Welcome to the *Climate-Safe Infrastructure* Webinar Series

Supporting AB2800 and the Work of California's Climate-Safe Infrastructure Working Group

June 8, 2018 | 12-1pm

CALIFORNIA natural resources AGENCY

Hosts

Juliette Finzi Hart | USGS

Co-Facilitator of CSIWG's work

Email: jfinzihart@usgs.gov

Susi Moser | Susanne Moser Research & Consulting

Co-Facilitator of CSIWG's work

Email: promundi@susannemoser.com

AB 2800 (Quirk): Purpose

Examine how to integrate scientific data concerning projected climate change impacts into state infrastructure engineering, including oversight, investment, design, and construction.

AB2800 Working Group and Support Team

Co-Facilitators

Juliette Finzi Hart
USGS

Susi Moser
Susanne Moser
Research & Consulting

The Climate-Safe Infrastructure Working Group

Amir Aghakouchak
UC-Irvine

Bruce Swanger
Cal-Trans

Chester Widom
DGS, State Architect

Cis Liban
L.A. Metro

Dan Cayan
UC-San Diego, SIO

David Groves
RAND

Nancy Ander
DGS, Off. of Sustain.

Deb Niemeier
UC-Davis

James Deane
High-Speed Rail Auth.

John Andrew
DWR

Kristin Heinemeier
Realized Energy

Kyle Meng
UC-Santa Barbara

Martha Brook
CEC

Noah Diffenbaugh
Stanford

Gurdeep Bhattal
Cal-Trans

Robert Lempert
RAND

Project Team

Keali'i Bright
Natural Resources
Agency

Elea Becker Lowe
Natural Resources
Agency

Joey Wall
Natural Resources
Agency

Guido Franco
California Energy
Commission

AB 2800 (Quirk): Scope of Assessment and Recommendations

The working group shall consider and investigate, at a minimum, the following issues:

(1) **informational and institutional barriers** to integrating climate change into infrastructure design.

(2) **critical information needs** of engineers.

(3) **selection of appropriate engineering designs** for different climate scenarios.

The *Climate-Safe Infrastructure* Webinar Series

Purpose

- Hear from others elsewhere with relevant experience and expertise.
- Hear from CSIWG members.
- Educate and engage with interested stakeholders on climate change and infrastructure issues.

Sample of Webinar Topics

- What climate science can offer
- Various sectoral perspectives
- Processes of changing engineering standards and guidelines
- Holistic infrastructure planning and management
- Financing climate-safe infrastructure
- And others…

A Couple of Housekeeping Items

- Please type your questions for presenters into the chat box
- We will try to answer as many as possible after the presentations
- Answers to remaining questions will be posted on the website
- Thank you to USC Sea Grant!

Tools Supporting Climate-Safe Infrastructure Design

David Groves
RAND Corporation
CSIWG Member

Wes Sullens
US Green Building Council

Kristin Baja
Urban Sustainability Director's Network

Developing Climate Safe Infrastructure Under Deep Uncertainty

Climate Safe Infrastructure Working Group Webinar

June 8, 2018

David Groves, Ph.D.
Co-Director Water and Climate Resilience Center (www.rand.org/water)

What is Climate Safe Infrastructure?

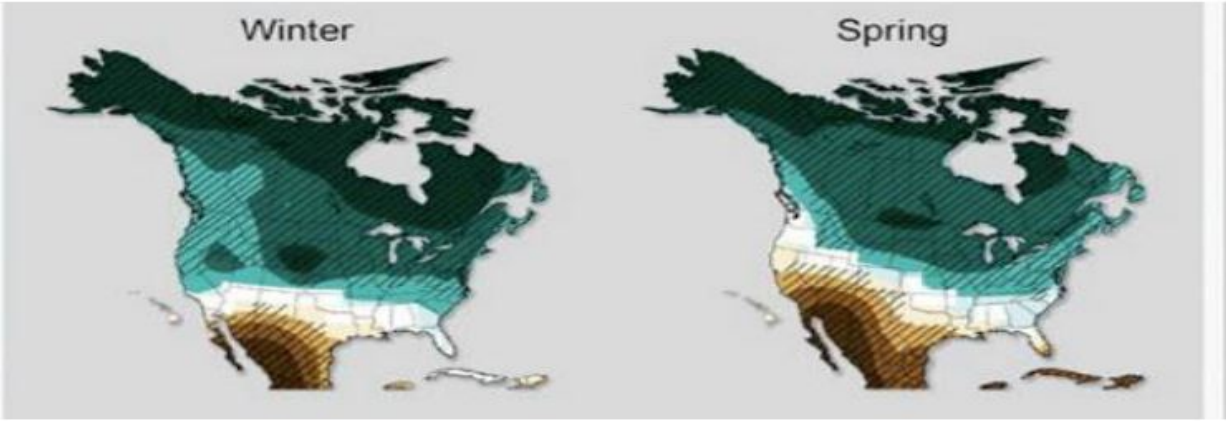
It encompasses:

Resilience + **Robustness**

- Withstands and/or recovers from climate related shocks now and in the future
- Achieves resilience over a wide range of plausible but uncertain futures

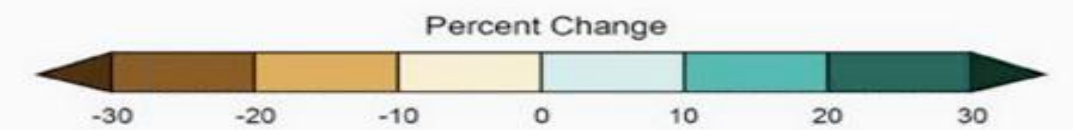
How the climate will change in the future is highly uncertain

IPCC Fifth Assessment report multi-model projections of precipitation changes



Lower emissions scenario
(RCP 2.6)

Higher emissions scenario
(RCP 8.5)



How the climate will change in the future is highly uncertain

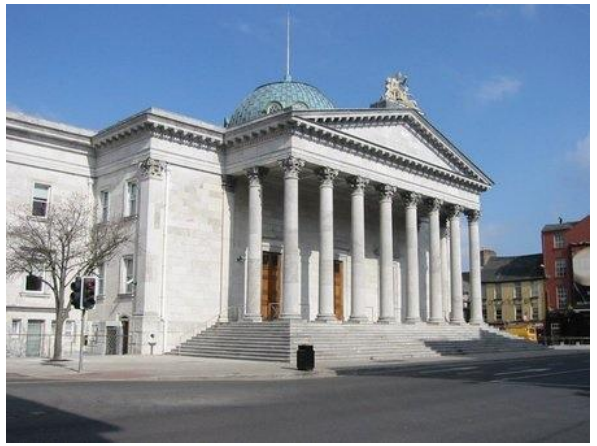
IPCC Fifth Assessment report multi-model projections of precipitation changes

What is resilient for one plausible future…

May not be resilient for another plausible future.

Other factors are also uncertain and difficult to predict

- **Demographic patterns**
- **Technology**
- **Legal and regulatory landscape**
- **Performance of some types of infrastructure**



Decisionmaking Under Deep Uncertainty (DMDU) Methods Can Help Design Robust Infrastructures

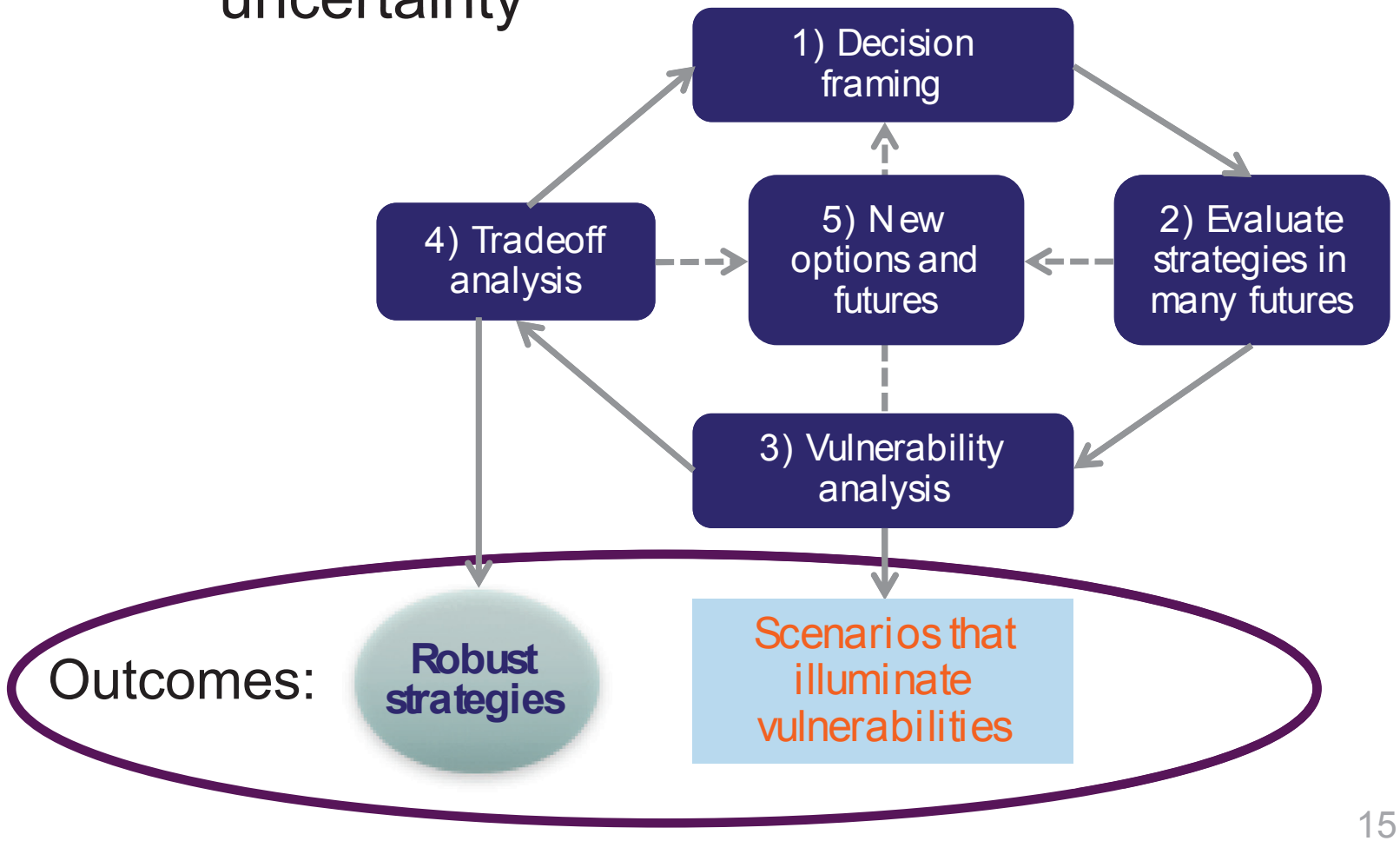
- Qualitative approaches
  - Scenario Planning
  - Assumption Based Planning
- Quantitative approaches
  - Robust Decision Making (RDM) and related approaches

Robust Decision Making (RDM)

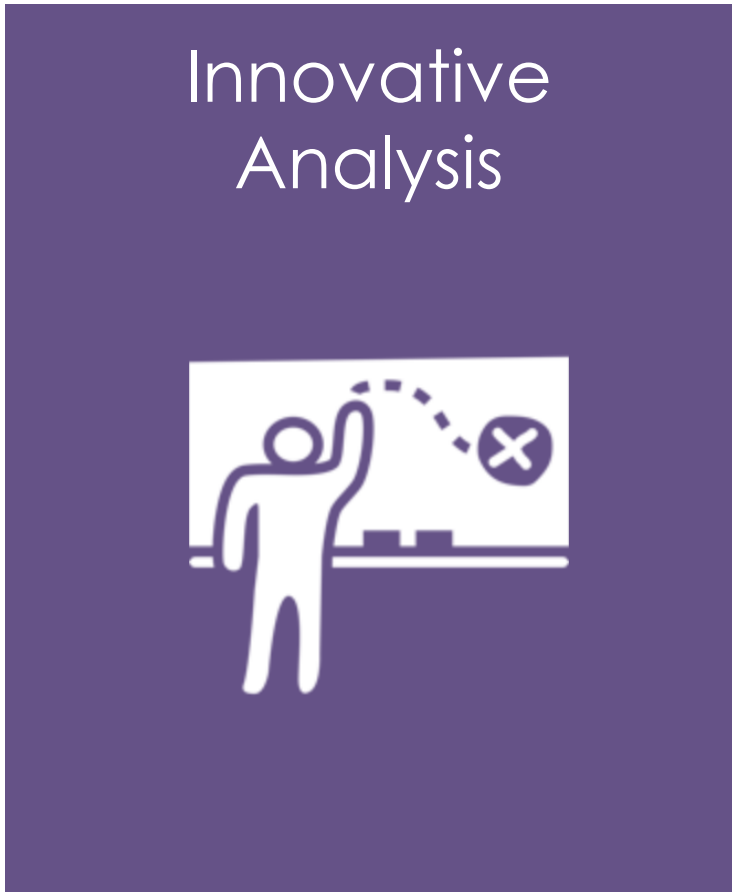
RDM is an iterative analytic process, often used in engagements with stakeholders, designed to support decision making under deep uncertainty

Key idea -- conduct the analysis "backwards":

- Start with strategy
- Use analytics to identify scenarios where strategy fail to meet its goals
- Use these scenarios to identify and evaluate responses



RDM embodies "Deliberation with Analysis"— a combination of analysis and participatory planning



Informing Decisions in a Changing Climate (National Research Council, 2009)

Example of Climate-Safe Infrastructure Planning using RDM

Does Considering Climate Change Suggest an Alternative Project Design?

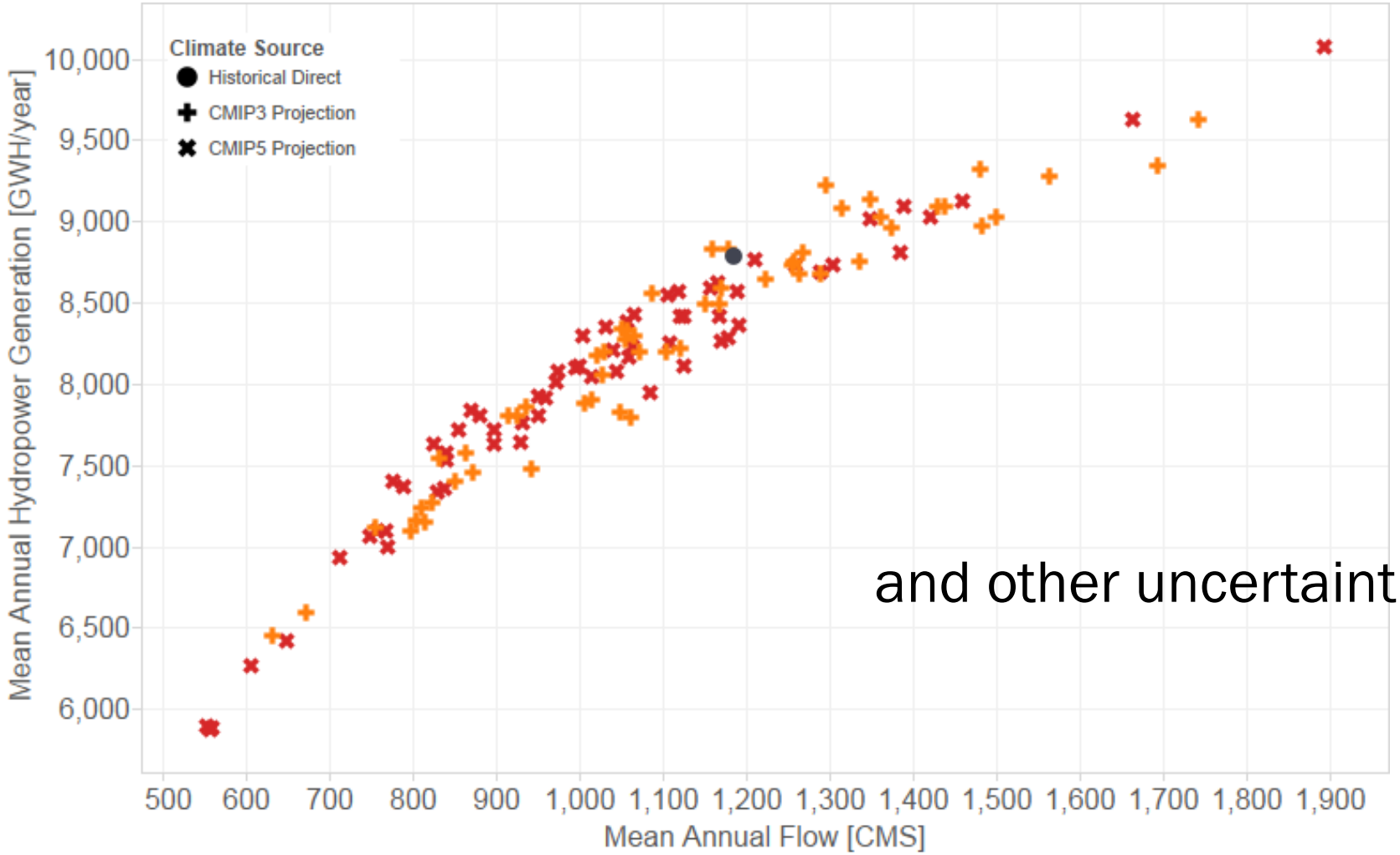
- Batoka Gorge, Zambezi River
- 181 meter-high dam; 1,680
  - Eight turbines
  - 1600 MW capacity
- Baseload and peaking capacity benefits
  - Zambia
  - Zimbabwe

Alternative Infrastructure Designs Considered

- Facility size (dam height and storage capacity)
- Facility capacity (turbines, transfer volumes)

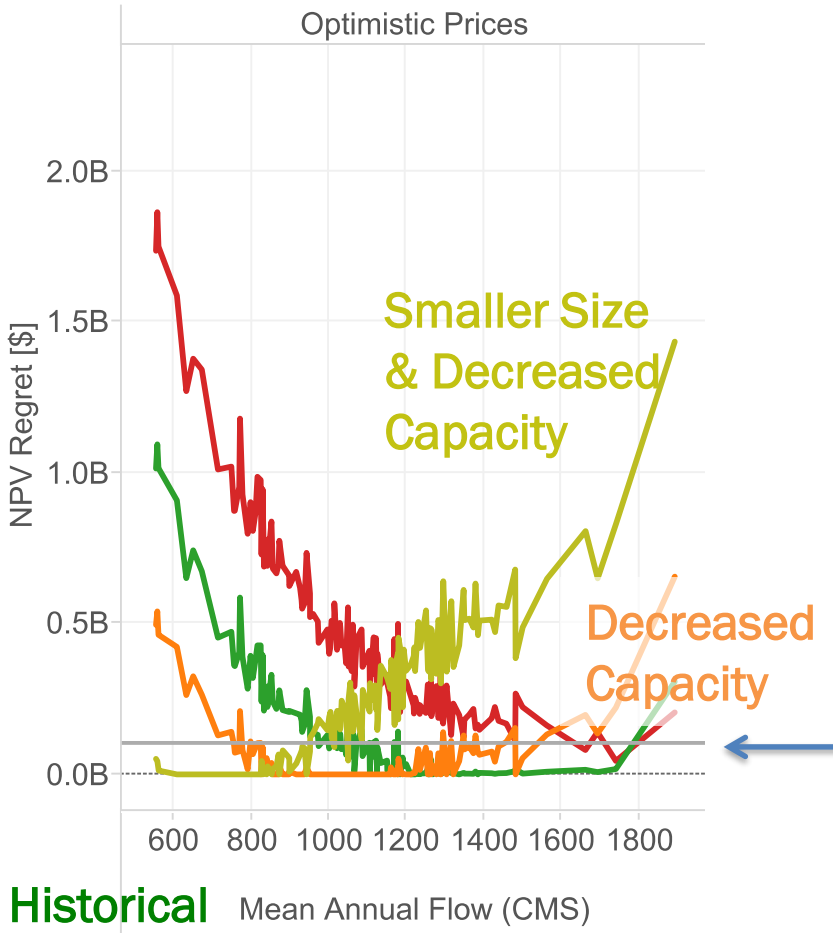
Simulation Models Evaluated the Vulnerability of Current Design to Wide Range of Plausible Futures

- 145 different climate futures



and other uncertainties…

Success of Dam Design Depends on the Expected Flow and Power Purchase Agreement



$1 billion regret threshold

Historical Optimal Design

Success of Dam Design Depends on the Expected Flow and Power Purchase Agreement

Robustness analysis suggest that “Decreased Capacity” is more robust and climate-safe, as it reduces high regret over a wide range of plausible climate futures.

In Conclusion….

- Developing climate-safe infrastructure requires a consideration of deep uncertainties
- New methods exist to identify robust designs
- Some robust designs reduce regret over a wide range of plausible conditions through different specifications
- Other robust designs incorporate adaptations to ensure resilience over plausible futures

Leadership Tools for the Built Environment

Presented to the California Climate-Safe Infrastructure Working Group

June 8, 2018

Wes Sullens Director, Codes Technical Development

USGBC's mission is naturally aligned with climate resilience objectives

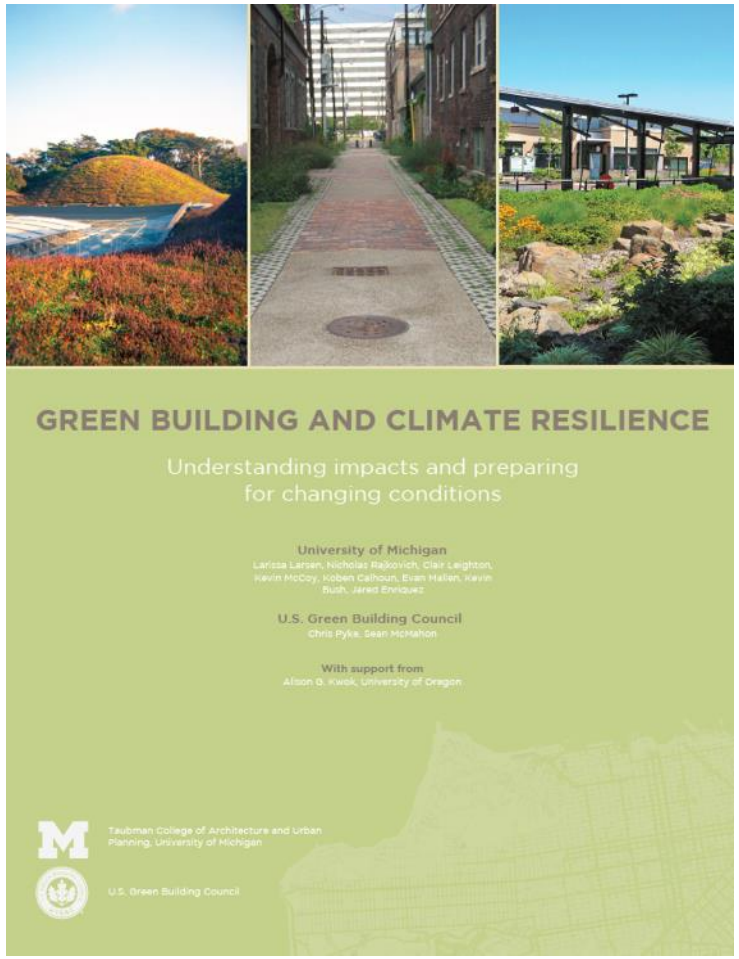
To transform the way buildings and communities are designed, built and operated, enabling an environmentally and socially responsible, healthy, and prosperous environment that improves the quality of life for all.


19.35 BILLION+ SQUARE FEET
91,000+ COMMERCIAL PROJECTS
2.2 MILLION+ SQUARE FEET DAILY
LEADERSHIP IN ENERGY & ENVIRONMENTAL DESIGN
LEED
164 COUNTRIES AND TERRITORIES

USGBC's growing suite of third-party certification tools include resilience design, planning, management, and performance

- **LEED:** for design and operations of buildings and transit systems
- **PEER:** for power system performance & electricity infrastructure
- **Sustainable SITES Initiative:** for landscapes and public spaces
- **ParkSmart:** for parking structure management, programming, design and technology
- **RELi:** for integrative resilience planning in neighborhoods, buildings, homes and infrastructure
- **GRESB:** for assessing the sustainability performance of real estate and infrastructure portfolios and assets worldwide

LEED & Climate Resilience



https://www.usgbc.org/resources/leed-climate-resilience-screening-tool

Analysis

Click to reset to original USGBC data

Home | User Guide | Dashboard | Results

		Rationale: Climate Sensitivity	Rationale: Climate Adaptation Oppo
Rating System	Credit Code		
LEED NC v4	SSp1	prerequisite outcome is not sensitive to climate conditions	soil stabilization measures should be specific to local climate risks and impac
LEED NC v4	SSc1	sites excluded may be located in climate sensitive zones (floodplain)	development locations should consider climate risk and improve selection st
LEED NC v4	SSc2	lands may be located in areas with high climate sensitivity (floodplain)	protection areas should be mapped according to local climate risks (floodpla
LEED NC v4	SSc3	credit outcome is not sensitive to climate conditions	open space requirements should consider climate risk (slope preservation/fl
LEED NC v4	SSc4	Rainwater management plans should account for extreme events, and are contingent on climate	rainwater designs should reflect more extreme events (drought/storms)
LEED NC v4	SSc5	credit outcome is not sensitive to climate conditions	pervious or reflective surface selection should be dependent on local climate
LEED NC v4	SSc6	credit outcome is not sensitive to climate conditions	no climate adaptation opportunity for this credit
LEED NC v4	WEp1	prerequisite outcome is not sensitive to climate conditions	water use reduction baselines should differ in regions dependent on local wa
LEED NC v4	WEp2	prerequisite outcome is not sensitive to climate conditions	water use reduction baselines should differ in regions dependent on local wa
LEED NC v4	WEp3	prerequisite outcome is not sensitive to climate conditions	credit outcome could lead to increased water conservation measures
LEED NC v4	WEc1	credit outcome is not sensitive to climate conditions	water use reduction baselines should differ in regions dependent on local wa
LEED NC v4	WEc2	credit outcome is not sensitive to climate conditions	water use reduction baselines should differ in regions dependent on local wa
LEED NC v4	WEc3	credit outcome is not sensitive to climate conditions	credit outcome could lead to increased water conservation
LEED NC v4	WEc4	credit outcome is not sensitive to climate conditions	credit outcome could lead to increased water conservation measures
LEED NC v4	EAp1	prerequisite outcome is not sensitive to climate conditions	commissioning should consider climate adaptation opportunities and risks (ir
LEED NC v4	EAp2	minimum energy performance is contingent on climate conditions (extreme heat/cold)	energy efficiency performance could be improved with climate adaptation st
LEED NC v4	EAp3	credit outcome is not sensitive to climate conditions	M&V plans should consider climate adaptation opportunity and risks (increas
LEED NC v4	EAp4	prerequisite outcome is not sensitive to climate conditions	no climate adaptation opportunity for this prerequisite
LEED NC v4	EAc1	credit outcome is not sensitive to climate conditions	commissioning should consider climate adaptation opportunities and risks (ir
LEED NC v4	EAc2	energy performance standards should consider climate zone sensitivity (extreme heat/cold)	energy performance standards should consider climate conditions and offse
LEED NC v4	EAc3	credit outcome is not sensitive to climate conditions	Credit outcome could lead to increased energy performance

https://www.usgbc.org/resources/green-building-and-climate-resilience-understanding-impacts-and-preparing-changing-conditi

Examples of Resilient LEED Buildings

MARCH 2018

POLICY BRIEF

PROFILES OF RESILIENCE: LEED IN PRACTICE

As part of our commitment to building a more resilient future for the built environment, USGBC defines resilience as "**the ability to prepare and plan for, absorb, recover from, and more successfully adapt to adverse events**." To meet this goal, USGBC is driving resilience in more ways than one by making buildings more sustainable, durable, and functional through the application of LEED. Through integrative design and key credits, LEED guides project teams to invest in climate adaptation strategies to enhance building and community resilience.

This brief dives into several examples of LEED-certified buildings that have been tested and have demonstrated exceptional resilience. These LEED project teams attest that the LEED process – including purposeful design and third-party validation – has helped these projects achieve critical resilience outcomes.

ÁLVAREZ-DÍAZ & VILLALÓN OFFICES

SAN JUAN, PUERTO RICO

Originally built in the early twentieth century, the building that is home to the offices of Álvarez-Díaz & Villalón (AD&V) was renovated in 2013 to maximize sustainability and resilience. In 2014, the AD&V offices became the first architecture and interior design firm in Latin America to earn LEED Platinum certification. The resilient features of both the office space and the building at large (outlined below), contributed to its quick recovery from Hurricane Maria in 2017.

certification. Each energy conservation measure (ECM) implemented as part of the project's renovation helped contribute to overall greater efficiency, cost savings, and a shorter period required to restore building operations.

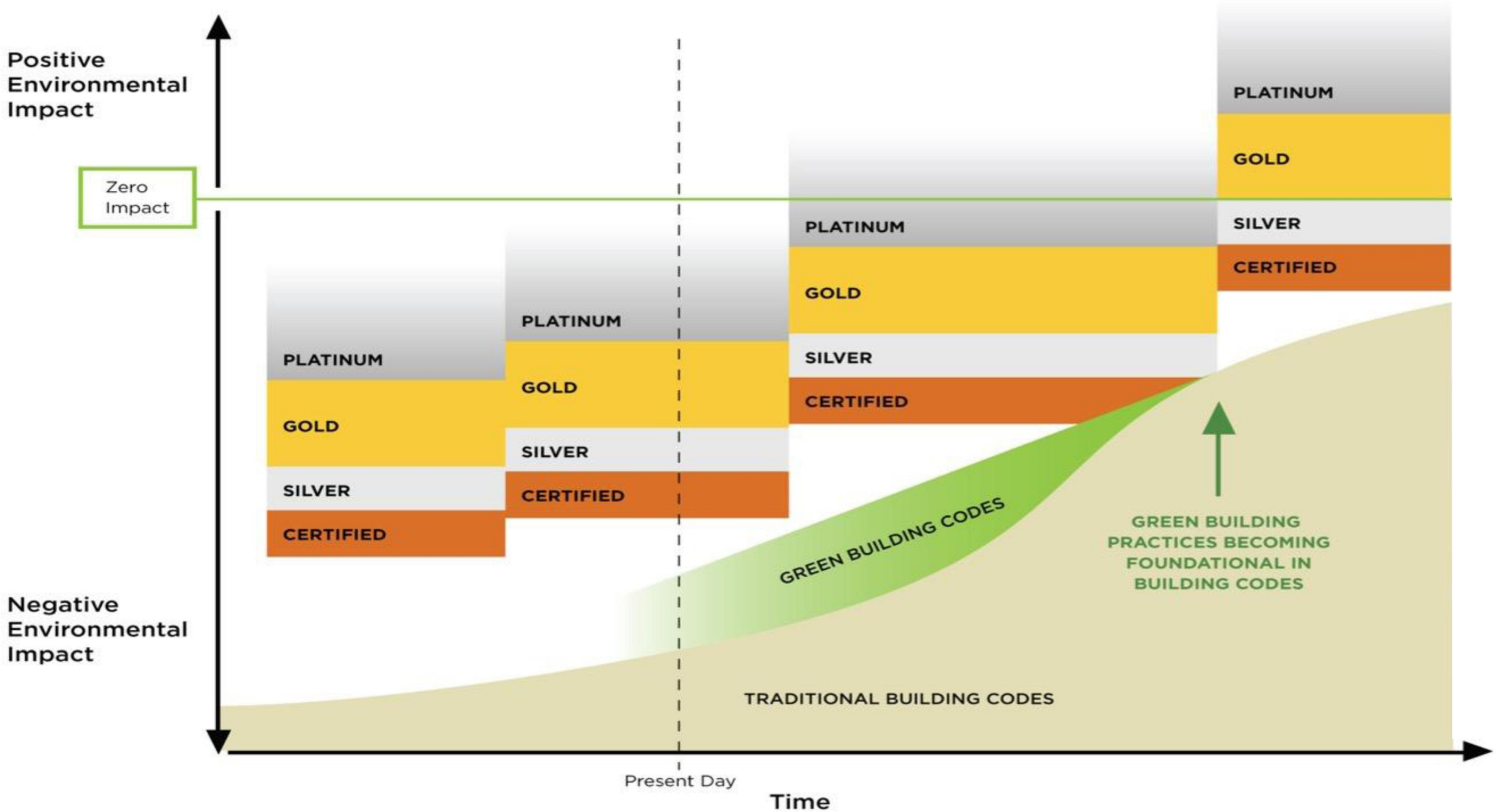
AD&V Offices

Following the devastation of Hurricane Maria, the AD&V office space returned to a fully functional work space within a few days, a

https://www.usgbc.org/resources/profiles-resilience-leed-practice

First Pilot of LEED for Transit: Delhi Metro Rail Corporation

Rating Systems	Buildings (Depots)	Stations	Line
LEED for Building Design & Construction (BD+C)	X		
LEED for BD+C Transit		X	
LEED for Operations & Maintenance (O+M)	X		
LEED O+M Transit		X	
LEED for Transit Line			TBD


Positive Environmental Impact
Zero Impact
PLATINUM
GOLD
SILVER
CERTIFIED
PLATINUM
GOLD
SILVER
CERTIFIED
PLATINUM
GOLD
SILVER
CERTIFIED
PLATINUM
GOLD
SILVER
CERTIFIED
GREEN BUILDING CODES
GREEN BUILDING PRACTICES BECOMING FOUNDATIONAL IN BUILDING CODES
TRADITIONAL BUILDING CODES
Negative Environmental Impact
Present Day
Time

2018: LEED Recognition for California Projects

www.usgbc.org/green-codes

These LEED v4 Prerequisites & Credits are pre-approved for many commercial buildings in California:

LEED v4 Building Design + Construction (BD+C)

SS Prerequisite: Construction Activity Pollution Prevention
SS Credit: Light Pollution Reduction (1 Point, Option 1)
WE Prerequisite: Outdoor Water Use Reduction
WE Prerequisite: Indoor Water Use Reduction
WE Prerequisite: Building-Level Water Metering
WE Credit: Outdoor Water Use Reduction (1 Point, Option 2)
WE Credit: Indoor Water Use Reduction (1 Point)
EA Prerequisite: Fundamental Commissioning & Verification
EA Prerequisite: Minimum Energy Performance
EA Prerequisite: Building-Level Energy Metering
EA Prerequisite: Fundamental Refrigerant Management
EA Credit: Optimize Energy Performance (1 Point, Option 1)
MR Prerequisite: Storage and Collection of Recyclables
MR Prerequisite: Construction & Demolition Waste Mgmt. Planning
MR Credit: C&D Waste Management (1 Point, Option 1)
EQ Prerequisite: Minimum Indoor Air Quality Performance
EQ Prerequisite: Environmental Tobacco Smoke Control
EQ Credit Construction Indoor Air Quality Management Plan (1 point)

LEED v4 *Interior* Design + Construction (ID+C)

WE Prerequisite: Indoor Water Use Reduction
WE Credit: Indoor Water Use Reduction (up to 2 Points)
EA Prerequisite: Minimum Energy Performance
EA Prerequisite: Fundamental Refrigerant Management
EA Credit: Optimize Energy Performance (1 Point, Option 1)
MR Prerequisite: Storage & Collection of Recyclables
MR Prerequisite: C&D Waste Management Planning
MR Credit: C&D Waste Mgmt. (1 Point, Option 1)
EQ Prerequisite: Minimum Indoor Air Quality Performance
EQ Prerequisite: Environmental Tobacco Smoke Control
EQ Credit: Construction Indoor Air Quality Mgmt. Plan (1 point)

Additional Streamlining Available:

LEED for Homes v4 (single family and midrise) streamlining
California Energy Code scoring pathway for LEED projects

Summary & Recommendations

- *USGBC and our allies can help define and certify leadership on climate safe infrastructure.*
- *We recognize California's important global role and are striving to better recognize your leadership in our tools.*
- *We urge the CSIWG to consider compatibility and leveraging tools like LEED in its recommendations and actions.*

THANK YOU!

Wes Sullens, LEED Fellow
Director, Codes Technical Development
wsullens@usgbc.org
Based in the Bay Area of California

U.S. Green Building Council
2101 L Street NW, Suite 500
Washington, DC 20037
Web: www.usgbc.org
Main: 202.828.7422

Links & Resources:

- USGBC resources on Resilience
  - LEED & Resilience fact sheets
  - Multi-program policy brief
- LEED v4.1: new.usgbc.org/leed-v41
- LEED for Transit pilot rating system:
  - Guide to the rating system
  - Press release with DMRC
- PEER
- SITES
- RELi
- ParkSmart
- GRESB Resilience Module

Tools Supporting Climate-Safe Infrastructure Design

Connecting science with practitioners

Kristin Baja

Climate and Resilience Officer

USDN | urban sustainability directors network

Categories and Classes of Tools

Planning Tools

Incentive-Based Tools

Budgeting Tools

Equity Tools

Regulatory Tools

Tracking & Metrics Tools

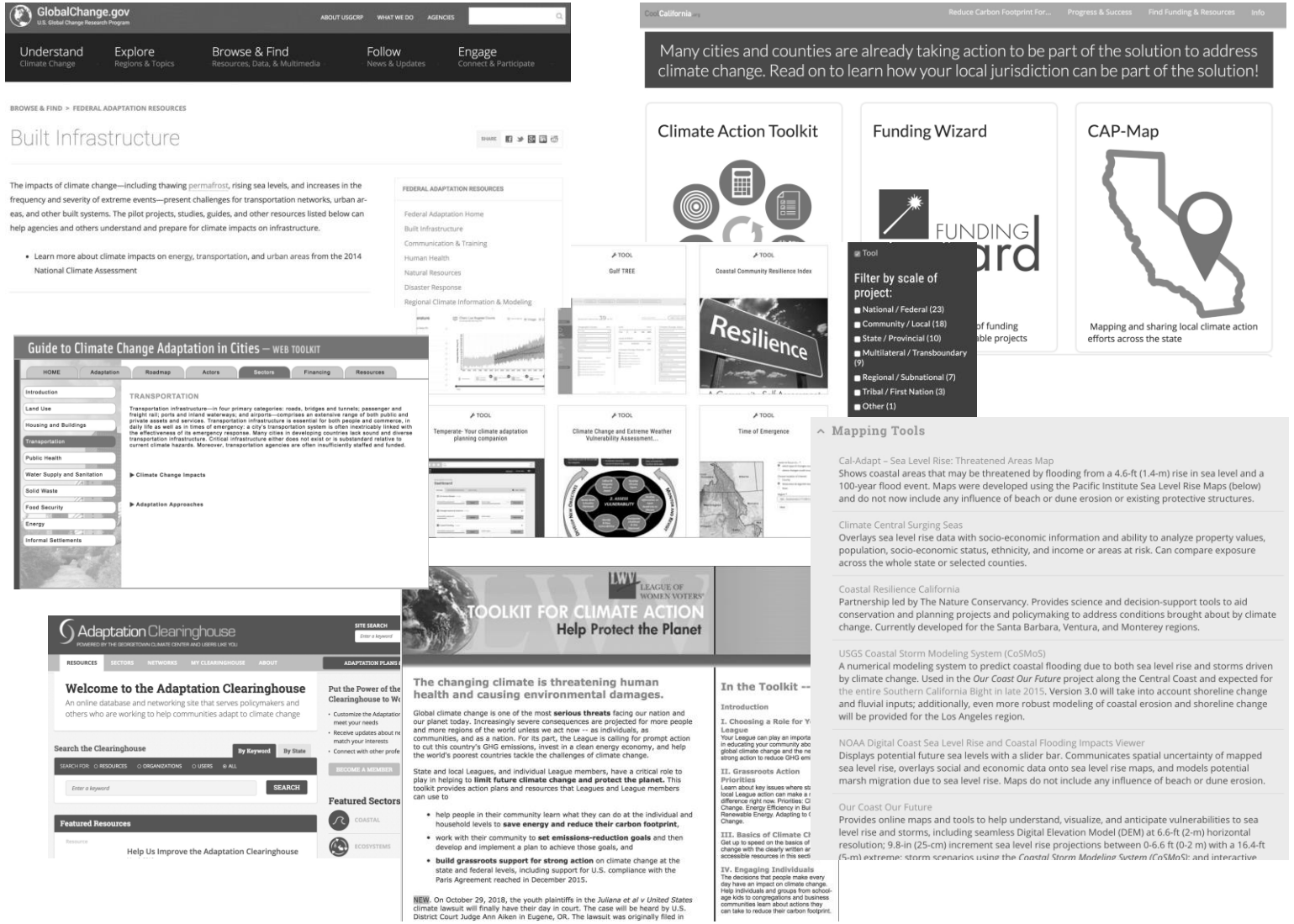
Investment Tools

Training Tools

Communications Tools

- Plan Development
- Conducting Assessments
- Development Incentives
- Financial Incentives
- Grant Finding Tools
- Capital Improvement
- Green Infrastructure
- Zoning Codes
- Building Codes
- Stormwater Ordinances
- Design Standards
- Racial Equity Lens for Adaptation Planning
- Communications & Behavior-Change
- Climate Resilience Toolkits
- Green Infrastructure Toolkits
- Climate 101 and 201 Series
- Climate Training with Games

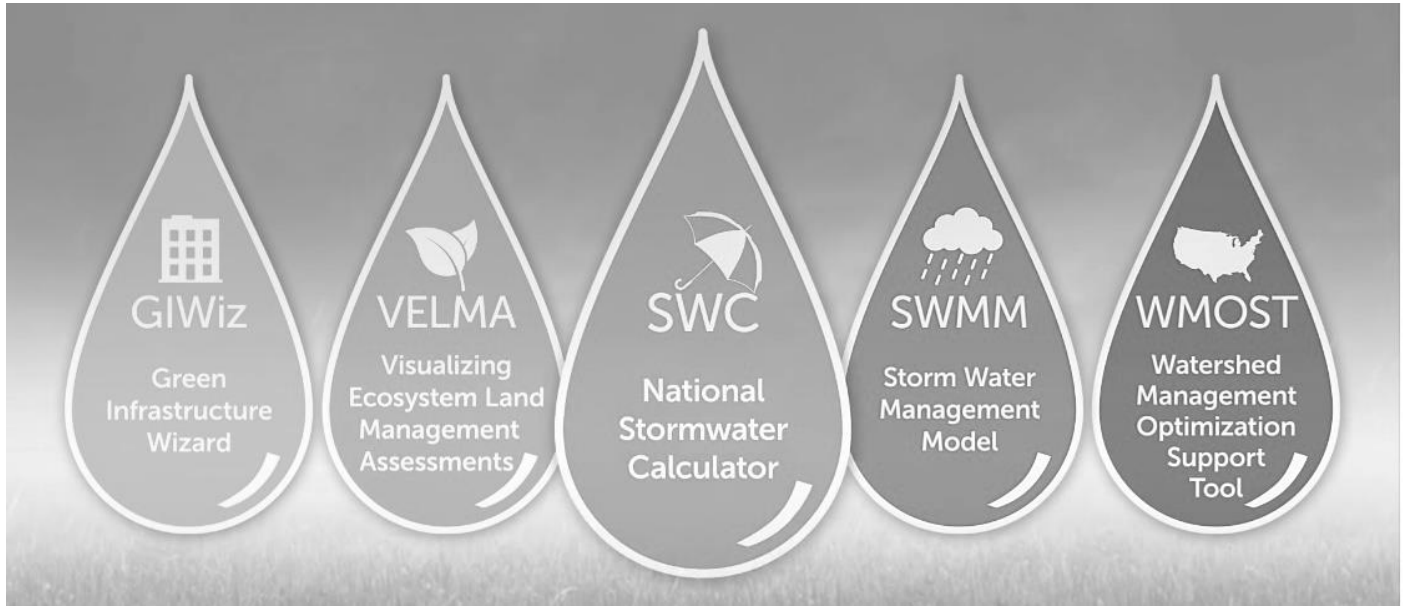
There are TOO many tools and not enough support to help use them effectively.



Above: A sample of the many Climate Toolkit Clearinghouse sites

There is also DUPLICATION which makes choosing a tool difficult and overwhelming

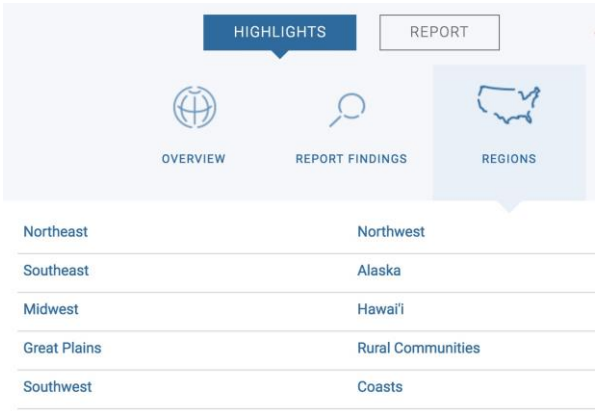
There are over **4,300** Green Infrastructure tools and resources available to practitioners.



Science

Currently science is provided by

- Sector
- Region



If CA requires state agencies to take into account the current and future impacts of climate change when planning, designing, building, operating, maintaining, and investing in state infrastructure.

<u>Need to change the way science is provided</u>

- Connect to end user needs
- Science must be translated
- Must consider multiple hazards, not just single hazards
- Must consider equity

Why do we use certain tools more than others?

Which tools are most used by practitioners and why?

- Easy to use
- Simple design (can't be overwhelming with # of materials)
- Peer recommendations - People trust their peers and people they know
- Meet the needs of practitioners & stakeholders
- Connect to existing structures and reporting requirements
- Consider and address complexities
- Integrate cost of inaction
- Connect to next steps to funding

Overcoming barriers to tool use

How do we begin to address barriers?

Co-development of the tool with the intended end user or stakeholder groups

- Ensures the tool meets the needs of the end user
- Helps tool developers identify effective layout and steps

Direct support in using the tool

- Step-by-step guidance for using the tool
- Provide direct one-on-one support and/or "hand hold" for beginner users

Tool must **consider differences** in end users

- Address differences in political will, budget/funding, socio-economic factors
- Tools must effectively integrate **equity**

Human Components of Tool Use

What will make a tool more useable?

How do we make people more comfortable using tools?

Training

Professional Development

Translation

Building and Sustaining Relationships

Building and Sustaining Trust

Design - simple design and easy to use and understand, visually

Human Components of Tool Use cont.

How do you demonstrate the benefit of a tool?

How do we know if a tool is actually helping the intended audience?

- Demonstrate the benefit of a tool or process through pilot projects
- Changes in decision-making or integration of the tool into processes
- Evaluation and metrics that prove success

Example
In California climate scientists sat with hydro dam operators for two years and assisted with running their models for water storage predictions based on a newer set of methods and approaches than what the operators were using.

Hydro operators were not willing to use the new data because they could lose their jobs if they messed up. It took two years to become more comfortable that the new method/approach and to understand it was better than their old way of doing things.

This happened by simply getting to know the researchers and seeing the better results with their own eyes.

Questions?

Kristin Baja
Climate and Resilience Officer
Urban Sustainability Directors Network
kristinbaja@usdn.org

USDN | urban sustainability directors network

Tools Supporting Climate-Safe Infrastructure Design

David Groves
RAND Corporation
CSIWG Member

Wes Sullens
US Green Building Council

Kristin Baja
Urban Sustainability Director's Network

Thank you!

- The ***Climate-Safe Infrastructure*** Webinar Series continues at least through July 2018
- Upcoming webinars:
  - Monitoring Performance – Working Toward Success – June 11
  - Financing the Future, Part 3 – late June
  - Talking Climate Change with Engineers – July 10 or 12
  - Track webinars and progress of CSIWG at: http://resources.ca.gov/climate/climate-safe-infrastructure-working-group/
- Questions: Joey Wall - Joseph.Wall@resources.ca.gov