percent of the population within each census tract without internet access, the number of individuals without internet access was divided by the total number of individuals.

Data Source(s)

U.S. Census Bureau (n.d.). [2017 ACS 5-year estimates](#). Internet Subscriptions in Household (B28011). CSV

Median Income

The median income indicator measures the median household income within the past 12 months for each census tract. Median income data are collected from the ACS, which is updated annually. The 2013-2017 five-year average is applied in this analysis.

Indicator Specific Methods

Data for this indicator were gathered at the census tract level from American Fact Finder, the online ACS data portal. No additional calculations or adjustments were needed to convert data.

Data Source(s)

U.S. Census Bureau (n.d.). [2017 ACS 5-year estimates](#). Median Income in the Past 12 Months (S1903). CSV

Poverty Rate

The poverty rate indicator measures the percent of the population within each census tract with an income below 300% of the federal poverty level (\$24,600 for a family of four in 2017). A 300% threshold was chosen as it most closely aligns with guidelines used by the County of San Diego to designate low-income households. Poverty rate data are collected from the ACS, which is updated annually. The 2013-2017 five-year average is applied in this analysis.

Indicator Specific Methods

Data for this indicator were gathered at the census tract level from American Fact Finder, the online ACS data portal. To calculate the percent of the population below 300% of the federal poverty level, the number of individuals below this threshold was divided by the total number of individuals for each census tract.

Data Source(s)

County of San Diego, Housing Commission (2018). [2017 SDHC Affordable Housing Resource Guide](#). PDF

U.S. Census Bureau (n.d.). [2017 ACS 5-year estimates](#). Poverty Status in the Past 12 Months (S1701). CSV

Change in Income

The change in income indicator measures the five-year annual percent change in median household income for each census tract. Change in income data are collected from the ACS, which is updated annually. The five-year average estimates from 2013-2017 are applied in this analysis.

Indicator Specific Methods

Data for this indicator were gathered at the census tract level from American Fact Finder, the online ACS data portal. Data for median household income for the 2013-2017 five-year estimates were collected and the percent change year-over-year was calculated and then averaged for each census tract. This represents the average five-year annual percent change in median household income.

Data Source(s)

U.S. Census Bureau (n.d.). [2017 ACS 5-year estimates](#). Median Income in the Past 12 Months (S1903). CSV

U.S. Census Bureau (n.d.). [2016 ACS 5-year estimates](#). Median Income in the Past 12 Months (S1903). CSV

U.S. Census Bureau (n.d.). [2015 ACS 5-year estimates](#). Median Income in the Past 12 Months (S1903). CSV

U.S. Census Bureau (n.d.). [2014 ACS 5-year estimates](#). Median Income in the Past 12 Months (S1903). CSV

U.S. Census Bureau (n.d.). [2013 ACS 5-year estimates](#). Median Income in the Past 12 Months (S1903). CSV

Energy Cost Burden

The energy cost burden indicator measures the three-year average annual household cost of energy per census tract as a percent of median household income. Energy data was provided to EPIC by request and is available annually by San Diego Gas and Electric (SDG&E). Median income data are collected from the American Community Survey (ACS), which is updated annually. The 2013-2017 five-year average is applied in this analysis.

Indicator Specific Methods

Data for this indicator were collected through American Fact Finder (median household income) and through a Privacy Greenlight request to SDG&E. SDG&E provided energy consumption by census tract and rate schedule for both natural gas and electricity. The average total energy cost per household assumes that each household has one natural gas and one electricity meter. Historic rates for 2015-2017 were multiplied by the kWh or therms reported depending on the corresponding rate schedule. Only those customers on the standard (DR or GR) or low-income (DR-LI or GR-LI) rate schedules were included. These totals were weighted by their respective number of meters and combined to provide a weighted average electricity cost per meter and a weighted average natural gas cost per meter by census tract. The sum of both is the average energy cost for each census tract, which was divided by the median household income to obtain the energy cost burden for that tract.

Data Source(s)

U.S. Census Bureau (n.d.). [2017 ACS 5-year estimates](#). Median Income in the Past 12 Months (S1903). CSV

SDG&E (n.d.). *2015-2017 Residential Energy Consumption Data*. Provided to EPIC through a Project GreenLight request

SDG&E (2017). [Schedule DR – Residential Rate](#). PDF

SDG&E (2017). [Schedule GR – Residential Natural Gas Service](#). PDF

SDG&E (2016). [Schedule DR – Residential Rate](#). PDF

SDG&E (2016). [Schedule GR – Residential Natural Gas Service](#). PDF

SDG&E (2015). [Schedule DR – Residential Rate](#). PDF

SDG&E (2015). [Schedule GR – Residential Natural Gas Service](#). PDF

Solar Photovoltaic Systems

The solar photovoltaic (PV) systems indicator measures the total number of installed solar photovoltaic (PV) systems per capita. Solar PV data were provide by City staff for years 2015-2018. Data for previous years was unavailable at the time for activity prior to 2015. Google Project Sunroof data was used as a supplement to estimate the number of PV systems installed across the City prior to 2015. Project Sunroof states that imagery used in its calculations was pulled sometime between 2013 and 2015. This means that PV systems may have been left out of the analysis if the imagery was pulled prior to 2015. Since calculating CEI scores, the City has been able to gather installation permit data for activity in earlier years. This will be used in lieu of Project Sunroof data in any updates to the CEI. Additionally, City permit data is

continuously updated. Population data used to calculate per capita estimates were collected from the ACS, which is updated annually. The 2013-2017 five-year average is applied in this analysis.

Indicator Specific Methods

Data for this indicator were directly downloaded from the Project Sunroof website (for years prior to 2015) and provided by the City (2015-2018). Project sunroof data was intersected with the census tract boundary layer and a count was taken of the number of systems within each census tract. Data provided by the City was spatially mapped and the same methods were applied to estimate the number of systems installed between 2015 and 2018. The two counts for each census tract were added together and this sum was divided by the census tract's population to estimate the number of PV systems per capita.

Data Source(s)

City of San Diego (2019). *2015-2018 Solar PV Installation Data*. Provided to EPIC by City staff

Google Project Sunroof (2019). [Google Project Sunroof Data Explorer](#). CSV

U.S. Census Bureau (n.d.). [2017 ACS 5-year estimates](#). Total Population (B01003). CSV

SANDAG, U.S. Census Bureau (2014). [Census Tracts 2010](#). Shapefile

Housing Indicators

The following sections detail the data sources and indicator-specific methods used in calculating CEI scores for the following two (2) housing indicators:

- Housing Cost Burden; and
- Overcrowdedness.

Housing Cost Burden

The housing cost burden indicator measures the median housing cost per census tract as a percent of median household income. It is a weighted average metric that factors in both rent and mortgage costs alongside the number of units that rent versus own. Housing cost data are collected from the ACS, which is updated annually. The 2013-2017 five-year average is applied in this analysis.

Indicator Specific Methods

Data for this indicator were gathered at the census tract level from American Fact Finder, the online ACS data portal. Two datasets were collected to estimate the housing cost burden – median income and select housing characteristics. The select housing characteristics dataset contains information on the number of households that are renter-occupied versus owner occupied as well mortgage and rent cost information. For mortgage costs, the bottom of each range is used for calculations as a conservative estimate and the average mortgage cost is weighted by the number of households within each range. The same is applied to renter costs. The overall average housing cost is weighted by the number of households that rent versus own. The housing cost burden takes the weighted average housing cost and divides it by the median income for the same census tract.

Data Source(s)

U.S. Census Bureau (n.d.). [2017 ACS 5-year estimates](#). Median Income in the Past 12 Months (S1903). CSV

U.S. Census Bureau (n.d.). [2017 ACS 5-year estimates](#). Selected Housing Characteristics (DP04). CSV

Overcrowdedness

The overcrowdedness indicator measures the percent of housing units within a census tract with greater than one occupant per room as defined by the American Community Survey and includes both renter and owner occupied units. In estimating the number of occupants per room, the ACS considers a room to be a whole room within a housing unit including: living rooms, dining rooms, kitchens, bedrooms, finished recreation rooms, enclosed porches suitable for year-round use, and lodger's rooms. Overcrowdedness data are collected from the ACS, which is updated annually. The 2013-2017 five-year average is applied in this analysis.

Indicator Specific Methods

Data for this indicator were gathered at the census tract level from American Fact Finder, the online ACS data portal. No additional calculations or adjustments were needed to convert data.

Data Source(s)

U.S. Census Bureau (n.d.). [2017 ACS 5-year estimates](#). Tenure by Occupants per Room (B25014). CSV

Mobility Indicators

The following sections detail the data sources and indicator-specific methods used in calculating CEI scores for the following nine (9) mobility indicators:

- Pedestrian Access;
- Commute Burden;
- Transportation Cost Burden;
- Disability;
- Street Conditions;
- Bikeability;
- Access to Public Transit;
- Traffic Density; and
- Electric Vehicle Charging Infrastructure.

Pedestrian Access

The pedestrian access indicator is a combination of four separate measures for each census tract: average walk score, population weighted miles of sidewalk, population weighted number of streetlights, and five-year average number of pedestrian-vehicle collisions. Walk scores were provided by City staff, are current as of 2016, and are frequently updated. Pedestrian-vehicle collision data is also frequently updated and the City provided data through 2018. A five-year average is used for pedestrian-vehicle collisions. The City's sidewalk inventory was most recently updated in 2015 and the streetlight inventory in 2019. It is unclear when the sidewalk and streetlight inventories will be next updated or if these updates will align with CEI updates. This may limit the ability of the CEI to comprehensively track progress on this indicator.

Indicator Specific Methods

All data for this indicator were provided by City staff. Each component (walk score, sidewalk, streetlights, and pedestrian-vehicle collisions) was calculated separately by census tract and then converted to a z-score following the same methods used to calculate CEI scores. Z-scores were then averaged for each census tract to determine an average pedestrian collision z-score to include in the CEI analysis. Walk scores were already provided at the census tract level and no additional calculations were needed before

converting to a z-score. Pedestrian-vehicle collision data were averaged across five years of data (2014-2018) for each census tract before converting to z-scores. The sidewalk dataset was intersected with the census tract boundary layer and the total miles of sidewalk within each census tract was weighted by the population. The population weighted miles of sidewalk were then converted to z-scores. A similar approach was used for streetlights by intersecting streetlight data with the census tract boundary layer to determine the number of streetlights per tract. These totals were then weighted by population to get a population weighted number of streetlights per tract before converting to z-scores. The four census tract level z-scores were then averaged into a single value.

Data Source(s)

City of San Diego (2015). *City of San Diego Sidewalk Inventory*. Shapefile. Data provided to EPIC by City staff

City of San Diego (2019). *City of San Diego Pedestrian-Vehicle Collision Data*. Excel. Data provided to EPIC by City staff

City of San Diego (n.d.). *City of San Diego Streetlight Inventory*. Shapefile. Data provided to EPIC by City staff

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U.S. Census Bureau (n.d.). [2017 ACS 5-year estimates](#). Total Population (B01003). CSV

SANDAG, U.S. Census Bureau (2014). [Census Tracts 2010](#). Shapefile

Commute Burden

The commute burden indicator measures the percent of the each census tract population with a commute time over the regional average. This is a weighted average value that considers the regional average commute time for both those that commute by car (~30 minutes) and those by mass transit (~45 minutes) along with the total population that commutes by each. Commute time data are collected from the ACS, which is updated annually. The 2017 five-year average is applied in this analysis.

Indicator Specific Methods

Data for this indicator were gathered at the census tract level from American Fact Finder, the online ACS data portal. Population counts were collected for individuals who commute more than 30 minutes if commuting by car or more than 45 minutes if commuting by mass transit. The sum of these two groups was divided by the total population for each census tract to get the percent of the population with a significant commute burden (a commute time over the regional average).

Data Source(s)

U.S. Census Bureau (n.d.). [2017 ACS 5-year estimates](#). Travel Time to Work (B08303). CSV

SANDAG, TrueNorth Research (2018). [Park & Ride / Commute Survey](#). PDF

Transportation Cost Burden

The transportation cost burden indicator measures the median household transportation cost by census tract as a percent of the median household income. This indicator uses data from both ACS and the Center

for Neighborhood Technology's (CNT) Housing and Transportation (H+T) Affordability Index. ACS data is updated annually and the 2013-2017 five-year average is applied here for median income. The H+T index was most recently updated in 2017; however, it is unclear how often the index is updated. This may limit the ability of future CEI updates to capture changes in transportation cost burdens.

Indicator Specific Methods

Data for this indicator were directly downloaded at the census tract level through American Fact Finder (ACS) and the CNT website. The average transportation cost included in the CNT dataset was divided by the corresponding median household income in the ACS dataset for each census tract. This provides the transportation cost as a percent of household income.

Data Source(s)

U.S. Census Bureau (n.d.). [2017 ACS 5-year estimates](#). Median Income in the Past 12 Months (S1903). CSV

Center for Neighborhood Technology (CNT) (2019). [Housing and Transportation \(H+T\) Affordability Index](#). CSV

Disability

The disability indicator measures the percent of the population with a Disability data collected from the ACS, which is updated annually. The 2013-2017 five-year average is applied in this analysis. Types of disabilities counted in the ACS include: ambulatory, hearing, cognitive, vision, independent living, and self-care.

Indicator Specific Methods

Data for this indicator were gathered at the census tract level from American Fact Finder, the online ACS data portal. The percent of the population with a disability was calculated by summing total males and females by age class with a disability and dividing that sum by the total population for each census tract.

Data Source(s)

U.S. Census Bureau (n.d.). [2017 ACS 5-year estimates](#). Sex by Age by Disability Status (B18101). CSV

Street Conditions

The street conditions indicator measures the weighted average Overall Condition Index (OCI) score for each census tract as determined by the City of San Diego. The City maintains the OCI and provides periodic updates for public download. The most recent dataset and that used for this analysis is from 2015. If updates to the publicly available OCI are not aligned with CEI updates, City staff may work internally to identify updates that can be made to the existing dataset explicitly for the CEI.

Indicator Specific Methods

Data for this indicator were provided by City staff and contains a list of all streets within the City and its corresponding OCI score. OCI scores were weighted by the length of the roadway and averaged across all weighted OCI scores within a given census tract to determine census tract level scores.

Data Source(s)

City of San Diego (2019). *City of San Diego Street Overall Condition Index (OCI)*. Excel. Data provided to EPIC by City staff

SANDAG, U.S. Census Bureau (2014). [Census Tracts 2010](#). Shapefile

Bikeability

The bikeability indicator measures the weighted average bikeability scores of each census tract as determined by the Bicycle Network Analysis. The most recent set of bikeability scores was updated in 2019; however, it is unclear how often scores will be updated to account for significant changes to the bikeability of each census block. This may limit the ability of future CEI updates to track progress for this indicator and updated CEI scores may not accurately capture City efforts to increase bicycle infrastructure within census tracts.

Indicator Specific Methods

Data for this indicator were directly downloaded at the census block level through the Bicycle Network Analysis website. Census block scores were weighted by the block's area and aggregated to the census tract level to achieve a weighted average bikeability score for each census tract.

Data Source(s)

People for Bikes (2019). [Bicycle Network Analysis \(BNA\)](#). Shapefile

SANDAG, U.S. Census Bureau (2014). [Census Tracts 2010](#). Shapefile

Access to Public Transit

The access to public transit indicator measures the population weighted average distance to the nearest transit stop. Transit stops are included for rail, trolley, and bus lines. Location data relevant to this indicator is publicly available through SanGIS and the most recent file represents transit stops in 2019. While the dataset is expected to undergo future updates; the frequency of those updates is unclear and may not align with CEI updates. This may limit the ability of future CEI updates to track progress for this indicator.

Indicator Specific Methods

Data for this indicator were directly downloaded through SanGIS as a point shapefile indicating transit stops through San Diego County. The average distance to the nearest transit stop was estimated across each census tract and a weighted average distance for each tract was calculated by weighting the average distance of populated neighborhoods by its population.

Data Source(s)

SANDAG, San Diego Metropolitan Transit System (MTS), North County Transit District (NCTD) (2019).
Transit Stops – General Transit Feed Specification (GTFS). Shapefile

U.S. Census Bureau (n.d.). [2017 ACS 5-year estimates](#). Total Population (B01003). CSV

SANDAG, U.S. Census Bureau (2014). [Census Tracts 2010](#). Shapefile

Traffic Density

The traffic density indicator measures total traffic volume by total road length as estimated by CalEnviroScreen 3.0. CalEnviroScreen data was last updated in 2017 and the most recent year of data available for traffic density is 2013. The CalEnviroScreen tool is expected to undergo future updates; however the frequency of those updates is unclear and may not align with CEI updates. Publicly available

datasets may be used to update this indicator in line with methods used in the current version of CalEnviroScreen for future CEI updates.

Indicator Specific Methods

Data for this indicator were gathered at the census tract level from CalEnviroScreen 3.0. No additional calculations or adjustments outside of what was done for CalEnviroScreen were done for purposes of the CEI.

Data Source(s)

California Environmental Protection Agency (Cal EPA) Office of Environmental Health Hazard Assessment (OEHHA) (2017). [CalEnviroScreen 3.0](#). Shapefile

Electric Vehicle Charging Infrastructure

The electric vehicle (EV) charging infrastructure indicator measures the number of publicly available charging stations within each census tracts. This includes both Level 2 and DC fast chargers. The U.S. Department of Energy's Alternative Fuels Data Center maintains a database with location data for multiple types charging infrastructure and is continuously updated with new data. Data for this analysis were current as of the download date (August 2019).

Indicator Specific Methods

Data for this indicator were directly downloaded from the Alternative Fuels Data Center website. The dataset was cleaned to include only publicly available EV charging infrastructure (Level 2 and DC fast chargers) within the City of San Diego. This excluded charging stations that are limited to a particular vehicle make or are exclusive to patrons of the facility (e.g., chargers at hotels limited to hotel guest use). Data was then spatially mapped using ArcGIS and overlaid with a census tract boundary layer. The two layers were spatially joined to get a count of the number of chargers within each census tract.

Data Source(s)

U.S. Department of Energy, Alternative Fuels Data Center (2019). [Alternative Fueling Station Locator](#). CSV

SANDAG, U.S. Census Bureau (2014). [Census Tracts 2010](#). Shapefile

Health Indicators

The following sections detail the data sources and indicator-specific methods used in calculating CEI scores for the following five health indicators:

- Asthma Rates;
- Cancer Fatalities;
- Healthy Food Access;
- Low Infant Birth Weight; and
- Heart Attack Fatalities.

Asthma Rates

The asthma rates indicator measures the rate of emergency department visits due to asthma. This includes all age groups and is expressed as an age-adjusted rate per 10,000 individuals. Asthma rate data are collected from Tracking California. Data are updated annually and the most recent year available is 2017.

Indicator Specific Methods

Data for this indicator were gathered at the zip code level from Tracking California. Rates were collected for zip codes that overlap with census tracts within the City of San Diego. A weighted average rate was then calculated for each census tract by weighting the respective rate for each zip code by its area that overlaps with a particular census tract. This was done by intersecting a zip code shapefile with the census tract boundary layer in ArcGIS. This is consistent with methods used in CalEnvironScreen to apportion zip code values to census tracts.

Data Source(s)

Tracking California, CA Office of Statewide Health Planning and Development (OSHPD) (2019). [Asthma](#). CSV

U.S. Census Bureau (n.d.). [2017 ACS 5-year estimates](#). Total Population (B01003). CSV

SANDAG, U.S. Census Bureau (2014). [Census Tracts 2010](#). Shapefile

Cancer Fatalities

The cancer fatalities indicator measures the five-year average percent of deaths within each census tract that are cancer related. Cancer fatality data were collected from the California Department of Public Health by zip code for years 1992-2016. Data is updated annually, however, there is a three year delay for each year. For instance, the most recent data available in 2019 is for 2016. A five year average is used in this analysis, which includes years 2012-2016.

Indicator Specific Methods

The data for this indicator were directly downloaded from the CA Department of Public Health's website by zip code. First, the percent of deaths associated with cancer was calculated for each zip code by dividing the total number of cancer related deaths by the total number of deaths. A weighted average percent was then calculated for each census tract by weighting the respective percent for each zip code by the area that zip code overlaps with a particular census tract. This was done by intersecting a zip code shapefile with the census tract boundary layer in ArcGIS. This is consistent with methods used in CalEnvironScreen to apportion zip code values to census tracts.

Data Source(s)

CA Department of Public Health (CDPH) (2018). [Leading Causes of Death by Zip Code 1989-Current](#). CSV

U.S. Census Bureau (n.d.). [2017 ACS 5-year estimates](#). Total Population (B01003). CSV

SANDAG, U.S. Census Bureau (2014). [Census Tracts 2010](#). Shapefile

Healthy Food Access

The healthy food access indicator measures the percent of the population within each census tract that has a lower level of access to healthy foods as measured by the USDA Food Access Research Atlas. Low access is considered greater than ½ mile for urban census tracts and greater than 10 miles for rural census tracts. The Food Access Research Atlas was last updated in 2015 and data contained within the atlas are reflective of that year. The Atlas is expected to undergo future updates; however the frequency of those updates is unclear and may not align with CEI updates. This may limit the ability of future CEI updates to track progress for this indicator.

Indicator Specific Methods

Data for this indicator were gathered at the census tract level from The USDA Food Access Research Atlas. Population counts are provided for the number of individuals considered to have low access to healthy food. Low access is defined as living greater than ½ mile from healthy food options for urban census tracts and greater than 10 miles for rural census tracts. The percent of the population considered to have low access was found by dividing the population with low access by the total population for each census tract.

Data Source(s)

U.S. Department of Agriculture (USDA) (2015). [Food Access Research Atlas](#). Excel

U.S. Census Bureau (n.d.). [2017 ACS 5-year estimates](#). Total Population (B01003). CSV

Low Infant Birth Weight

The low infant birth weight indicator measures the percent of full term births (37 weeks of gestation) within each census tract with a birthweight less than 2,500 grams. Low infant birthweight data is collected from Tracking California. Data is updated annually; however, each update is for data that is for three to four years previous. As such the most recent data available is for 2015.

Indicator Specific Methods

Data for this indicator were gathered at the census tract level from Tracking California. No additional calculations or adjustments outside of what was done for Tracking California were done for purposes of the CEI.

Data Source(s)

Tracking California, CA Department of Public Health, Office of Vital Statistics (2019). [Maternal and Infant Health](#). CSV

Heart Attack Fatalities

The heart attack fatalities indicator measures the five-year average percent of deaths within each census tract that are heart attack related. Heart attack fatality data were collected from the California Department of Public Health by zip code for years 1992-2016. Data is updated annually, however, there is a three year delay for each year. For instance, the most recent data available in 2019 is for 2016. A five year average is used in this analysis, which includes years 2012-2016.

Indicator Specific Methods

The data for this indicator were directly downloaded from the CA Department of Public Health's website by zip code. First, the percent of deaths associated with heart attacks was calculated for each zip code by dividing the total number of heart attack related deaths by the total number of deaths. A weighted average percent was then calculated for each census tract by weighting the respective percent for each zip code by the area that zip code overlaps with a particular census tract. This was done by intersecting a zip code shapefile with the census tract boundary layer in ArcGIS. This is consistent with methods used in CalEnvironScreen to apportion zip code values to census tracts.

Data Source(s)

CA Department of Public Health (CDPH) (2018). [Leading Causes of Death by Zip Code 1989-Current](#). CSV

U.S. Census Bureau (n.d.). [2017 ACS 5-year estimates](#). Total Population (B01003). CSV

SANDAG, U.S. Census Bureau (2014). [Census Tracts 2010](#). Shapefile

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City of San Diego (2019). *City of San Diego Street Overall Condition Index (OCI)*. Excel. Data provided to EPIC by City staff

City of San Diego (2019). [Recreation Center Locations](#). Shapefile

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SANDAG, San Diego Metropolitan Transit System (MTS), North County Transit District (NCTD) (2019). *Transit Stops – General Transit Feed Specification (GTFS)*. Shapefile

SANDAG, TrueNorth Research (2018). [Park & Ride / Commute Survey](#). PDF

SANDAG, U.S. Census Bureau (2014). [Census Tracts 2010](#). Shapefile.

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U.S. Census Bureau (n.d.). [2017 ACS 5-year estimates](#). Poverty Status in the Past 12 Months (S1701). CSV

U.S. Census Bureau (n.d.). [2017 ACS 5-year estimates](#). Tenure by Occupants per Room (B25014). CSV

U.S. Census Bureau (n.d.). [2017 ACS 5-year estimates](#). Travel Time to Work (B08303). CSV

U.S. Census Bureau (n.d.). [2017 ACS 5-year estimates](#). Selected Housing Characteristics (DP04). CSV

U.S. Department of Agriculture (USDA) (2015). [Food Access Research Atlas](#). Excel

U.S. Department of Energy, Alternative Fuels Data Center (2019). [Alternative Fueling Station Locator](#). CSV

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This information is available in alternative formats upon request.

(1-2020)