California's Fourth Climate Change Assessment

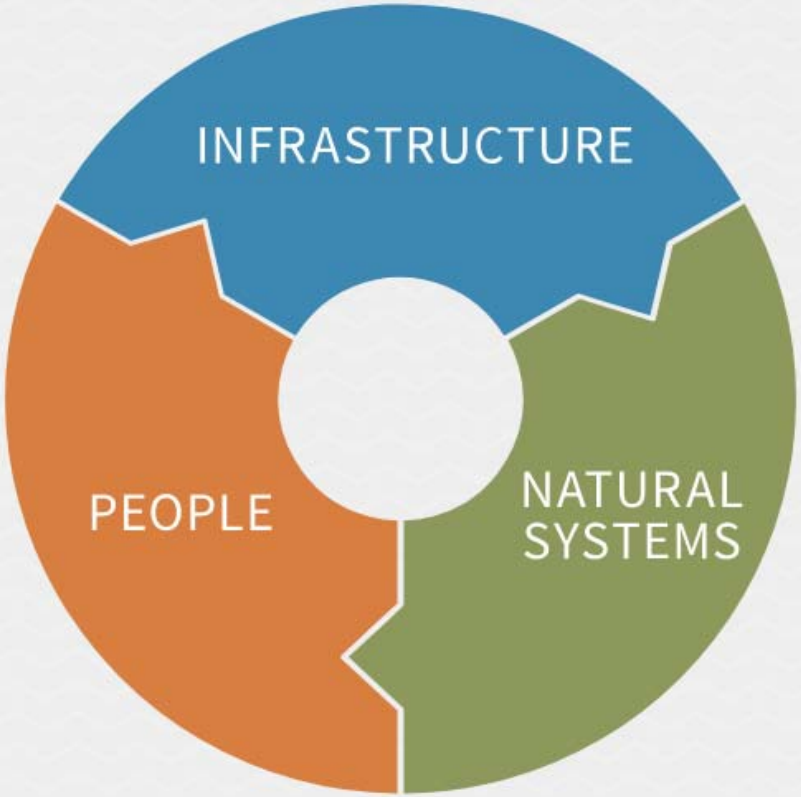
Board of Directors Meeting

March 5, 2019

Item 6

Overview

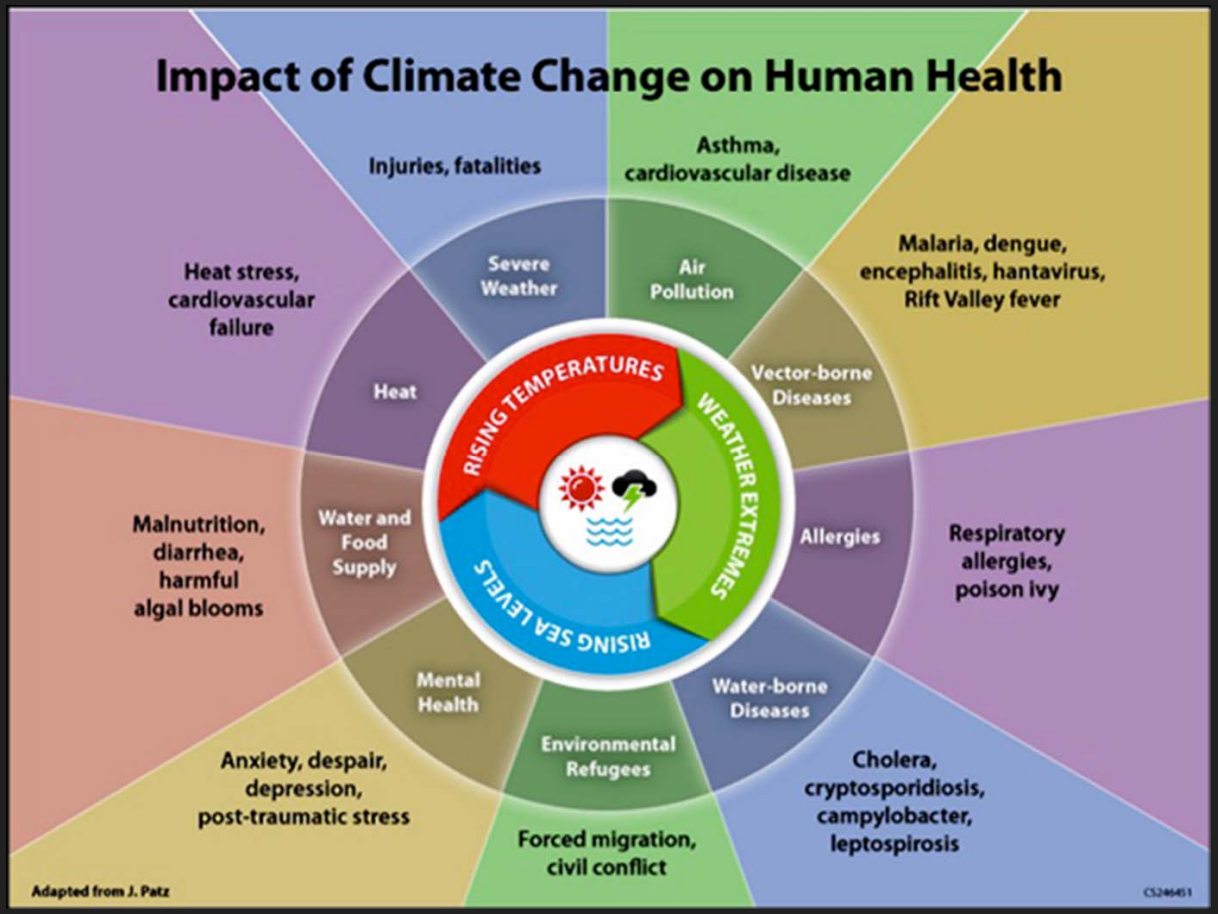
1. Climate Change & Science
2. California Assessments
3. Projections (modeling & results)
4. LA Region and Santa Clarita
5. Water Impacts
   a. Water supply and demand
   b. Imported Water
   c. Watershed
   d. Water quality
   e. Groundwater management
6. Adaptation



The State's approach to building resilience in California, which recognizes the interconnections and interdependences across people, nature, and infrastructure.

Not covered

- Santa Ana Winds
- Clouds
- Sea Level Rise
- Humidity
- Air Quality
- Energy
- Transportation
- Land Use & Development
- Emergency Management
- Public Health

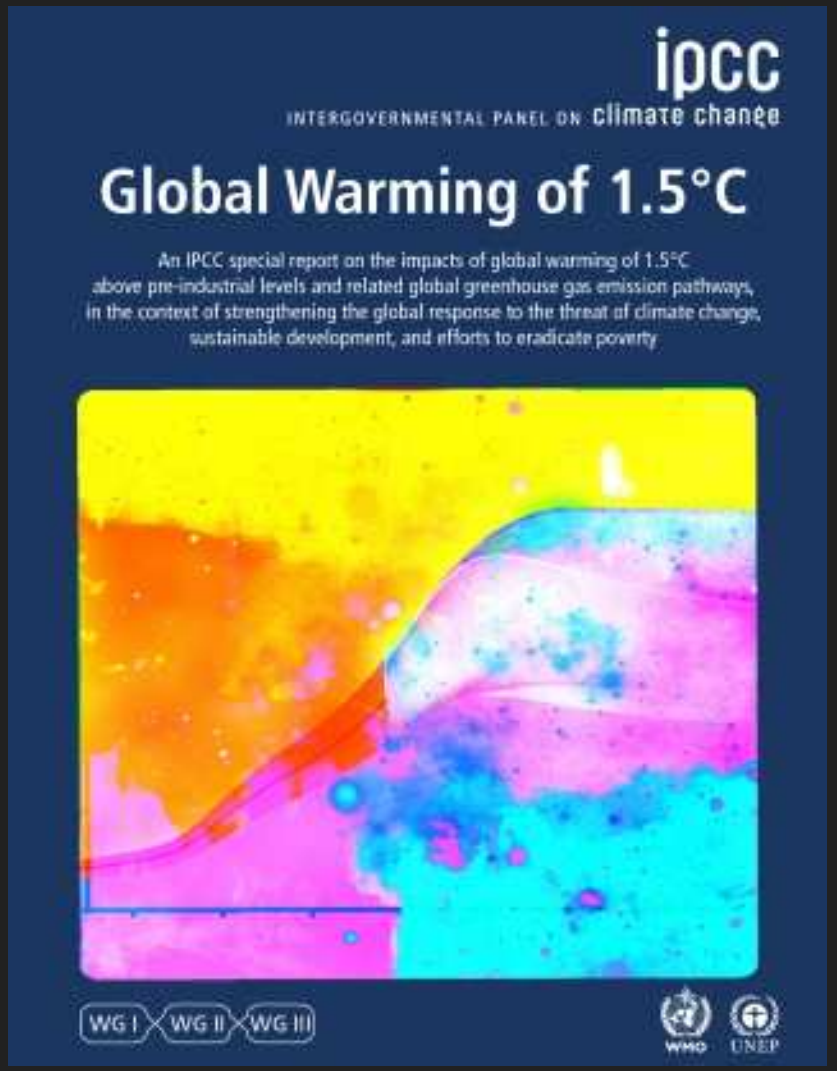


Yesterday, next week, last year, tomorrow, this winter…

Weather changes over extended period of time - 30 years

Why is understanding climate change important?

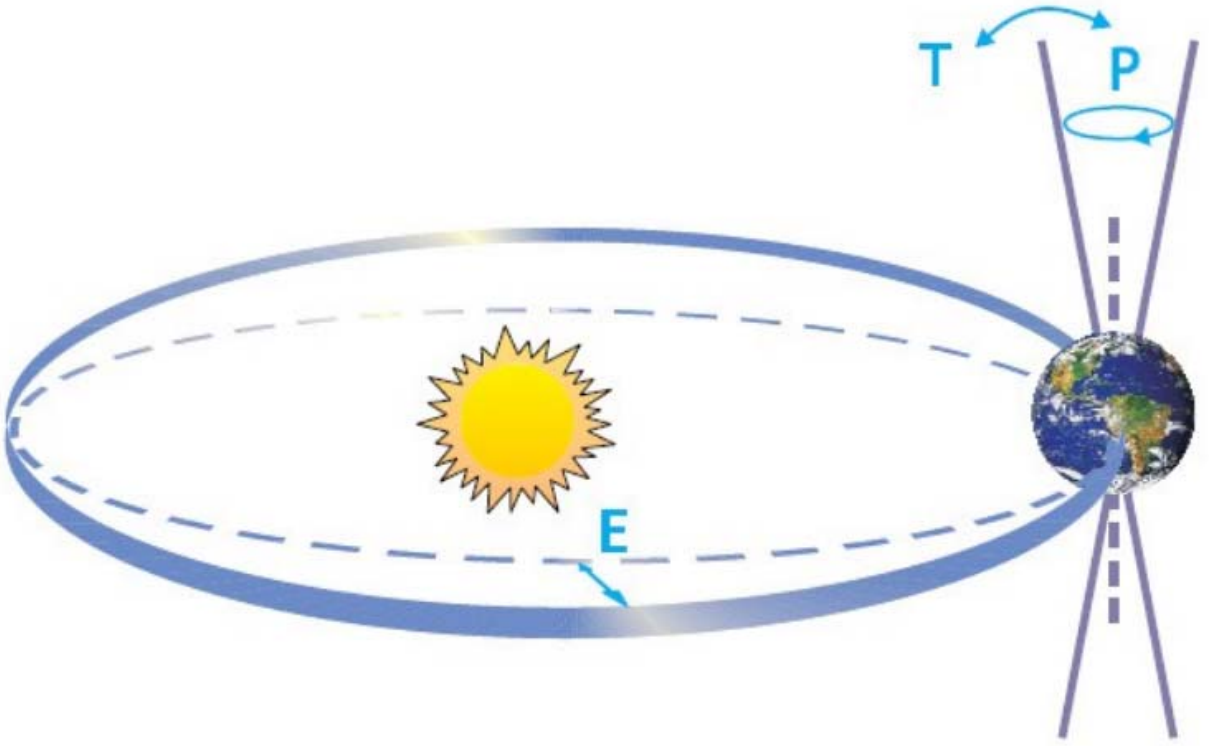
Climate change will affect nearly all aspects of life, including ecosystems, the built environment, and public health.



Natural Climate Change

Milankovitch Cycles-

Natural warming and cooling climate cycles



Milankovitch Cycles. *Schematic of the Earth's orbital changes (Milankovitch cycles) that drive the ice age cycles. 'T' denotes changes in the tilt (or obliquity) of the Earth's axis, 'E' denotes changes in the eccentricity of the orbit (due to variations in the minor axis of the ellipse), and 'P' denotes precession, that is, changes in the direction of the axis tilt at a given point of the orbit. Source: Rahmstorf and Schellnhuber (2006).*

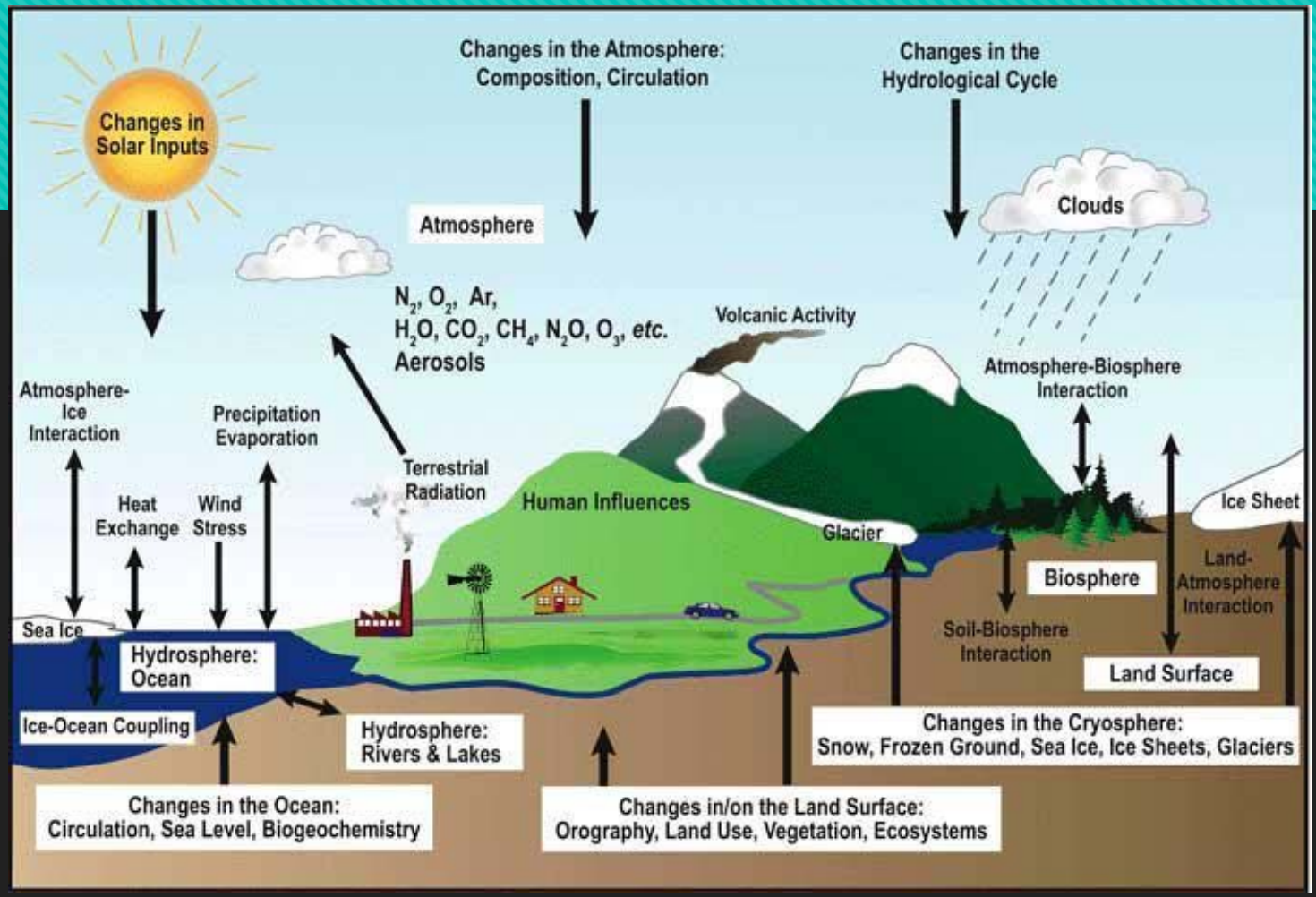
Uncharted Territory

97% of climate science experts and 97% of climate science papers (12,000) agree warming is man-made

Concentration of Co2 in the atmosphere over the past few hundred thousand years. NASA/NOAA

Climate Projections

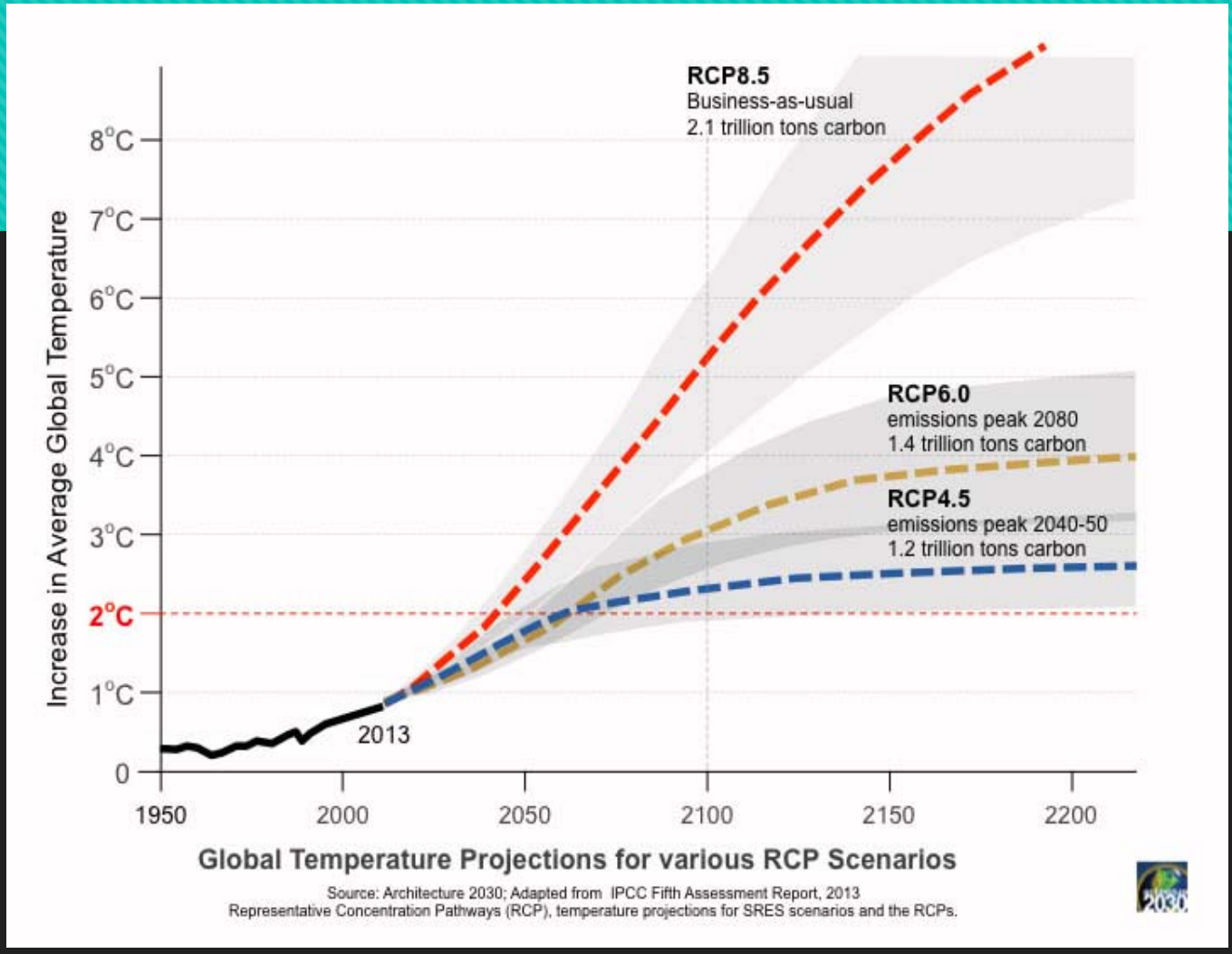
Global Climate Models (GCM's) – model of how the Earth's atmosphere, oceans, land surfaces and sea ice interact to affect the climate.



Climate Projections

Representative Concentration Pathways (RCP's)

"Green House Gasses"



California's Climate Change Assessments

TABLE 1 | SUMMARY OF CALIFORNIA'S CLIMATE CHANGE ASSESSMENTS

	FIRST CALIFORNIA CLIMATE ASSESSMENT	SECOND CALIFORNIA CLIMATE ASSESSMENT	THIRD CALIFORNIA CLIMATE ASSESSMENT	FOURTH CALIFORNIA CLIMATE ASSESSMENT
YEAR	**2006**	**2009**	**2012**	**2018**
DESCRIPTION	Understanding climate impacts in California. Developed to provide support for undertaking greenhouse gas emission reductions.	Understanding how climate change will affect specific sectors. Made the case that adaptation could reduce costs.	Increased understanding of vulnerability in natural and human systems, and generated two pilot regional assessments.	Technical and regional reports designed to support adaptation actions at the state, regional, and local level.
DRIVER	Executive Order S-3-05	Policymakers' desire to know if adaptation was needed.	2009 Climate Adaptation Strategy	2015 Climate Change Research Plan
OUTCOME	Assembly Bill (AB) 32	2009 Climate Adaptation Strategy	Supported passage of new climate adaptation laws.	Informing the implementation of AB 2800, which requires a report on how engineering standards should be changed to consider climate change. Other outcomes to be determined.

Fourth Assessment: Supporting Adaptation and Resilience

- Statewide Reports
  - Summary Report
  - California's Ocean and Coast
  - Tribal and Indigenous Communities within California
  - Climate Justice
- Regional Reports (9)
- Technical Reports (44)
  - Agriculture, Biodiversity, Energy, Forests and Wildfire, Governance, Oceans & Coasts, Projections, Datasets, and Tools, Public Health, Water (10)
- Tools
  - State portal for accessing climate change projections
  - Health informed heat thresholds for communities
  - Coastal flooding scenarios

CA Climate Projections

"These findings are profoundly serious and will continue to guide us as we confront the apocalyptic threat of irreversible climate change." – Gov. Jerry Brown

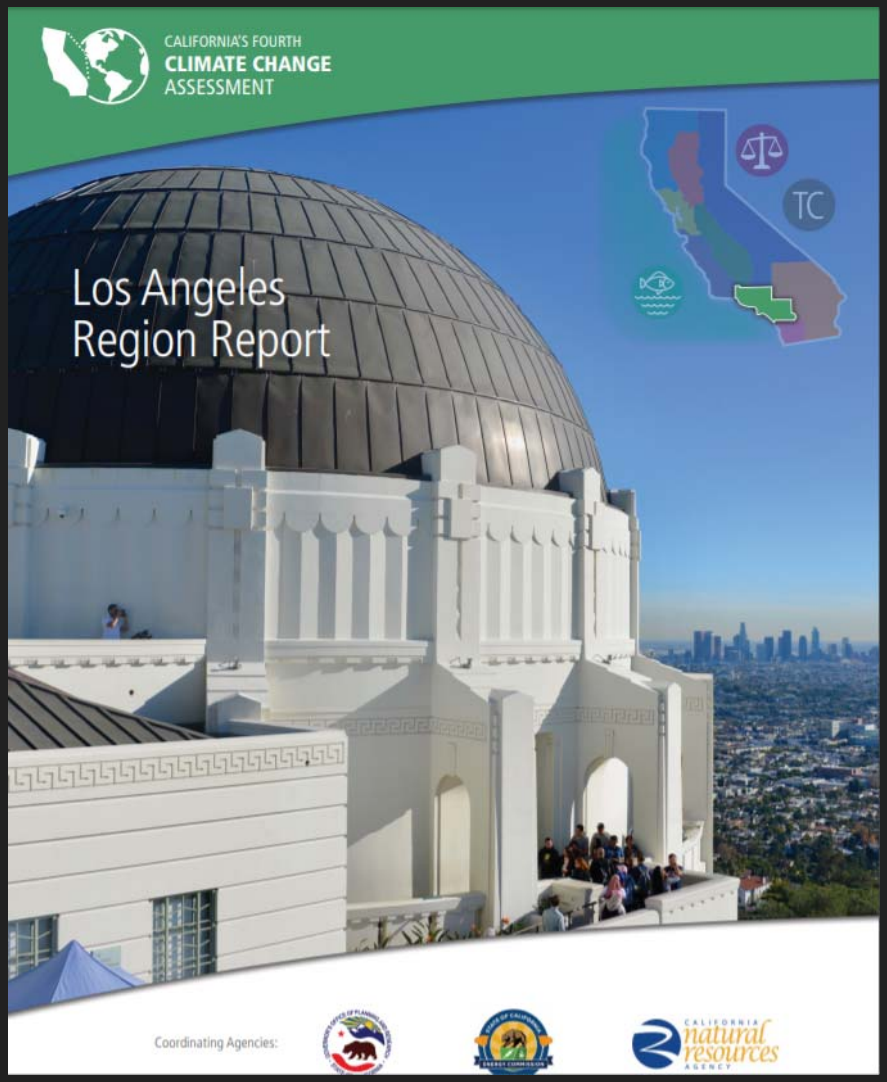
	CLIMATE IMPACT	DIRECTION	SCIENTIFIC CONFIDENCE FOR FUTURE CHANGE
	TEMPERATURE	WARMING ↗	Very High
	SEA LEVELS	RISING ↗	Very High
	SNOWPACK	DECLINING ↘	Very High
	HEAVY PRECIPITATION EVENTS	INCREASING ↗	Medium-High
	DROUGHT	INCREASING ↗	Medium-High
	AREA BURNED BY WILDFIRE	INCREASING ↗	Medium High

While most of these trends have been generally understood and expected since before California's First Climate Change Assessment in 2006, the Fourth Assessment provides new quantitative tools to understand and address these impacts. The updated results from the suite of Fourth Assessment models and analyses demonstrate the importance of achieving global reductions in greenhouse gas emissions. [1]

Los Angeles Region Report

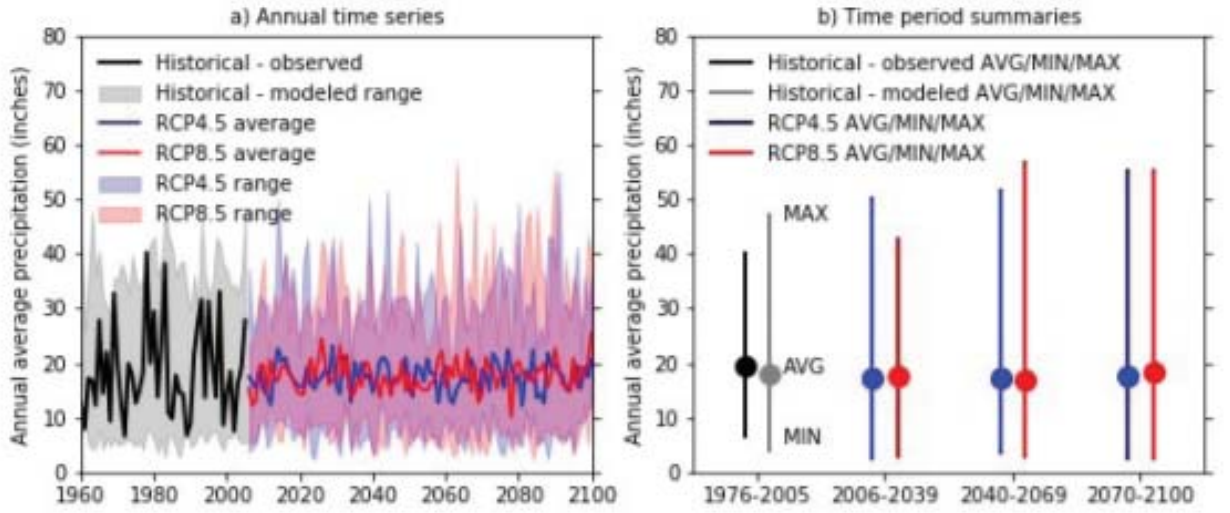
Key projected climate changes:

1. Continued future warming (Avg. max temps)
   - -4-5° F increase by mid-century
   - -5-8° degree F increase by late-century
2. # extreme temp days to increase as well as temperatures
3. Precipitation – dry and wet extremes expected to increase
4. Sea level rise
   - 1-2 ft increase by mid-century
   - 8-10 ft increase by end of century
5. Wildfire increases



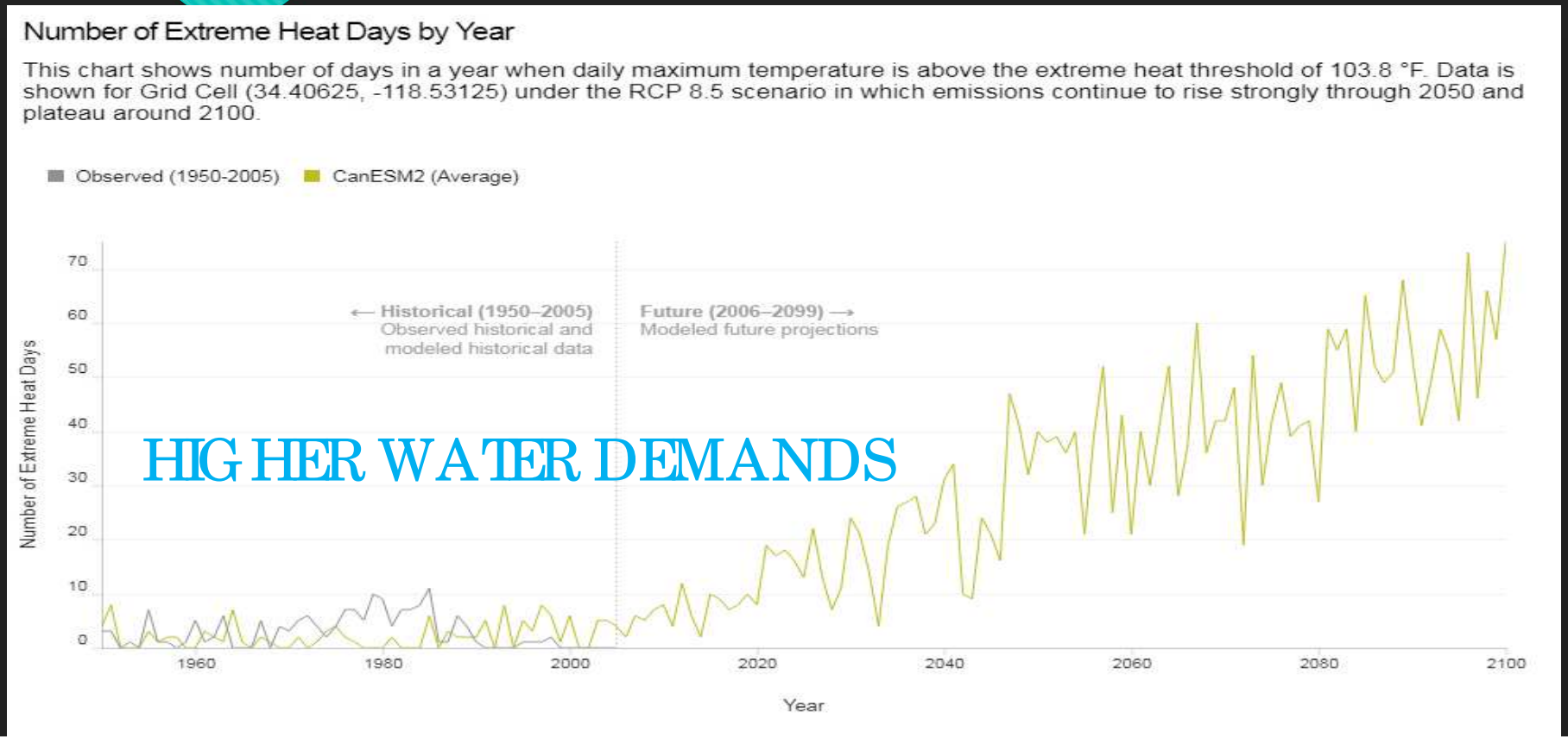
LA Region Precipitation

FIGURE 5



Historical observed (black), historical modeled (grey), and projected future (RCP4.5 - blue, RCP8.5 - red) annual average precipitation over the LA region. (a) Annual time series (historical: 1960-2005, RCP4.5/RCP8.5: 2006-2100), with solid lines representing model averages and shading representing spread across models. (b) Summary of model averages (circles) and spread (vertical lines) across four time periods: 1976-2005 (historical), 2006-2039 (early-21st century), 2040-2069 (mid-21st century), and 2070-2100 (late-21st century). Unit is inches.

Santa Clarita Extreme Heat Predictions – Days over 103.8° F

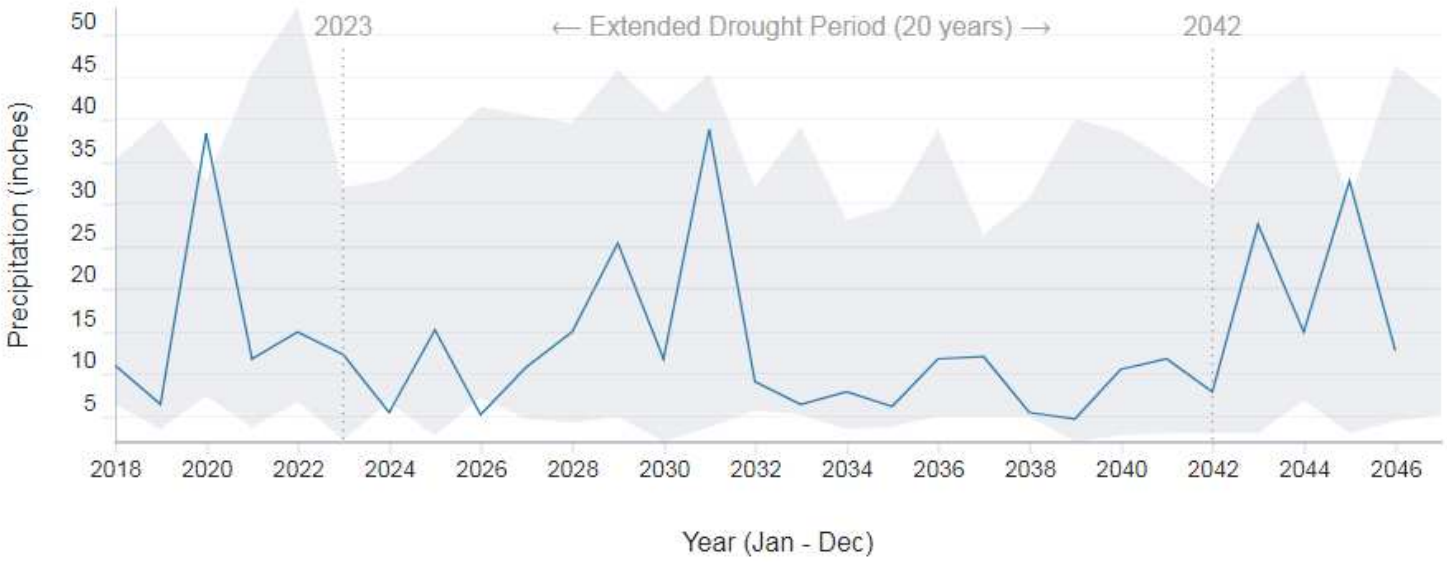


Santa Clarita Extended Drought Scenarios

GCM's project > 80% chance of a multidecadal drought during 2050-2099 under RCP 8.5

Precipitation

Accumulated rainfall and snowfall.



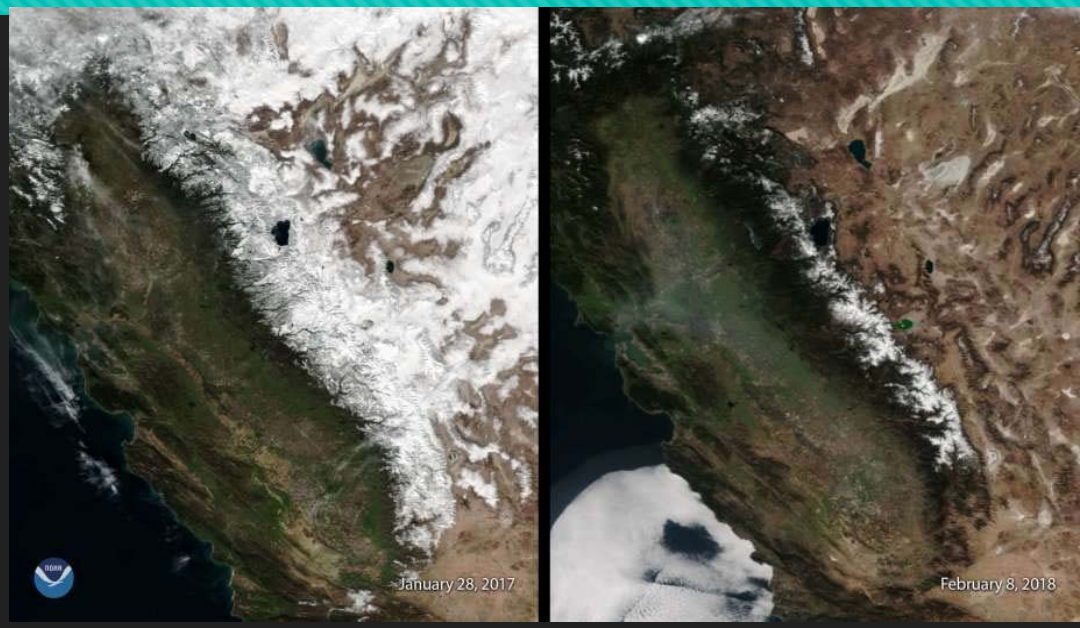
OBSERVED HISTORICAL
1961–1990 Average
16.7 inches

DROUGHT SCENARIO
2023–2042 Average
11.7 inches

Water Impacts

Water Supply Management Changes

- Timing of supply
- Reduced water availability
- Water supply portfolio
- New supply options

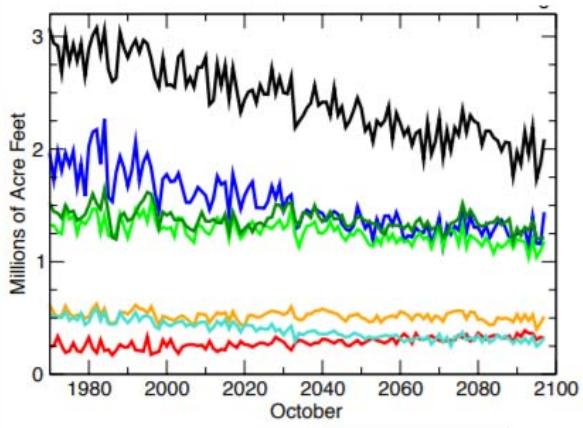


BY 2050
WATER SUPPLY FROM SNOWPACK
IS PROJECTED TO
DECLINE BY TWO-THIRDS

Imported Water

- Increased floods
- Reservoir operation risks
  - managing more extreme rainfall events and preventing floods
  - Carryover storage decline
- Increased drought
- Reduced water availability

FIGURE 17 | POTENTIAL CHANGES IN OCTOBER RESERVOIR STORAGE



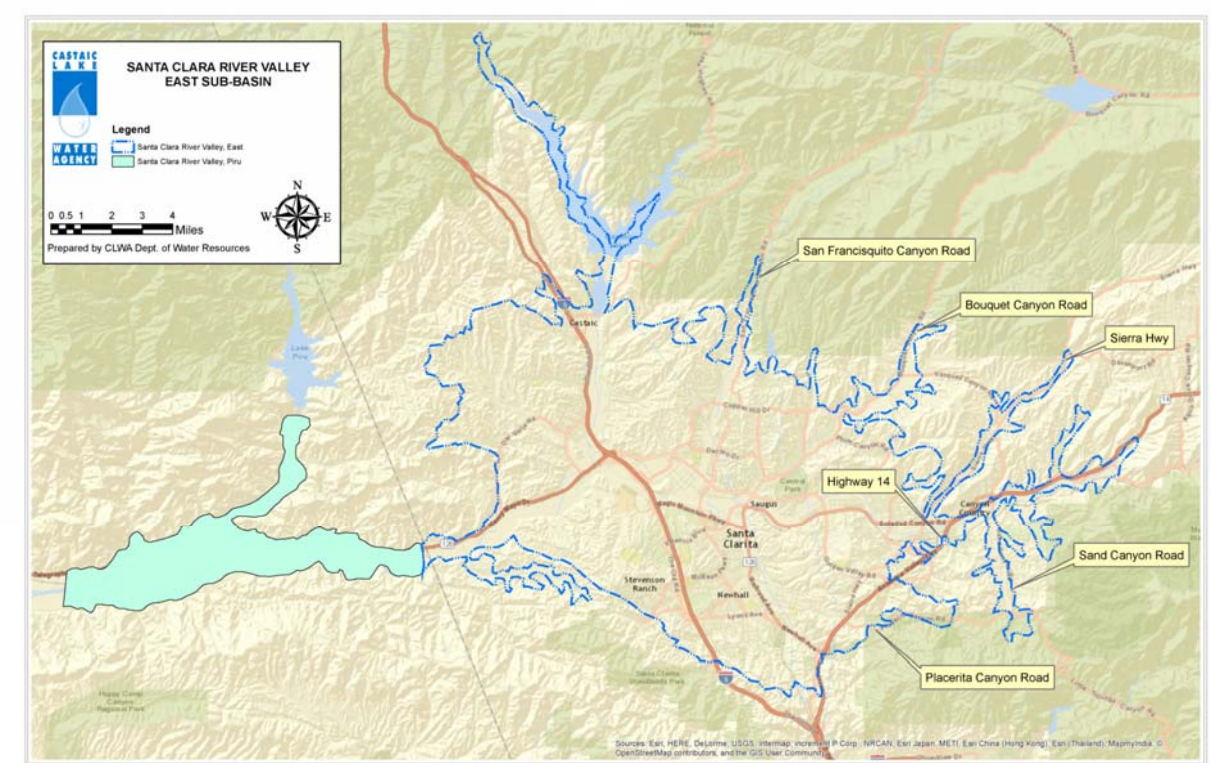
Potential changes of October reservoir storage for major water reservoirs in California. Source: Sierra Nevada Regional Report, 2018.

CA Delta

- Higher sea levels
- Levee failure
- Greater floods
- Saltwater intrusion
- Uncertainties in management of critical habitat
- Uncertainties in management of conveyance areas

Groundwater Management

- Critical source
- Increased groundwater storage
- Manage fluctuations (drier dry's and wetter wets)
- Shift from voluntary to mandatory requirements
- Groundwater drought reserves



Water Demand Changes

- Evapotranspiration increase
- Urban landscape – CRITICAL
- Water use behavior

Without adaptation demand increases

Water Energy Efficiency

Future of SCV Water Carbon Neutral

Watershed

- Wildfires – soil erosion
- Precipitation intensity
  - Capture and use more difficult
  - Greater flood risk and damages
  - Stormwater pollutant loading
- Ecosystem (warming)
  - Native plants deaths
  - Invasive species
  - Increased threat to stressed and endangered species

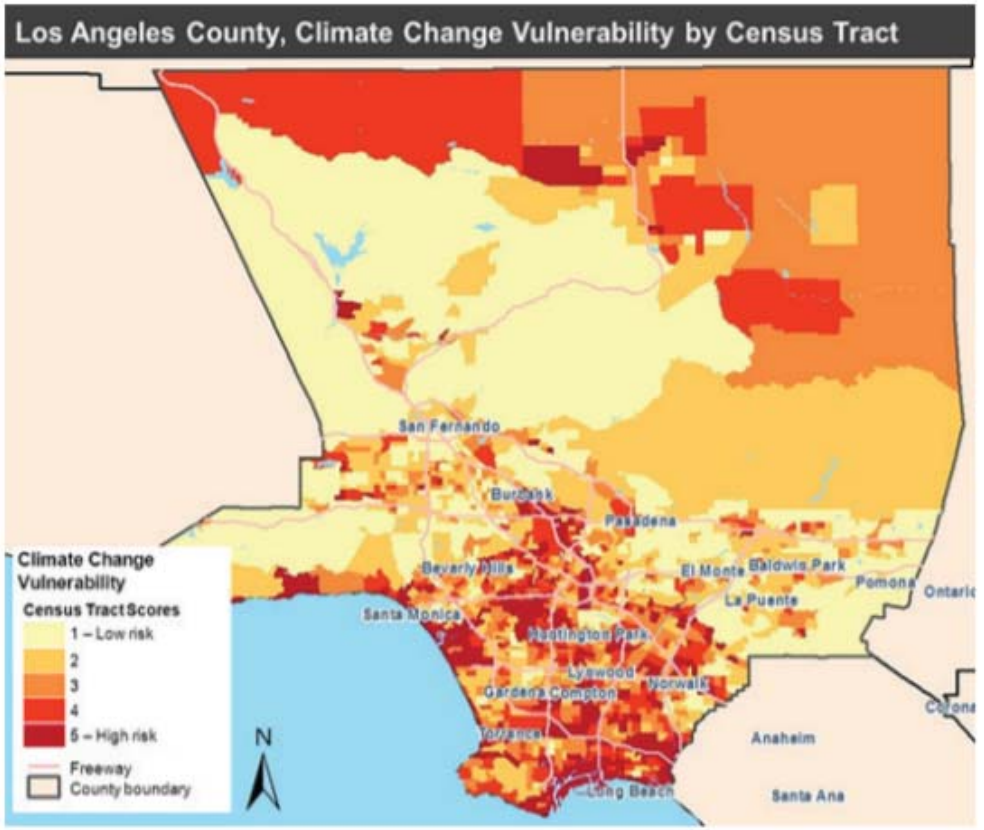
Water Quality

- Algae blooms
- Water treatment processes may need to change
  - Warmer water holds more dissolved material

Climate Change Vulnerability

1. Exposure related to climate change
2. Population sensitivity
3. Adaptive capacity

FIGURE 11



Distribution of cumulative impact and vulnerability screening scores using the Environmental Justice Screening Method (Sadd et al. 2011) that includes a climate change impacts score. The impact is more concentrated in urban portions of the region. (Map from English, et.al, 2013: https://escholarship.org/uc/item/8h669570)

Adaptation Strategies

1. Capture water in wet periods
2. Increase local storage water
3. Stormwater capture
4. Recycling
5. Updating infrastructure
6. Improve public communication
7. Increase water efficiency and conservation

Climate and Regulatory Vulnerability

Scenario C

- Reduced Alluvial and Saugus supplies
- RRB Bank at 10 TAF Recovery
- No Newhall Land Semitropic Bank Supplies
- 2035 Climate Change Assumptions (SWP)
- Restrictive Delta Operations (SWP)
- No Water Fix

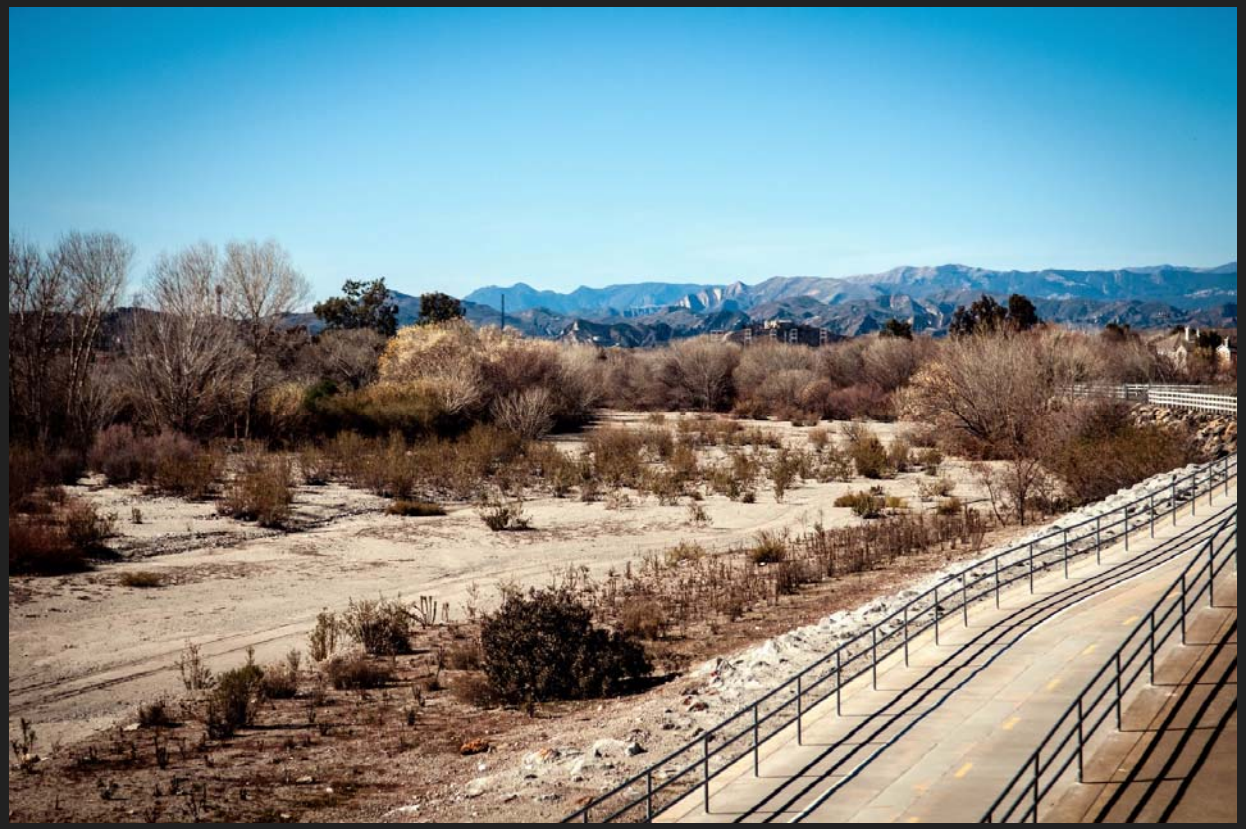
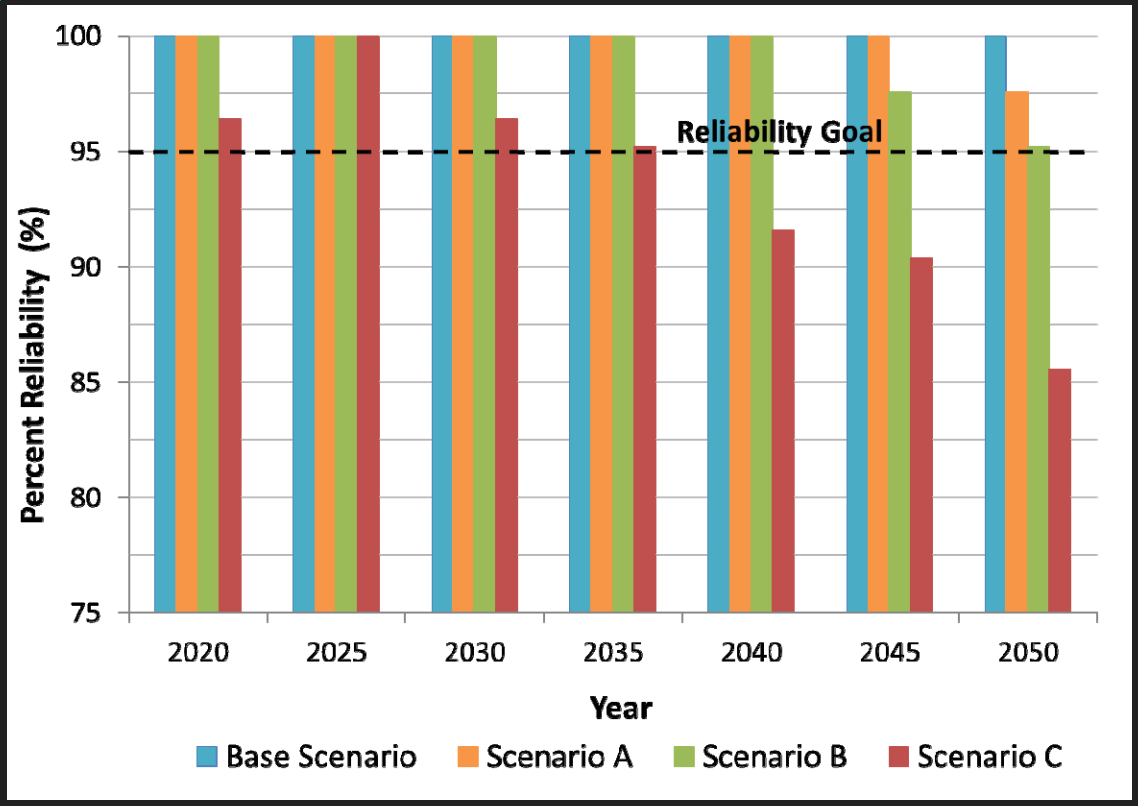


Photo by Thomas Wasper

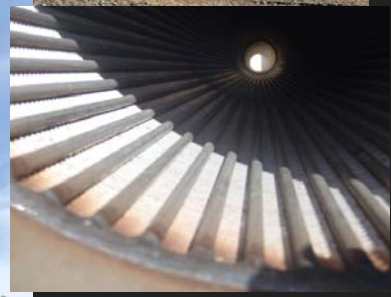
Supplies Without Adaptation



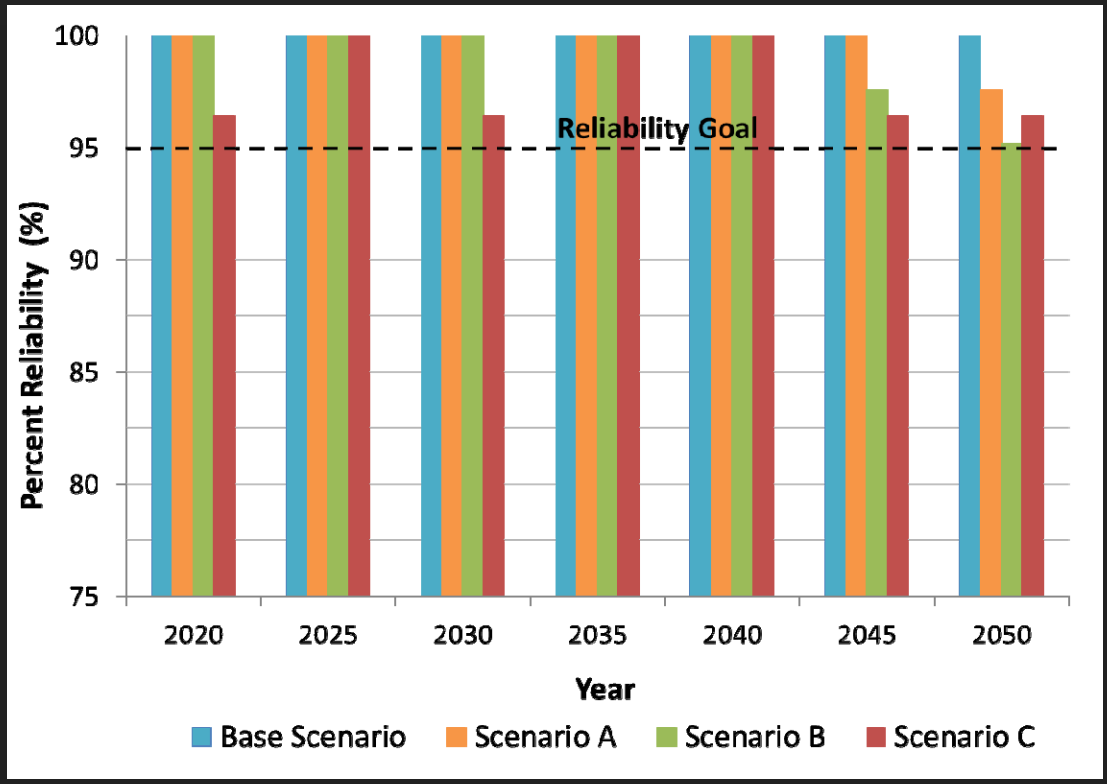
Adaptation Measures

Actions proposed to reach 95% reliability goal:

- Existing Rosedale-Rio Bravo Banking Program
  - Increase take capacity to 20,000 AFY
  - By 2035
- New Saugus storage and recovery program
  - Injection capacity of 5,000 AFY
  - Recovery capacity of 10,000 AFY
  - By 2046



Reliability of Scenarios with Scenario C Proposed Actions



Additional Adaptation Under Investigation

- Alluvium Recharge
- New State Water Conservation/Efficiency Standards
- Stormwater Capture
- Recycled Water

Conclusion

Continue to integrate climate change into existing planning and decision-making processes that traditionally excluded climate change considerations.