California's 4th Climate Change Assessment: Lake Tahoe Implications

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TAHOE REGIONAL PLANNING AGENCY

Presentation Overview

- Lake Tahoe background
- California's 4th Climate Assessment Report
- Policy implications going forward

Only a handful of lakes in the world have Lake Tahoe's combination of spectacular natural features along with its significant size and depth – and it's not a national park.

- Lake Tahoe is one of only three bodies of water on the West Coast designated as an *Outstanding National Resource Water*, under the Clean Water Act.

THE WATERSHED

- 501 sq. miles
- 192 sq. miles lake surface area
- 12 miles wide
- 22 miles long
- 72 miles of shoreline
- 1,625 ft. deep
- 6,223 ft. natural rim elevation

- 50,000 year-round residents
- Majority of property owners are part-time residents
- USFS and States manage 85% of land
- 600+ yr. retention rate


WELCOME TO
SQUAW VALLEY USA

2 states: CA, NV
(183 state legislators)

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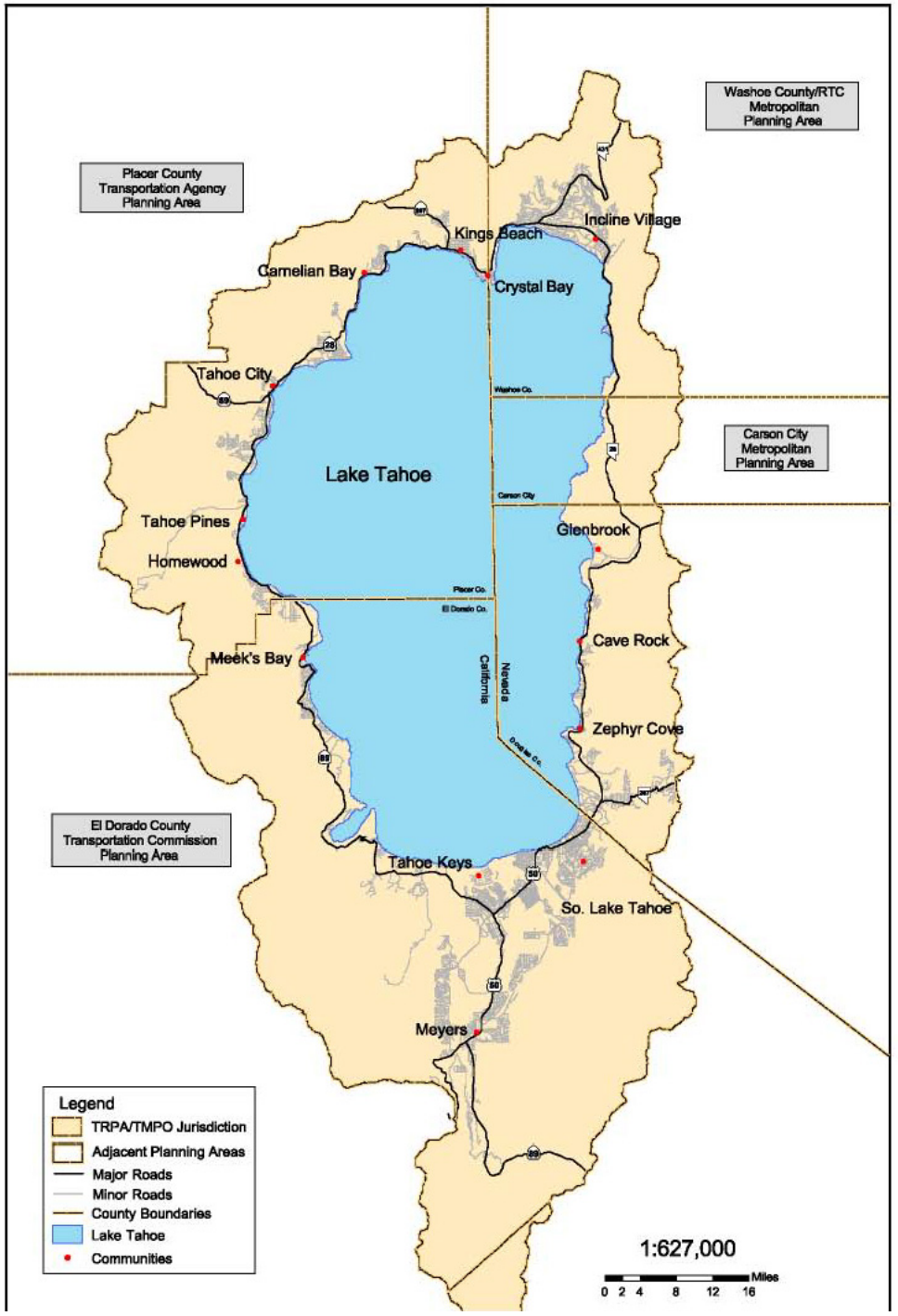
5 counties/
1 city
(30 locally elected officials)

Federal Government



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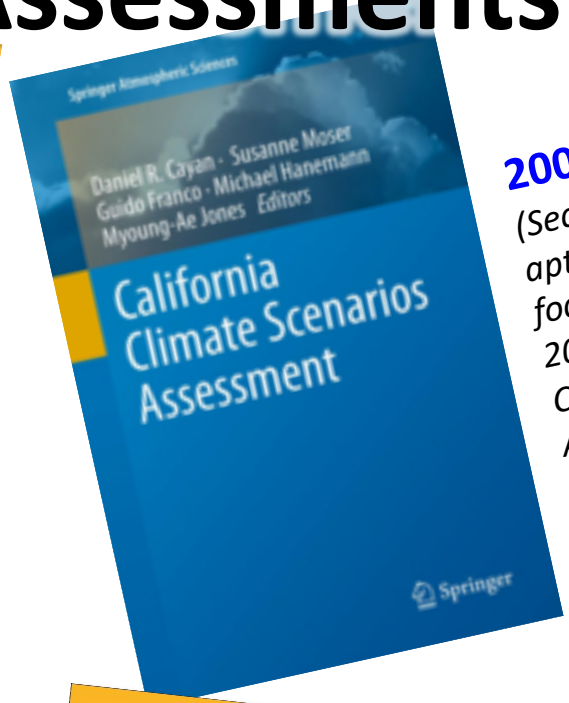
Sierra Nevada Region Report

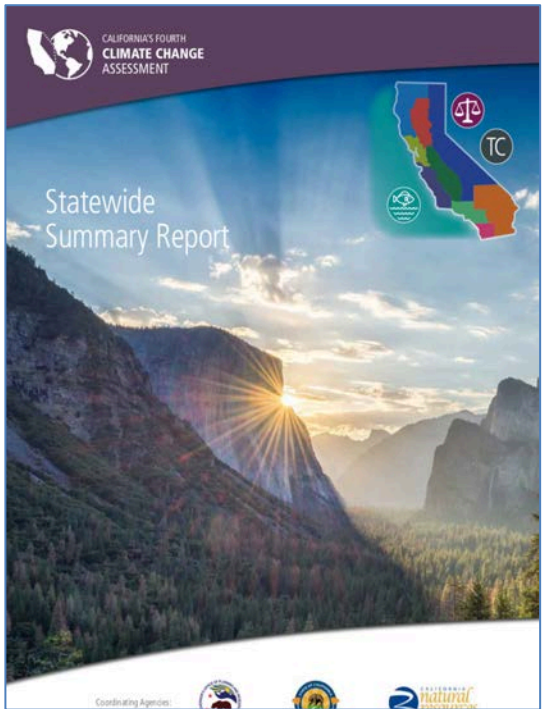
California Climate Assessments

- Executive Order S-3-05, from Schwarzenegger (June 2005) → **preparation of regular assessments of the science**

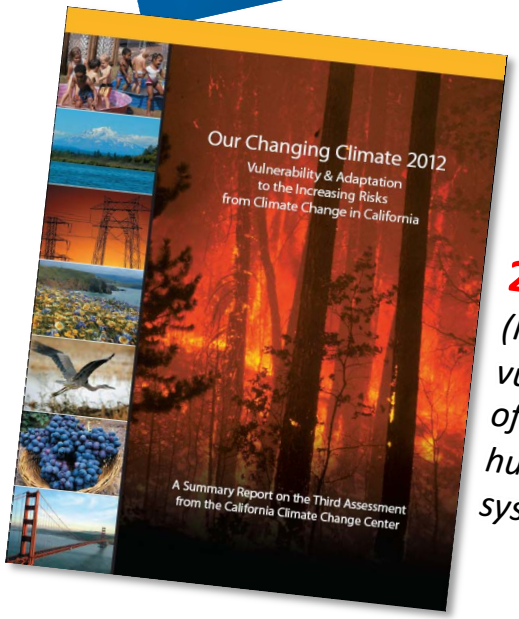
2006
(Impacts focus → AB32)



2008/9
(Sectors/adaptation focus → 2009 Climate Adaptation Strategy)



2018 ***(Topical & regions scales → Implementation of AB2800 → getting down to action)***



2012
(Focus on vulnerabilities of natural & human systems)

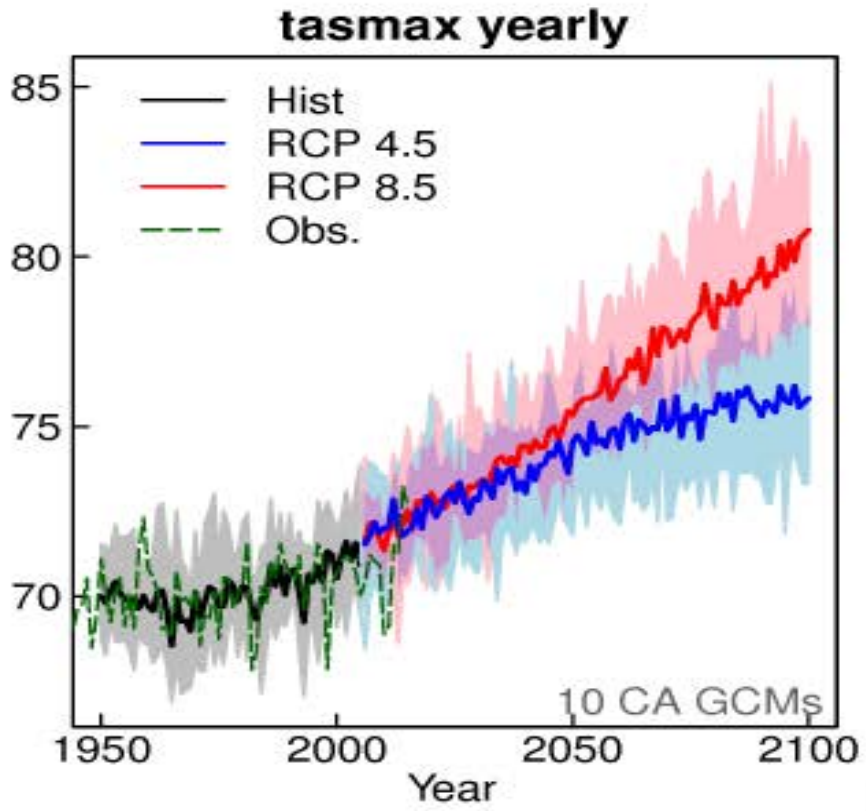
0. Temperature Projected to Rise Substantially

Under plausible future greenhouse gas emissions

BY 2100
AVERAGE ANNUAL MAXIMUM
DAILY TEMPERATURE
IS PROJECTED TO
INCREASE BY
5.6°–8.8° F

Depending on greenhouse gas emissions reductions. The greatest increase is seen with business-as-usual emissions levels.

Pierce, Cayan, Kalansky, 2018



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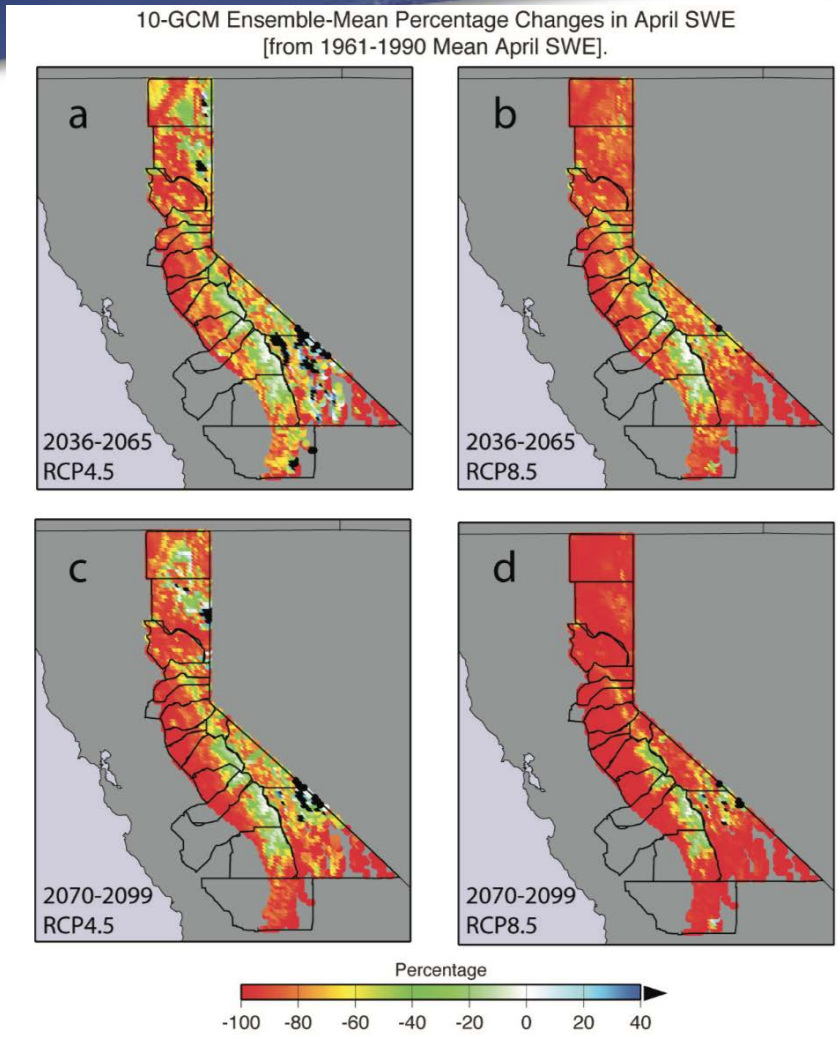
SNOWPACK CHANGE

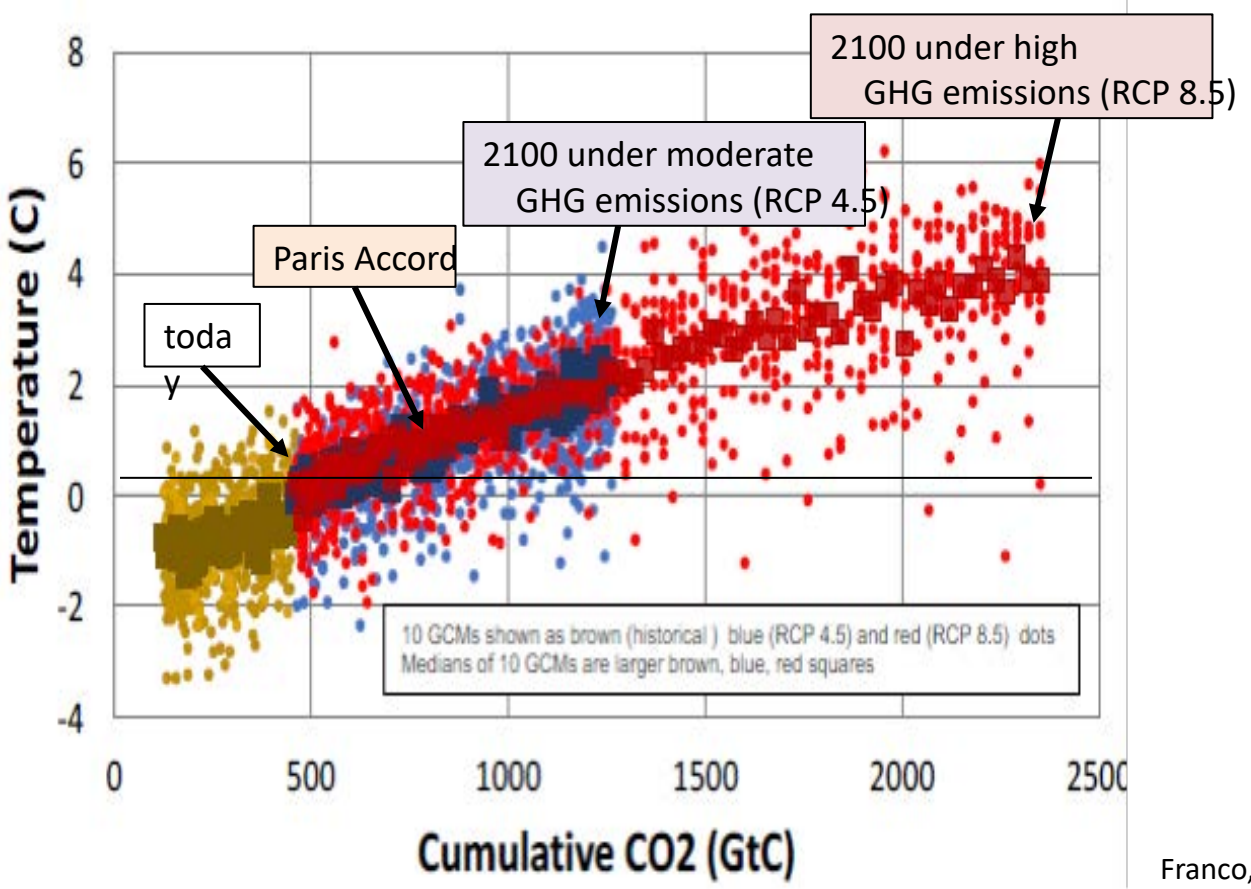


Changes in snow-water content projected for 2036-2065 (a, b) and 2070-2099 (c, d), under two greenhouse-gas concentration pathways into the future.

http://www.climateassessment.ca.gov/regions/docs/20180827-SierraNevada.pdf

Overarching themes

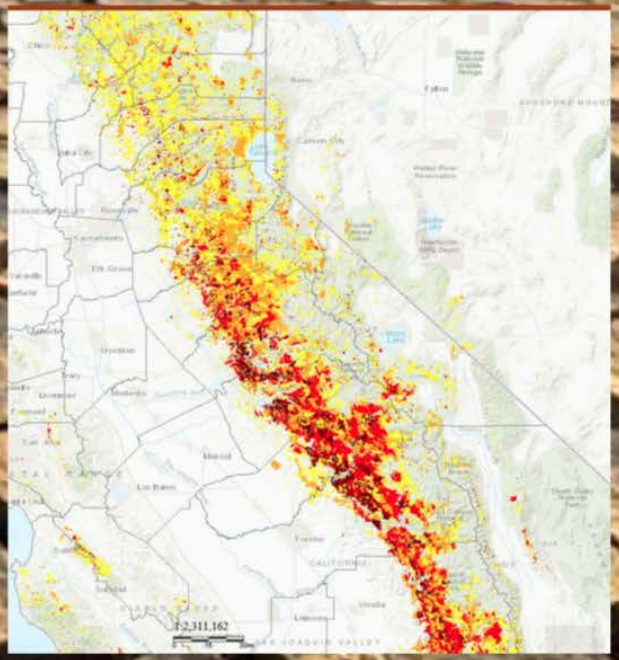
1. Adaptation Will be Less Demanding if Global GHG Emissions are Greatly Reduced (Soon)



Franco, Cayan, et al., 2018

2. Extremes Are Important

- Greater likelihood of multi-year or even multi-decade droughts
- Devastating 2012-2016 drought
  - Water stress and weak trees
  - Bark beetles
- More variation year to year
- Droughts punctuated by major floods



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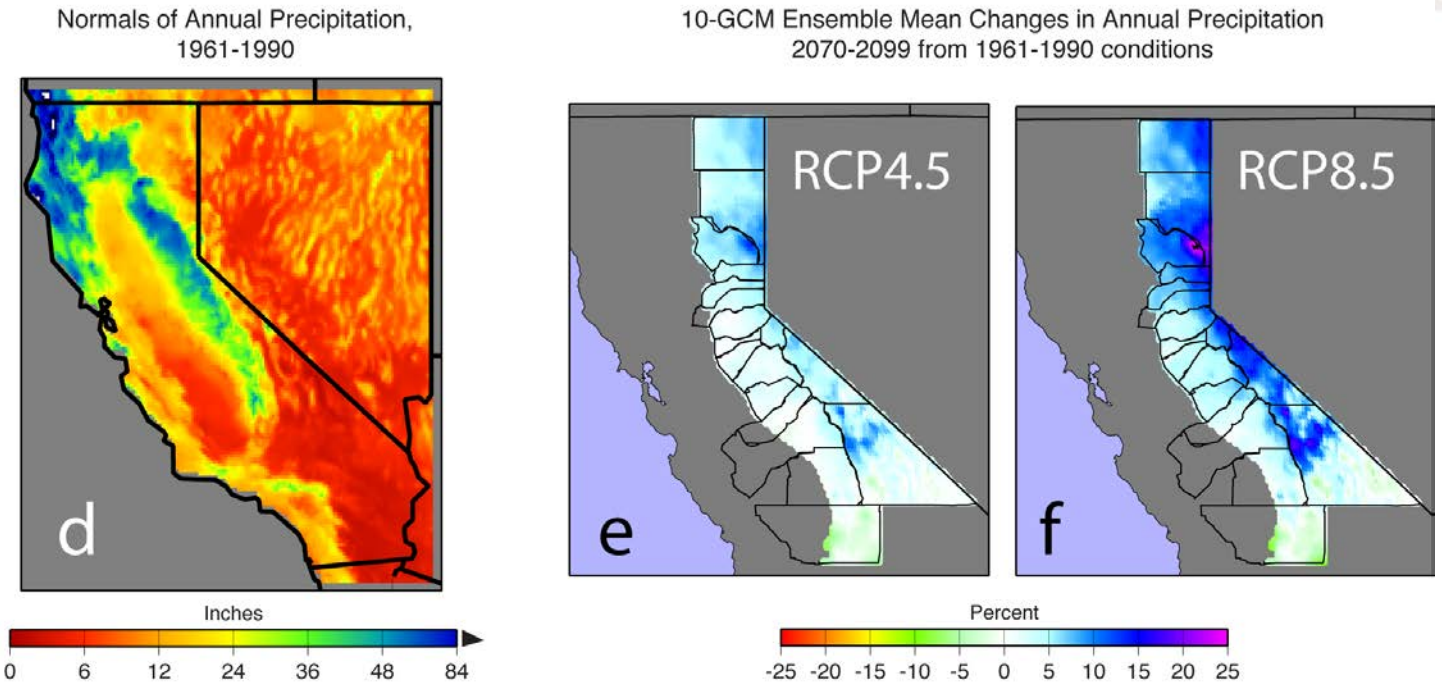
Future of Annual Precipitation uncertain

(perhaps modest increases?)

Annual Precipitation



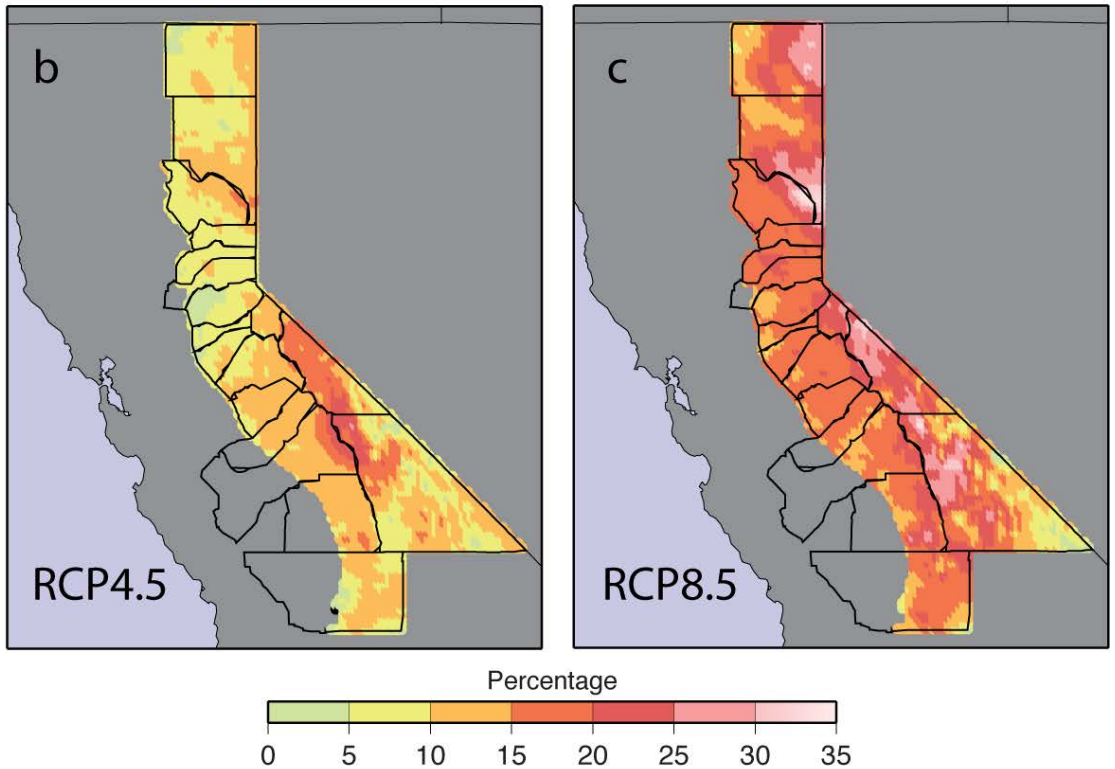
Future of Annual Precipitation uncertain, but Extremes WILL Increase

Extreme Precipitation Intensities

Changes in 3-day Max Precipitation

2070-2099 minus 1961-1990

10-15% larger large storms



20-25% larger large storms!

3. Land Use Decisions Will Be Crucial Tools

Overarching themes

4. California's Most Immediate Challenge is likely to be WATER

Apr 1, 2014

Apr 1, 2015

5. Barriers to adaptation recognized

Leading barriers to climate adaptation for CA local governments:

- **Lack of funding**
- **Insufficient staff resources and capacity**

Kay et al., 2018
Moser et al., 2018

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SIERRA NEVADA REGION

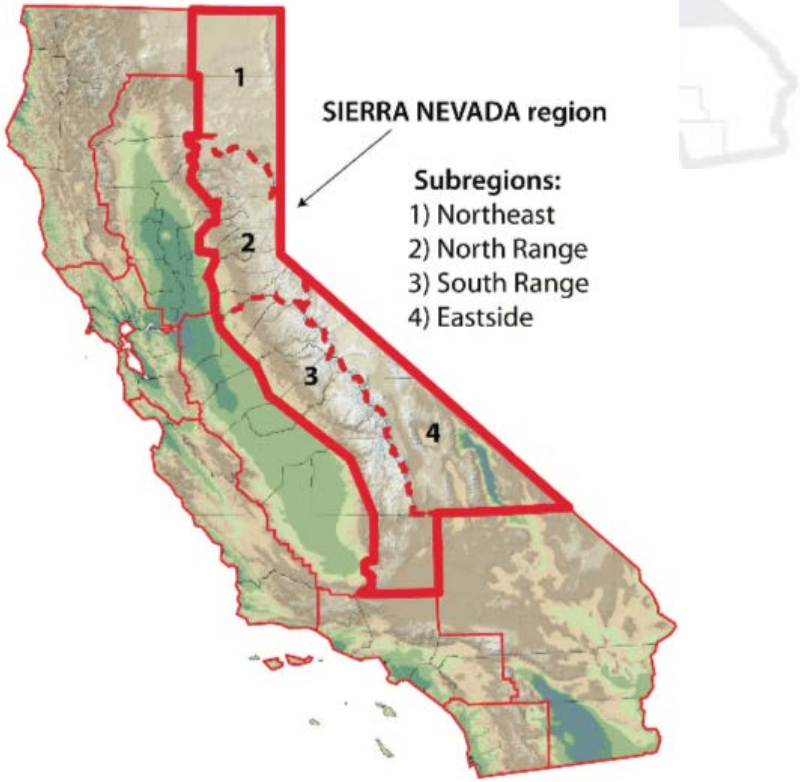
MAIN ELEMENTS OF REPORT

- Background & Projections

- Landscapes, Fires & Wildlife
- Water Resources
- Communities

- Info Gaps & Needs

- Current Adaptation/Planning



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SURFACE-WATER CHANGE

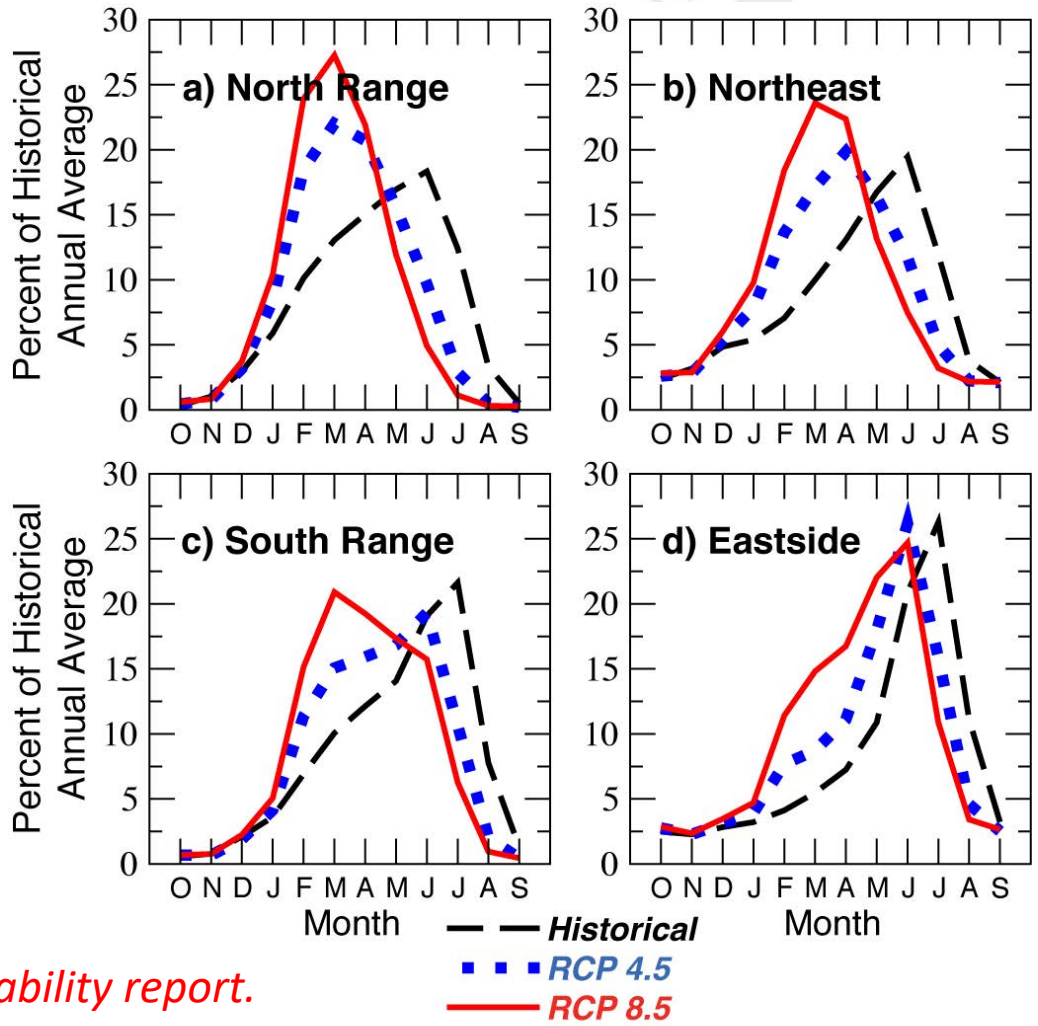
Water-Year Runoff Totals by 2071-2099 (as percents of 1961-1990 norms

± 1 std deviation)

Subregion	RCP4.5	RCP8.5
Northeast	**107***±18%*	**113***±27%*
North Range	**103***±17%*	**107***±26%*
South Range	**100***±20%*	**105***±36%*
Eastside	**108***±22%*	**121***±47%*

10-climate-model averages *± std devs*

PROJECTIONS of Runoff Seasonality



Details for Tahoe await the TCCAAP vulnerability report.

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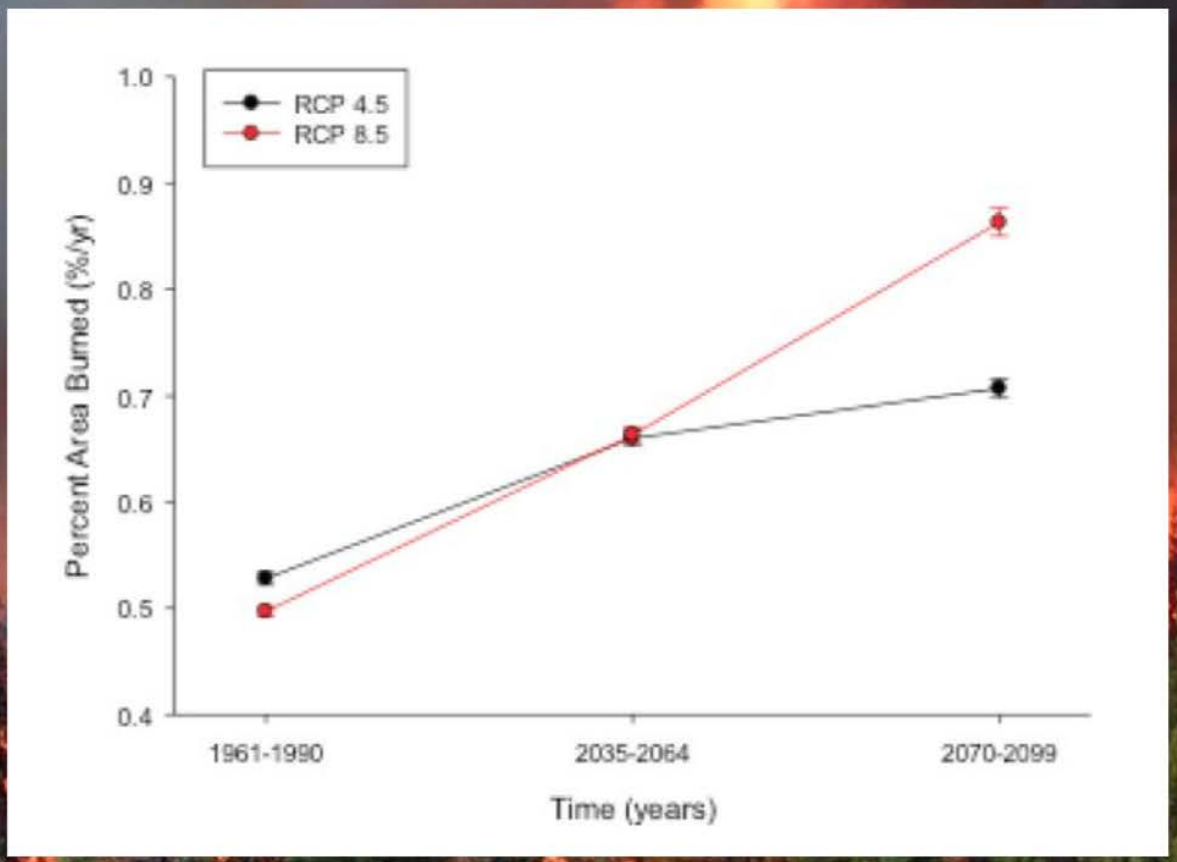
Landscapes, Fires & Wildlife



Projections:

- More wildfire
  - Larger areas burned
  - More large fires (>24,700 ac)
- More drought stress
- Less carbon stored
- Reproduction & survival threatened
- Range shifts
  - Range edges most vulnerable

h/t Battles, Knight, Safford & Sawyer,
UC Berkeley & Forest Service

Climate change impacts to SN water resources

- Snowpack loss
- Shifts to snowmelt/runoff /streamflow timing
- Extreme events: drought, flood
- Groundwater use
- Water quality changes

h/t Alpert & Dettinger,
Inyo-Kern IRWMP & USGS

New realities of water management

Longer and drier Sierra Nevada summers

Changes in hydrology not uniform over SN

Extreme events will increase in magnitude and frequency

h/t Alpert & Dettinger,
Inyo-Kern IRWMP & USGS

COMMUNITIES

- **Communities are being challenged by the changing climate.**
- **Their abilities to respond depend on (1) how severe the climate challenges are/will be,**
- **And (2) on the "capital" available to them.**

h/t Kusel & Miller,
Sierra Institute

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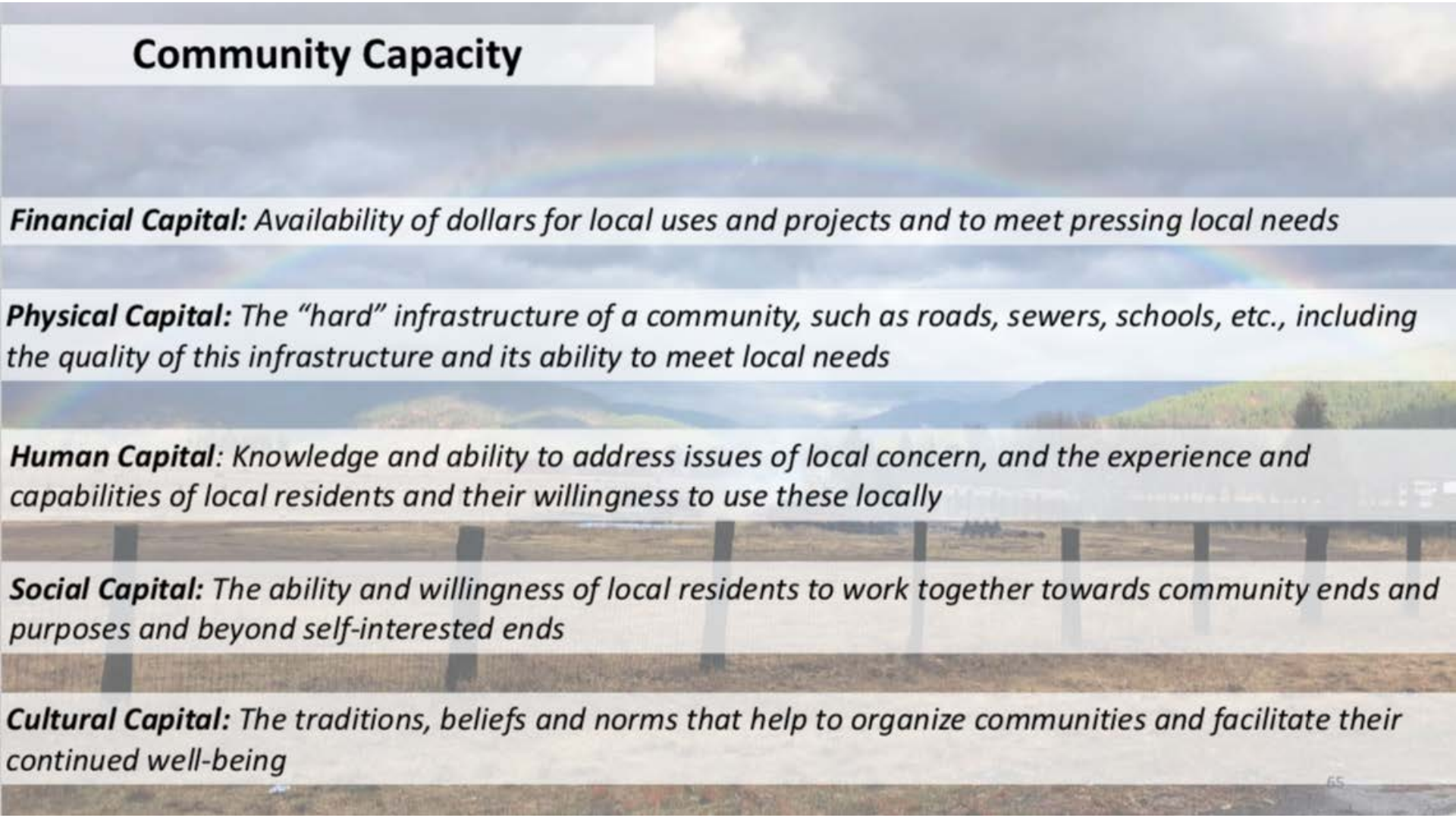

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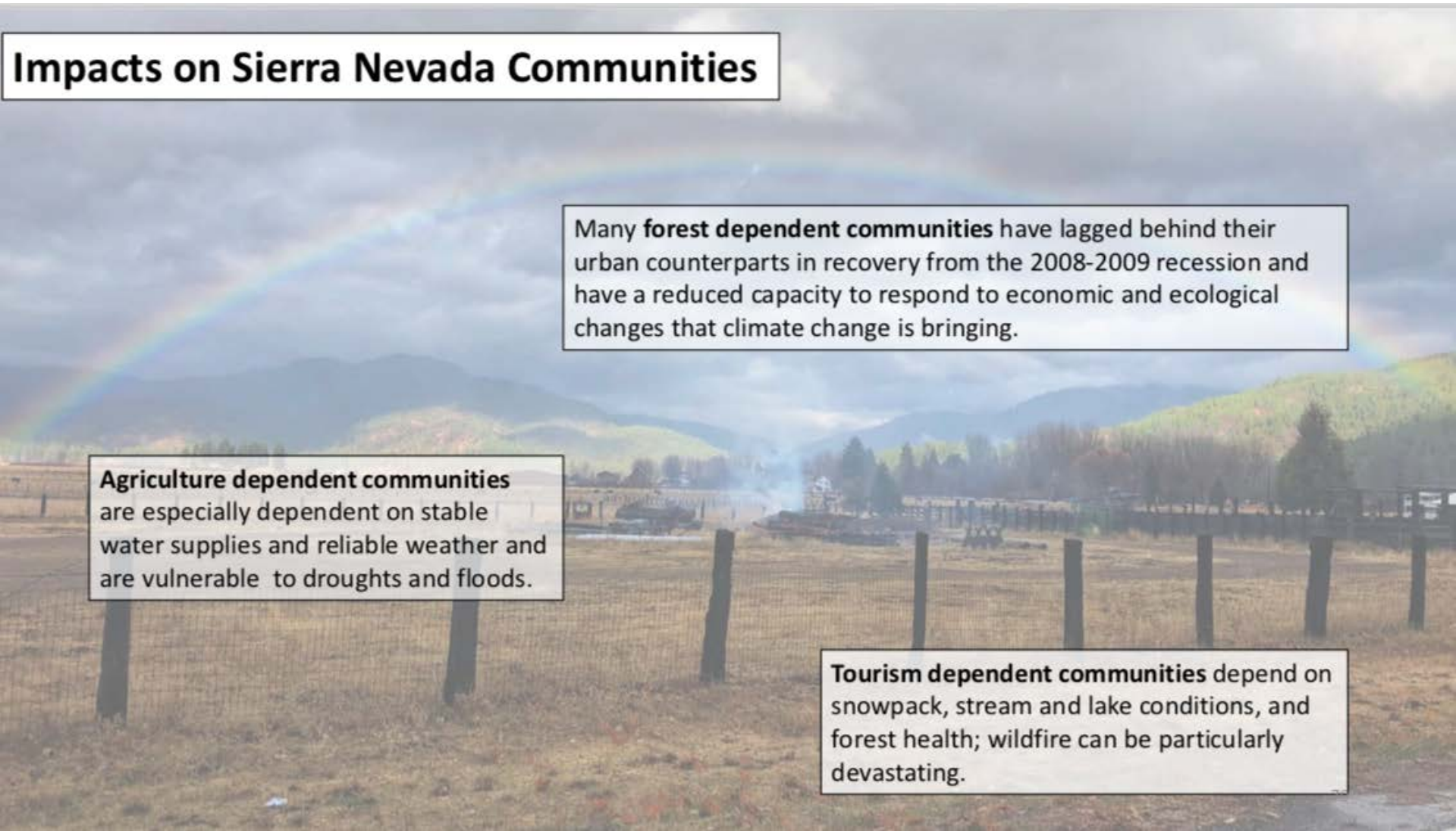

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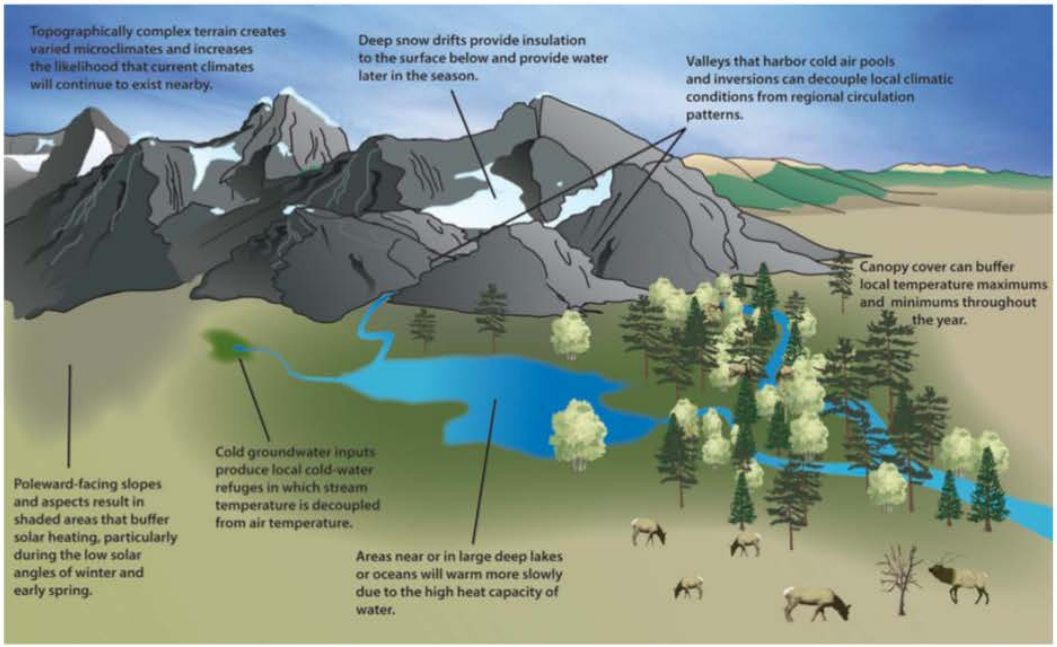
The Four R's of Climate Adaptation

Resistance:

- Remove tree seedlings encroaching into meadows
- Protect climate refugia

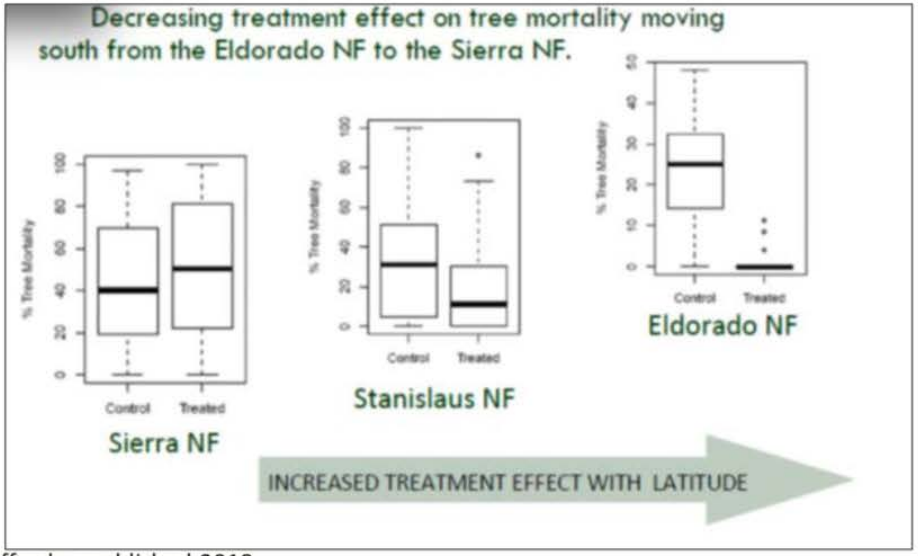


- Suppress Fire

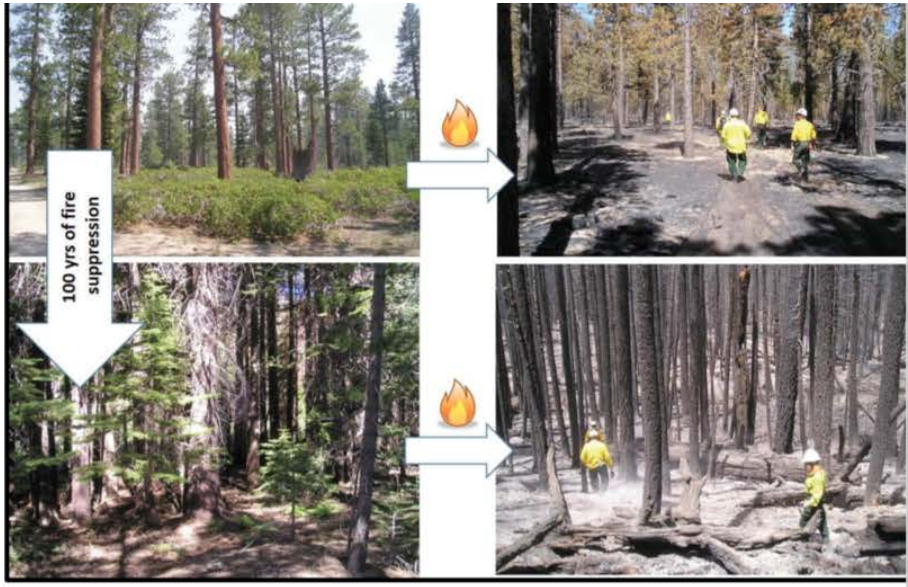
The Four R's of Climate Adaptation

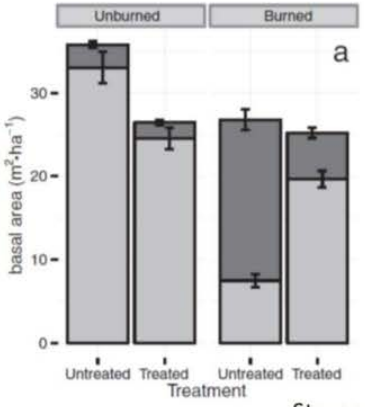
Resilience:

- Reduce forest densities to decrease water stress, fire hazard, and insect outbreaks
- Manage rather than suppress wildfires when possible;



Safford unpublished 2018





Stevens et al. 2014

The Four R's of Climate Adaptation

Response & Realignment:

- assisted migration/managed relocation of species or genotypes to locations beyond native ranges but where current or future climate is favorable;
- promotion of hardwood/broadleaf species in settings currently dominated by lower-elevation conifers;
- cessation of planting or protecting species where their sustainability is highly doubtful;
- decommissioning roads and trails in locations where large and recurrent climate change-related impacts

ACTIVE ADAPTATION EFFORTS

EXAMPLES:

- Lake Tahoe Environmental Improvement Program
  - Forest Health, Invasive Species, Watershed Restoration Projects
- Sierra Nevada Watershed Improvement Program
- Tahoe Climate Adaptation Plan
- Lake Tahoe West Restoration Partnership
- Integrated Regional Water Management Program

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Fuels Treatments Underway at Tahoe

Project Before Treatment

LAKE TAHOE
ENVIRONMENTAL
IMPROVEMENT
PROGRAM

Project After Treatment

LAKE TAHOE
ENVIRONMENTAL
IMPROVEMENT
PROGRAM

Special thanks to Dr. Mike Dettinger, USGS

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http://www.climateassessment.ca.gov/regions/


Thank You!
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