

SIZING UP CLIMATE RESILIENCE IN THE BAY AREA

A white paper by the Bay Area Joint
Policy Committee and SPUR

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Introduction

With atmospheric carbon dioxide continually exceeding levels considered “safe” and unlikely to decline anytime soon, it is now clear that some climate impacts are unavoidable. In the future, the Bay Area is expected to experience sea level rise and more frequent and severe heat waves, droughts, floods and wildfires. As our region has become more aware of the local impacts of climate change, our communities have grown more interested in understanding our vulnerabilities, and what actions we can take to become more resilient to climatic changes. While we know how to determine our impacts on the climate, by inventorying and developing plans to reduce greenhouse gas (GHG) emissions, we know much less about how to measure our ability to respond to the climate’s potential impacts on us. While there is general understanding that multiple measures of climate resilience are needed, there is currently no consensus on what those measures should be or what climate impacts categories they should include.

In May 2014, SPUR¹ and the Bay Area Joint Policy Committee (JPC)² partnered to conduct an initial assessment of the efforts already underway in the Bay Area to measure and build climate resilience, and to pull leaders from some of these efforts together to discuss best practices in developing and monitoring resilience through ongoing measurement of key indicators – directional trends and/or quantitative or qualitative assessments – towards strategic targets and goals. For this project, we focused on resilience in the face of a changing climate, and therefore used the following definitions of resilience to guide our discussions and research:

The capacity of individuals, communities, institutions, businesses and systems within a [community] to survive, adapt, and grow no matter what kinds of chronic stresses and acute shocks they experience. (Rockefeller Foundation 100 Resiliency Cities Challenge)

The capacity to recover quickly from difficulties; toughness (Oxford Dictionary)

SPUR and JPC joined forces to develop this white paper because there were a number of areas of overlap in our research on resilience planning and indicators, and we believed we could host a better workshop to discuss best practices in resilience measurement by bringing our networks together. In this white paper, the result of our research and a one-time workshop held with key Bay Area resilience stakeholders on June 16, 2014, we:

1. Describe several resilience indicators projects underway in the Bay Area and beyond;
2. Provide recommendations about how to undertake indicator development; and
3. Identify preliminary indicators for measuring both community and region-wide resilience to climate change.

Background

SPUR and the JPC have separately conducted research and analysis on climate adaptation and resilience for several years. In 2011, SPUR produced a landmark report, [*Climate Change Hits Home*](#), containing a

¹ SPUR is a member supported Bay Area nonprofit organization that promotes good planning and good government through research, education, and advocacy.

² The Bay Area Joint Policy Committee helps coordinate the San Francisco Bay Area’s four regional agencies – The Metropolitan Transportation Commission (MTC), the Association of Bay Area Governments (ABAG), the Bay Area Air Quality Management District (BAAQMD), and the San Francisco Bay Conservation and Development Commission (BCDC) - on efforts of regional significance related to transportation, land use, and air quality. The JPC is comprised of Commissioners and Board Members of the four JPC member agencies and is a venue for aligning public policy and investments to support critical issues like climate resilience that fall outside the purview of any one agency.

discussion of potential impacts of climate change on the Bay Area, and recommending over 30 planning actions for local and regional governments. Following that, SPUR has undertaken conceptual adaptation planning for two sections of shoreline in San Francisco ([Ocean Beach](#) and Mission Creek), and written an extensive report with recommendations about [the future of the Bay Area's water supply](#) in light of climate change. Most recently, SPUR's April 2014 [Urbanist](#) magazine featured an essay about long-term sea level rise, and profiled several important projects in the Bay Area that are [models of adaptation planning](#) for the shoreline.

In 2012, the Joint Policy Committee launched the Bay Area Climate & Energy Resilience Project (BACERP), a collaborative that has now grown to more than 200 public, private, and non-profit climate stakeholders in the nine-county San Francisco Bay Area. The purpose of the project is to support and enhance the local climate adaptation efforts of cities, counties and other organizations. BACERP staff has held multiple public [workshops](#) on key climate adaptation topics including climate and sustainability indicators, the roles of local, regional and state governments, and how to engage vulnerable communities. As a project of the JPC, and with funding support from the Kresge Foundation, BACERP released [five reports](#) in 2013 covering topics such as potential adaptation governance structures and win-win strategies for both greenhouse gas reduction and adaptation. Building on this work, BACERP staff published a [regional needs assessment report](#) in March 2014 that provides an overview of current climate adaptation and resilience projects, plans, organizing structures and needs in each of the nine Bay Area counties.

Indicators Projects Underway in the Bay Area and Beyond

The Bay Area is home to 101 cities spread across nine counties with diverse qualities, populations, capacities and goals. Many of the region's local governments and other organizations are currently engaged in efforts to better understand and focus their role in supporting climate resilience. There are also a number of cross-agency partnerships to measure and promote resilience being undertaken at different scales (local, regional, and sub-regional). Aside from the Bay Area's Sustainable Communities Strategy (required by state law SB375³), these projects have mostly been taken on voluntarily and with a wide range of funding sources. As noted above, our collective understanding of how best to define and measure our progress towards creating more resilient communities is much less advanced than our understanding of policies and tools to mitigate GHGs. For example, over 50 local governments in the Bay Area have adopted GHG reduction goals and Climate Action Plans to achieve reductions from buildings, transportation, electricity use, and other sectors. Only a few of these characterize local or sub-regional climate risks or contain policy or planning recommendations to prepare for climate impacts.

The table below provides a brief sample of recent and ongoing climate resilience indicator or measurement projects by government, nonprofit, and philanthropic organizations in the Bay Area. Although all of these initiatives include measures relevant to resilience in the Bay Area, they utilize different categories, indicators, measures and performance metrics—and even define some of these terms differently. For example, Plan Bay Area's performance metrics include target states or goals, while ABAG and BCDC's Housing and Community Risk Assessment project's metrics include measures of vulnerability that would not make sense to set targets for. The information below reflects the indicators and performance metrics directly reported by each project.

³ SB 375: The Sustainable Communities and Climate Protection Act of 2008

Bay Area Climate/Resiliency Indicator Projects

Project	Project Goal	Lead/Owner(s)	Geographic Scope	Project Status	Sample of Relevant Indicators Category Indicator <i>Measure or Performance Metric</i>
Housing and Community Risk Multiple Hazards Risk Assessment	Inform an understanding of the ability to prepare for, respond to, and recover from earthquakes or flooding	Association of Bay Area Governments (ABAG) and the Bay Conservation and Development Commission (BCDC)	Regional: Focus on 8 specific community profiles	Completed initial assessment and currently developing final “safe smart growth” strategies to be released September 2014	Household Capacity <u>Housing Cost Burden</u> <i>% Of households with monthly housing costs</i> Socio-economic Status Household Income <i>% households with income less than <50% AMI</i> Community Capacity <u>Racial/Cultural Composition</u> <i>% Non-white</i> Information & Mobility Challenges <u>Age – Elderly</u> <i>% Elderly > 75 years</i>
Bay Area Vital Signs Regional Performance Monitoring Initiative	Track regional progress towards key transportation, land use, environmental, and economic goals. Inform the general public and inspire positive behavior change.	Metropolitan Transportation Commission (MTC)	Regional	Vital Signs will be updated annually and will be accessible via an online, interactive platform. Release of first set of indicators is set for September 2014 and results of all categories will provide an early look at progress	Transportation & Land Use Environment Economy

				towards regional objectives established in <i>Plan Bay Area</i> .	
Plan Bay Area	Long-range integrated transportation and land-use/housing strategy that includes the region's Sustainable Communities Strategy (SCS) required for all MPO's under SB 375.	MTC, ABAG	Regional	Plan Bay Area was adopted in July 2013. The first plan update will be developed in 2017.	<i>Required under SB375:</i> Climate Protection <u>C02 emissions from cars and light-duty trucks</u> <i>Reduce per-capita C02 emissions from cars and light-duty trucks by 15% by 2035</i> Adequate Housing <u>Housing stock proportionate to population</u> <i>House 100% of the region's projected growth by income level without displacing low-income residents</i> <i>Voluntary:</i> Open Space and Agricultural Preservation <u>Preservation of Open Space</u> <i>Direct all non-agricultural development within the urban footprint</i> Equitable Access <u>% Of Income Spent on Transportation and Housing</u> <i>Decrease by 10 percentage points the share of low-income and lower-middle income residents' household income consumed by transportation and housing</i>

State of the Bay	Educate the public and help scientists and managers make decisions about how to best allocate resources to protect and restore the San Francisco bay.	San Francisco Estuary Partnership	Regional	Performance metrics are assessed and reported on every five years. Next update will be released in 2016.	Water <u>Fish Safe to Eat</u> <i>Measure trend (improving or deteriorating)</i> Habitat <u>Baylands</u> <i>Measure trend (improving or deteriorating)</i> Living Resources <u>Bird Population</u> <i>Measure trend (improving or deteriorating)</i> Ecological Processes <u>Flood Events</u> <i>Measure trend (increasing or decreasing frequency and duration)</i> Stewardship <u>Individual/Community Action</u> <i>Measure trend (improving or deteriorating)</i>
Indicators for a Sustainable San Mateo County	To provide governments, businesses, civic groups and nonprofit organizations with information to set goals, measure progress towards achieving them, and prioritize the allocation of resources.	Sustainable San Mateo County	County	Released annually since 1997.	Economy <u>Innovation</u> <i>Venture capital funding</i> Equity <u>Community Cohesion and Safety</u> <i>Civic engagement: voter participation trends</i> Environment <u>Natural Resources</u> <i>Water: Supply and demand trends</i>

Silicon Valley Index	Measure the strength of the Silicon Valley economy and the health of the community.	Joint Venture Silicon Valley and Silicon Valley Community Foundation	Regional	Released annually since 1995.	People <u>Talent Flows and Diversity</u> <i>Net population change</i> Economy <u>Innovation</u> <i>Trends in patent registration</i> Society <u>Quality of Health</u> <i>% Of population with health insurance</i> Place <u>Environment</u> <i>Alternative fuel vehicle registrations</i>
City Resilience Framework⁴	Facilitate collaboration and alignment of global resiliency efforts at the city level.	Rockefeller Foundation and ARUP	City: Framework is meant to be used by cities globally to develop local resiliency plans	By the end of 2014, a final version of the City Resiliency Index will be available and piloted in multiple cities both in and outside the Bay Area through the Rockefeller Foundation 100 Resilient Cities Challenge (RC100). ⁵	Leadership & Strategy <u>Effective leadership and management</u> <i>Multi-stakeholder alignment</i> Health & Wellbeing <u>Diverse livelihoods and employment</u> <i>Access to financial assistance</i> Economy & Society <u>Availability of Financial Resources and Contingency Funds</u> <i>[Existence of] business continuity planning</i> Urban Systems & Services <u>Continuity of Critical Services</u> <i>Flood Risk Management</i>

⁴ More detailed performance metrics for the Resilience Framework will be developed by individual cities per unique site specific goals and climate impacts

⁵ Three Bay Area cities, Berkeley, San Francisco and Oakland, are participating in the Rockefeller RC100

City of Berkeley Climate Action Plan Progress	Inform the public of the Berkeley Climate Action Plan goals and status of progress towards achieving those goals ⁶	City of Berkeley	City	Performance metrics are updated annually and published on the City's website	Transportation & Land Use <u>Increase green space, open space, tree planning and local food</u> <i>Farmer's market attendance</i> Building & Energy Use <u>Commercial: Enhance energy services</u> <i>Annual commercial energy consumption</i> Community Outreach <u>Mobilize Community Members</u> <i>Participation in Climate Change Action Groups</i> Climate Adaptation <u>Mitigate extreme heat events</u> <i>Annual net tree gain</i>
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⁶ The City of Berkeley CAP identifies 30 specific goals designed to help reduce Berkeley's community-wide global warming emissions 33% by 2020 from 2000 levels.

In addition to the local and regional projects detailed above, there are state- and national-level efforts to develop performance metrics to gauge progress on resilience. Specifically, the California Governor's Office of Planning and Research (OPR) is currently developing an update to the state's Environmental Goals and Policy Report (EGPR). The EGPR will identify metrics and indicators to track progress towards achieving five cross cutting climate and resiliency goals for the state.⁷ Funded by the Strategic Growth Council, the Healthy Communities Data and Indicators Project (HCI), the result of a 2-year collaboration between the California Department of Public Health and the University of California, has developed indicators of health equity based on the Healthy Communities Framework. The Framework outlines 20 priority attributes of a healthy community, including environmental quality and sustainability, while the HCI identifies specific indicators and performance metrics to track progress on those attributes.⁸ Additionally, the 2010 California Regional Progress Report, also funded by the Strategic Growth Council, outlines twenty integrated place-based quality-of-life indicators that measure regional progress towards sustainability.⁹

At the federal level, the third National Climate Assessment was released in May 2014 and details climate change impacts across sectors and regions of the US. The third Assessment provides a framework for more comprehensive assessments – including the development of indicators of change within regions and sectors – in the future. From an international perspective, the Notre Dame Global Adaptation Index (ND-GAIN) measures national vulnerabilities and readiness to adapt through the use of 50 variables to rank and compare countries globally. Although these initiatives assess resilience at very different scales, they provide relevant and valuable context for local and regional agencies in the Bay Area. At the same time, the effectiveness of indicators can be sensitive to scale. What is useful at the state or federal level may not be directly applicable when measuring and developing policy and programs to build resilience in the region.

Preliminary List of Resilience Indicators

In addition to the above-listed sample of Bay Area projects, and state and federal efforts, we identified through research and our June stakeholder workshop several additional potential indicators of resilience. Along with samples from the above list, these could be helpful in guiding policy or resources toward resilience efforts, at either the regional or local scale. The list is organized according to categories proposed at the workshop that could be considered when measuring resilience. Each potential indicator within the category is paired with one or two proposed performance measures to inform policy and implementation. This is not an exhaustive list but rather a preliminary one to help inform future discussions and research.

PUBLIC HEALTH	
Indicator	Performance measure(s)
Safe air	Air quality measurements for specific criteria pollutants: PM, ozone, NOx, etc.

⁷ EGPR discussion draft available here: http://opr.ca.gov/s_ca50m.php

⁸ The Bay Area Regional Health Inequities Initiative (BARHI) is currently working in close collaboration with the staff of the HCI on an indicator guide that will provide specific recommendations on use of health equity indicators by public health officials at the local level, as well as an analysis of mortality framed with a health equity perspective. The BARHI Indicator Guide will be released late summer 2014 <http://www.barhi.org/>.

⁹ http://www.dot.ca.gov/hq/tpp/offices/orip/Collaborative%20Planning/Files/CARegionalProgress_2-1-2011.pdf

Safe water	Water quality standard attainment for surface waters (fishable, swimmable, etc.), drinking water quality meeting all federal goals (maximum contaminant levels)
Reliable mobility	% Population with access to public transit within ¼ mile
Reliable emergency communications	% Of people who know what to do in an emergency
Heat resilience	% Of people in homes that have air conditioning; cooling centers per capita; % of people in homes that are retrofitted for energy efficiency and thermal comfort
Access to hospitals during a weather event	% People that can walk, bike, or drive to a health care facility within 20 minutes
ECONOMIC PROSPERITY	
Livable wages	% People with household income above regionally-adjusted poverty thresholds
Access to food	Food costs as a percentage of household income
Stability of lifeline infrastructure	% Lifeline infrastructure facilities (gas, water, sewer, electricity, etc.) that have been evaluated and retrofitted for climate impacts
ECOSYSTEM HEALTH	
Coastal subsidence	Rate of subsidence; existence of restoration plans to stop or ameliorate subsidence
Rarity	% Endemic or endangered species
Resilience to disturbances	% Of important species that can move/shelter or have adaptive survival mechanisms in severe weather or fire
Protected migration corridors	Acres of protected land in ecologically rich areas; acres of protected land upland of existing wetlands for them to migrate
RESOURCES DEVOTED TO INCREASING RESILIENCE	
Climate-resilient homes and workplaces	Availability of financing for retrofits; Participation in trainings and incentive programs
Educated, aware people	% of people who have access to resources in their own language about climate/weather and how to improve personal resilience % of people over age 18 with a high school diploma
Reduction of greenhouse gases	GHG reduction per capita; number of jurisdictions with Climate Action Plans that address adaptation/resilience

Best Practices and Observations About Resilience Indicators

At our workshop on June 16, Bay Area resilience stakeholders discussed some of the following ideas (numbered for reference only) about how to make indicator projects successful.

Indicators must be tied to a goal, benchmark, or other desirable end-state. While measuring directional change for any one indicator can be helpful, especially at first, it is ideal to set goals and interim benchmarks in order to track progress toward achieving them, and see if we are proceeding at the necessary rate of change. If we find it's easier to make progress in one area, we could reallocate resources toward catching up where we are behind. As an example of effective goal-setting, the Baylands Ecosystems Habitat Goals project united the conservation community around an ecosystems goal of “100,000 acres of tidal wetlands” when the project was completed in 1999. Progress toward this resilience end-state might have been measured in terms of “acres purchased for restoration” and “acres restored to tidal function” each year.

The right geographic scale for resilience indicators will vary. The Bay Area is a very diverse region in terms of community resilience. Regional-scale indicators will be more useful for monitoring certain attributes of resilience than others. For example, measures of environmental quality (air and water), habitat availability, or local capacity (% local jurisdictions that have a climate action plan) may be well suited to measurement at a regional scale. For other qualities, indicators at a smaller geographic scale may much more accurately measure community resilience and better direct local resources toward improvement. For example, the percentage of people who know what to do in an emergency, or who have access to cooling centers, may make more sense to measure on a smaller scale. Certain populations - likely the most-impacted or vulnerable - could get missed if measures are based on the ‘regional average’. Yet, improving outcomes for the most-impacted groups is one of the most important reasons for taking action on climate impacts. The most effective scale for resilience indicators may emerge as they are developed and tied to performance measures.

Indicators should have clear “owners”. Successful indicator projects must be managed by a specific agency, organization, or group of partners that has the capacity to collect and verify necessary data on a regular and ongoing basis. Responsibilities regarding how this information will be reported and interpreted must also be clear and should ideally be informed by existing projects to reduce duplication and leverage scarce resources. Ultimately, if indicators show that progress is not being achieved at the speed and scale required, there should be a mechanism to engage the correct players to address this issue depending on the scale and focus area of the specific indicator project. The agency or partners that develop indicators should ideally engage as diverse a set of partners and perspectives in the development process as necessary to understand relevant policy implications and create momentum and support.

Focus on the positive side of resilience. Indicators for the region should be focused on resilience, not vulnerability – in other words, positively framed rather than negatively, wherever possible. The idea of moving toward a resilient state is probably more appealing to a broader audience than talking about risk reduction or managing harm, which may seem uncontrollable and overwhelming.

A key value proposition of regional indicators is their potential to drive stakeholder engagement and public and private investment in resilience-building. Both funders and the public could more readily identify our resilience priorities and how well we are meeting them if we could measure our goals and progress toward them. Indicators can play a key role in building targeted political support for climate goals; however, both the metrics and exactly how these numbers are tracked and reported must be

designed with this end in mind. For example, the City of Berkeley posts ongoing progress on specific goals outlined in their Climate Action Plan on the City's website to engage and inform the public, communicate a larger vision and highlight real-time gaps between these goals and current resources. Painting a clear picture of resilience strengths and weaknesses through indicators could help direct, align, and marshal resources toward filling in the gaps.

Be clear and relevant to a broad audience at the highest level, but tie indicators to specific performance measures that directly inform policy & implementation. The best indicators include measures of resilience that are clear, relatable and speak to the values of the general public, paired with performance measures tied to outcomes and specific implementation strategies. This multi-level approach improves communicability to the many potential audiences of indicators, from the general public to elected officials to local government staff who implement programs. For example, an indicator of resilience might be something like “reduced (or low) physical exposure to climate risks and hazards”; performance measures tied to it might include things like “% buildings retrofitted to withstand a 5 year storm with no damage” and/or “% buildings with air conditioning”. The multi-level approach allows measurement over time for policy-makers and a clear direction for implementation, but speaks to values that make sense for the general public - thus winning broader support for resilience-building.

Local governments within the Bay Area vary widely in terms of having capacity to take on either resiliency planning or resiliency measurements. Local and county governments generally do most of the land use planning, building inspection, public works projects, transportation planning, public health programming, communicating with the public, and other functions directly tied to resilience. Their ability to develop and finance climate resilience plans varies quite a bit, with smaller cities generally having less capacity. Efforts to measure regional resilience must be translatable through performance measures into specific strategies for local governments, who do the bulk of on-the-ground planning and public outreach work in the Bay Area. Measuring resilience through indicators at the local level may not be something that certain jurisdictions have the ability to take on at all without a commitment of resources, technical assistance and financial support.

Conclusion

As the impacts of climate change become more frequent and widespread, our ability to accurately measure progress towards climate and resilience goals will continue to become more important. In recent years, we've seen an increasing number of efforts at the regional, state and national levels to both define climate resilience and to develop targets to assess our progress towards these expanded climate goals. Yet, we are still continuing these disparate efforts as we experiment with determining adequate definitions and measurements of climate resilience. Although we have many GHG mitigation examples to look to for guidance, climate resilience must be approached more holistically and with a more diverse set of local stakeholders at the table in order to create indicators and metrics that capture the diverse and unique impacts that each community must respond to. Accordingly, efforts to develop effective and accessible tools and educational materials to guide future climate and adaptation strategy development will continue to be developed at multiple scales. Bay Area agencies and organizations can benefit from these initiatives by considering both their individual and collective regional goals when developing new or coordinating current indicator projects. Given the scale of the challenges we face, we should leverage the region's valuable experience and expertise to identify the potential benefits of using consistent and coordinated measurements across agencies and jurisdictions.

June 16 Bay Area Resilience Indicators Workshop Participants

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