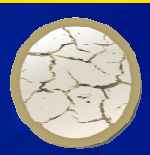
EXTREME CLIMATE RISKS AND CALIFORNIA'S FUTURE



EXTREME CLIMATE RISKS AND CALIFORNIA'S FUTURE

Confronting Climate Change

A Focus on Local Government
Impacts, Actions and Resources

EXTREME CLIMATE RISKS AND CALIFORNIA'S FUTURE

Local Governments and Climate Adaptation Planning

Louise Bedsworth
Governor's Office of Planning and Research

Local Governments are Key Partners in Climate Adaptation Planning

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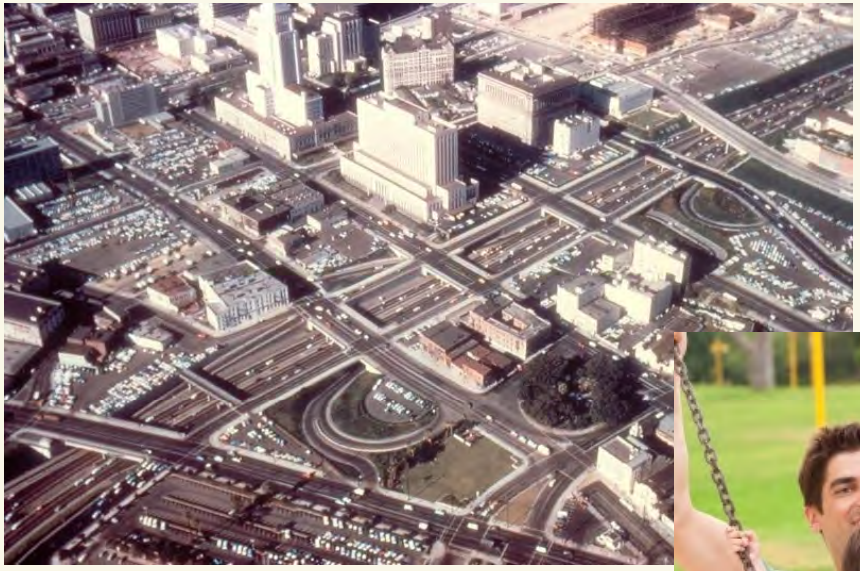

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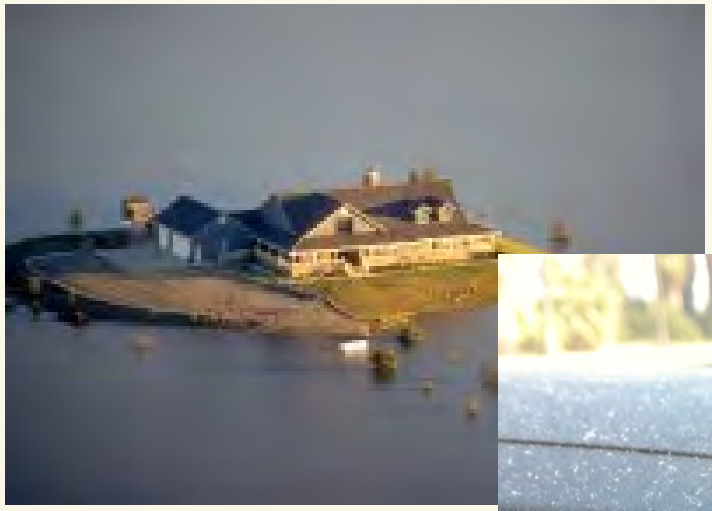

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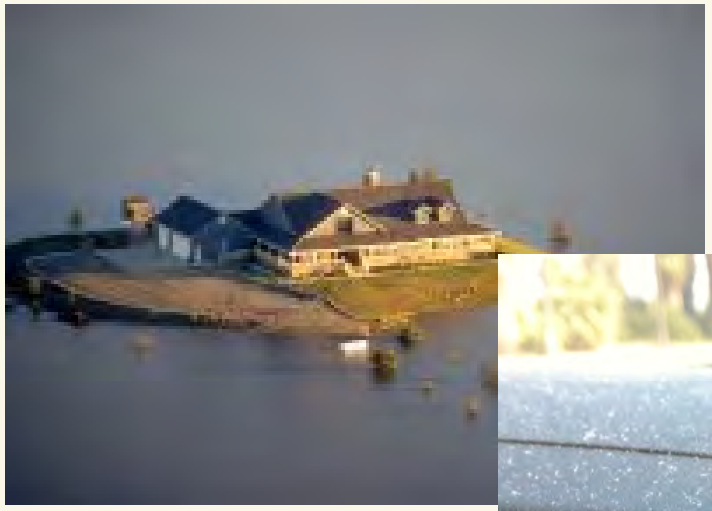
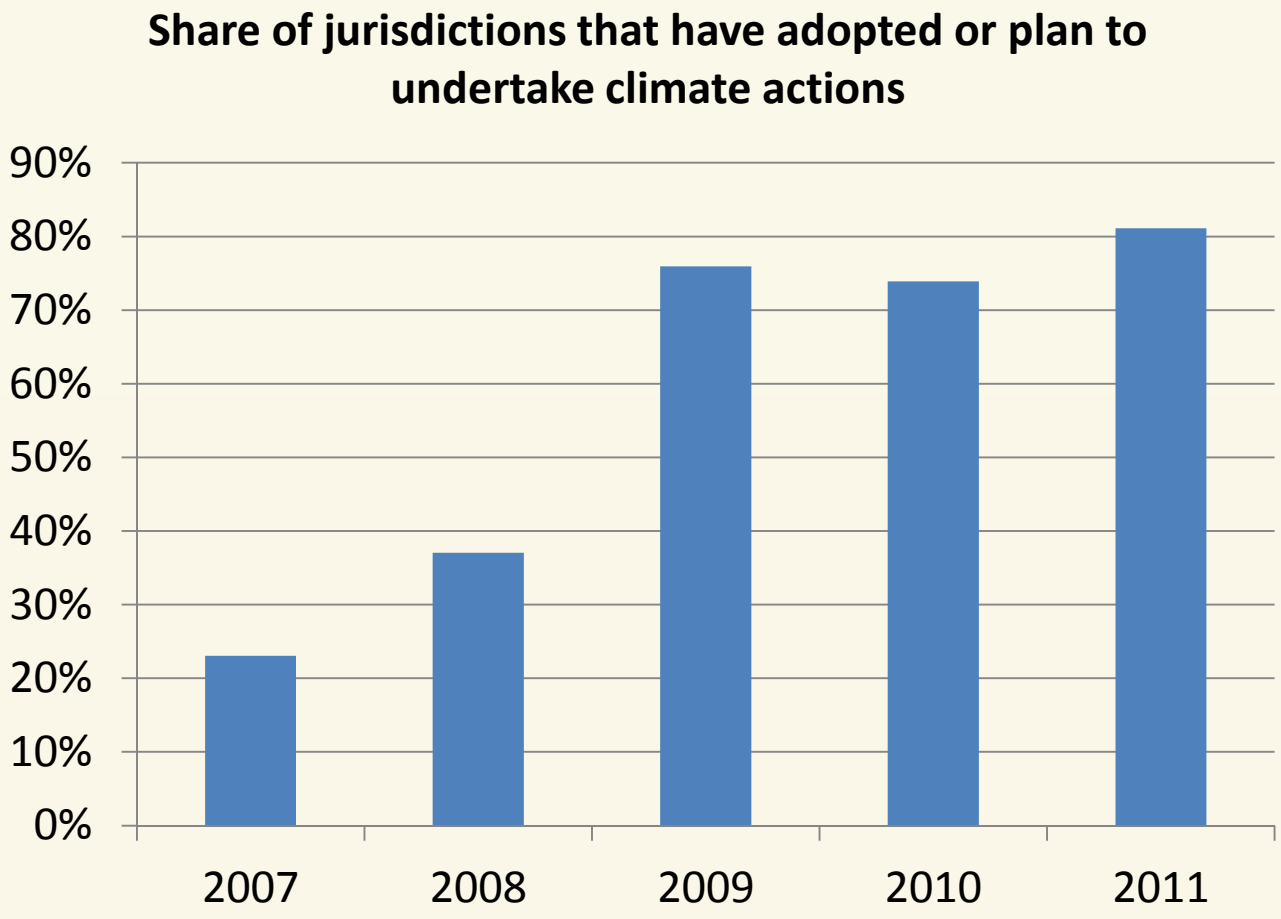
Local Governments are Key Partners in Climate Adaptation Planning

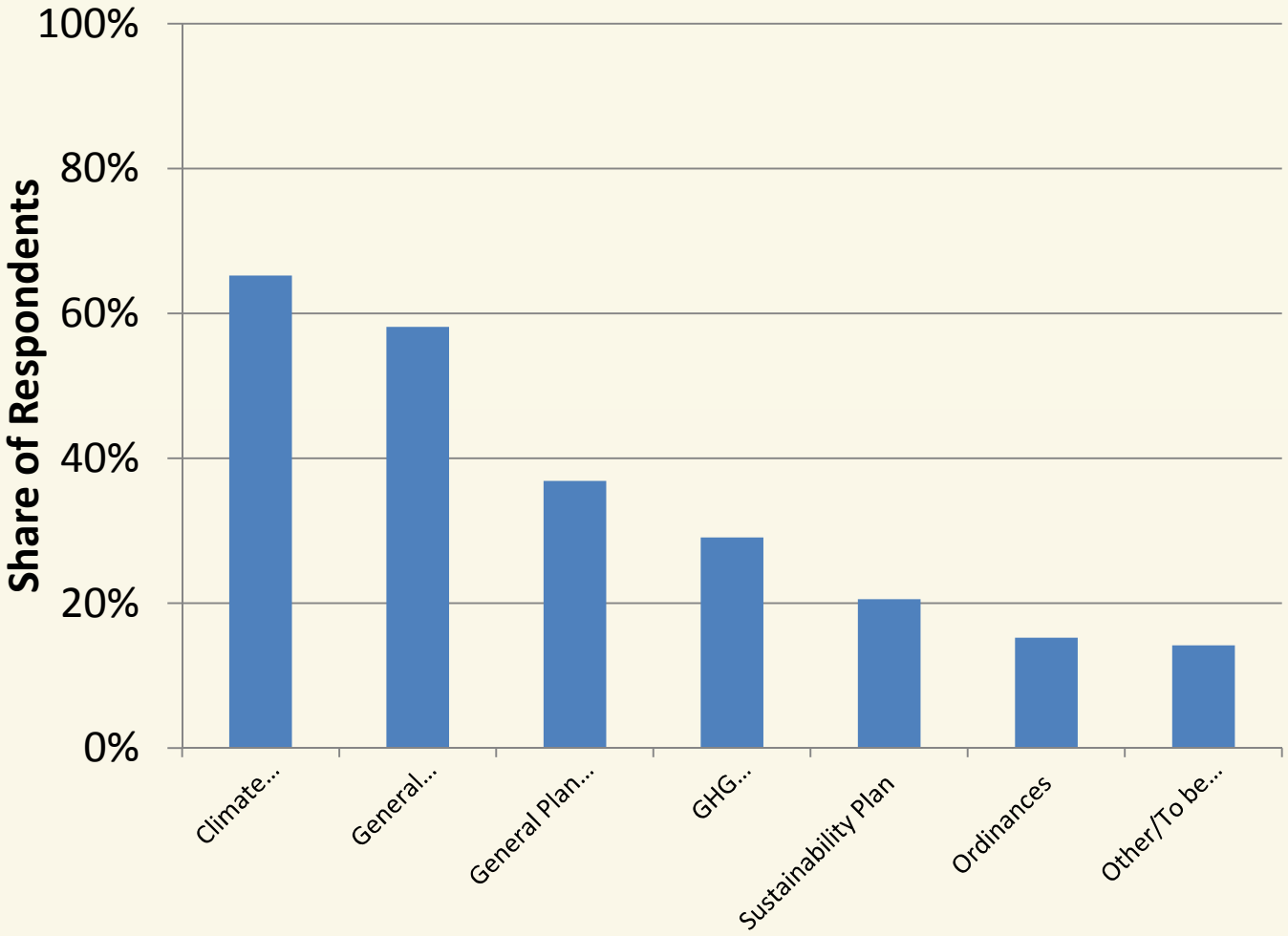


More and More Localities are Addressing Climate Change



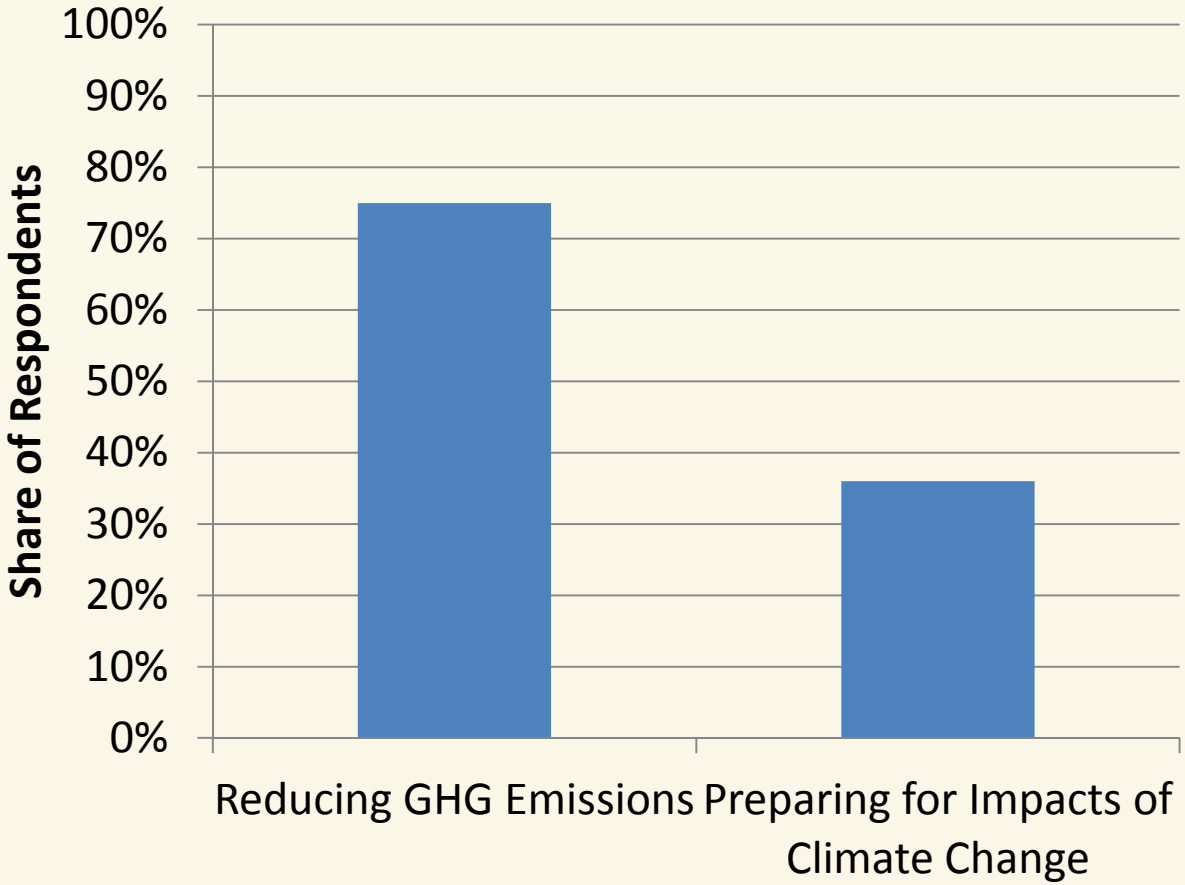
Source: OPR Annual Planners' Survey, 2007-2011

Climate Action is Taking Different Forms



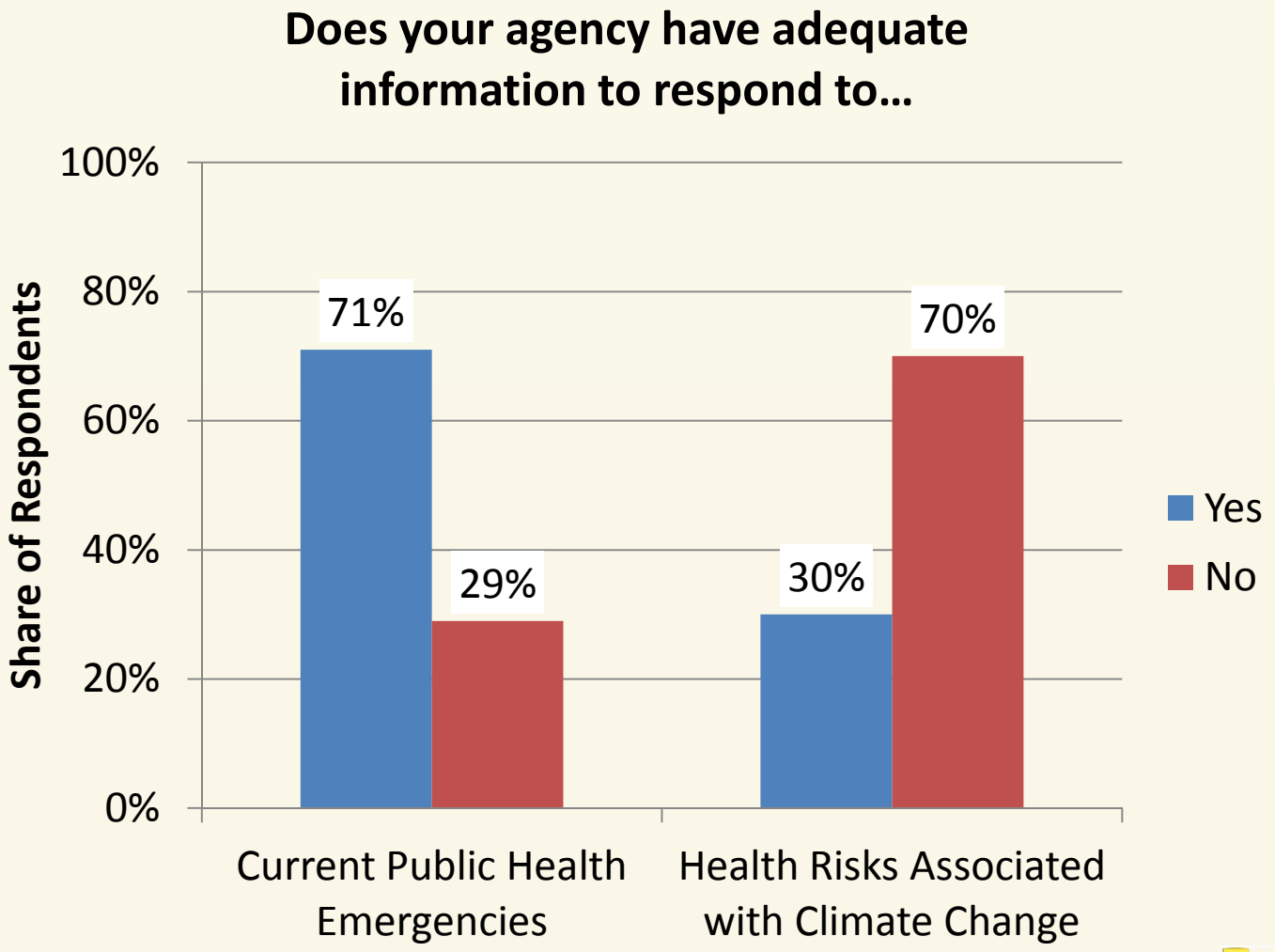
Source: 2011 OPR Planners' Survey

Local Action has Focused on Reducing GHG Emissions



Source: Hanak et al, 2008

Challenges to Climate Action Include Information and Resources



Source: Bedsworth, 2008

There are Successful Examples of How These Barriers Have Been Overcome

- Partnerships between regional organizations, academic institutions, business, and government
- Creative approaches to financing
- Education and outreach

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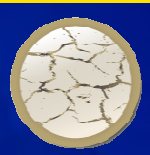

EXTREME CLIMATE RISKS AND CALIFORNIA'S FUTURE

Opening Remarks and Logistics

Michael McCormick
Governor's Office of Planning and Research

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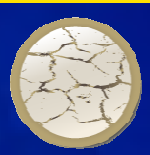

EXTREME CLIMATE RISKS AND CALIFORNIA'S FUTURE

Changing Paradigms in Climate Change Science

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Update on Climate Change Science:

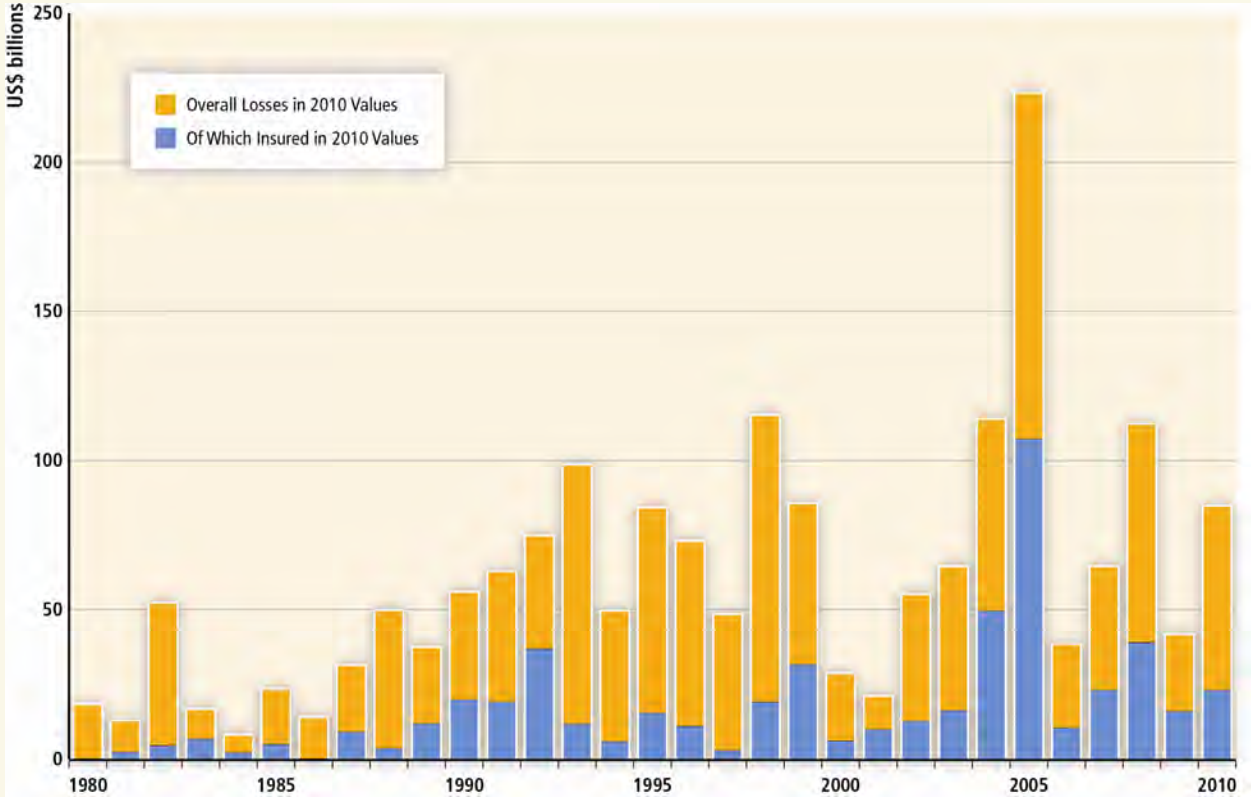
Drawing on the IPCC Special Report on Managing the Risks of Extreme Events and Disasters to Advance Climate Change Adaptation

Robert Lempert

RAND Pardee Center

IPCC SREX Report

Economic Losses from Climate-Related Disasters Have Increased Worldwide Over Recent Decades



Economic losses are greater in developed countries

Fatalities, and fraction of economy lost, are greater in developing countries

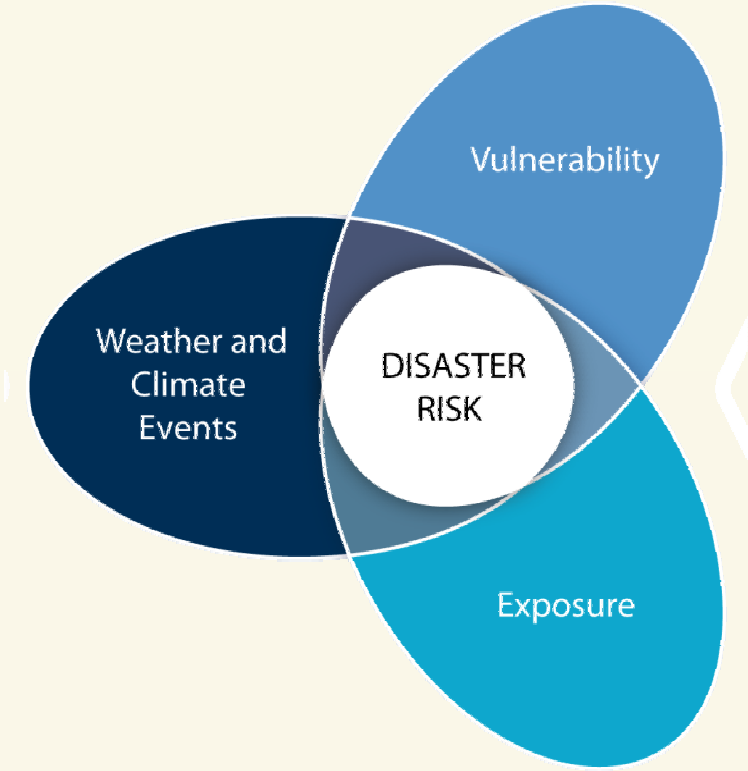
IPCC SREX

Three Key Factors Contribute to Climate-Related Disaster Risk

1) Climate Extremes:

The occurrence of a weather or climate event outside the expected norm

Note: Extreme impacts can occur from less than extreme events



IPCC SREX

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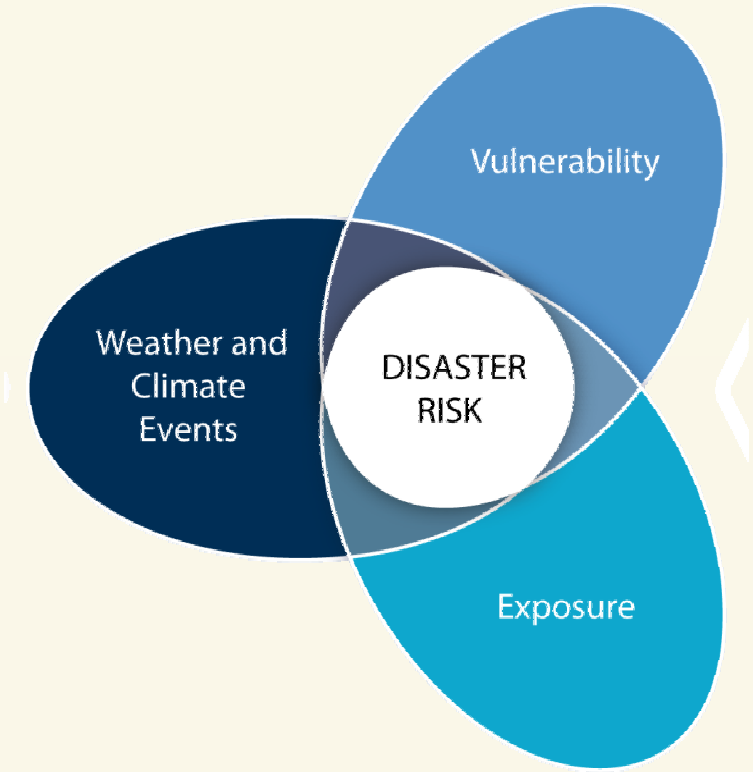
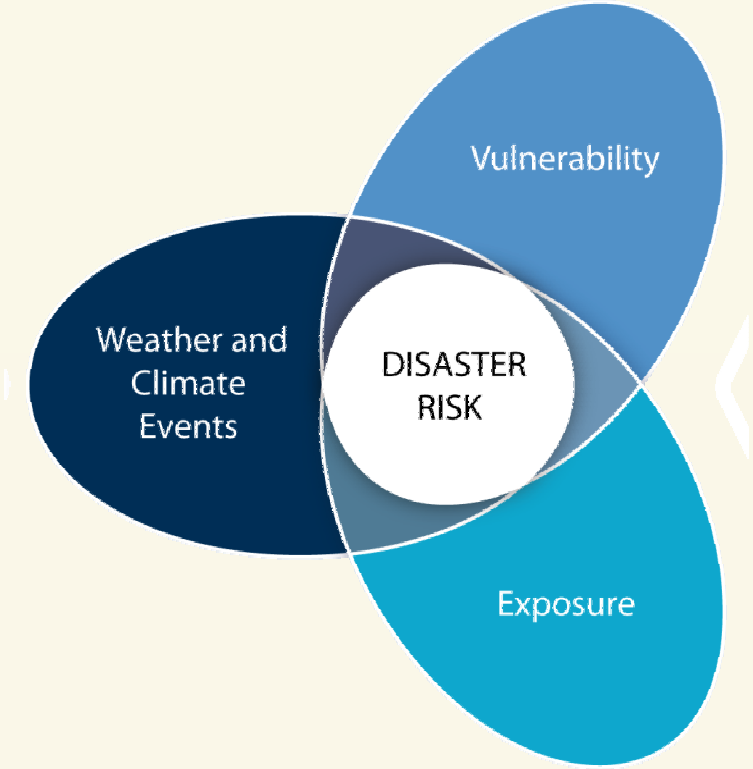


2) Vulnerability:

The predisposition of a person or group to be adversely affected

IPCC SREX

Increasing Exposure Has Been the Major Cause of Recent Increase in Climate-Related Disaster Risk



Source: Louisiana 2012 Coastal Master Plan

3) Exposure:

The presence of people and the things they care about in places that could be adversely affected

IPCC SREX

Frequency of Extreme Climate Events Will Change In The Future

Future changes include:

- More days with extreme temperatures
- Higher storm surges due to sea level rise
- More storms with heavy precipitation
- Increased wind speed of cyclone/hurricanes
- More intense droughts
- Changed El Nino patterns

High confidence in predictions

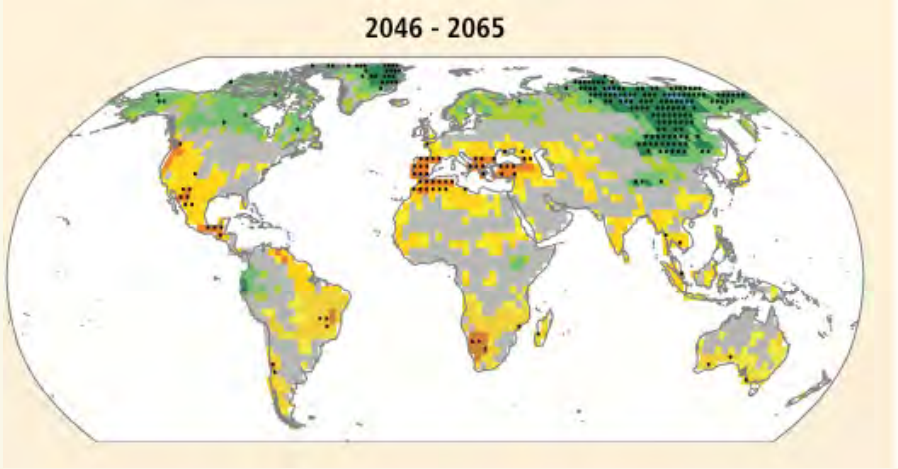
Less sure what may happen

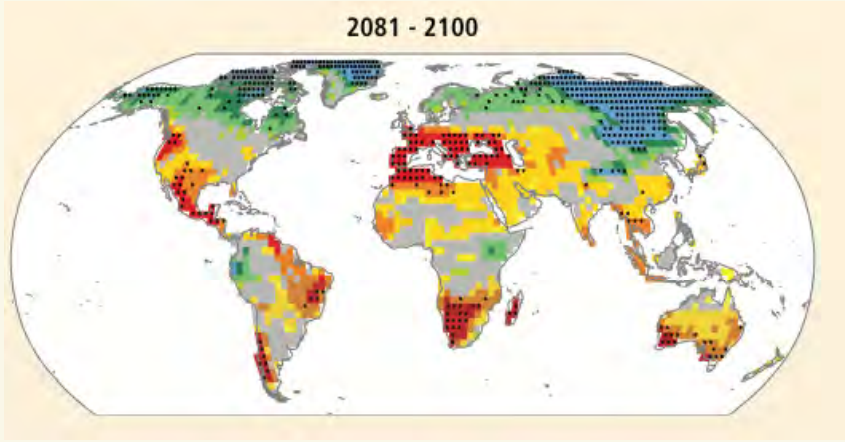
IPCC SREX

Drought Projections Are Uncertain, But Future Drought May Be An Important Source of Risk

Projected change in consecutive dry days

Results from 17 climate models

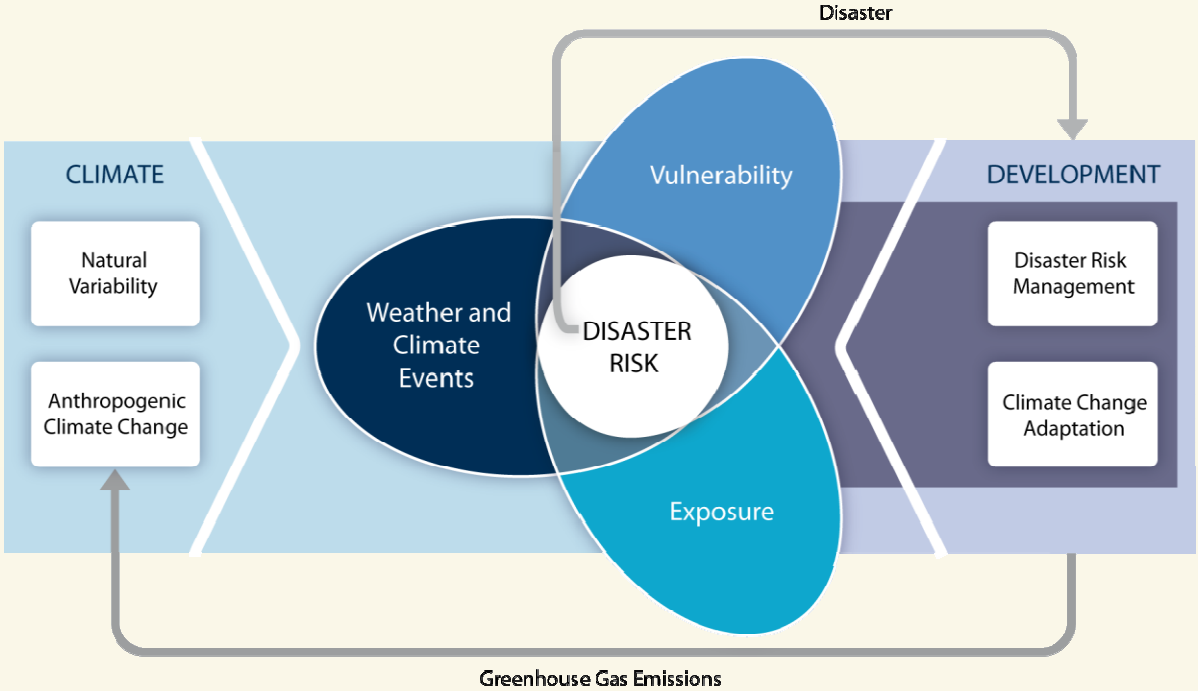




Stippling indicates 90% of models agree on sign of change
Grey shading indicates significant disagreement among models

IPCC SREX

Reducing Future Risk Requires Addressing Events, Vulnerability, and Exposure



Hard because:

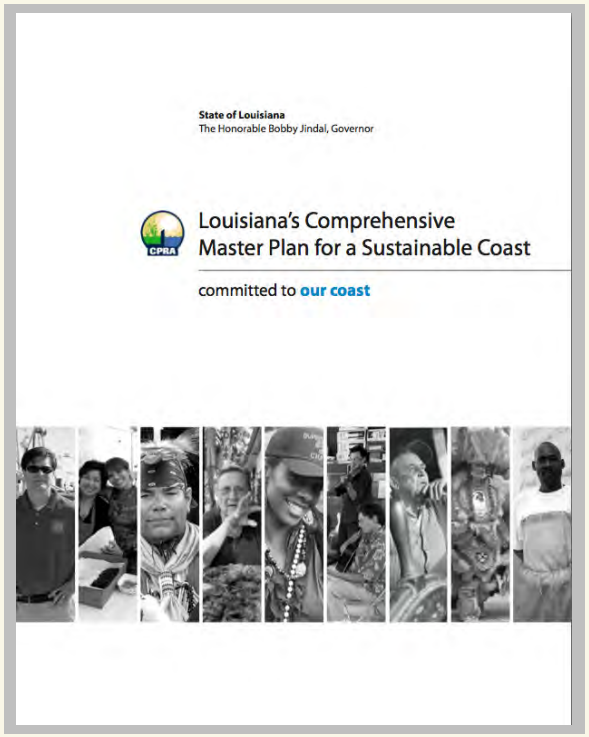
- Many factors are changing simultaneously
- Engineering solutions alone cannot effectively reduce risk
- Many different government agencies need to work closely together
- Seemingly helpful short-term actions may increase long-term risk

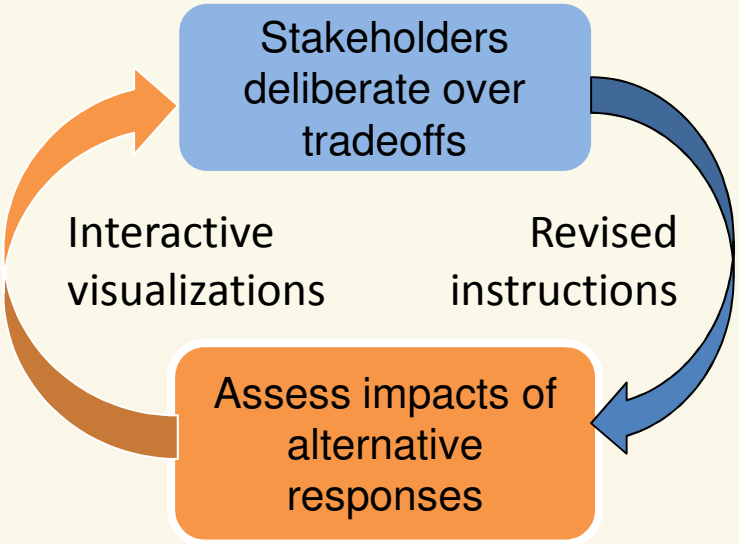
IPCC SREX

New Methods and Tools for Decision Support Can Help Implement Integrated, Science-Based Strategies

Louisiana faces increased flooding risk and serious coastal land loss due to sea level rise, land subsidence, lack of river-borne sediments, and any changes in storm intensity

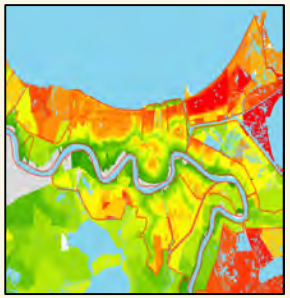
New decision support tools helped the state to develop a comprehensive coastal master plan that prioritizes responses to serve many competing objectives





RAND-Developed Planning Tool and Risk Assessment Model

Compares consequences of alternative combinations of 100's of responses



Estimates risk to different communities and industries

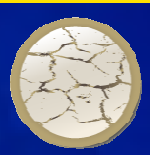
RAND

EXTREME CLIMATE RISKS AND CALIFORNIA'S FUTURE

Summary

- Risk from extreme climate events
  - Results from interaction of events, exposure, and vulnerability
  - Has been increasing worldwide, largely due to changes in exposure
  - Likely to additionally increase in the future due to changes in the intensity and frequency of climate events
  - Is reduced most effectively with integrated responses involving many organizations and groups that don't currently work together
    - New methods and tools for decision support can facilitate science-based, integrated risk management approaches

EXTREME CLIMATE RISKS AND CALIFORNIA'S FUTURE



EXTREME CLIMATE RISKS AND CALIFORNIA'S FUTURE

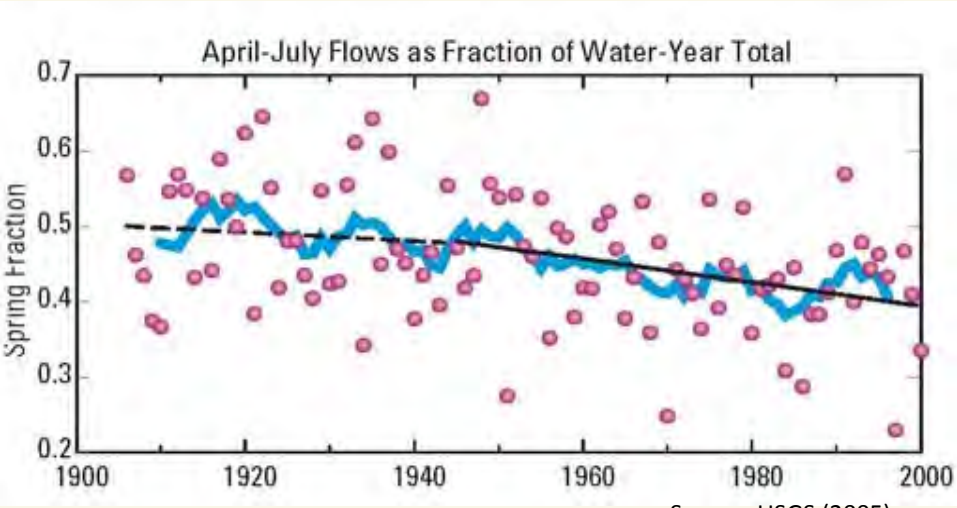
Climate Change: A March Toward A Warmer and Drier Southern California

Dan Cayan
Scripps Institution of Oceanography, UC San Diego
USGS Water Resources Discipline

Climate Change Evidence already seen in California

Source: Spinics.net

- More precipitation as rain than snow
- Snowmelt sooner
- Earlier runoff
- Migratory birds arriving sooner, leaving later

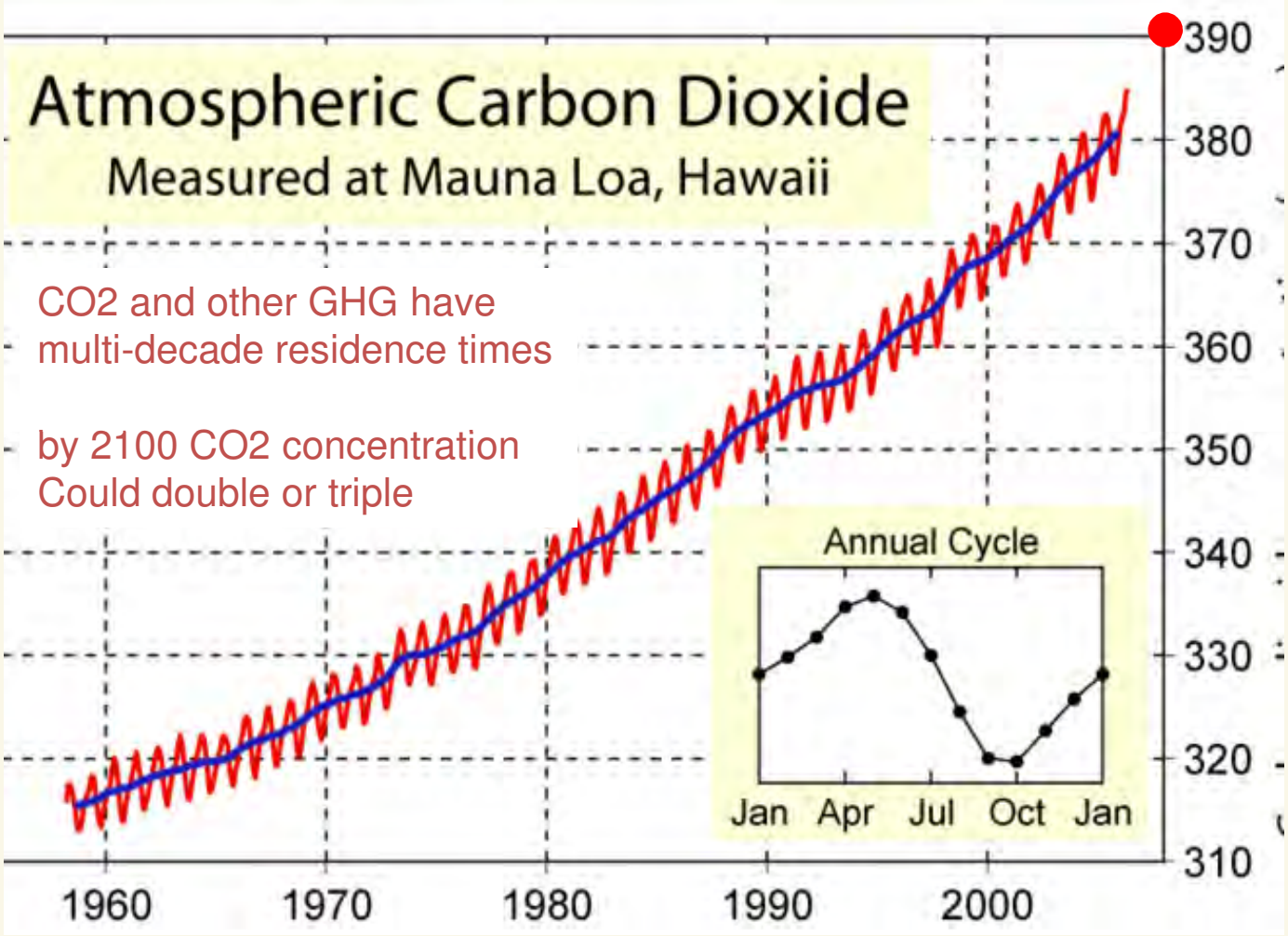


Source: USGS (2005)

Source: FWS

What's driving climate change besides natural causes?

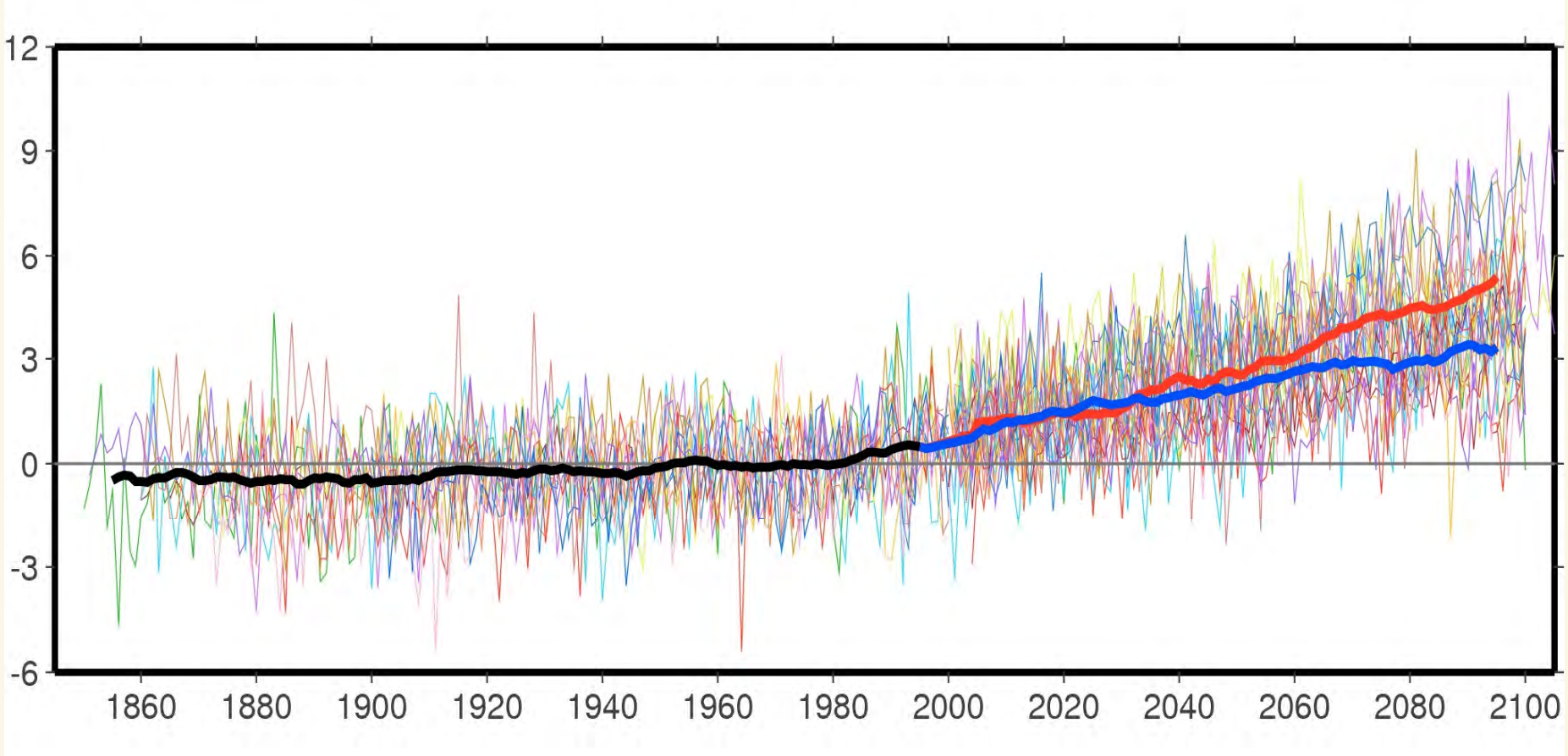
anthropogenic greenhouse gases including CO2

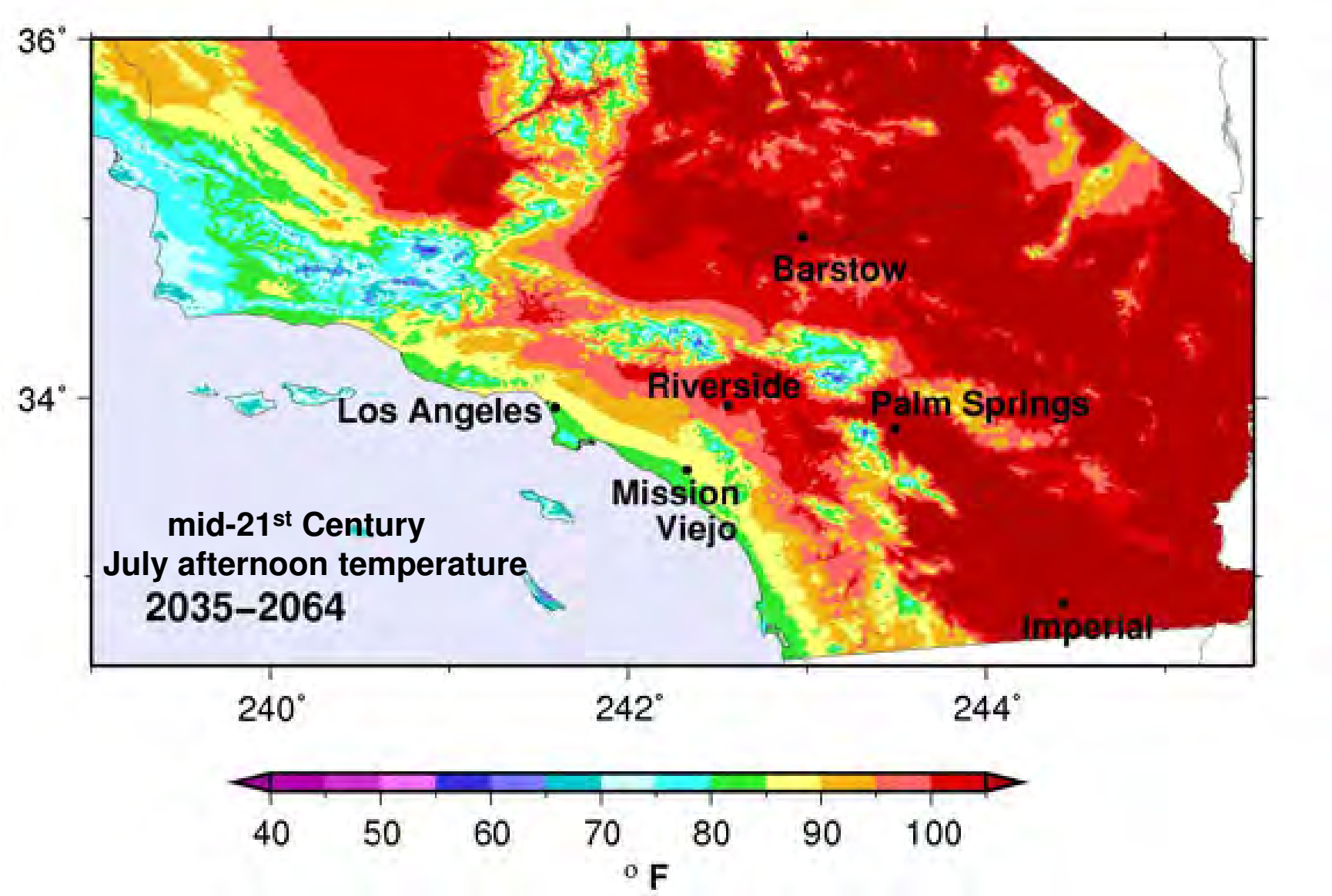


Source: Scripps Institution of Oceanography, NOAA "The Keeling Curve"

Climate models simulations indicate substantial global and regional warming

- 16 models run under 2 separate scenarios of plausible Greenhouse Gas increases





GFDL A2 1km downscaled to 1km
Hugo Hidalgo Tapash Das Mike Dettinger

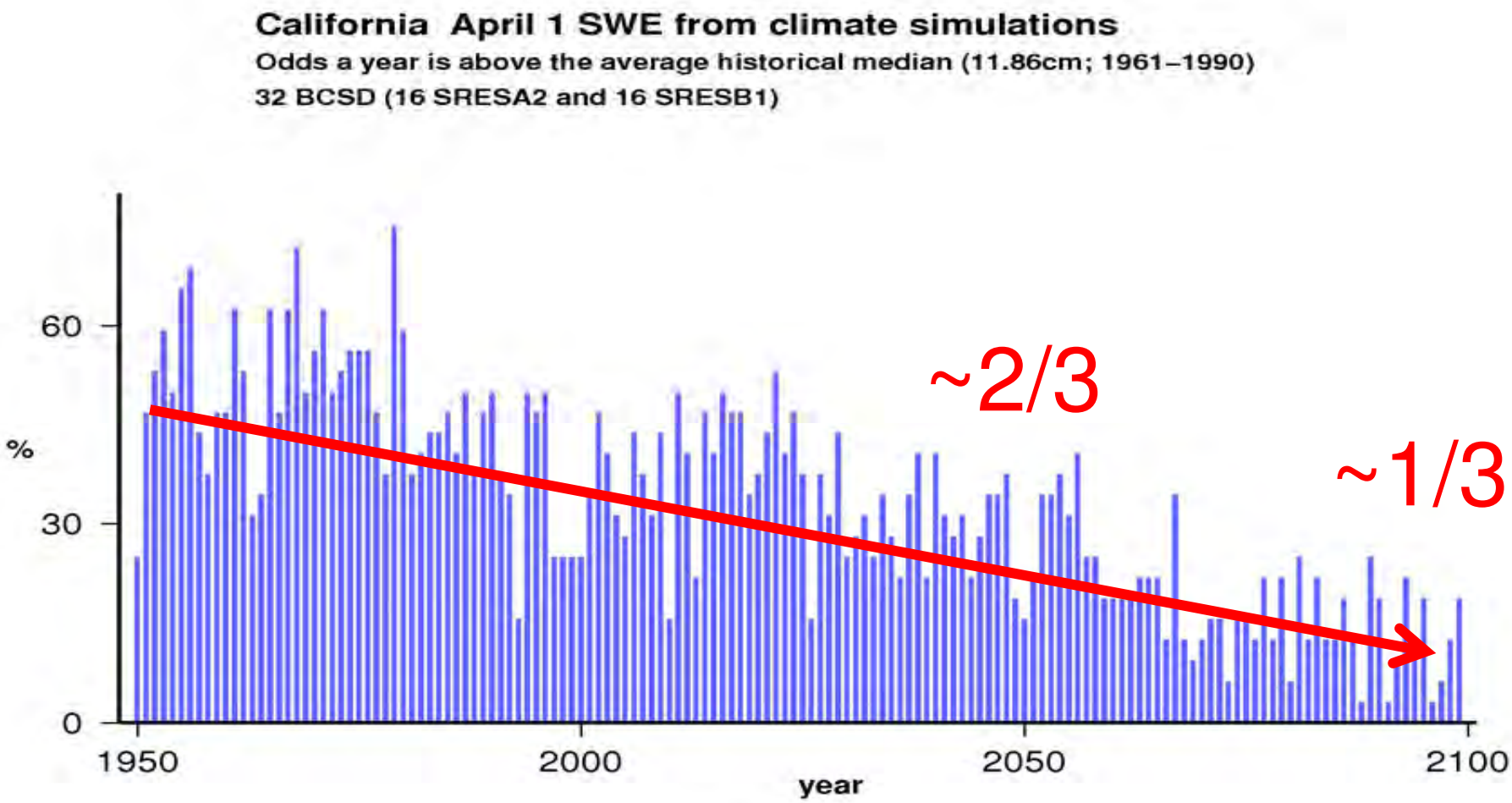
Meeting Our Water Needs

- Growing water demands in agriculture and urban areas

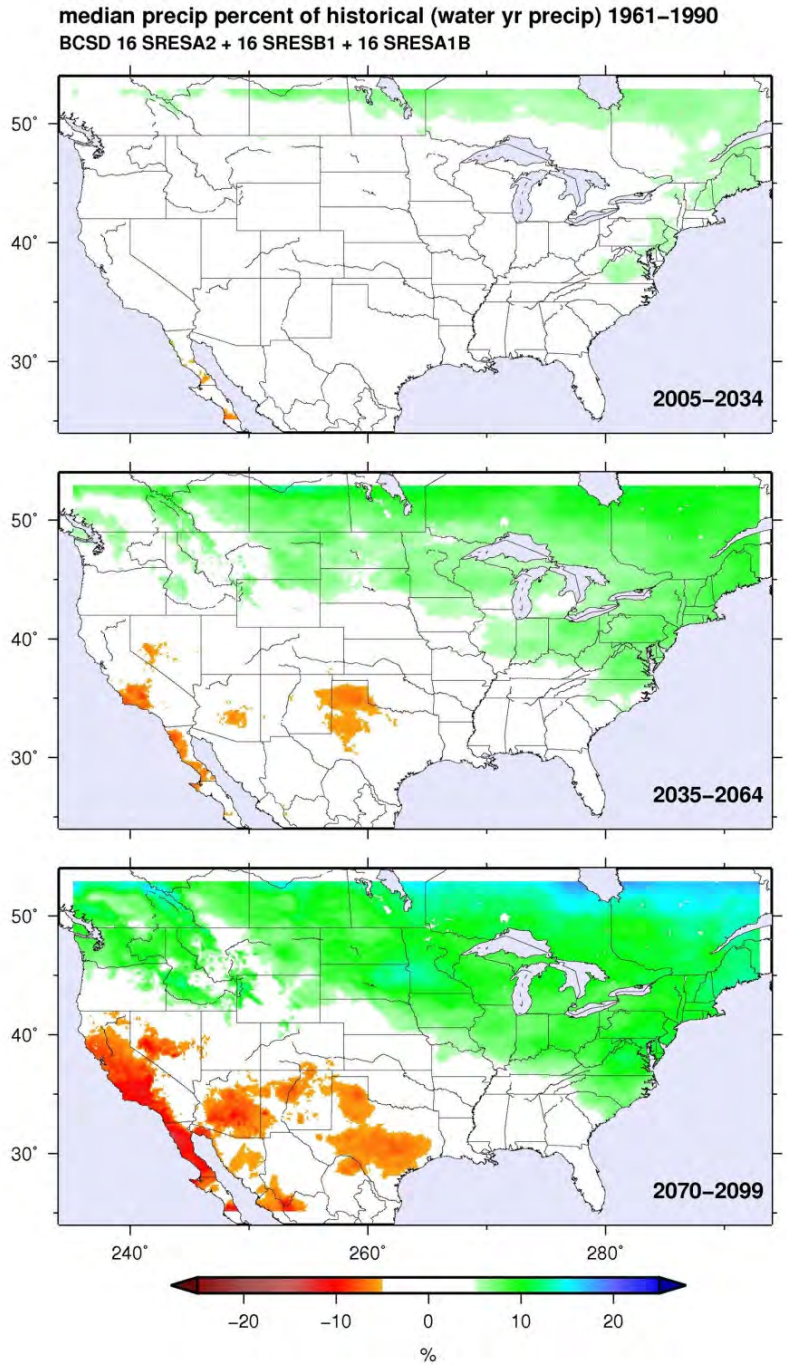
- Much tougher water management challenge
  - Balancing demands for water supplies in dry periods and flood control in winter months

EXTREME CLIMATE RISKS AND CALIFORNIA'S FUTURE

Declining Snowpack



Source: Cayan et al. (2011)



- A tendency toward drying in the Southwest, especially Southern California develops over the 21st Century.

- Drying becomes greater as climate becomes warmer

- from 48 climate model projections downscaled to 12km using BCSD

EXTREME CLIMATE RISKS AND CALIFORNIA'S FUTURE

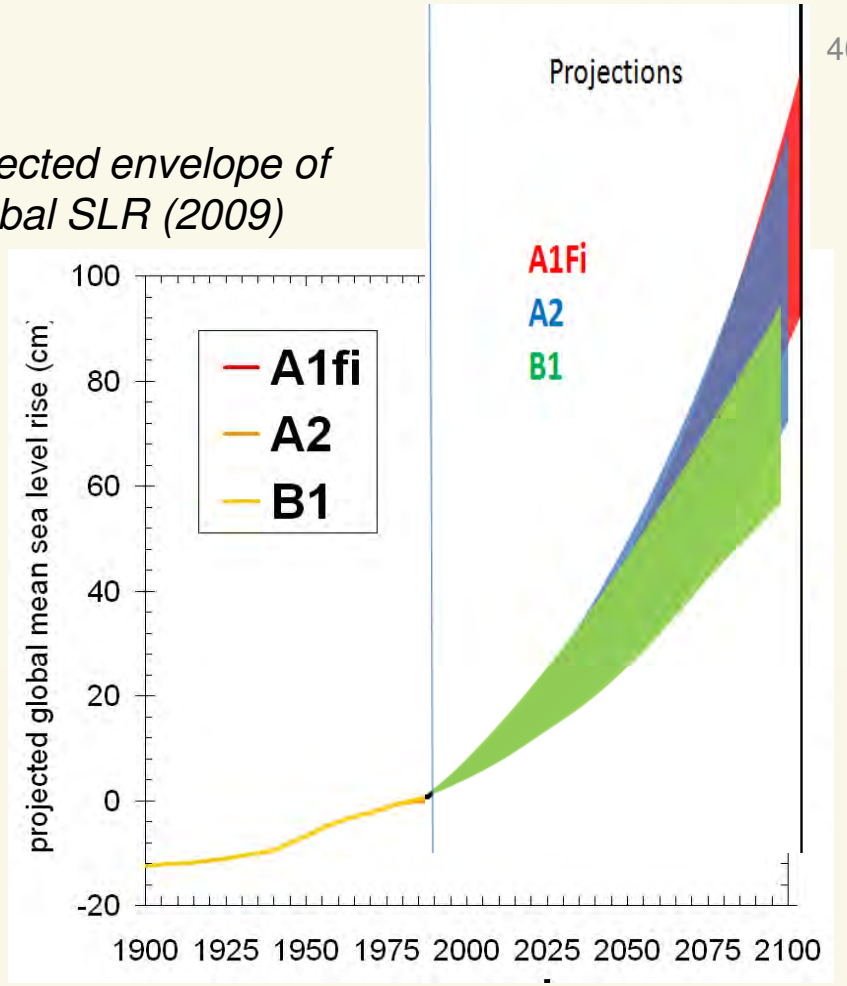
- Increased threat of wildfires as warm season becomes longer combined with dry wind events

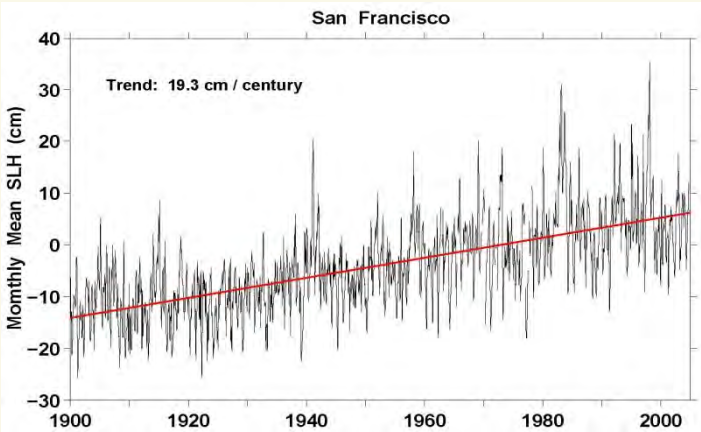
EXTREME CLIMATE RISKS AND CALIFORNIA'S FUTURE

•during high sea levels, the sea is often *not* quiescent

- Observed SFO (left) and modeled Global (right). Sea level rise estimates based upon an envelope of output from several GHG emission scenarios

Projected envelope of global SLR (2009)





Climate models only provide loose guidance on the amount of sea level rise—full physics models are still under development.

But it is quite likely that rates will increase greatly in future decades

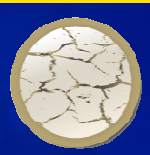
EXTREME CLIMATE RISKS AND CALIFORNIA'S FUTURE

Summary

- Warming is already underway and considerably more is projected.
- Recent IPCC model projections for California precipitation are scattered, but *several* simulations show moderate drying in Southern California as tends to be characteristic of Mediterranean regions globally.
- Wildfire could become a larger threat.
- Climate warming projections, combined with recent global sea level rise estimates suggest increases in California open coast sea levels of 0.5m to more than 1.5m by 2100.
- Tides, weather, short period climate will exacerbate SLR impacts.
- Although some model simulations yield drier conditions in California over the next century, large storms likely to occur at about historical recurrence intervals.

Frank Gehrke,
California Cooperative Snow Surveys, DWR

EXTREME CLIMATE RISKS AND CALIFORNIA'S FUTURE



EXTREME CLIMATE RISKS AND CALIFORNIA'S FUTURE

Mid-Century Warming in the Los Angeles Region and its Uncertainty

Alex Hall

UCLA

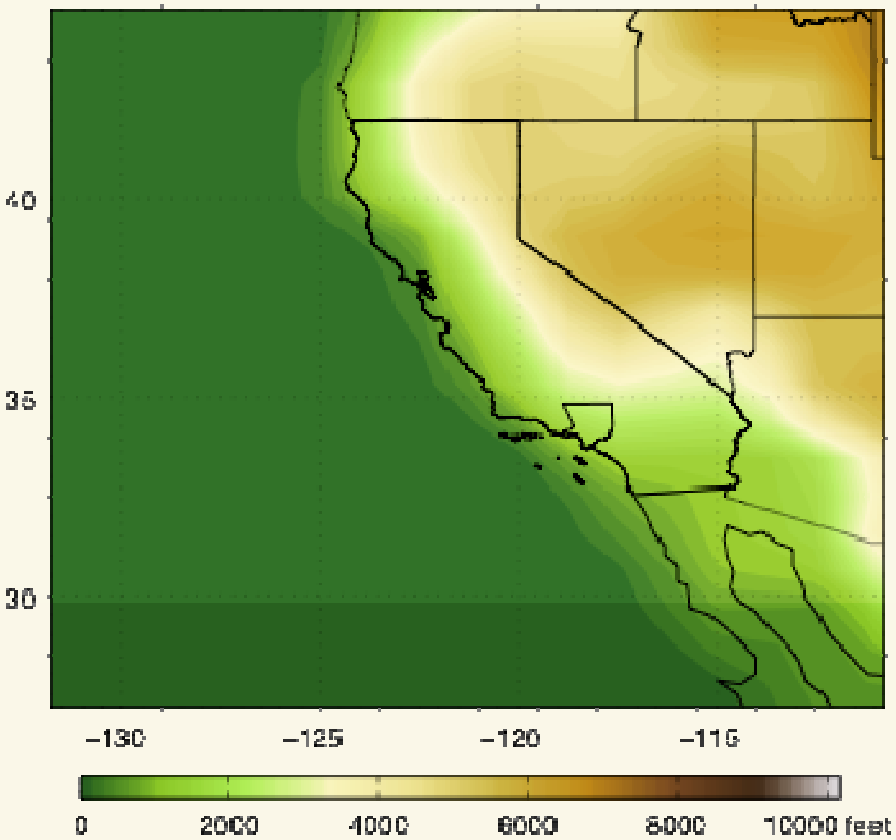
LARC
Los Angeles Regional Collaborative for Climate Action and Sustainability

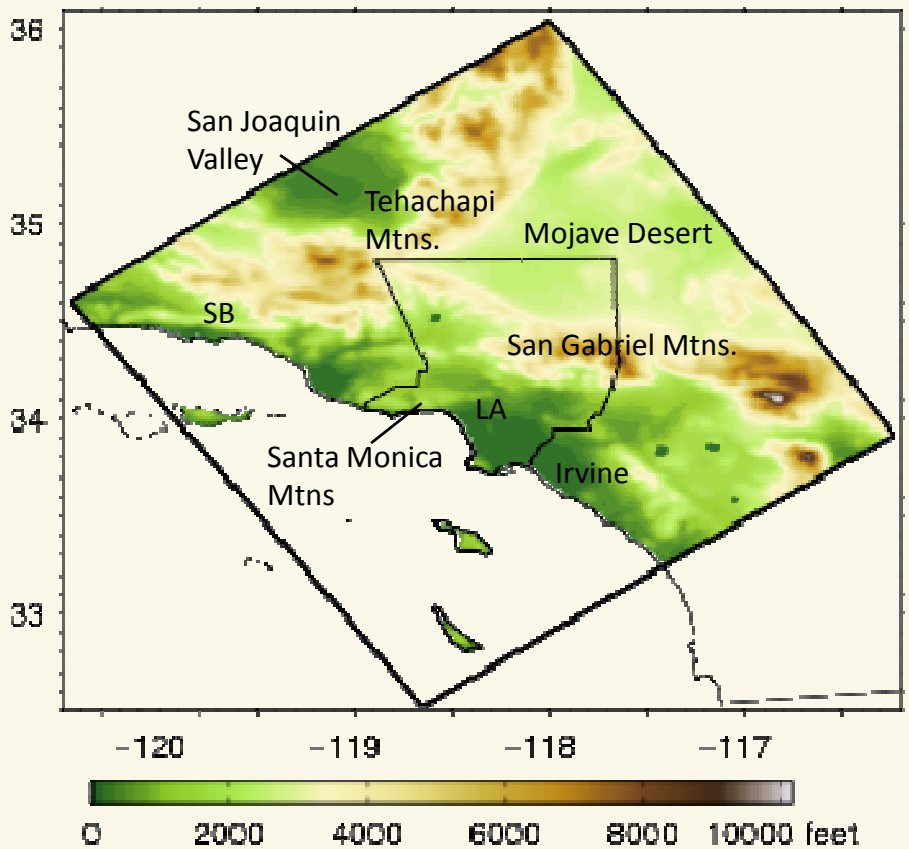
Los Angeles Regional Climate Change Study Overview

- The aim of this study is to provide credible and relevant information about climate change in the Los Angeles region in the middle of the century.
- Our study surmounts two problems associated with climate change simulations.
  - The resolution of the models is much too coarse to be believable at the regional scale, especially in this region of complex topography and coastlines, and such evident variations in climate across the landscape.
  - The simulations provide very different views of future climate change, so that no single simulation can be thought of as giving the "right" answer.

Climate Downscaling

- We combine two complementary techniques to bridge the scales of the global climate model and the local scales of interest.
  - ***Dynamical downscaling***
  - ***Statistical downscaling***
- After several months of supercomputer time, we are able to produce accurate climate change information at the regional scale corresponding to all global climate models.
- We then provide information about the expected (ensemble-mean) climate response, and its uncertainty (model spread) under different climate change scenarios.





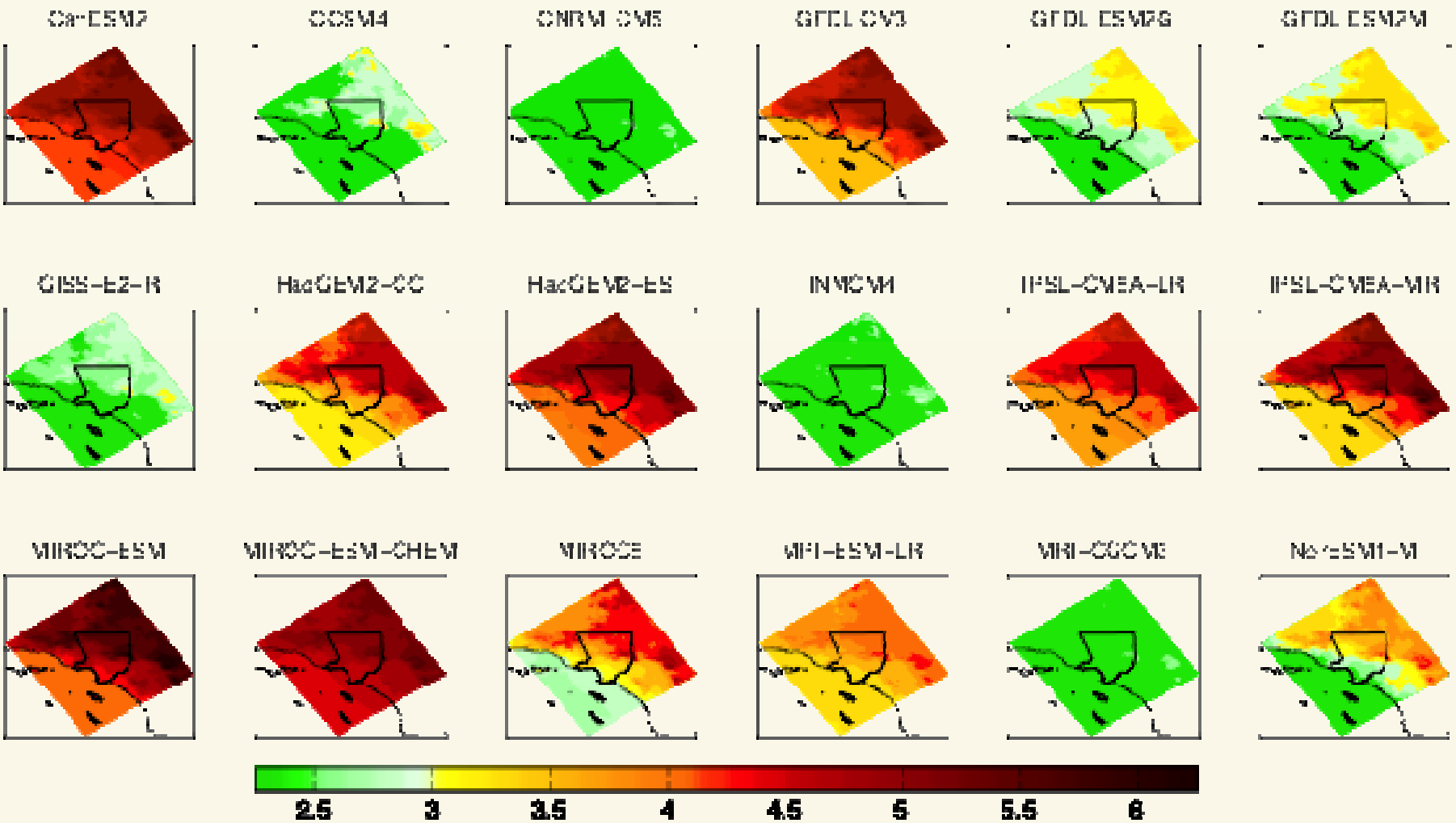
Topography from a typical global climate model (100-200 km). The climate information from such a simulation may not be particularly useful for local planning.

Topography and coastline are well represented in the 2 km resolution innermost domain of the regional climate model

Time Periods and Scenarios

- Two time periods
  - Baseline climate simulation (1981-2000)
  - Future climate change simulation (2041-2060)
- The differences between the two simulations allow us to quantify climate change in the region.
- Two emissions scenarios
  - RCP 8.5 – “Business as Usual”
  - RCP 2.6 – Mitigation Scenario

When the global models' RCP 8.5 climate change signals are regionalized, a variety of warming patterns is seen…



Forthcoming Papers & Rough Timeline

- Climate Change Science
  - Temperature and extremes (Sun et al., spring 2012)
  - Precipitation and snow (Berg et al., summer 2012)
  - Surface hydrology (Huang et al., summer 2012)
  - Santa Ana wind strength, frequency & duration (Capps et al., summer 2012)
  - Low cloud (Qu et al., summer 2012)
  - Statistical downscaling methodology (Walton et al., summer 2012)
- Project Summary (Hall et al., late 2012)
- Impacts
  - Fire impacts
  - Agriculture impacts
  - Renewable resource assessment

A Foundation for Science-based Local Decision Making…

- Public health
  - Heat exhaustion and stroke
  - Air quality
  - Infectious disease
- Water supply
- Electric load
- Fire management
- Agriculture and gardening
- Real estate development

For further information, and to register to obtain notification of the future study releases, go to the "C-Change LA" web site.

C-CHANGE.LA

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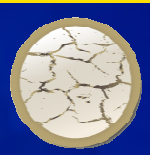


EXTREME CLIMATE RISKS AND CALIFORNIA'S FUTURE

Local Government Case Studies

EXTREME CLIMATE RISKS AND CALIFORNIA'S FUTURE

A Focus on Local Government Action:

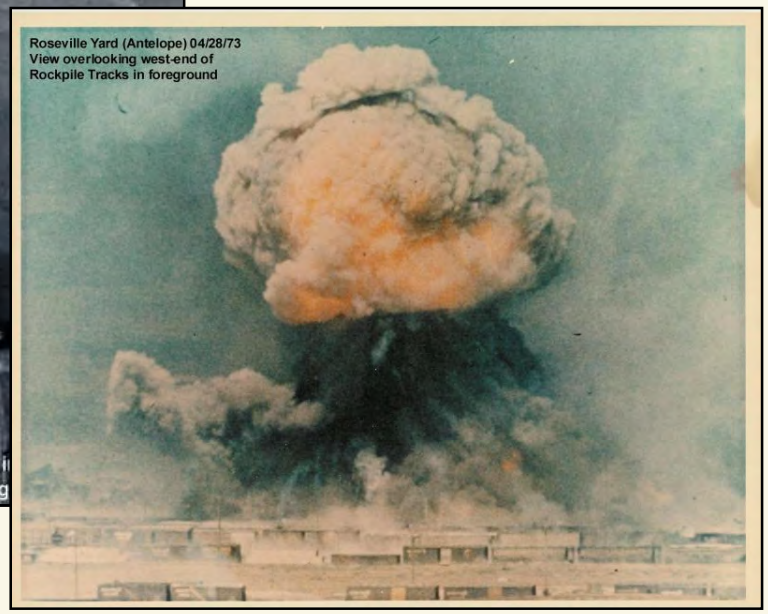
Multi-Hazard Mitigation Planning in Roseville, CA

Julia Burrows

Greenwise JV

Floods of 1995 – 300 homes impacted

- Roseville, CA



Largest rail yard west of Mississippi River

- Roseville, CA

Hazard Ranking	Hazard Event	Category
1	**Human Caused**	**High**
2	**Severe Weather**	**High**
3	**Flooding**	**Medium**
4	**Earthquake**	**Medium**
4	**Wildfire**	**Medium**
5	**Dam Failure**	**Medium**
6	**Drought**	**Low**
7	**Human Health**	**Low**
8	**Landslide**	**Low**

Climate change a secondary impact on each hazard of concern (2011)

- Roseville, CA

Repetitive Structure HMG (Flood)

- Roseville, CA

Repetitive Structure HMG (Flood)

- Roseville, CA

Repetitive Home Buy-out HMG (Flood)

- Roseville, CA

Reason Farms Open Space (Flood)

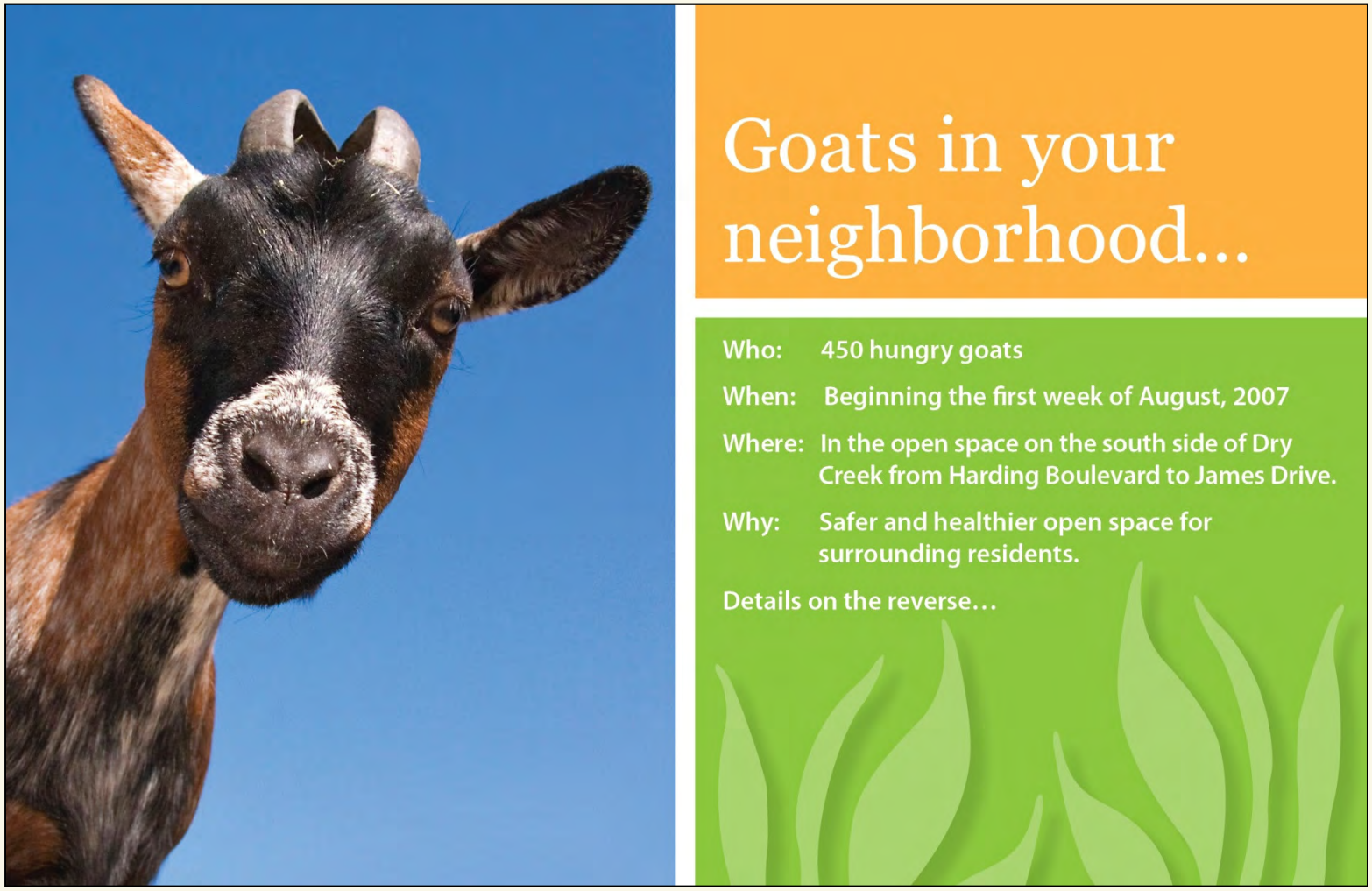
- Roseville, CA

Water Conservation – Irrigation Retrofits (Drought)

- Roseville, CA

Native Oak Tree Planting (Multi-hazards)

- Roseville, CA



Goat Grazing Grant (Severe Weather & Wildfire)

- Roseville, CA

FEMA CRS Class 1 (first and only in U.S.)

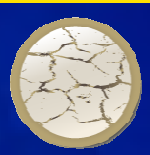
- Roseville, CA

Local Action

- Identify a Champion; Involve Community
- Integrate Efforts
  - General Plans, MHMP, Climate Action Plans, Design Guidelines, CIPs, Emergency Response Plans, Stormwater Management
- Leverage Resources
  - Grants, mitigation fees, state mapping
- Make a Business Case to Defend Standards
- Communicate Benefits Constantly
- Consult State Experts

- Roseville, CA

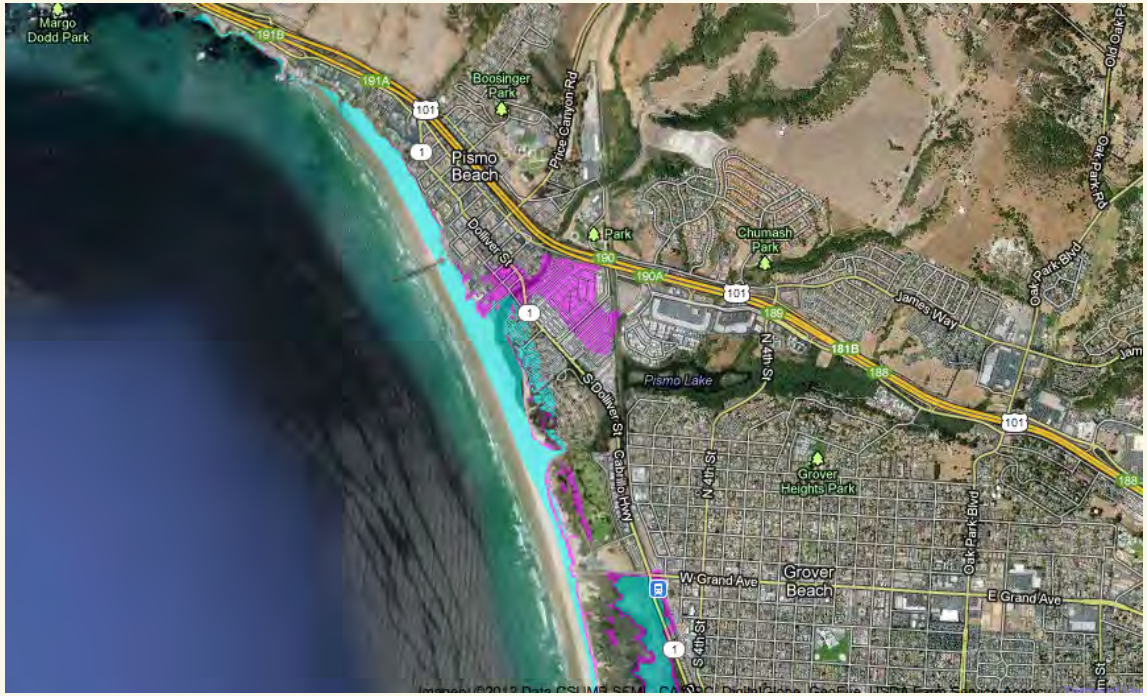
EXTREME CLIMATE RISKS AND CALIFORNIA'S FUTURE

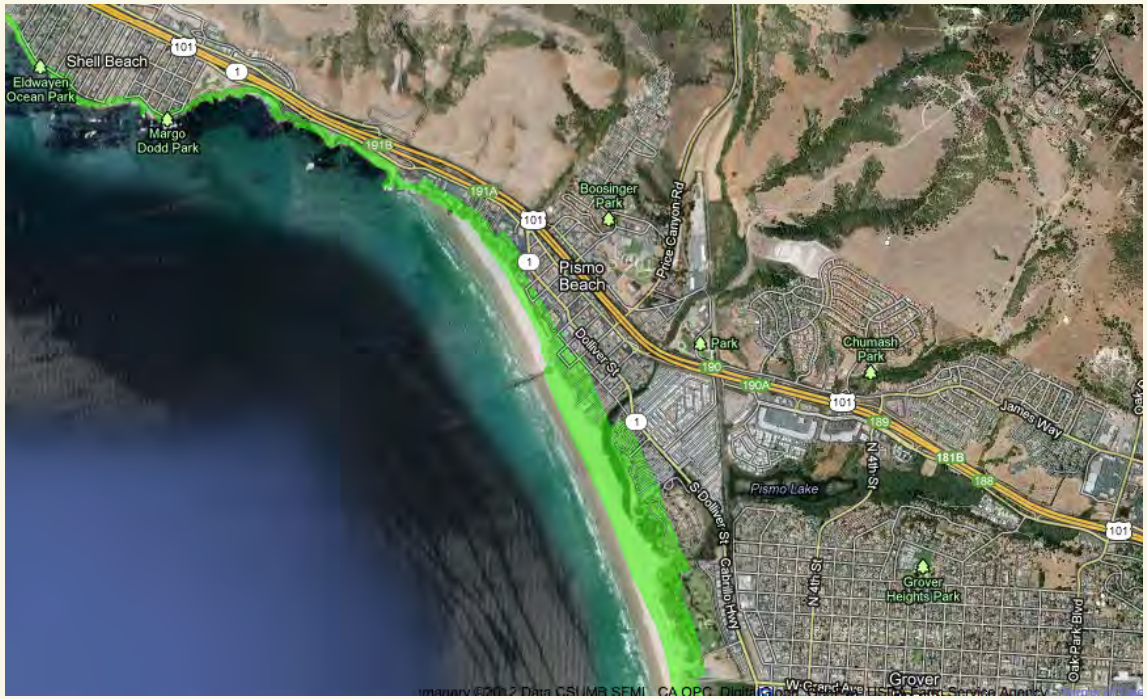


EXTREME CLIMATE RISKS AND CALIFORNIA'S FUTURE

San Luis Obispo: Local Case Study

Kate Meis
Associate Director, Local Government Commission





Risk from 100-year Coastal Flood Event

Current area at risk

Area at risk with a 1.4 meter sea-level rise

Risk from Erosion in 2100

Source: Pacific Institute

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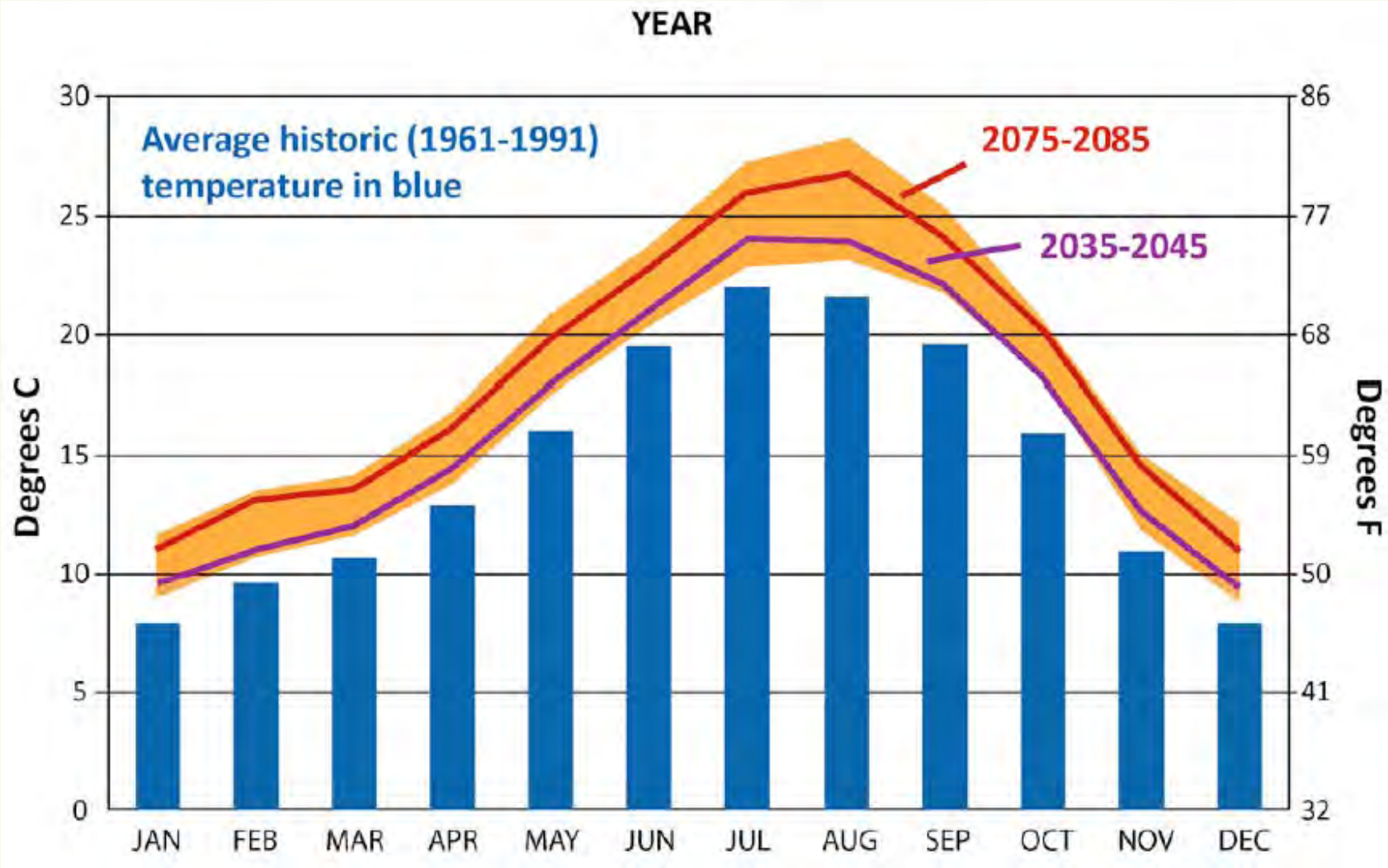

Increase in Average Monthly Temperature

Source: GEOS Institute

- Climate Impacts

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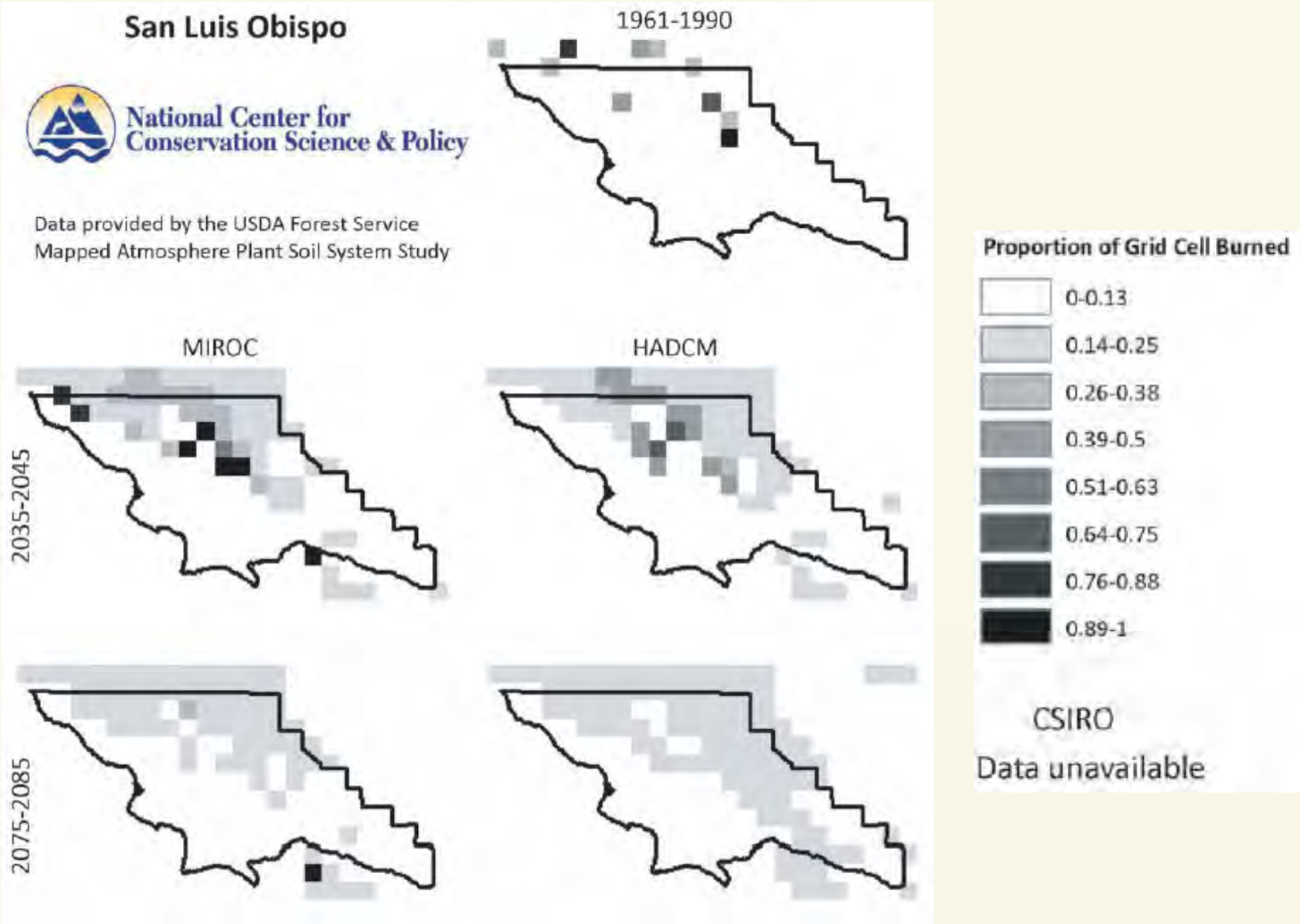

Wildfire- Area Burned Annually

Source: GEOS Institute

- Climate Impacts

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Replacement Value of Buildings & Contents Source: Pacific Institute

- Climate Impacts

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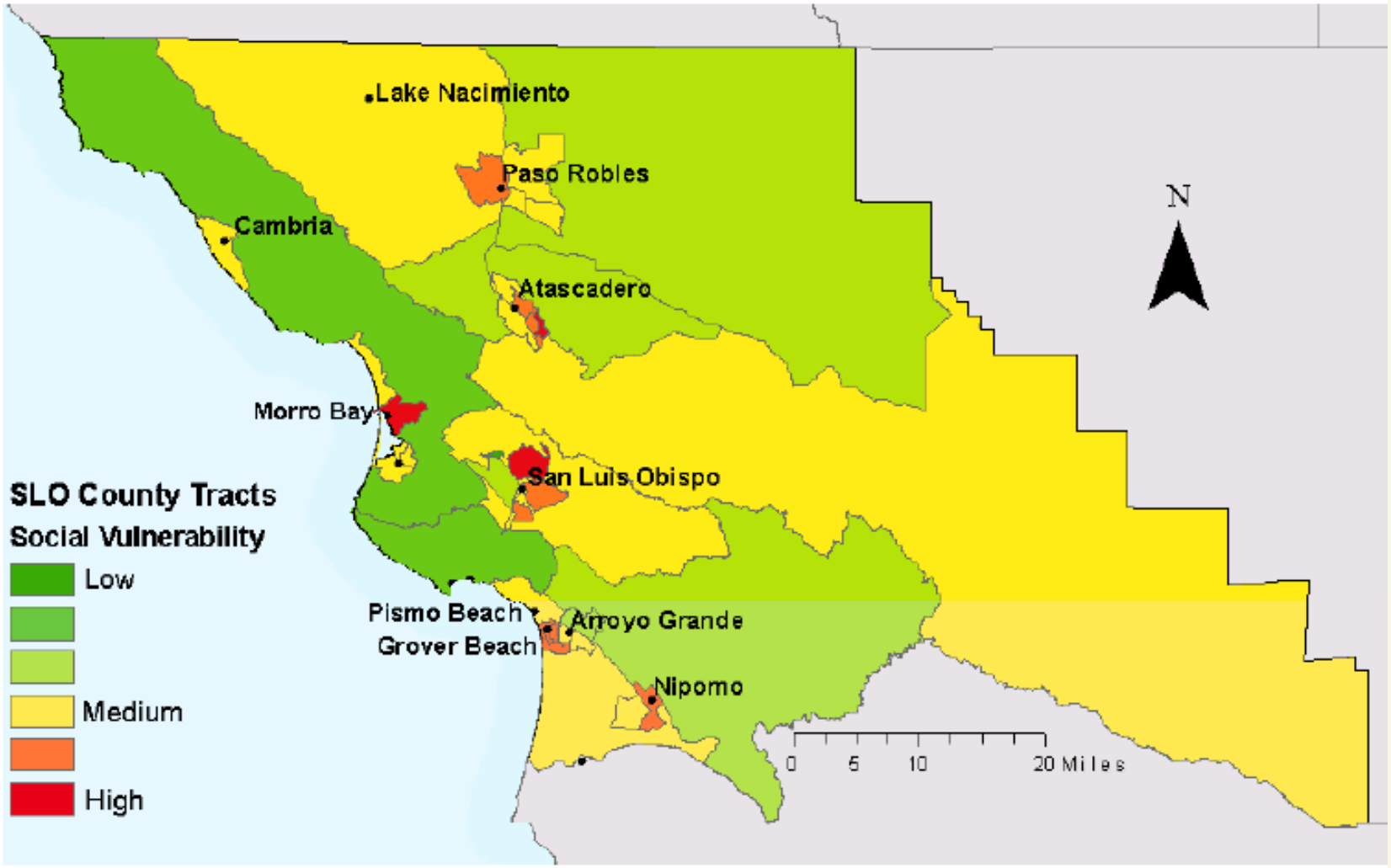

Overall Vulnerability

Source: Susanne Moser and Julie Ekstrom

- Climate Impacts

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EXTREME CLIMATE RISKS AND CALIFORNIA'S FUTURE

Challenges

1. Political Climate
2. Local Budget Constraints

- Challenges

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Solutions

Political Climate

1. Identify local champions
2. Data- regional climate impacts and vulnerabilities
3. Frame it right
4. Utilize local media
5. Build a Coalition: key experts, stakeholders, elected officials, public

Local Budget Constraints

1. Phase implementation
2. Build on current opportunities
3. Utilize state resources

- Solutions

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EXTREME CLIMATE RISKS AND CALIFORNIA'S FUTURE

COUNTY OF
SAN LUIS OBISPO

ENERGYWISE PLAN

Designing Energy and Climate Solutions for the Future

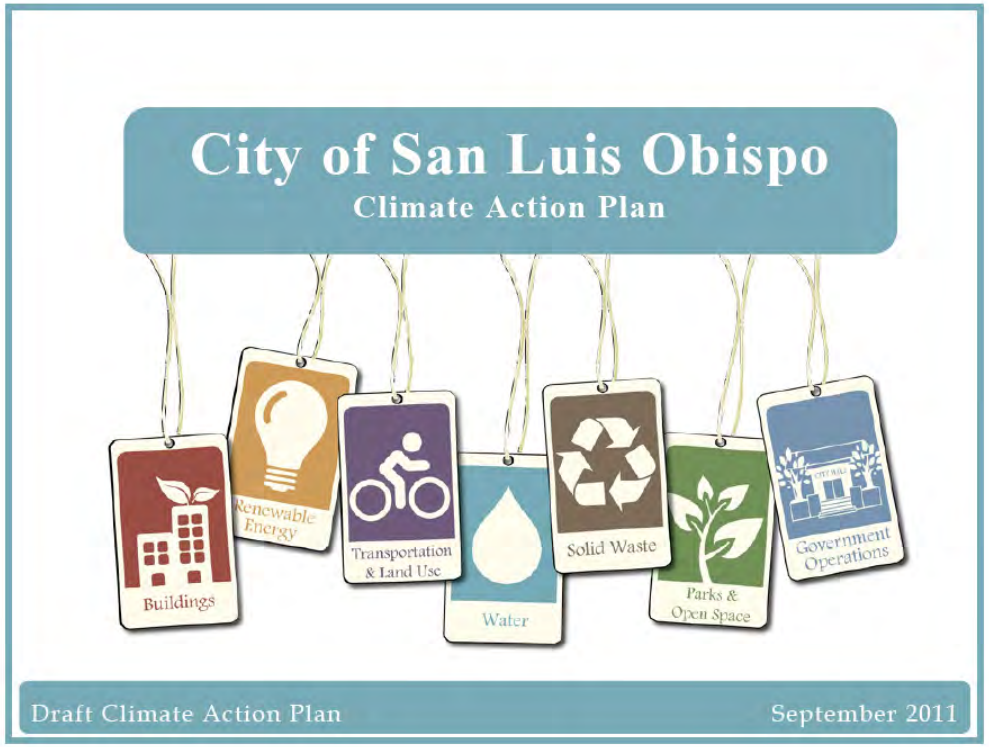
November 2011

Adopted by the San Luis Obispo County Board of Supervisors

November 22, 2011 - Resolution 2011- 381

County of San Luis Obispo

Department of Planning and Building



County- Adaptation Chapter in Adopted CAP

City of SLO- Adaptation Strategies throughout Draft CAP

- Outcomes

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Require new development to account for sea level rise

Tiered water rate structures

Land management practices to reduce sedimentation

Low-impact development standards

Require new development to cluster for fire protection

let's move SLO
healslo.com

Partner with health groups to identify risks

Changes in crop selection, patterns, and practices

Ecotourism

- Outcomes

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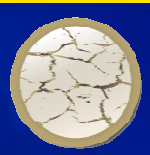

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Adapting to Climate Change in Chula Vista

Brendan Reed

Environmental Resource Manager, City of Chula Vista

Chula Vista Statistics

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Past Climate Action Efforts

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Climate Adaptation Planning

Stakeholder-driven planning process

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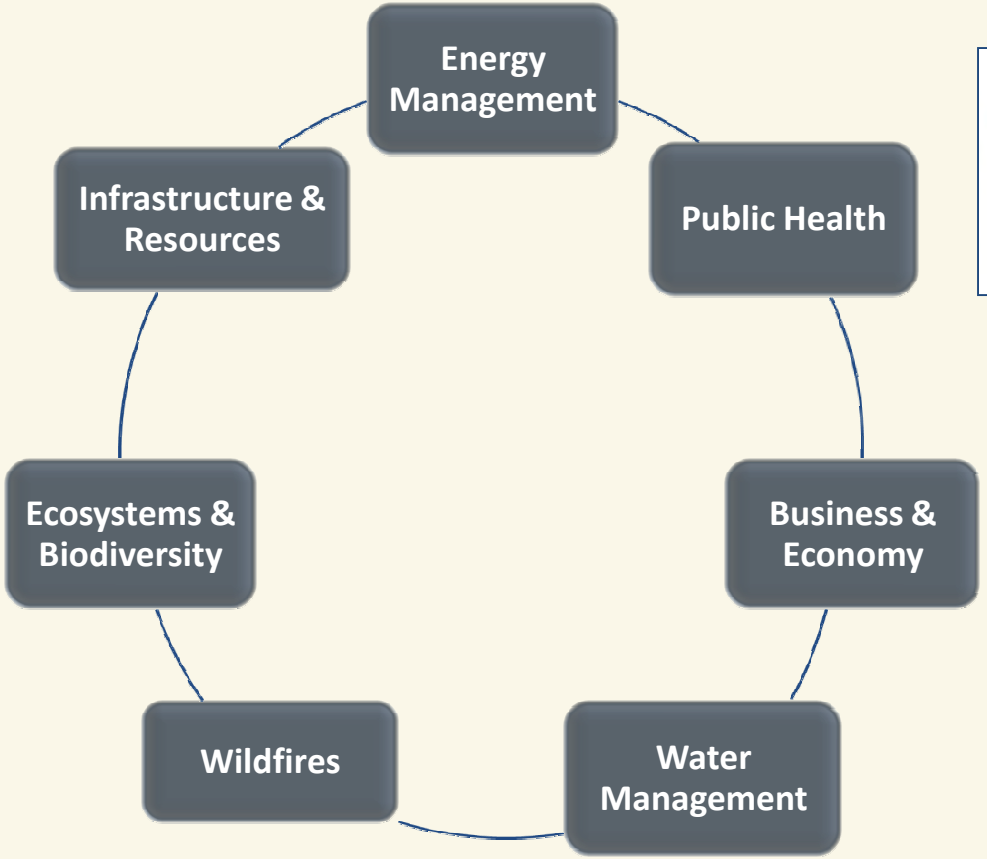
Climate Adaptation Planning



Systematic review of "risk" & potential adaptation strategies

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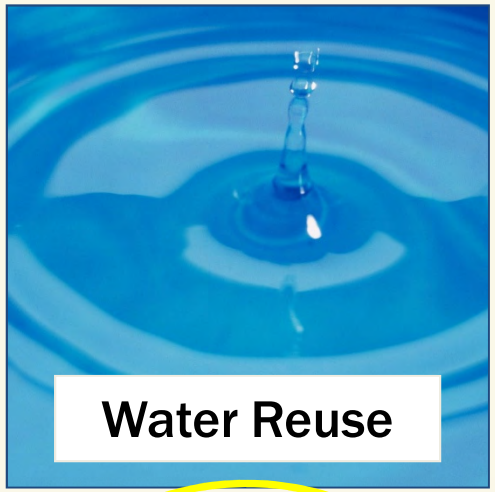
Climate Adaptation Strategies



- Local Government Case Studies

THANK YOU!

Brendan Reed, Environmental Resource Mgr.

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CITY OF CHULA VISTA

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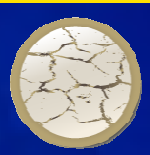

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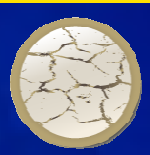
Local Government Case Studies: Los Angeles

Beth Jines
Office of Mayor Antonio Villaraigosa, City of Los Angeles

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