

Integrated Climate Adaptation and Resiliency Program
Technical Advisory Council Resilience Metrics Work Group Meeting
January 20, 2021
Meeting Minutes

Zoom Video Conference
10:00 AM – 12:00 PM

Item 1 | Welcome and Roll Call

Present: Jacob Alvarez, JR DeLaRosa (Alternate for Christina Curry), Susan Haydon (Alternate for Grant Davis), Laura Engeman, Jana Ganion, Clesi Bennett (Alternate for Amanda Hansen), Andrea Ouse, Jonathan Parfrey, Heather Rock, Mark Starr, Brian Strong

Absent: Karalee Browne, Jason Greenspan, Nuin-Tara Key, David Loya, Dan McDonald, Sona Mohnot, Darwin Moosavi, Michelle Passero, Lauren Sanchez, Gloria Walton, John Wentworth, Wilma Wooten

Item 2 | Discussion on Social, Natural and Built Resilience

OPR ICARP Program Manager Juliette Finzi Hart provided contextual remarks, process reminders, and definitions to open the discussion on resilience metrics and indicators based on the built, natural and social systems framework.

DISCUSSION

Definitions and Framing

Jonathan Parfrey: The IPCC has traditionally framed vulnerability as exposure, sensitivity and adaptive capacity. Why the use of the word risk instead of exposure?

Mark Starr: We could also delete “exposure” from the phrase. Risk to the impacts seems to be more important, or at risk from exposure to impacts.

Brian Strong: Part of it is thinking about when the exposure happens. There’s some concern about addressing risks before the exposure happens. I believe this is why we chose risk over exposure. There may be communities who are at risk of exposure later, and we shouldn’t wait until moment of exposure to act.

Mark Starr: I think that’s conveyed currently; vulnerability describes the degree to which systems are at different levels of risk.

Heather Rock: The other IOUs and stakeholders have debated with CPUC on this definition. The Commission adopted a DWR definition of climate vulnerability as risk as a culmination of exposure and sensitivity to climate impacts. This would acknowledge that exposure is part of the equation, and align with what other agencies are using.

Laura Engeman: The vulnerable communities definition repurposes this to mean heightened exposure and increased sensitivity as a definition of risk.

Juliette Finzi-Hart: We can look into the history, examine comments and take it back to the Council for discussion.

PUBLIC COMMENT

Alexandra Huttinger (RAND Corporation): In risk analysis (e.g. in heat vulnerability indices) it tends to be that Risk = Hazard x Exposure x Vulnerability.

Meeting Process Note: For the remainder of this agenda item (Item 2), ICARP Council members were asked to answer three questions for each of the resilience systems: human-social; built; and natural. The questions were:

1. Why do we want to measure resilience in built/natural/social-human systems?
2. How would we know if California has resilient built/natural/social-human systems?
3. Who's already measuring built/natural/social-human system resilience?

Council members were asked to type their responses in the Zoom chat. These chats were then transferred verbatim by Nikki Caravelli and Taylor Carnevale to an Miro board that was visible to all participants via Zoom's screenshare option. After each resilience system, there was an opportunity for Council discussion, followed by public comment. Meeting discussion notes following each resilience system Miro session are included below. A verbatim transcription of the chat comments that were transferred to the Miro board are included at the end of these meeting minutes in the supplemental materials.

Built Systems Discussion

Jana Ganion: We've incorporated carbon life cycle analysis into our built system projects. As we build to become more resilient, we ensure we're not contributing more GHG's. This is a long standing tenet of California's strategy but it's difficult to do this in the built environment because we're not used to it. The metrics piece is important, there are good models, but we need to standardize and institutionalize it.

Juliette: Thank you for the reminder about the emissions mitigation link.

Heather Rock: Given that we have a lot of vulnerable state infrastructure systems, in order to prioritize investments, allocate resources efficiently, and know whether the benefits outweigh the costs, we need to measure what the vulnerability and resilience is.

Laura Engeman: We want resilient built systems to maintain continuity of equitable and critical public services and infrastructure. When we pursue resilience in siloed systems, we may get locked into thinking that a built system needs to stay the way it is. For both built and natural systems we have to focus on what the critical services and processes are, what they're designed to do, and whether there are other ways to provide them. For example, some of these systems are inherently built into old electricity generation frameworks; if we're phasing these old systems out, are there new ways we can move grids and transmission infrastructure to provide those services, but move substations away from vulnerable locations?

Brian Strong: Part of the way we're thinking about equity and equity metrics is through the connection to the levels of service to which different populations have access. Whether it's proximity to parks, clean air, ambulance arrival time, these are all related to an infrastructure system. Understanding levels of service can help us develop equitable outcomes. Meaningful metrics means understanding basic service outcomes, during both regular times and during times of stress.

Jonathan Parfrey: [How would we know if we have resilient built systems]: Take the previous categories and flip them. Are people getting electricity, potable water, and healthcare? How long are they going without? Do a gap analysis and then figure out what the fulfillment of that gap might be.

Andrea Ouse: We need to acknowledge that the best way of measuring this is by ensuring that prior to the system existing, there is adequate study and resources dedicated to evaluating, designing and constructing systems for the purpose of resilience. For local governments and special districts, often the amount of resources dedicated prior isn't adequate.

Juliette Finzi Hart: The analogue to that is asking what we do with the existing systems?

Andrea Ouse: In terms of capital and public improvements, identify those areas that are not adequate and then allocate the appropriate amount of resources to bring them to the resilient standard over the course of the life of those improvements.

Jonathan Parfrey: The list of existing groups that are performing these measurements related to adaptation and resilience may be thin.

Juliette Finzi Hart: A lot of the work we've seen tends to be focused on energy and grid resilience. There's also a chapter in the National Climate Assessment on built systems that we'll review for insights.

Laura Engeman: We also need to consider that people have started doing adaptation but are framing it differently. Regional water districts look at capital improvement plans for water resource management, which in Southern California often includes reducing dependency on freshwater systems and investing in storm water runoff treatments and aquifer building. In essence, they are measuring built systems resilience and thinking about what to retire and what new infrastructure needs to be built, the timeline, and the lifespan, and also considering how that relates to projected climate impacts for precipitation; including dams, water storage, etc. For transportation and other built systems we could use the state's log for existing state maintenance needs as a resilience metric. Even without future climate impact projections we already have a measure of how degraded or resilient some of these are in present day, so we could also look at how they will be 30 to 50 years from now. Those that are already failing will fail more in a shorter time frame.

Juliette Finzi Hart: I have noted to look at deferred maintenance and look for people who are measuring resilience without calling it resilience.

Brian Strong: There are groups who have looked at earthquake resilience and established performance standards. In San Francisco we did performance standards/infrastructure grading for all of our lifeline providers that gets at this, but it's not defined as a resilience metric.

JR DeLaRosa: There are instances seen in progress reports like OneNYC's report, which include metrics that are used to report back on how they're meeting their goals to meet infrastructure resiliency and increased democracy. They also list the agency in charge; There are other entities doing progress report exercises.

Brian Strong: OneNYC has been doing this for a while, it came from PlanNYC.. There's been a lot of effort around creating resilience plans and programs and equity metrics in a few cities including Oakland, St. Louis and New York where they graded themselves. No one is looking at equity in terms of outcomes or levels of service. Resilient Cities Network and other groups are also working on it.

Jonathan Parfrey: There might be some interesting examples from USDN and the organizations that spun out of 100 Resilient Cities. From your participation, have you heard of any efforts along these lines?

Brian: Resilient Cities Network has talked about this, often about place based resilience; same with USDN with their resilience hubs and that type of idea. That would be another concept to look at: what's more

important? The infrastructure that's serving an entire area, or more place-based like a 15 block city where you can get everything you need? I can look into resources for this.

Jonathan Parfrey: Juliette, could we incorporate the AB 2800 infrastructure and resilience group findings into this effort?

Juliette Finzi Hart: That group hasn't been restarted. That report referenced the need for metrics, and linked to the equity metrics in the Equity Atlas, but didn't list metrics.

PUBLIC COMMENT

None Received.

Natural Systems Discussion

Clesi Bennett: I would add to the list [of why we want resilient natural systems] the vast amount of co-benefits that well-functioning, healthy systems provide, including carbon sequestration, water filtration, flood protection, recreation, water storage, etc.

Juliette Finzi Hart: A lot of these note how natural resources help human systems. Should there be an intrinsic value aspect?

Clesi Bennett: I would add habitat; a benefit of resilient systems is providing habitat for endemic California species, or threatened or endangered species.

Clesi Bennett: Similar to built systems, [we know we have resilient natural systems] when we see that natural processes are still occurring and we're not seeing the destruction or loss of these ecosystem services.

Juliette Finzi Hart: The natural analogue to continuity of level of service.

Jana Ganion: There was a report or presentation given to this Council from a water district office about how natural systems can be used around the Bay to combat sea level rise. There were some good metrics in there that compare the natural vs. the built approach.

Brian Strong: That was done in Sonoma. There was also some work from the Resilient by Design competition a few years ago, where teams developed resilience measures and tools.

Jana Ganion: It was San Francisco Estuary Institute's Adaptation Atlas.

Brian Strong: The Atlas is good also because it spans across jurisdictional boundaries.

Clesi Bennett: Agreed, they also use OLU's - operational landscape unit: nature's jurisdictions.

PUBLIC COMMENT

None Received.

Social Systems Discussion

Jonathan Parfrey: It is crucial to use an environmental justice framework and examine how things like extreme heat exacerbate air quality impacts communities are already experiencing from transportation or industrial uses, and access to air conditioning at the same time. It's important to explore who the uniquely sensitive populations are in the state that are the frontline communities, which becomes defined even broader under climate change. This process gives us the opportunity to identify those most vulnerable groups and redefine who is frontline and truly most at risk, and identify where to focus our resources to protect human life. This exercise may be the most crucial one.

Heather Rock: As we think about prioritizing investments to improve our critical infrastructure to perform under stress, we need to understand that vulnerable communities are at the forefront and both least equipped to respond and most dependent on services. How we weave in equity, whether it's for built and natural, has to be at forefront of how we prioritize. Understanding this will inform those decisions.

Juliette Finzi Hart: As we think about how we would know if we have resilient social systems, one of the challenges is thinking about events versus the chronic: sea level rise continues, it doesn't just stop, and days will get hotter. We need to consider this in combination with the more event-based impacts. Is there a way to think about resilient social systems with respect to this?

PUBLIC COMMENT

Kai Lord-Farmer (Ascent Environmental): The measure of resilience in a social system also depends on how well we can address resilience in the built and natural environment. Things like political stability or economic conditions for government agencies; to address climate impacts, they need to have social resilience to do that. There's a glue that combines all of this within this category.

Clesi Bennett: The new Federal EPA administration might revamp the EJ screen, the federal corollary to CalEnviroScreen. There's going to be a revamp of data and analysis around environmental justice and social systems.

Item 3 | General Public Comment

None Received.

Item 4 | Closing, Future Agenda Items, Meeting Adjourned

Juliette Finzi Hart: We will combine all of this, organize, incorporate survey results, and bring it back to the Council at the next meeting and start identifying indicators.

Jonathan Parfrey: Who is on the Interagency Resiliency Work Group?

Juliette Finzi Heart: Any state agency who works in the adaptation and resilience space.

Jonathan Parfrey: Amanda indicated there would be a new approach with the Safeguarding Report. Is this the forum where this will be discussed?

Juliette Finzi Heart: We will discuss it there and here with the TAC, but it's not ready for the public process just yet.

Clesi Bennett: Best to discuss at the March TAC meeting, we are still getting approvals from leadership. Generally we're trying to break down silos, and integrate sectors, departmental work, and levels of government.

Adjourn.

[Miro board verbatim transcript is included in the Supplemental Materials in the subsequent pages.]

Meeting Notes - Supplemental Materials

Miro Board Verbatim Transcription (next 9 pages)

Resilient Built Systems

Definition: *"Infrastructure and built systems withstand changing conditions and shocks, including changes in climate, while continuing to provide essential services."*

Questions:

1. Why do we want to measure resilience in built systems?

- People with special needs taken care of
- Goods movement, roads maintained
- Delivery of water to California homes
- Built systems enable the provision of services. If those systems fail or operate poorly, services become disrupted
- to know that the costs of investments in infrastructure are yielding benefits
- To ensure that we are making progress on our resiliency goals/objectives.
- they provide essential services that people need and we want to make sure breaks in services are anticipated and planned for (and prevented!)
- Indicates emergency response capacity (shelters, energy, evacuation)
- Pets and stock animals taken care of
- to ensure statewide goals are met, inform future planning and prioritize investments
- Important to understand how infrastructure will function in light of shocks and stressors for resilience planning.
- lifespan of built systems is key to resilience.
- If we track changes in the function and use of built systems, we can learn if they are working as expected and how we might modify them or manage their use to meet the original expectations
- lifespan of built systems is key to resilience
- Human (and animal) health and well-being depend on built systems (in our culture/society).
- Delivery of electricity to CA Homes and businesses.
- to ensure critical infrastructure can perform under times of stress under dynamic scenarios
- Identify gaps where vulnerabilities exist
- Telecommunications are live, and emergency services are accessible to all
- To ensure we are allocating resources in an effective manner
- built systems enable equitable basic services (clean water, energy, etc)
- Water quality and air quality maintained as best as possible.
- built systems enable equitable basic services (clean water, energy, etc)
- gaps in resilience can indicate exposure to large recovery costs
- Helps to understand the connection between infrastructure systems and the provision of equitable Levels of Service.

- mobility
 - continuity of services (maybe not 100%, but 80%) during extreme weather events
 - Understand at what point thresholds in built systems are exceeded and how the systems begin to fail
 - Food systems are operating
 - In order to gauge the level of future investment in infrastructure
 - continuity of services (maybe not 100%, but 80%) during extreme weather events
 - Medicines and health care available
 - To ensure we are allocating resources in an effective manner
 - want to measure resilience to ensure equitable services throughout communities from the built ecosystem, and we want to measure carbon emissions through lifecycle carbon analysis to ensure that measures to improve resilience across built environment do not make the core climate crisis worse (avoid maladaptation through increased GHGs).
 - to identify weak points in our systems and prioritize investment accordingly
2. How would we know if California has resilient built systems?
- existing infrastructure is improved to withstand climate impacts
 - The system would be considered resilient if it is able to provide the same or a similar level of service during or soon after hazards events or prolonged but permanent changes
 - policies are in place to require planning and incorporating resilience, and those policies are implemented
 - any new systems are built with climate impacts in mind
 - we can provide critical services during shocks to our system; we have built our systems to function reliably and safely amid changing environmental conditions
 - intentional redundancies to compensate for failure points
 - Built systems are proven carbon-emission neutral. Built systems can serve one purpose in business as usual situations, and perhaps serve more critical purposes in times of shock and stress. Use of built systems is equitable (e.g., EV charging, electrified transport in lower income areas).
 - water resources is great case study of what built we have now, what needs to be maintained, or evolved or newly built to accommodate new water regime of 30-50 year future
 - continuity of services in the face of extreme weather events
 - continuity of services is held, or only disrupted temporarily
 - Key infrastructure can withstand climate impacts that become increasingly more intense
 - That part is important (measuring after an event), but it is also important to have a way to measure before any events or changes in services occur.
 - The system would be considered resilient if it is able to provide the same or a similar level of service during or soon after hazards events or prolonged but permanent changes
 - By ensuring that State and local governments have access to adequate resources necessary to plan for, design and construct resilient systems.

- Need specific metrics and look at them collectively to determine trends, change or no change, and can then assess if the system is resilient.
 - If the system can withstand adverse events, and provide consistent services to all or at least provide the framework to bounce back after a disturbance
 - (Prior question) Lifeline service restoration timeframes are tracked, trended, and improved.
 - A system that enables us to both recover and move forward after shocks.
 - Drills, exercises, tests, etc. (e.g., "load testing").
 - Key infrastructure can withstand climate impacts that become increasingly more intense
 - #1 is what is current condition of built systems. I.e. what does the maintenance or upgrade list look like now and how old/degraded are they as a baseline.
 - #2 what are 30-50 year public service goals and how well does built structure system support that
3. Who's already measuring built system resilience?
- [CAMPO City of Austin Vulnerability Assessment](#)
 - Current question - [City and County of San Francisco](#).
 - https://www.rand.org/pubs/research_reports/RR2129.html and https://www.rand.org/pubs/research_reports/RR2130.html
 - transportation planning is usually done long timeframes — there might be some lessons to learn here?
 - Hazard Mitigation Plans will often have resilience goals and metrics, but those are not necessarily shared due to confidentiality or just lack of forum.
 - There are proxies for resilience...typically around performance standards. San Francisco developed a Lifelines Restorations Performance Project that looks at this for earthquakes.
 - Here's the link to RCN. <https://resilientcitiesnetwork.org/>
 - <https://sustainable.dc.gov/sdc2> — Sustainable DC 2.0 - have tried to incorporate metrics across various sectors
 - Here's the link to the performance report: <https://onesanfrancisco.org/lifelines-program>
 - USDN
 - FHWA Vulnerability Assessment and Adaptation Framework, 3rd Edition
 - I think RAND has done some research in this area
 - Entities involved in disaster planning and preparedness?
 - I think OneNYC might have metrics for infrastructure in their 2050 plan.
 - OEHHA on some matters
 - 100 Resilient Cities — and their resilience plans??
 - City and County maintenance and operations
 - The City of Houston has just completed a "Resilient Houston" effort.
 - SF "Performance Standards"
 - (RAND Resilience Dividend Valuation Model)
 - AB 2800
 - CalBrace

- PG&E has a climate resilience maturity model
- The City of Houston has just completed a "Resilient Houston" effort
- bureau of reclamation on flooding?
- Some of the public utility systems around water are doing this
- City of Elk Grove - Community Mobility Resilience Project

Resilient Natural Systems

Definition: *"Natural systems adjust and maintain functioning ecosystems in the face of change."*

Questions:

- Why do we want to measure resilience in natural systems?
 - it gets even more complicated because often we are trying to simultaneously restore or rejuvenate a habitat or species and now we are also looking to make it resilient for the future, but what is resilience for that habitat (simply that it exists still or that it is at a healthy level?)
 - natural systems provide a multitude of benefits so ensuring that actions we take to build resilience are successful is crucial. Some of these benefits include carbon sequestration, water filtration, water storage, improved air quality, flood protection, cooling, wildlife habitat, outdoor recreation, etc.
 - Maintaining a healthy natural system protects and improves our ability to be more resilient.
 - Moving target as refugia takes place
 - We rely on them for basic ecosystem services and natural resources e.g., air, water, soils
 - thriving natural systems are essential to functioning human systems
 - Natural systems including biodiversity are critical to our well being and happiness.
 - intrinsic value
 - natural systems are inherently resilient (thought that depends on what time scale one is looking at), a breakdown of resilience (e.g., biodiversity loss) indicates anthropogenic damage that impacts ecosystem services
 - to identify potential risks to wildlife and critical ecosystems so that we can adaptively manage any changes that need to be made in order to best align with statewide goals or management priorities
 - natural systems provide a sense of harmony, which relates back to overall happiness
 - to assess risk
 - We have an unfortunate tendency to disrupt natural systems that have proved to be incredibly resilient over long periods of time.
 - Natural systems support human health and core, clean air / food / water needs. Natural systems are proven to absorb and sequester climate forcing constituencies. Natural systems buffer the human environments. For these reasons we want to measure their health and productivity.
2. How would we know if California has resilient natural systems?
- Understanding the baseline conditions that you are basing resiliency upon would be critical.

- Maintain high biodiversity
 - wildlife are able to adapt to a changing climate (e.g. can easily move to more suitable habitat)
 - our wetlands and beaches can keep pace with sea-level rise
 - species and ecosystems stop collapsing
 - In order to allow for better comparison to areas and for tracking over time, it would be helpful to develop standard methods and metrics for certain ecotypes, or areas of concern
 - rate of endangerment or extinction of species
 - number of catastrophic wildfires per year
 - water flows
 - yields of industries that depend on natural resources, like fisheries or agricultural
 - Limiting loss of life and loss of property from wildfires
 - We recognize the benefits of natural systems through our laws
 - people start to better value the multitude of benefits from nature
 - We are able to measure impacts on natural systems and committed to doing no more harm and hopefully much more good.
 - health of keystone species
 - key natural processes are still occurring
 - To be able to objectively measure the rate and extent of change
 - biodiversity is a good indicator, but it alone can not point to causes of biodiversity loss or potential measures to reduce loss
 - They are helping mitigate and adapt to climate-amplified disasters. They help humans and other species recover from disasters. They avoid carbon emissions compared to 'built' counterparts (e.g., mangroves vs. concrete sea wall)
3. Who's already measuring natural system resilience?
- academia — too many to name here, but lots of universities are engaged in this work
 - Lake Tahoe West project in Tahoe
 - OEHHA
 - NOAA
 - Look to Sonoma County TAC meeting
 - Resilience by design (SF)
 - might be worth looking at SFEI's work on natural shoreline resilience and adaptation
 - Fourth Climate Change Assessment
 - Metropolitan Water District of Southern California measures Colorado River snowpack
 - Marin Wildfire Prevention Authority
 - National Weather Service
 - For natural systems: Southern California Coastal Water Research Project measuring ocean acidification
 - Many state agencies are contributing to measuring resilience by way of monitoring particular elements (species/abiotic indicators) that can collectively inform ecosystem- or habitat-wide change.

- Here at CNRA, the Monitoring & Stewardship Unit (my team) is developing something called the Resources Agency Project Tracking and Reporting (RAPTR) system.
- Our goals with RAPTR are to support the collaboration, coordination, and sharing of information offices under the California Natural Resources Agency. This includes tracking project metrics.
- <http://www.resilientbayarea.org/> is the link to the projects that did some of this work around rising seas. See sediment along Alameda Creek.
- there are some metrics in the TCSI framework as well. The metrics were identified in the Framework for Resilience, <https://sierranevada.ca.gov/wp-content/uploads/sites/326/2020/10/TCSIframework.pdf>.
- SF's Estuary Institute, Adaptation Atlas (https://www.sfei.org/sites/default/files/toolbox/ICARP%20TAC%20mtg%2028June2019_SFEI.pdf)

Resilient Social Systems

Definition: *“All people and communities respond to changing average conditions, shocks, and stresses in a manner that minimizes risks to public health, safety, and economic disruption and maximizes equity and protection of the most vulnerable.”*

Questions:

1. Why do we want to measure resilience in social systems?
 - need to sure what efforts we are taking to protect our most vulnerable are actually working
 - measure resilience to better inform strategies focused on maintaining the social systems
 - To improve equity and the lives of those most vulnerable.
 - resilience acknowledges that there are multiple pathways to maintaining or improving quality of life though disruption, and that different populations/regions have different needs and strategies
 - Social systems are often the most important politically, and for decision-makers, so understanding what works in terms of social resilience can be the starting point for aligning built and natural system resilience actions.
 - As a framework for influencing how resilience is ensured, including making sure equity and community participation are at the forefront
 - Critical to reducing long-term stressors associated with social inequity.
 - to ensure that we are not causing any unintended consequences/maladaptation in vulnerable communities
 - To measure sensitivity and adaptive capacity.
 - Plus the obvious factor that we want to be protected and stay healthy and safe!
 - It has the most direct impact on people's lives and how we interact together toward a better future.
 - to uplift underserved communities and enable the capacity for all to be more prepared to adapt and adjust to changes.
 - It's the right thing to do and it provides an opportunity to improve our social systems

- To inform and help create a fail safe to protect the most vulnerable when the economics or the economy says otherwise.
 - to ensure we do not perpetuate existing injustices and inequities
 - It goes toward balance and understanding the impacts of individual, business, government, and other sector impacts.
 - to better understand how communities are building their own resilience and strengthen and support those efforts (they have answers for what works best for them that govt can then support)
2. How would we know if California has resilient social systems?
- Jurisdictions have climate action plans that address health and equity
 - more equitable and just systems
 - Our economies are built to be sustainable
 - Communities are able to bounce forward after climate impacts
 - Ability for individuals and communities to thrive despite climate impacts
 - Key social indicators such as poverty, educational attainment, life expectancy, living wage, access to health, etc. are being achieved.
 - people's lives are improved, our social systems are strengthened, and historically marginalized populations are active participants in decision making
 - Long-term: Incomes are more equitable, life expectancy rates are more equivalent, potable water quality is uniform across communities. Short term/event based: lifelines service recovery timeframes are equitable across communities.
 - Injuries, deaths, health impacts after events are minimized
 - strong community bonds/social capital
 - what is the (in)equity spread at status quo, and under duress, for indicators such as the service level indicators mentioned by Mr. Strong, and the risk faced by frontline communities as mentioned by Mr. Parfrey
 - We see an overall improvement in health outcomes and a prosperous economy equitably distributed
 - We are able to measure and respond to change more effectively
 - People feel connected and empowered to improve their lives.
 - We need to make sure that our activities to create resilience are not inadvertently mal-adaptive to negatively impact health
 - community trust and leadership in public processes regarding climate resilience
 - High levels of social cohesion and civic engagement in communities
 - homelessness is reduced, unemployment levels drop, small businesses are thriving, diversity of race, gender, and perspective is a priority and is reflected across the workforce
 - look at wellbeing measures as a proxy/ corollary
 - People have access to what they need to be and stay healthy
 - When well thought out policies or mandates are enacted that begin to reduce impacts over time.
 - We see an overall improvement in health outcomes and a prosperous economy equitably distributed

3. Who's already measuring social system resilience?

- Gross National Happiness Index/Bhutan
- Healthy Places Index
- City of Santa Monica Civic Wellbeing
- Academics. Not enough governments or practitioners.
- Sierra Institute for Community and Environments
- SUNY NYC Equity Resilience Indicator Project. Here's the link:
<https://islg.cuny.edu/sites/our-work/equality-indicators/>
- Robert Wood Johnson Foundation
- BCDC's community vulnerability mapping in the Bay Area -
<https://bcdc.ca.gov/data/community.html>
- CDPH Climate Change and Health Vulnerability Indicators
- CDPH Healthy Communities Data and Indicators Project
- California Health Interview Survey may be a resource
- <https://www.opm.gov/policy-data-oversight/data-analysis-documentation/employee-surveys/results/results-of-the-employee-benefits-survey/> Federal employee wellness survey
- HARC, Inc- Health Assessment and Research for Communities
- <https://equalityindicators.org/> for cities that adopted the suny nyc tool.
- Town of Truckee <https://www.sierrasun.com/news/business/truckee-socio-economic-metrics-accepted-by-truckee-town-co>
- CalEnviroScreen
- EPA and CDC climate change and health indicators
- Buro Happold is doing social analyses for LA County climate vulnerability assessment
- heat vulnerability in Alameda County:
<https://data.acgov.org/datasets/063725ccf3214fcc9d74d3fe05eae9e5>
- Census data, employment rates (state and national), employee surveys (governmental/public), etc...
- APEN has done some analysis on various vulnerability measuring tools -
https://apen4ej.org/wp-content/uploads/2019/10/APEN-Mapping_Resilience-Report.pdf
- there has been some indication that US EPA might update their EJSCREEN tool with the new admin coming on board — will be something to watch out for