Climate Trends in the Central Valley:

Historic and Projected Changes in Habitat Due to Climate Change

Erin Chappell
Senior Environmental Scientist
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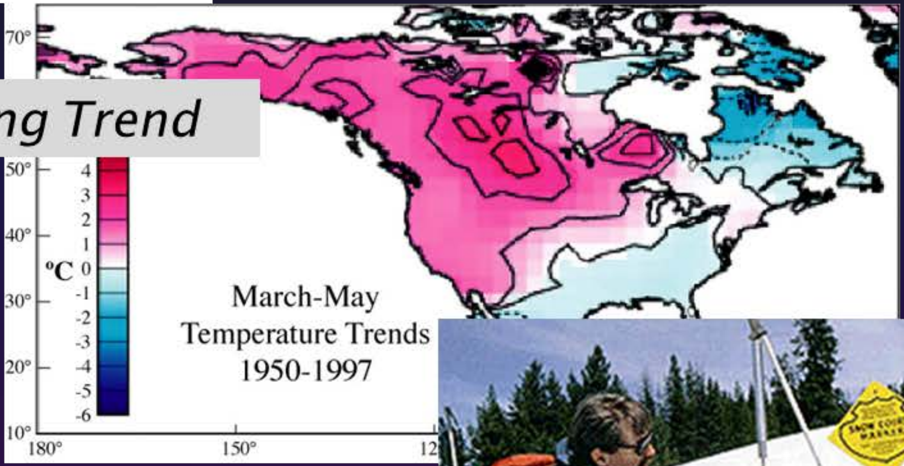
Recent Observations

Warming Trend



Less snow/more rain; changing snow thresholds

Less Snowpack

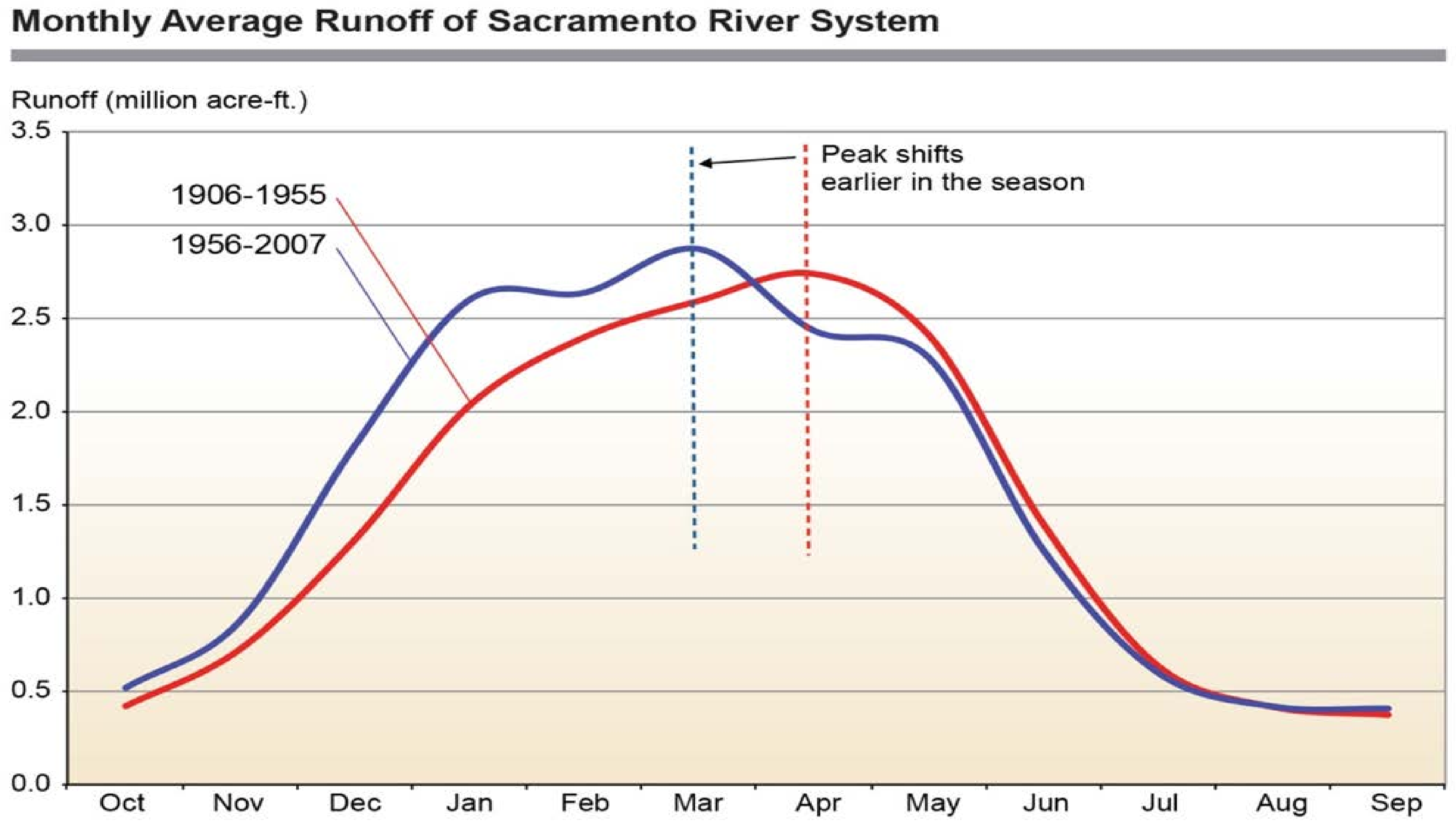
Earlier greenup dates; more tree mortalities; enhanced wildfires

Animals moving north

Earlier snowfed streamflow

Mike Dettinger, USGS and SIO/UCSD

Shifts in Runoff Timing



Average monthly runoff in the Sacramento River System is a critical component of California's water supply. Flood protection and water supply infrastructure have been designed and optimized for historical conditions. However, the timing of peak monthly runoff between 1906-1955 (redline) and 1956-2007 (blue line) has shifted nearly a month earlier indicating that this key hydrology metric is no longer stationary. Timing is projected to continue to move earlier in the year, further constraining water management by reducing the ability to refill reservoirs after the flood season has passed.

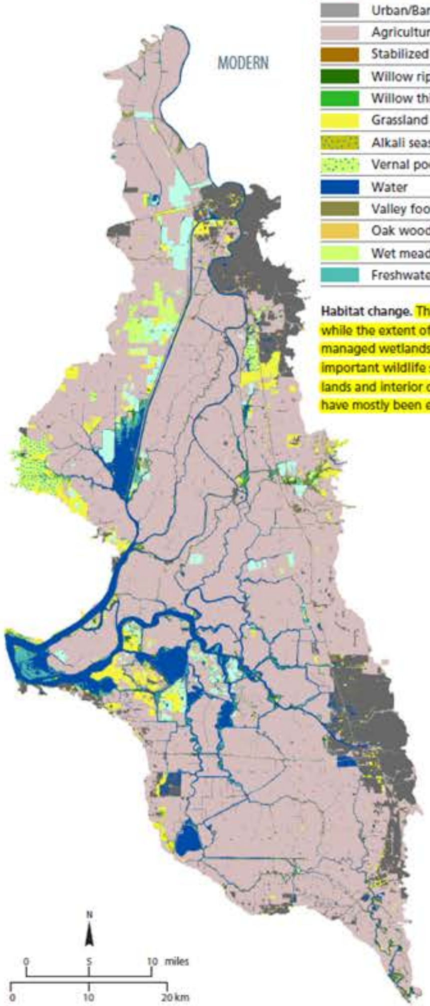
Visualization of the Central Valley (1850s)

Credit: Mark Clark
Source: Frank Jacobs

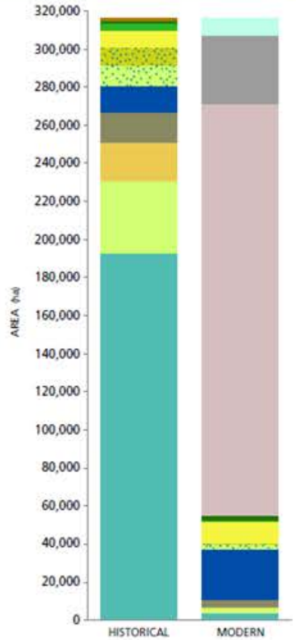
Habitat Changes in the Sac-SJ Delta

Source: SFEI (2014) - ***A Delta Transformed***

Habitat Type	Area (ha) Historical	Area (ha) Modern	% Change
Managed wetlands	0	9,454	∞
Urban/Barren	0	35,517	∞
Agriculture/Non-native/Ruderal	0	216,085	∞
Stabilized interior dune veg.	1,032	4	-99
Willow riparian scrub/shrub	1,637	2,878	+76
Willow thicket	3,567	132	-96
Grassland	9,108	11,800	+30
Alkali seasonal wetland complex	9,193	238	-97
Vernal pool complex	11,262	3,007	-73
Water	13,772	26,530	+93
Valley foothill riparian	15,608	4,010	-74
Oak woodland/savanna	20,460	0	-100
Wet meadow/Seasonal wetland	37,561	2,445	-93
Freshwater emergent wetland	193,224	4,253	-98



Habitat change. The extent of wetland habitats has decreased in the modern Delta while the extent of open water and grasslands has increased. Agriculture and managed wetlands take up a large portion of the modern Delta and provide some important wildlife support but are not equivalent to historical habitats. Oak woodlands and interior dune scrub have mostly been eliminated.



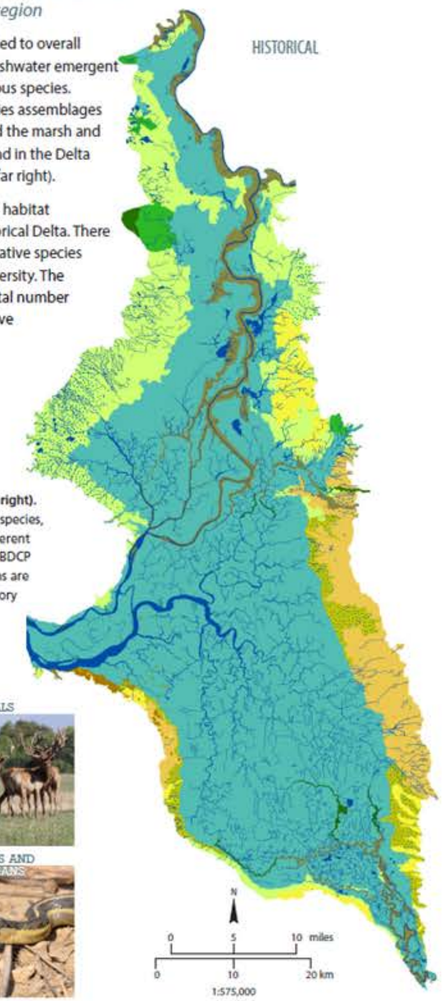
Species habitat associations

The variety of Delta habitats supported native wildlife diversity

The historical Delta supported a unique assemblage of species, contributing to the overall biodiversity of the region

Habitat diversity within the historical Delta contributed to overall species diversity. Much of the historical Delta was freshwater emergent marsh and aquatic habitat, which supported numerous species. Adjacent habitat types each supported distinct species assemblages and provided additional support to species that used the marsh and aquatic habitats. Many of the protected species found in the Delta today relied on varied habitat types historically (see far right).

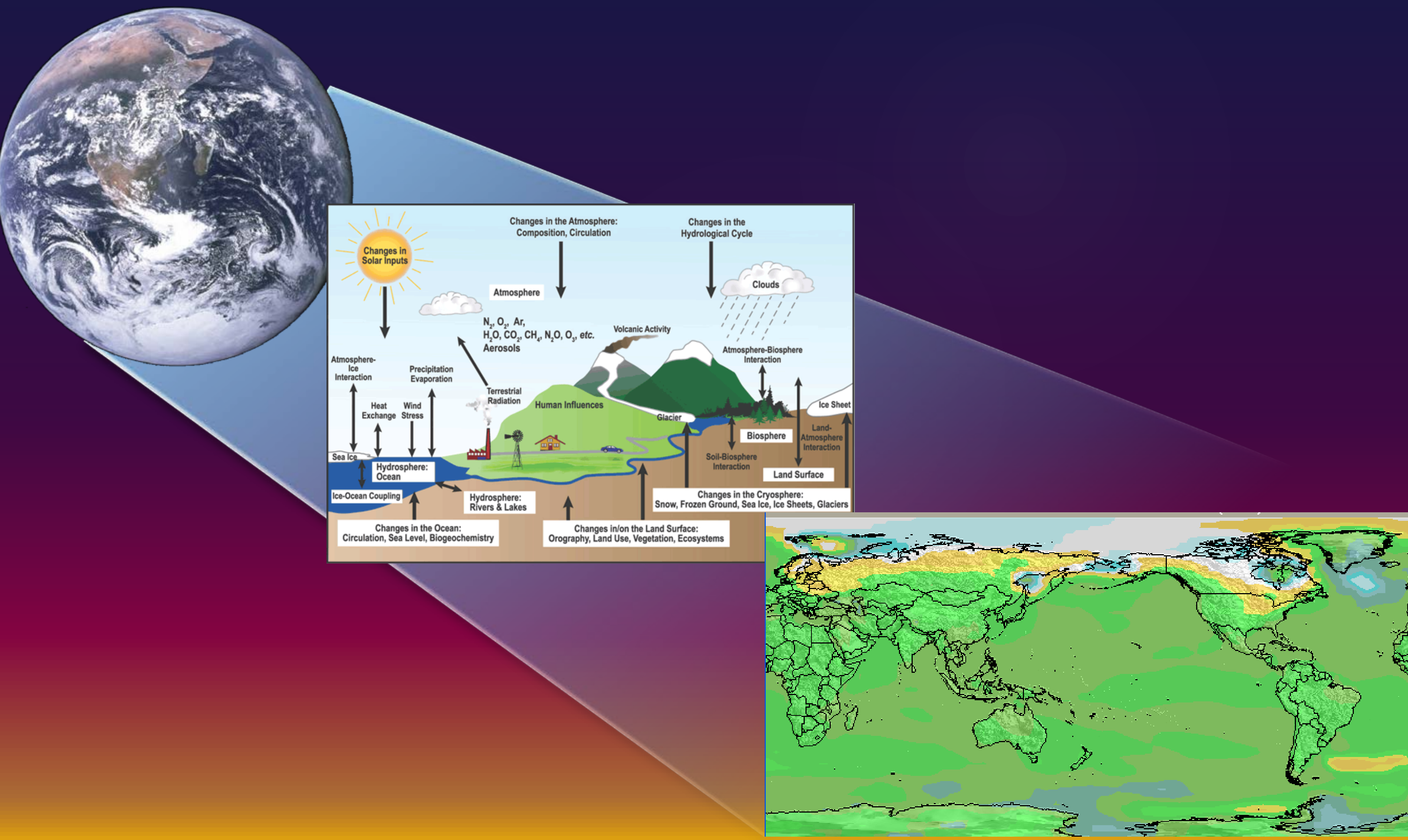
Abundant resources from multiple habitat types and habitat adjacencies led to significant biodiversity in the historical Delta. There were also areas of importance to endemic and rare native species that disproportionately contributed to overall biodiversity. The introduction of invasive species has increased the total number of species in some areas, likely at the expense of native species diversity.[20]



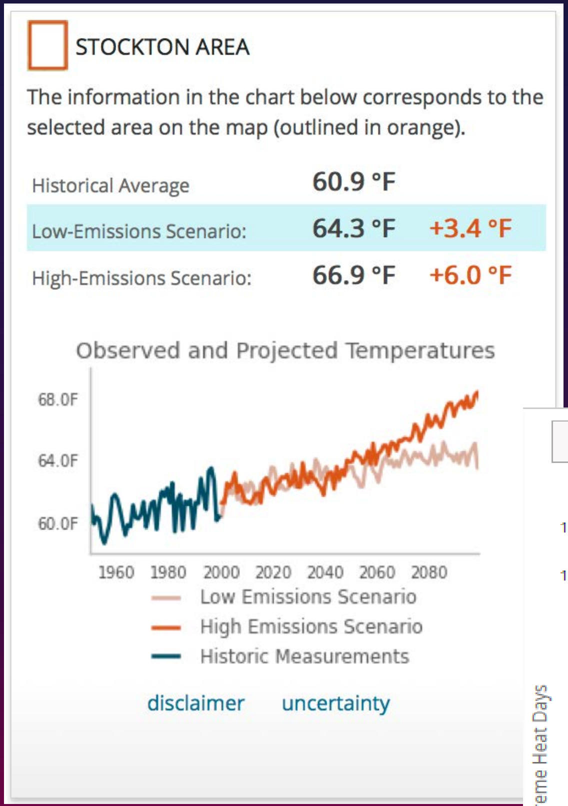
Delta habitat types (right) and their affiliated species (far right). Each habitat type in the Delta supported specific suites of species, though several species used multiple habitat types for different phases of their lives. The species listed to the far right are BDCP Covered Species. Historical species-habitat type associations are based on modern species-habitat associations and life-history characteristics.[21]

Photo Credits (clockwise from top left): Dan Cox, USFWS; Steve Emmons, USFWS; Lee Eastman, USFWS; Brian Hansen, USFWS; Jon Katz and Joe Silveira, USFWS; Steve Martarano, USFWS

Projected Changes in Climate



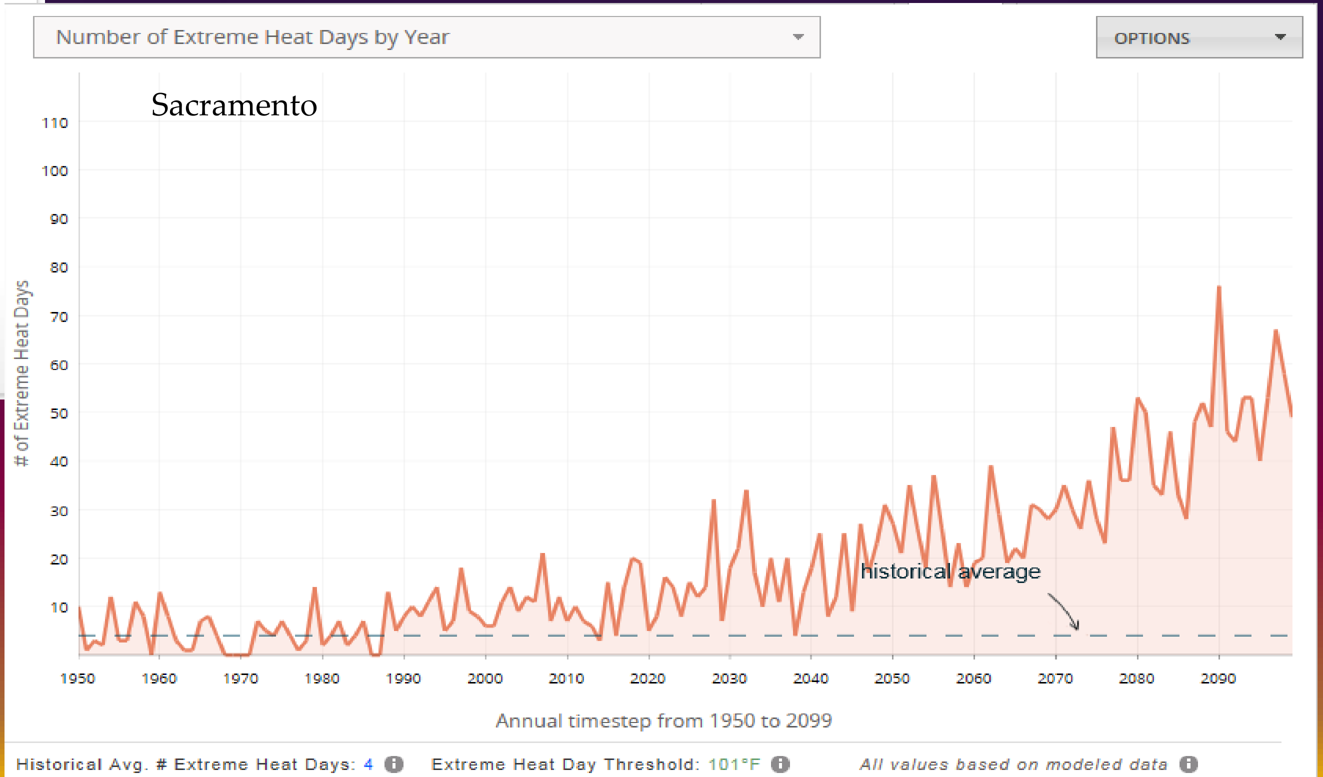
Projected Changes: *Temperatures*



Increase in mean temperature of 5-6ºF

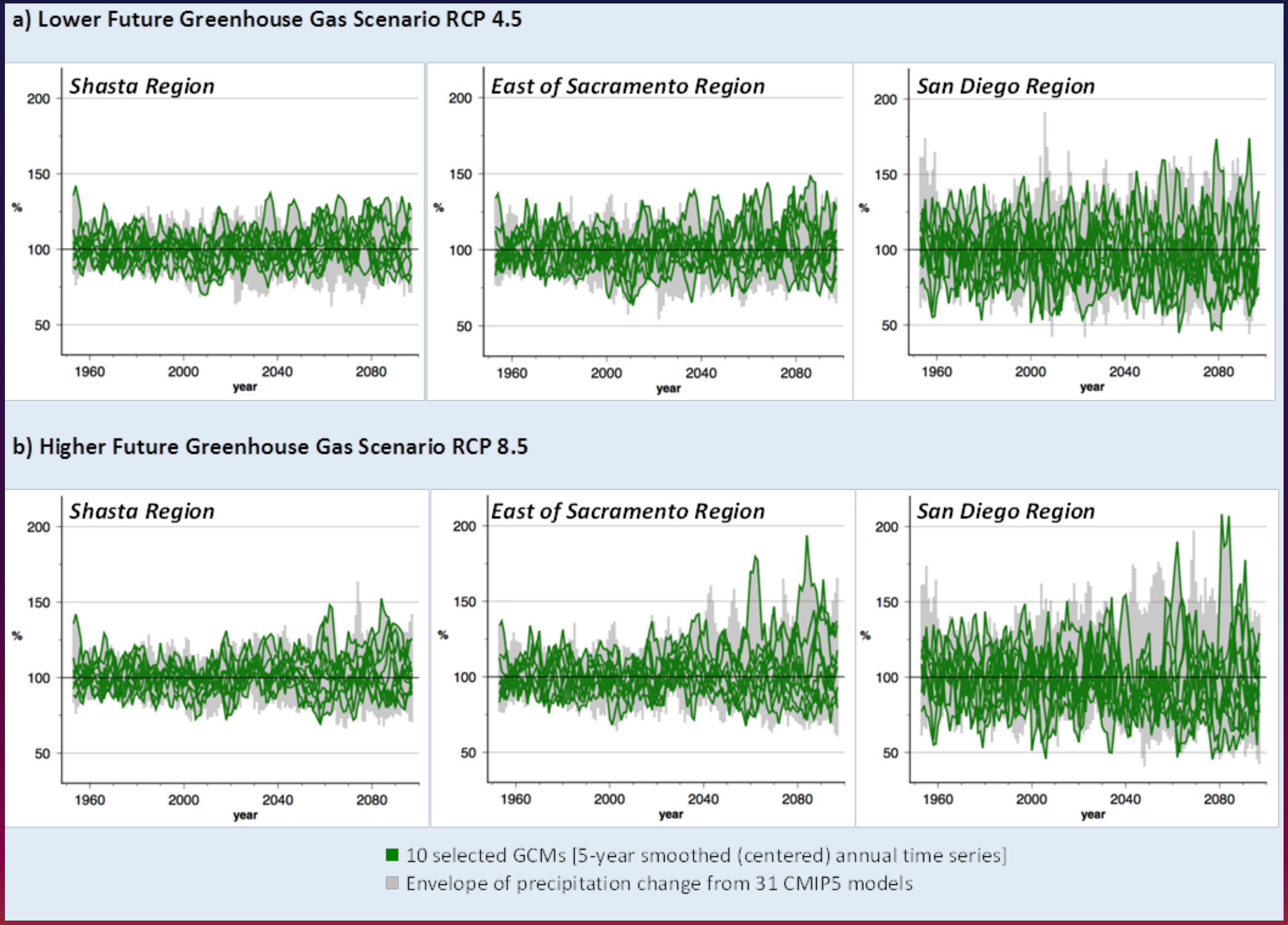
Summer warming more significant that winter warming

Increase in frequency, intensity, and length of heat waves



Source: Cal-Adapt

Projected Changes: *Precipitation*



Projections nearly evenly split between more precipitation and less

Trend toward more extreme years

SoCal tending drier, NorCal maybe slightly wetter

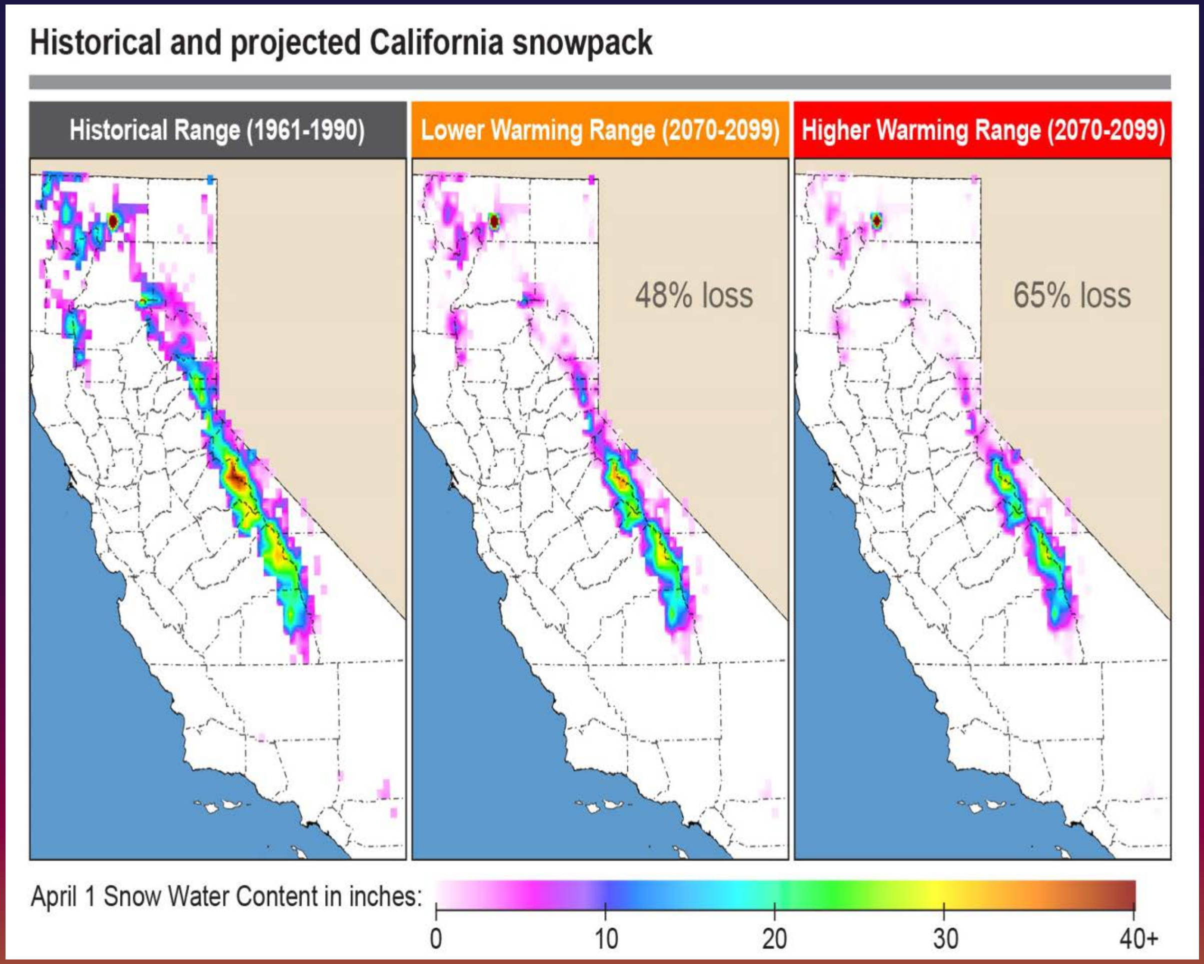
Projected Changes: *Snowpack*

30-40% Reduction in Snow Water Equivalent across the Sierras by mid-century

48-65% Less snowpack by end of century

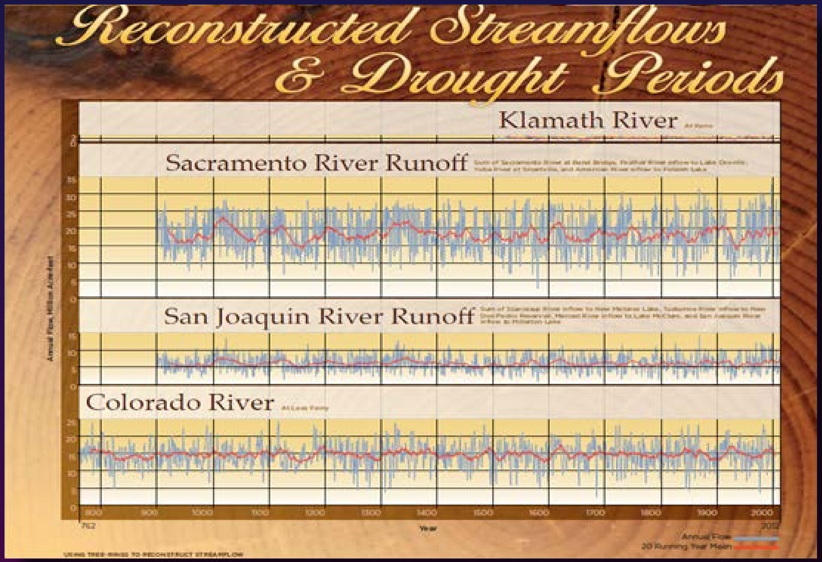
Changed runoff patterns lead to less summer runoff

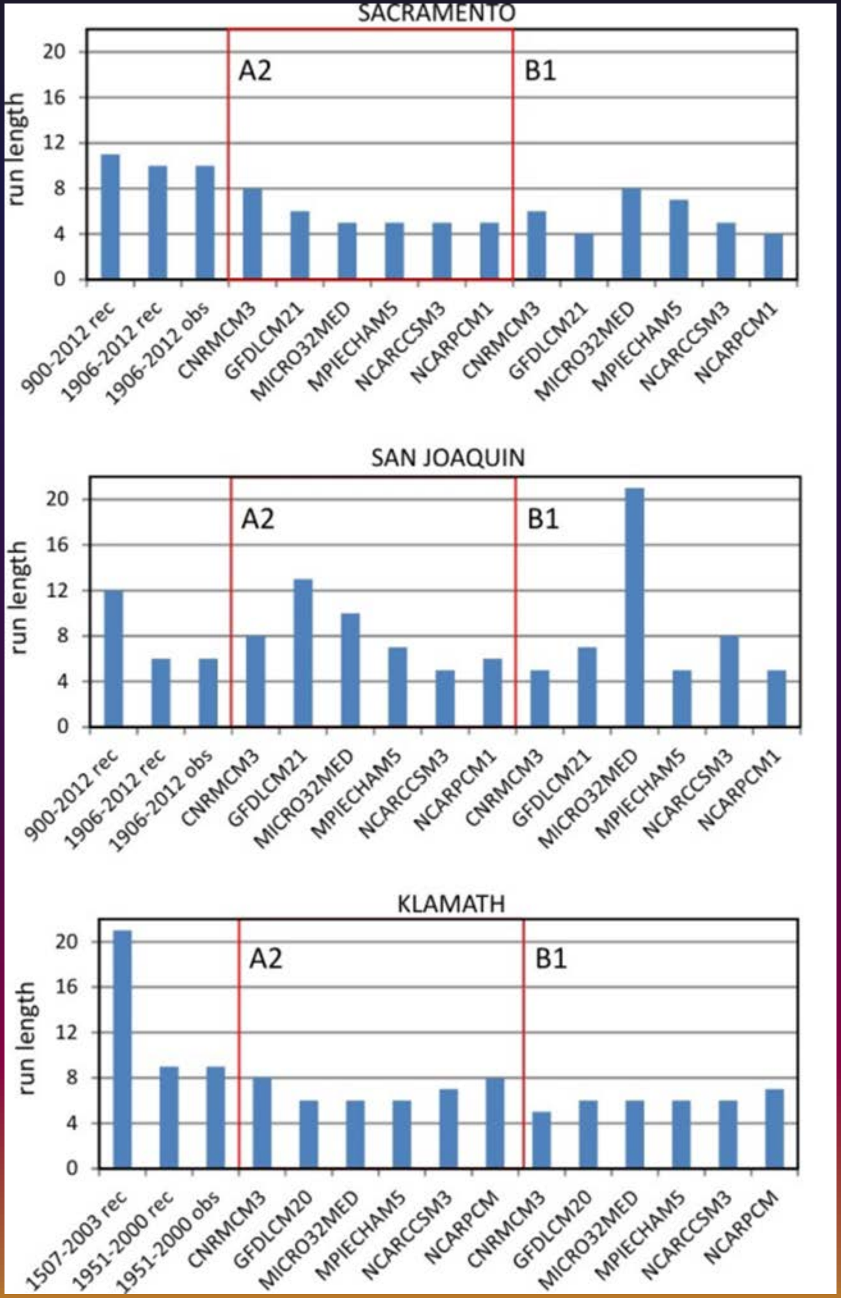
15-20% Lower soil moisture



Source: California Water Plan Update 2013

Projected Changes: *Hydrology*





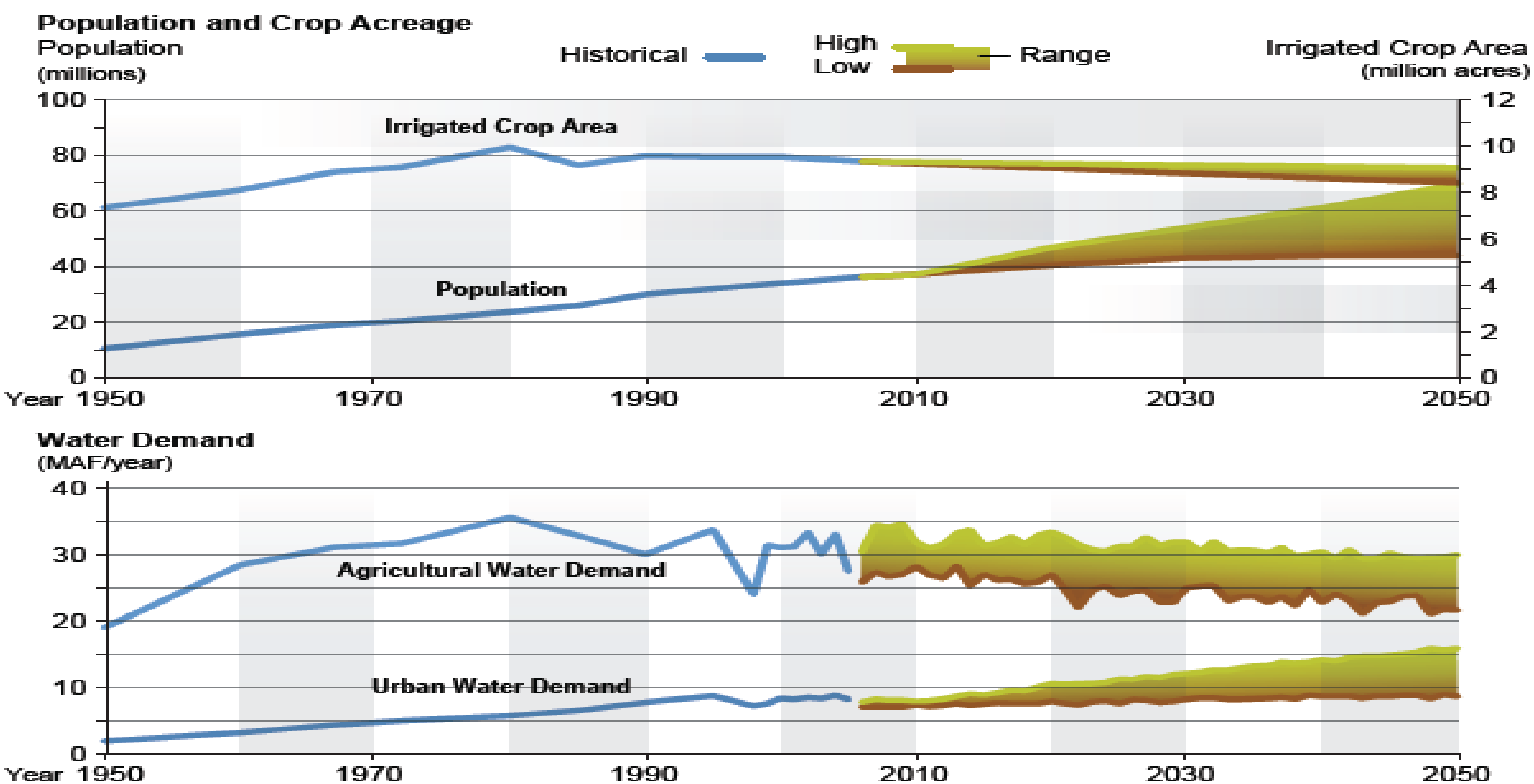
Range of natural climate variability likely to continue

Anticipate droughts similar to those in past 1000+ years but with added effects of climate change

Source: University of Arizona

Projected Impacts: *Water Demand*

Figure 5-1 Scenario Drivers and Water Demand

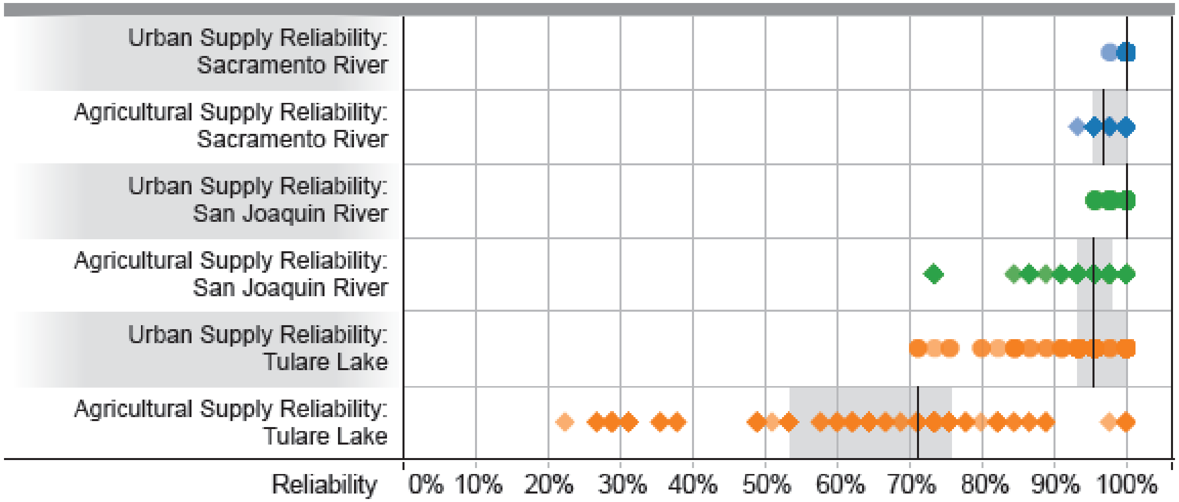


Irrigated land area is the total agricultural footprint. Irrigated crop area is the cumulative area of agriculture, including multi-crop area, where more than one crop is planted and harvested each year. Each of the growth scenarios shows a decline in irrigated acreage over existing conditions, but to varying degrees.

Source: California Water Plan Update 2013

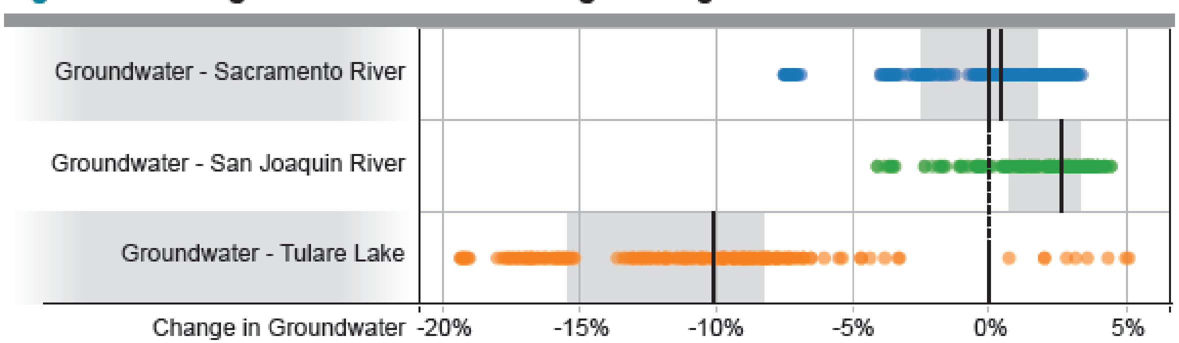
Projected Impacts: *Water Reliability*

Figure 5-11 Range of Urban and Agricultural Reliability Results Across Futures



Note: Circles indicate urban reliability results, and diamonds indicate agricultural reliability results. Blue, green, and orange symbols correspond to results for the Sacramento River, San Joaquin River, and Tulare Lake hydrologic regions, respectively.

Figure 5-12 Range of Groundwater Storage Changes Across Futures



Note: Blue, green, and orange symbols correspond to results for the Sacramento River, San Joaquin River, and Tulare Lake hydrologic regions, respectively.

Higher supply reliability in northern portion of the CV

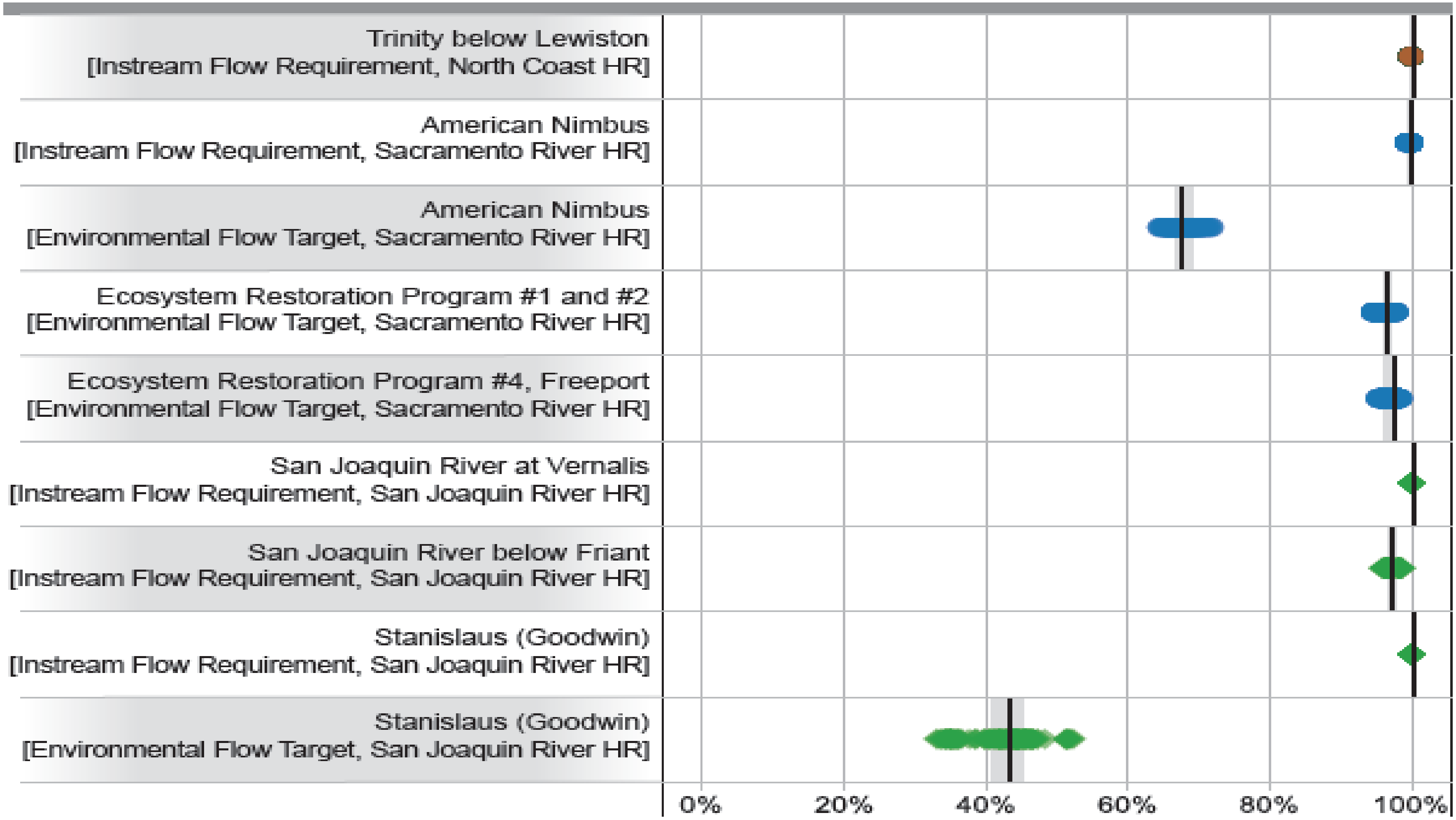
Significantly lower ag supply reliability in Tulare Hydrologic Region

Declines in groundwater storage highest in Tulare Hydrologic Region

Source: California Water Plan Update 2013

Projected Impacts: *Environmental Water*

Figure 5-13 Range of Reliability for Environmental Flow Objectives Across Futures



Note: Circles correspond to IRFs and diamonds correspond to EFTs. The color of the symbols indicates the hydrologic region — Sacramento River (blue) and San Joaquin River (green). The Trinity River (brown) below Lewiston is located in the North Coast Hydrologic Region and is included in the Central Valley WEAP model in relation to imports to the Sacramento River Hydrologic Region.

Source: California Water Plan Update 2013

Projected Changes: *Species and their Habitats*

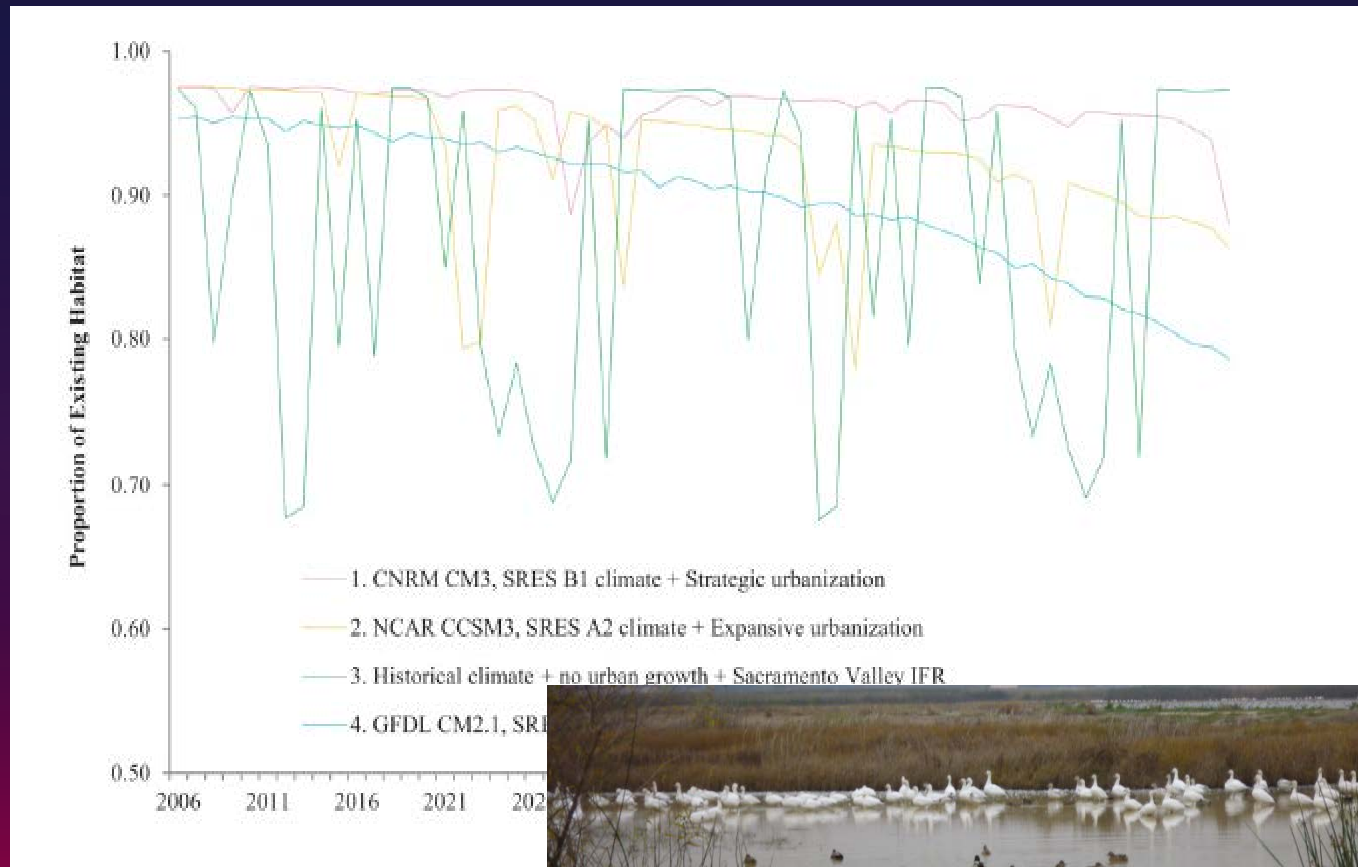
natomasbasin.org

Projected Changes: *Wetland Habitat*

Overall reduction in water availability

Marked decreases in waterbird habitat availability by mid-century

Shifts in wetland species due to changing salinity regime (Delta)



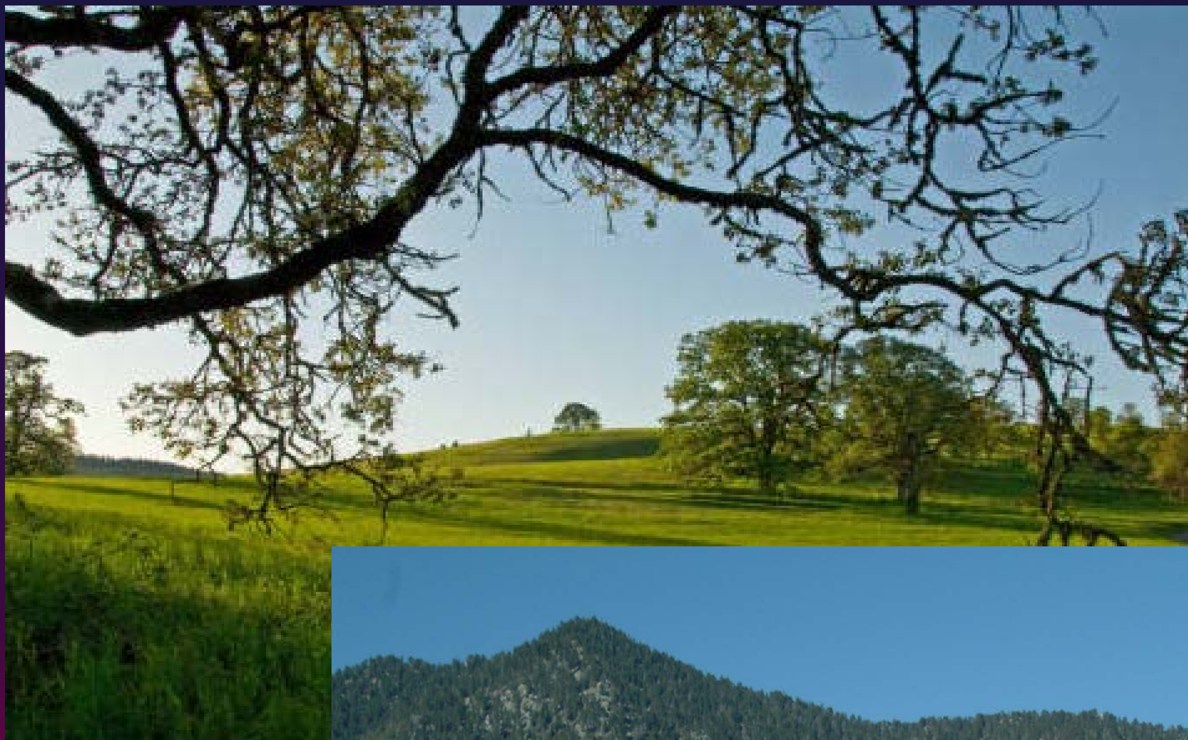
Projected Changes: *Riparian Habitat*

Altered floodplain inundation frequency and duration due to changing hydrology

Increase in thermal stress for native fish species

Change in riparian bird distribution, especially for southern Central Valley

Projected Changes: *Upland Habitat*



Increase in climatic water deficit

Increase in wildfire risk in terms of frequency, total acreage burnt, and/or return interval

Range shifts or contraction due to warmer conditions

Projected Changes: *Desert/Grassland Habitat*


UC Merced
USFWS
DWR

Decrease in grassland habitat due to changing hydrology/ land use

Accelerated conversion of grasslands to desert associated with drought

Changes in water availability predominant factor for wildlife populations


Questions?