The current drought exposes long-term water problems; it does not create them

Speaking to the Soroptimist International of Metropolitan Sacramento

Phil Isenberg, Vice Chair
Delta Stewardship Council

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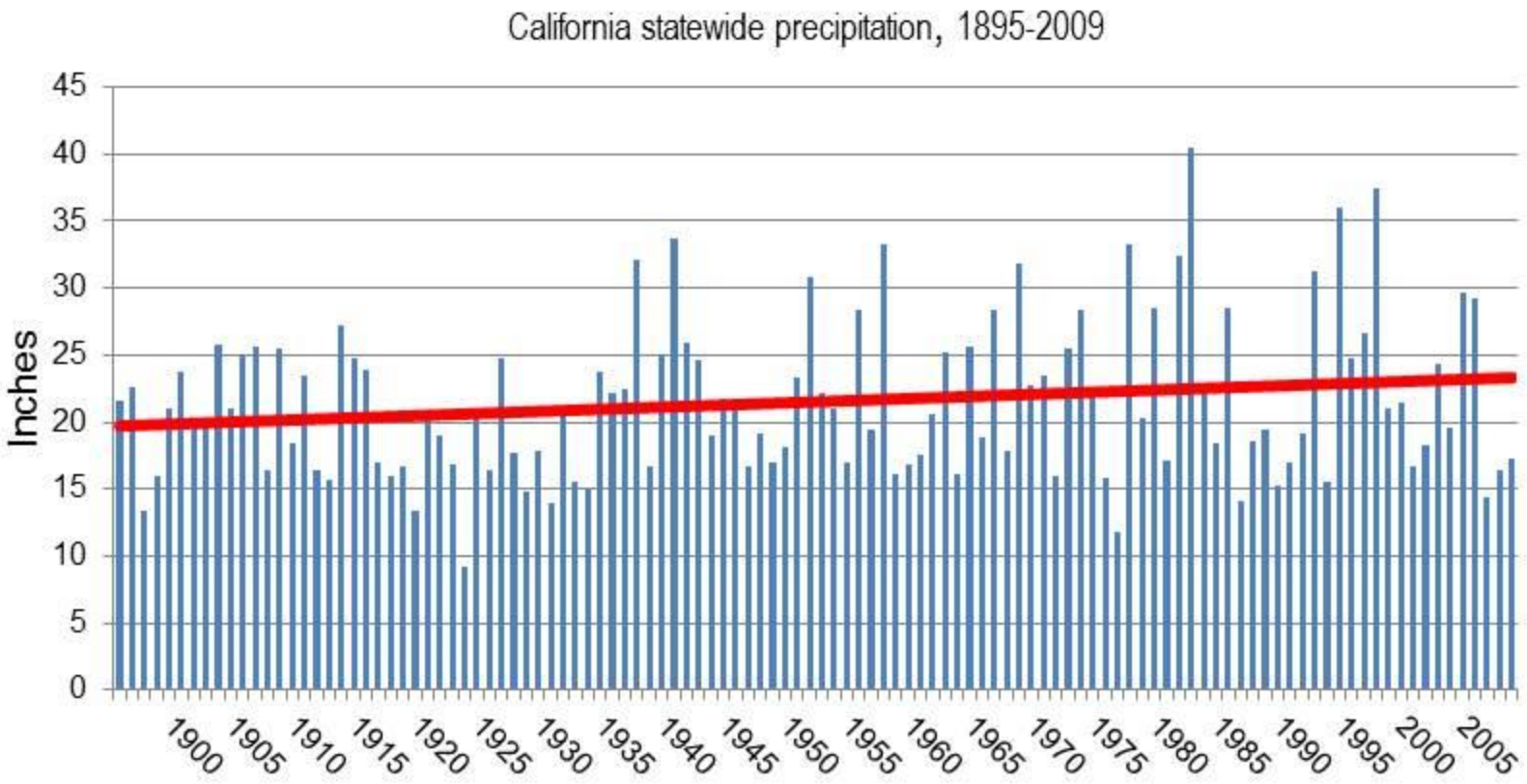
DELTA STEWARDSHIP COUNCIL

Water supply in California

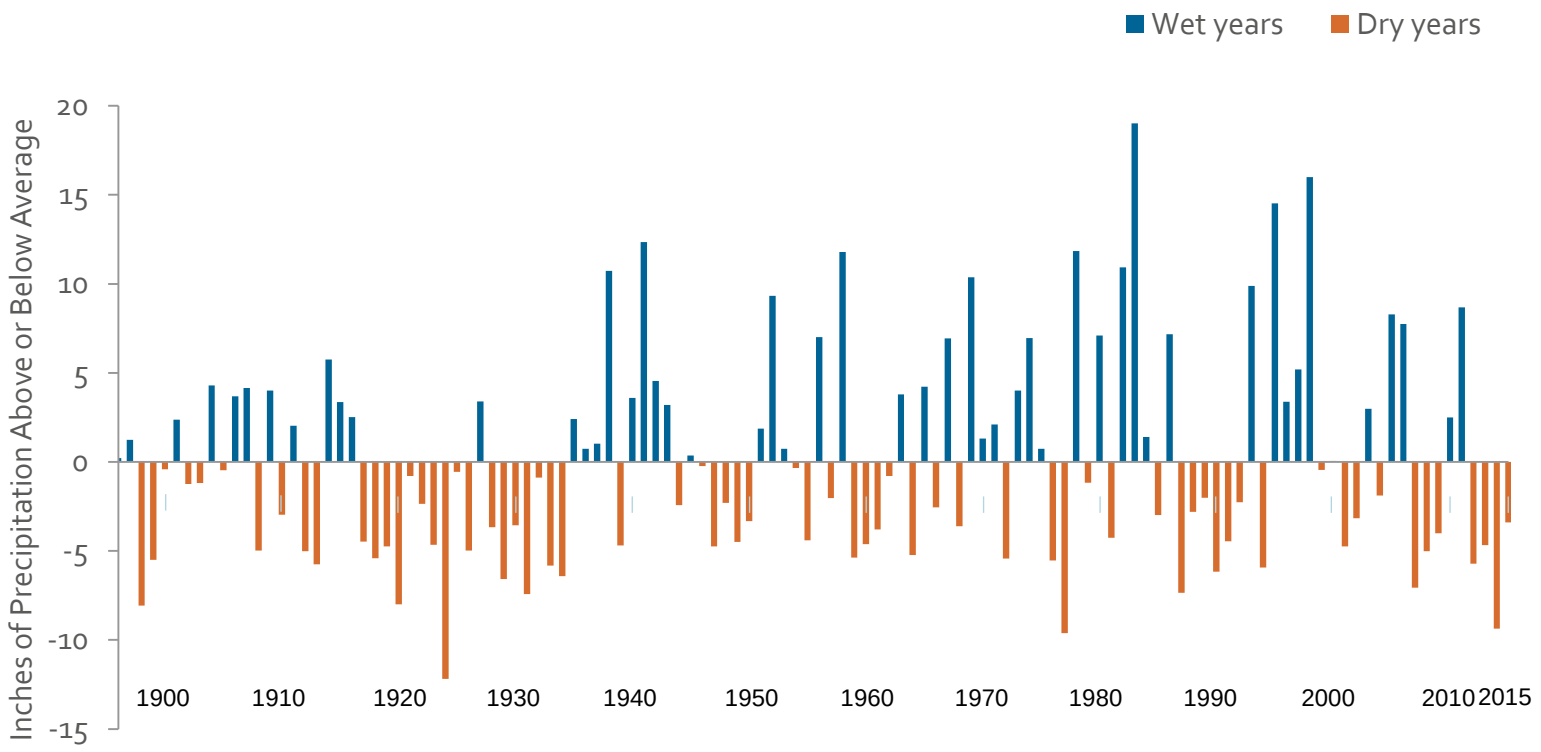
- It comes from precipitation --- rain and snow
- It is increasingly erratic
- The amount of water is not increasing
- We can’t use all of it; that why water is a ‘renewable’ resource
- The climate is changing, with higher temperatures, and thus, less snow and more rain

Precipitation varies – with a slight increasing trend – and generally provides 97% of California's water supply



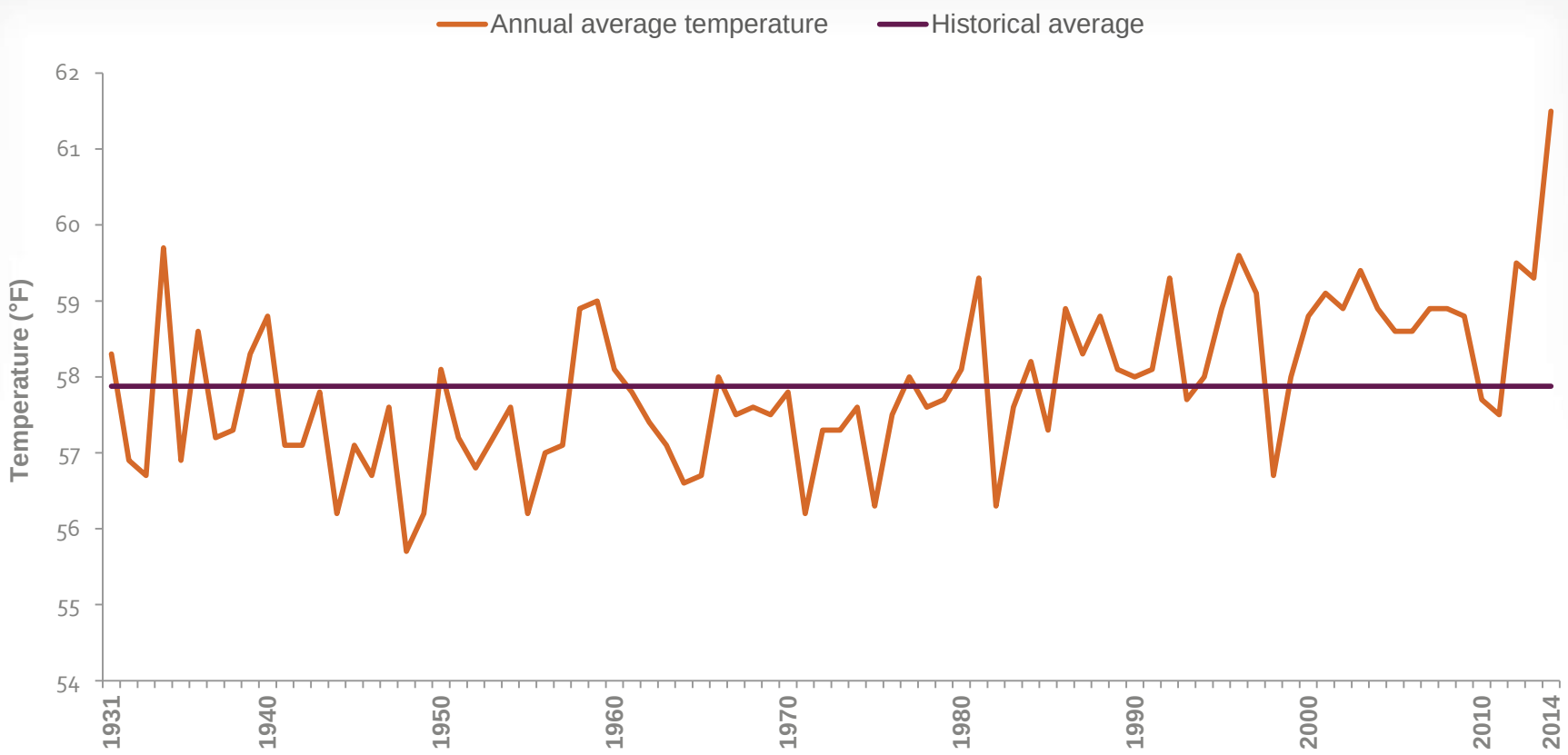
SOURCE: Precipitation from Western Regional Climate Center, 2010

California's variable climate requires us to prepare for droughts and floods



SOURCE: Western Regional Climate Center. Bars show inches above/below long-term statewide average precipitation (21.42 inches) based on water year (October–September) since 1896.

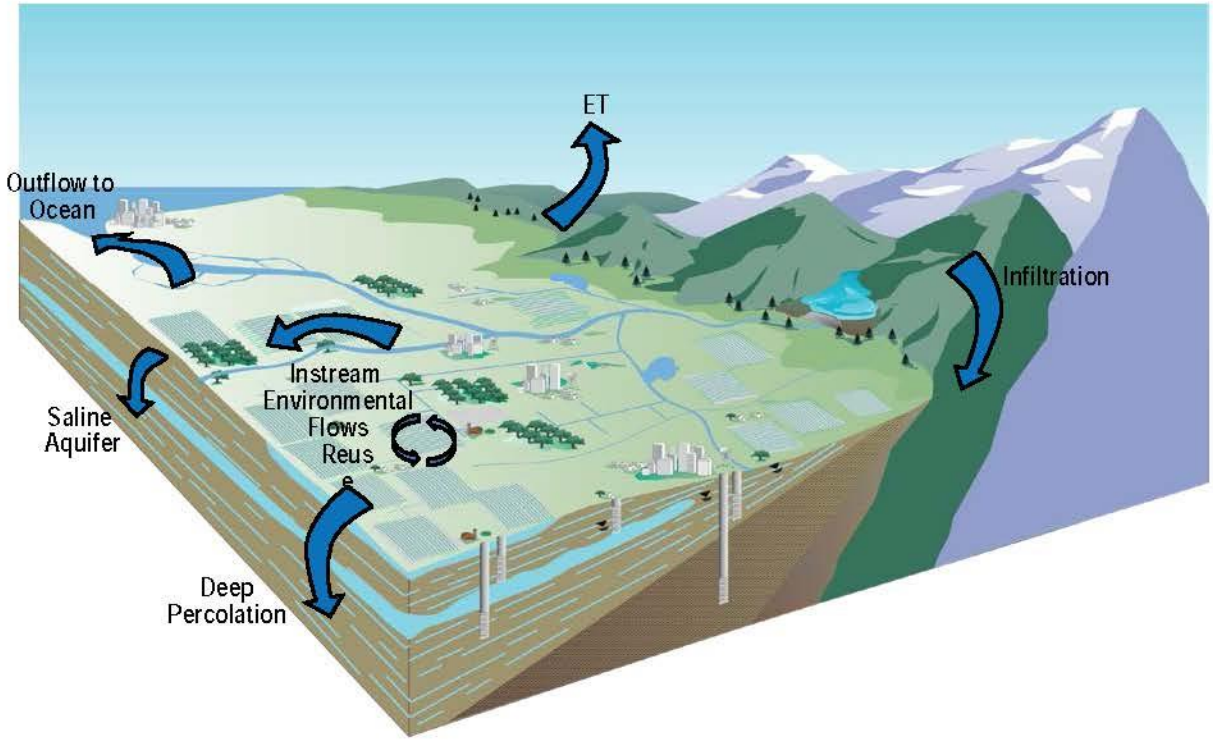
California is getting warmer



SOURCE: National Oceanic and Atmospheric Administration.
NOTE: Average statewide temperatures from 1931 to 2014. Data accessed from http://www.ncdc.noaa.gov/cag/ on June 29, 2015.

Over 50 percent of precipitation is not available for urban and agricultural water supplies

- Of the precipitation, 50 to 60 percent evaporates, is used by native vegetation, or flows out to the ocean, to other states, or to saline groundwater aquifers
- The remaining runoff is "stored" in mountain snowpack, reservoirs, o r distributed to the environment and to water users



California Compared to Australia: Residential and Urban Uses

Location	Residential Use** (gpcd)	Urban Use** (gpcd)
Portland, OR	**60**	**116**
Albuquerque, NM	**74**	**154**
Tucson, AZ	**97**	**144**
Denver, CO	**104**	**160**
California	**111**	**162**
San Francisco	54-56*	95-102*
Los Angeles	77*-107	139*-154
San Diego	79*-113	136*-157
Oakland/East Bay	87*-100	138*-146
San Jose	91*-97	156-160*
Sacramento	93-128*	142-247*
Australia	**63**	**100**
Melbourne	53	87
Sydney	56	90
Canberra	61	95
Brisbane	74	122
Perth	78	110

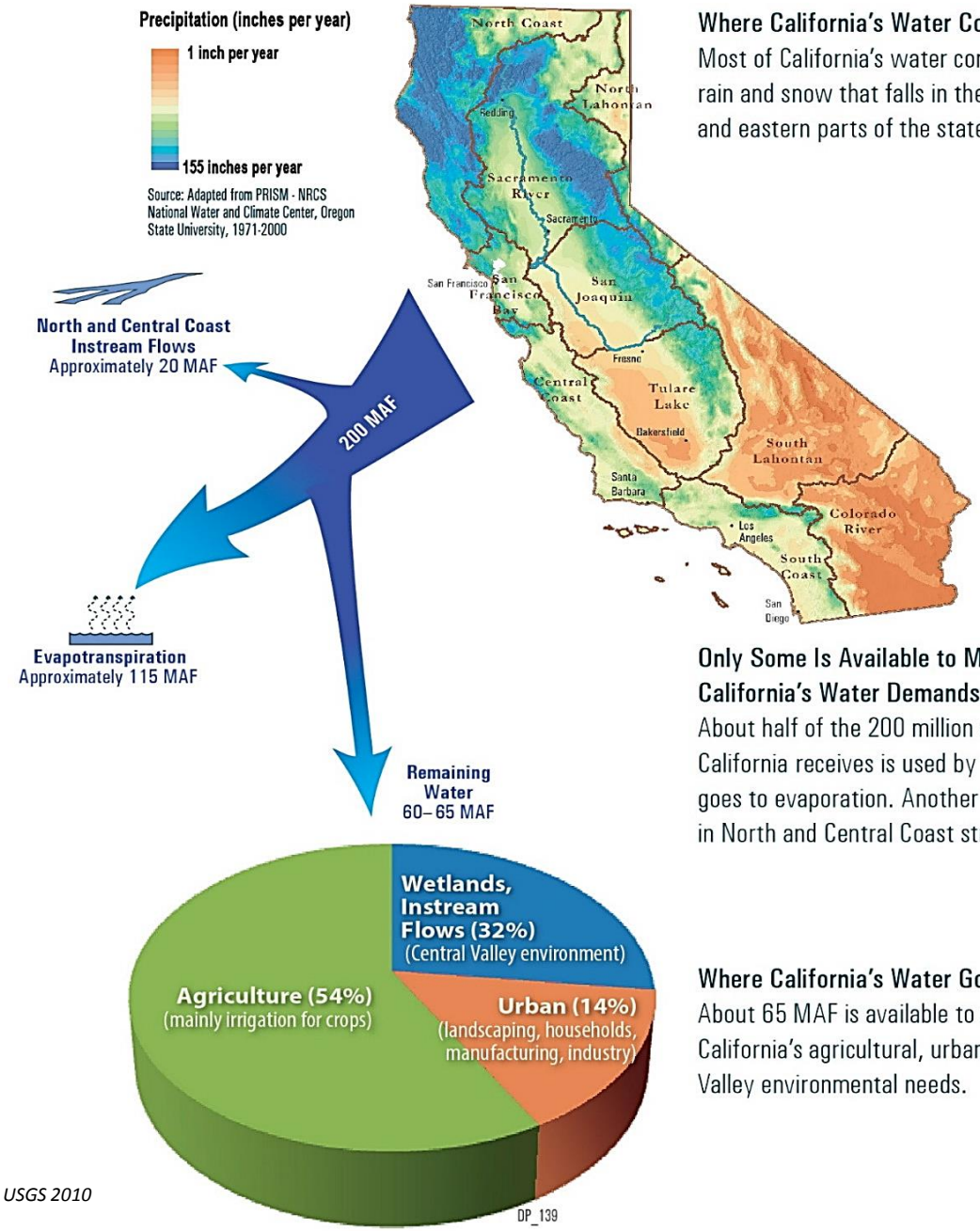
Notes:

*From Urban Water Management Plan

**Does not include unaccounted for water (e.g. system leaks)

Source: Dr. Jay Lund, UC Davis, the Ray B. Krone Professor of Environmental Engineering, UC Davis Ryan Cahill, graduate student, Department of Civil and Environmental Engineering, UC Davis

Water Use Overall



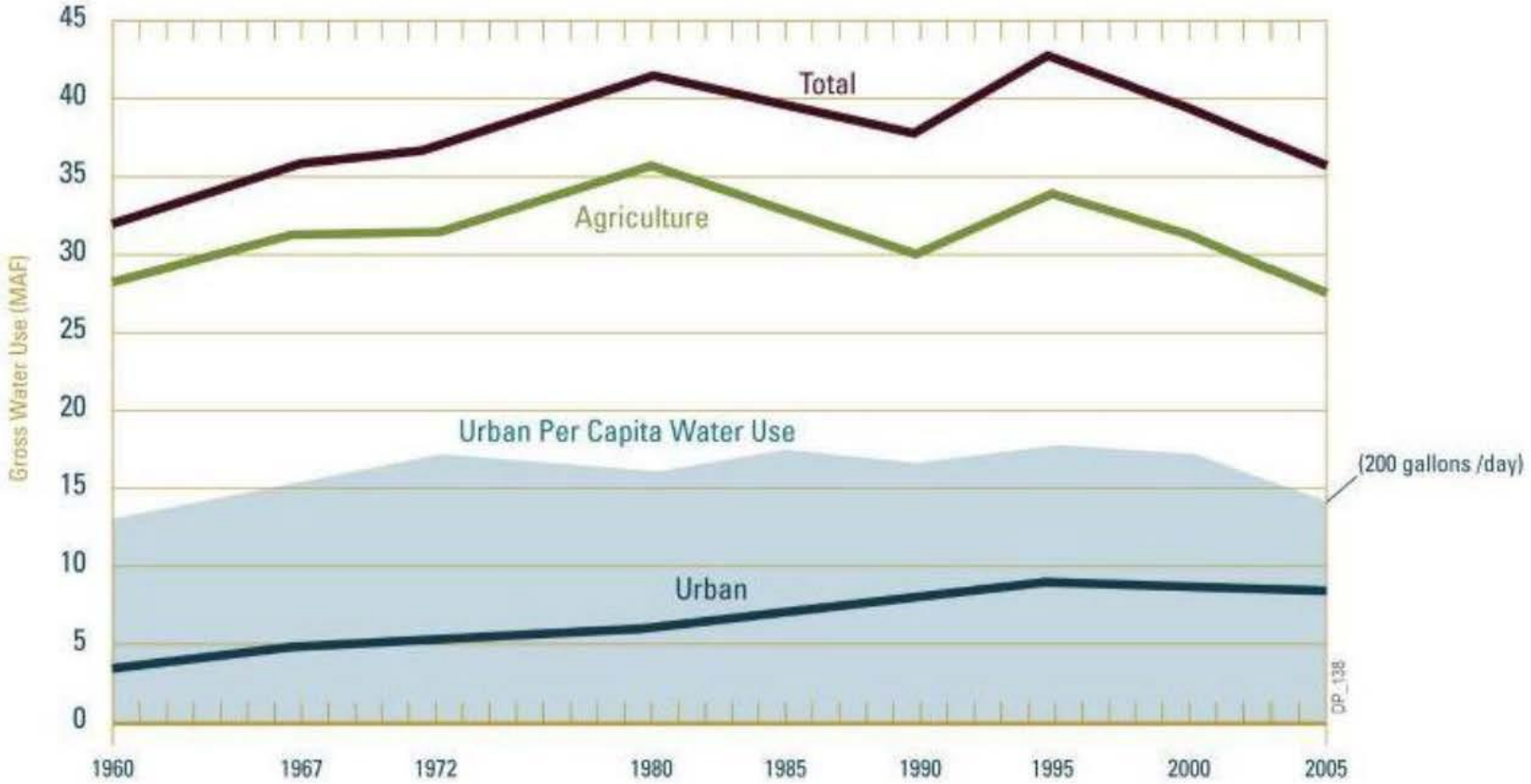
Where California's Water Comes From
Most of California's water comes from rain and snow that falls in the northern and eastern parts of the state.

Only Some Is Available to Meet California's Water Demands
About half of the 200 million acre-feet (MAF) California receives is used by vegetation or goes to evaporation. Another 20 MAF stays in North and Central Coast streams.

Where California's Water Goes
About 65 MAF is available to meet California's agricultural, urban, and Central Valley environmental needs.

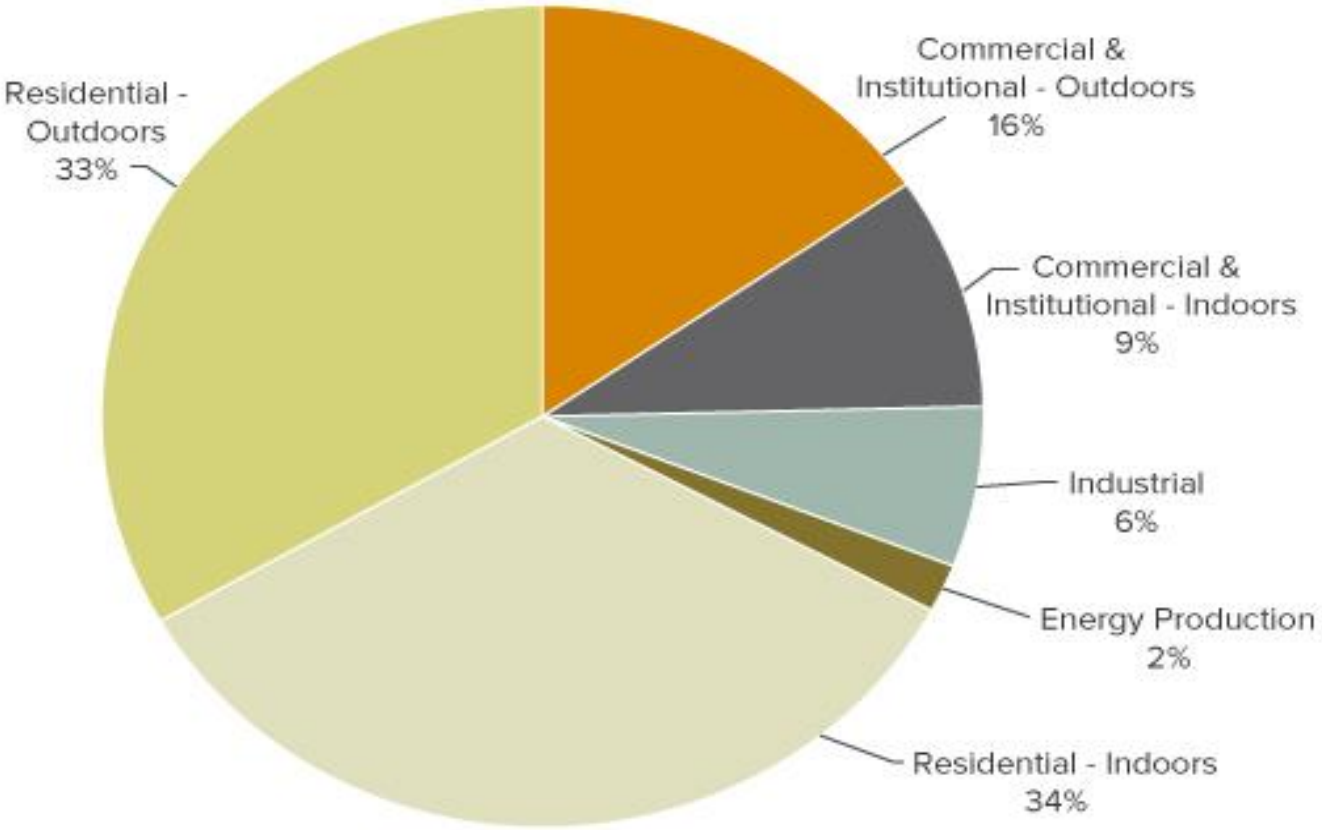
Sources: Adapted from DWR 2009, USGS 2010

Water Use Trends



Source: Hanak et al. 2011; adapted from DWR 2009 Delta Plan, 2013, Figure 3-8, Chapter 3, Page 97

ANNUAL URBAN WATER USE, 8.5 MILLION ACRE-FEET (2006-2010)



SOURCE: California Department of Water Resources.

NOTE: The figure shows the average applied urban water use, excluding water used to recharge groundwater basins (5%) and conveyance losses (2%). Net water use—i.e., the volume consumed by people or plants, embodied in manufactured goods, evaporated, or discharged to saline waters—is lower (5.9 maf). Commercial and institutional outdoor use includes official estimates for "large landscapes" (parks, golf courses, cemeteries, etc.) and one-third of the total estimate for commercial and institutional demand, which includes other outdoor water use.

Much water use in California relies on "captured" water moved to new locations (2000 data)

Delta Watershed (equal to Sacramento and San Joaquin Hydrologic Regions as defined by DWR)

Annual Magnitude of Regional Diversion from Within the Delta Watershed (1,000 af) (Dashed arrows represent return flows after diversion)

Annual Magnitude of Water Directly Diverted from the Delta Watershed (1,000 af)

Annual magnitude of Water Diverted from a Delta Tributary (1,000 af)

Annual Magnitude of Significant Transfers and imports Outside the Delta Watershed

DWR Hydrologic Region Boundaries

SOURCE: Adapted from *Delta Vision Strategic Plan, 2008*; Original data from DWR.

Water is overpromised --- by a lot

"State water right allocate more than 500% of average annual river flows (Grantham and Viers 2014). The current drought climate change, and normal year-to year variability in in precipitation are increasing uncertainty in water supply."

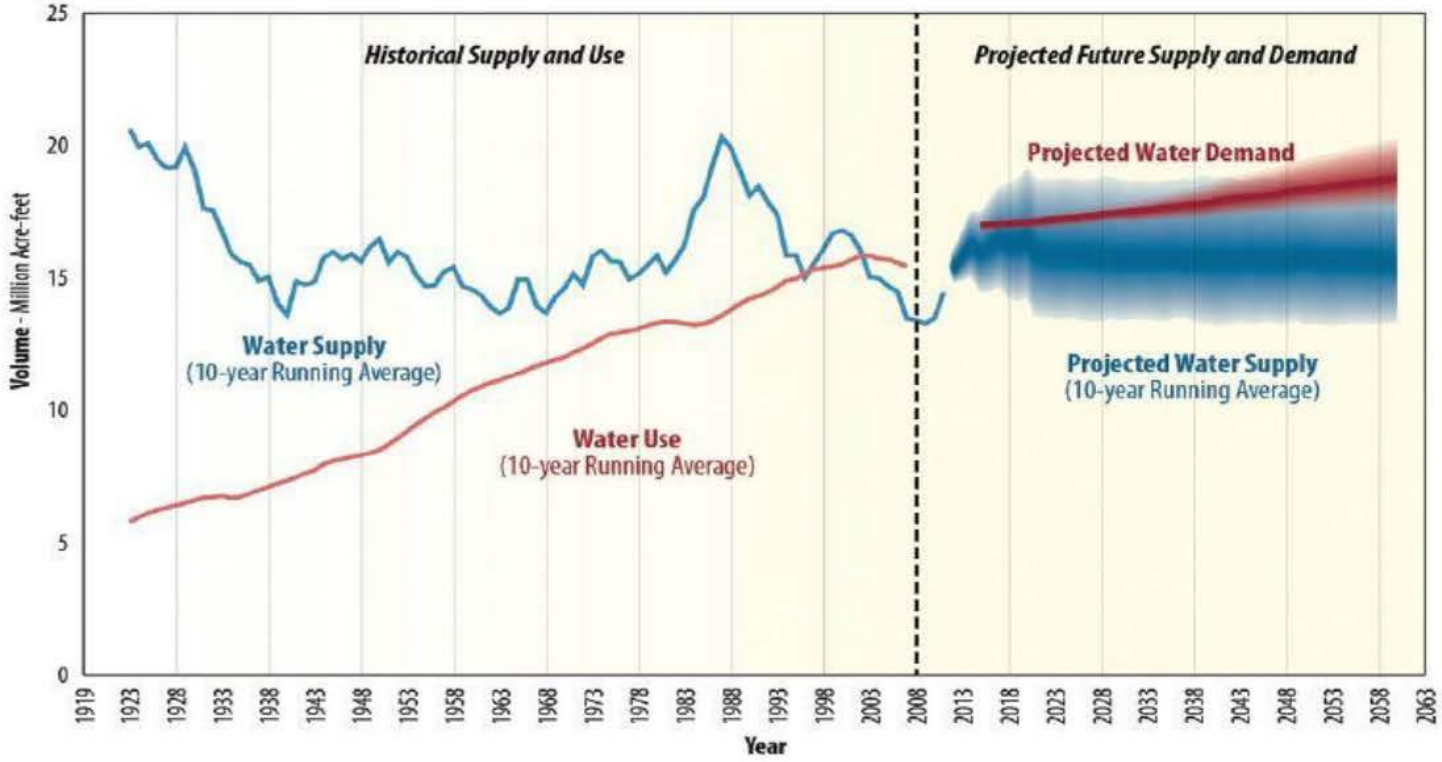
Challenges Facing the Sacramento-San Joaquin Delta: Complex, chaotic or simply cantankerous? (September 2015), report of four former Lead Delta Scientists to federal and state agencies: Samuel N. Luoma, Clifford N. Dahm, Michael Healey and Johnnie N. Moore

The Colorado River: keep this in mind

Southern California gets about half of its water from the Colorado River, so any reduction in use of that source means more pressure on the Delta.

Matching Demands to the Supply Available from the Colorado River is Inevitable

Historical Supply and Use and Projected Future Colorado River Basin Water Supply and Demand



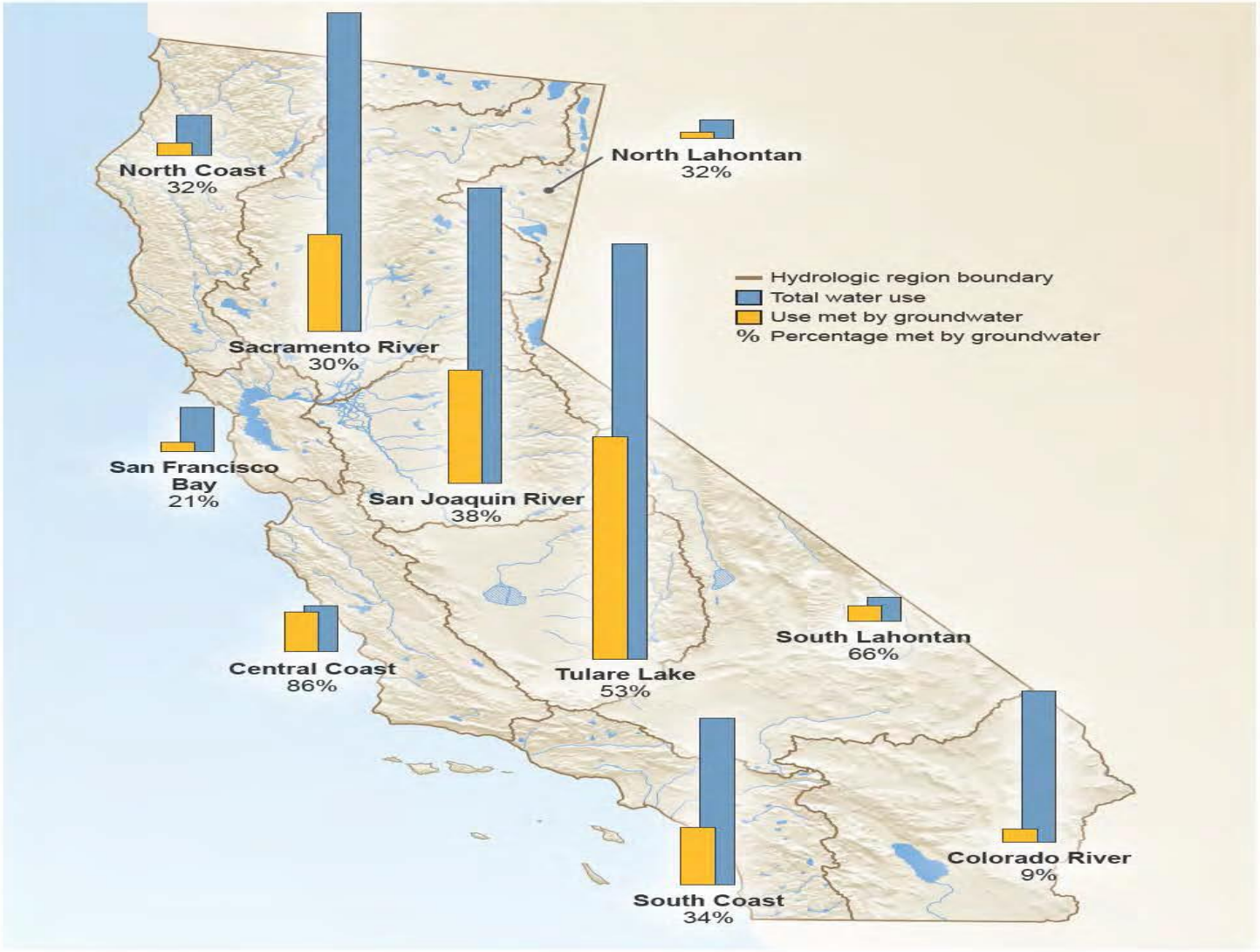
Source: US Bureau of Reclamation

Groundwater: a special problem

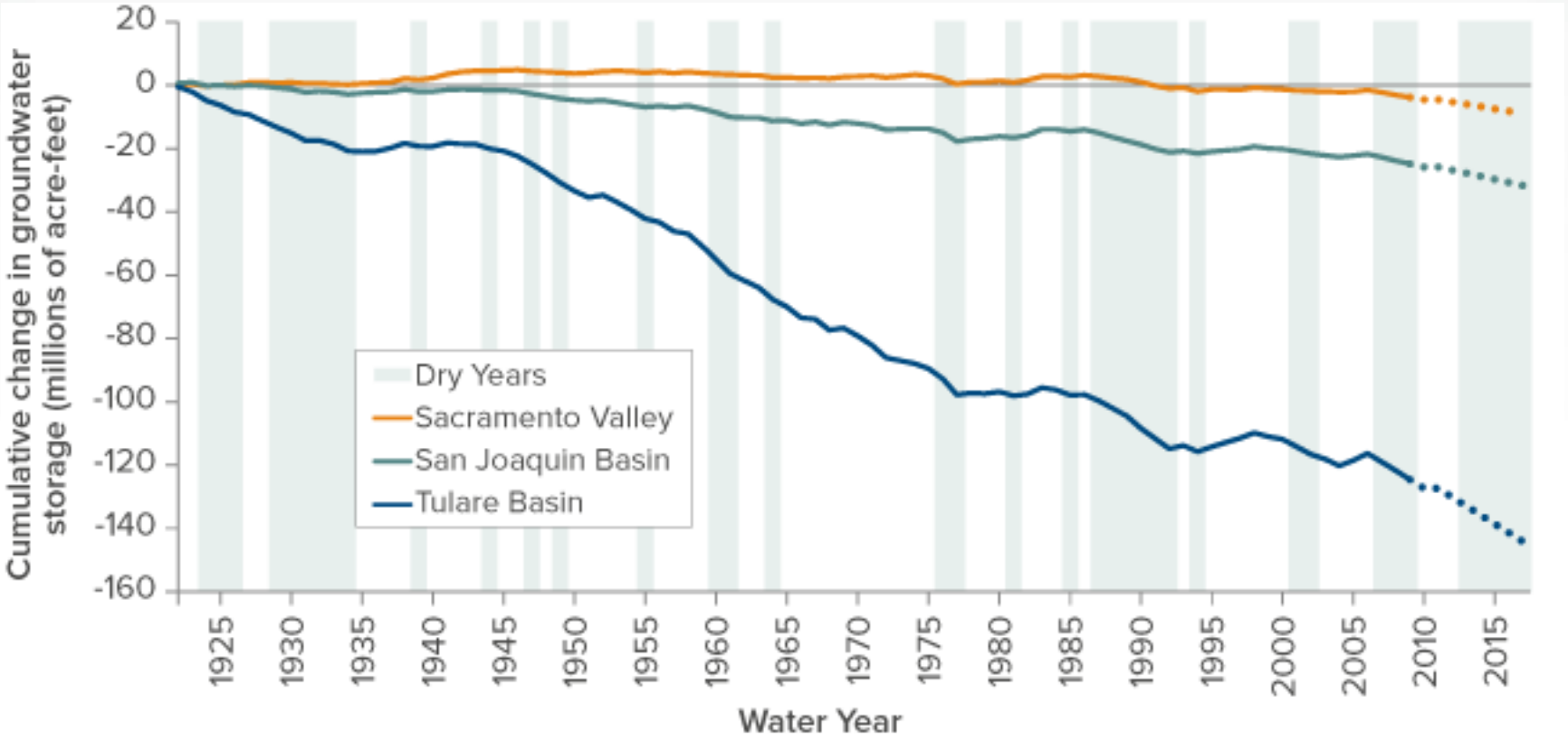
In an average water year, almost 40% of our total water use for human purposes comes from underground. In a dry year, underground water can account for a much larger percent.

Source: DWR, California's Most Significant Droughts: Comparing Historical and Recent Conditions (February 2014) See next slide.

Figure 1.13: Groundwater Contribution to Total Water Use by Hydrologic Region



Groundwater reserves are being depleted, especially in the Tulare Basin



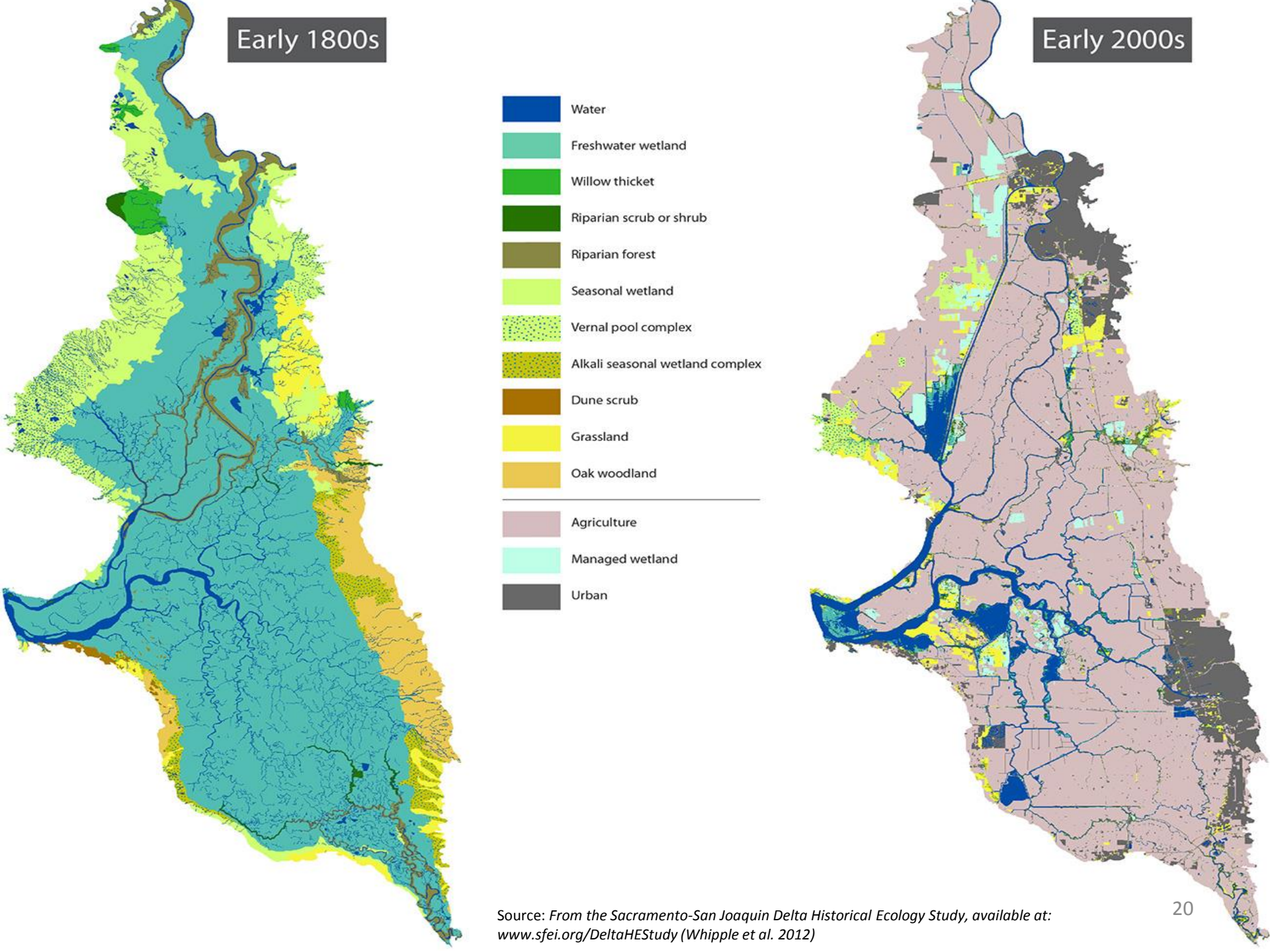
SOURCE: What If California's Drought Continues? (PPIC, 2015), Figure 3.Data through 2009 from DWR; author estimates after 2009. Projections since 2009 may underestimate depletions since the onset of the latest drought (2012+)..


1925
1955
SAN JOAQUIN VALLEY
CALIFORNIA
BM S661
SUBSIDENCE BM
1925-1977
1977

The Sacramento-San Joaquin Delta: another special problem

Multiple water/environmental problems:

- Delta landscape almost completed altered
- Water supply over allocated
- Water infrastructure decaying & overtaxed
- Ecosystems & native species declining in Delta
- Upgrading Delta levees very costly
- Delta water quality threatened by pollutants and salt water intrusion
- Water management very complex



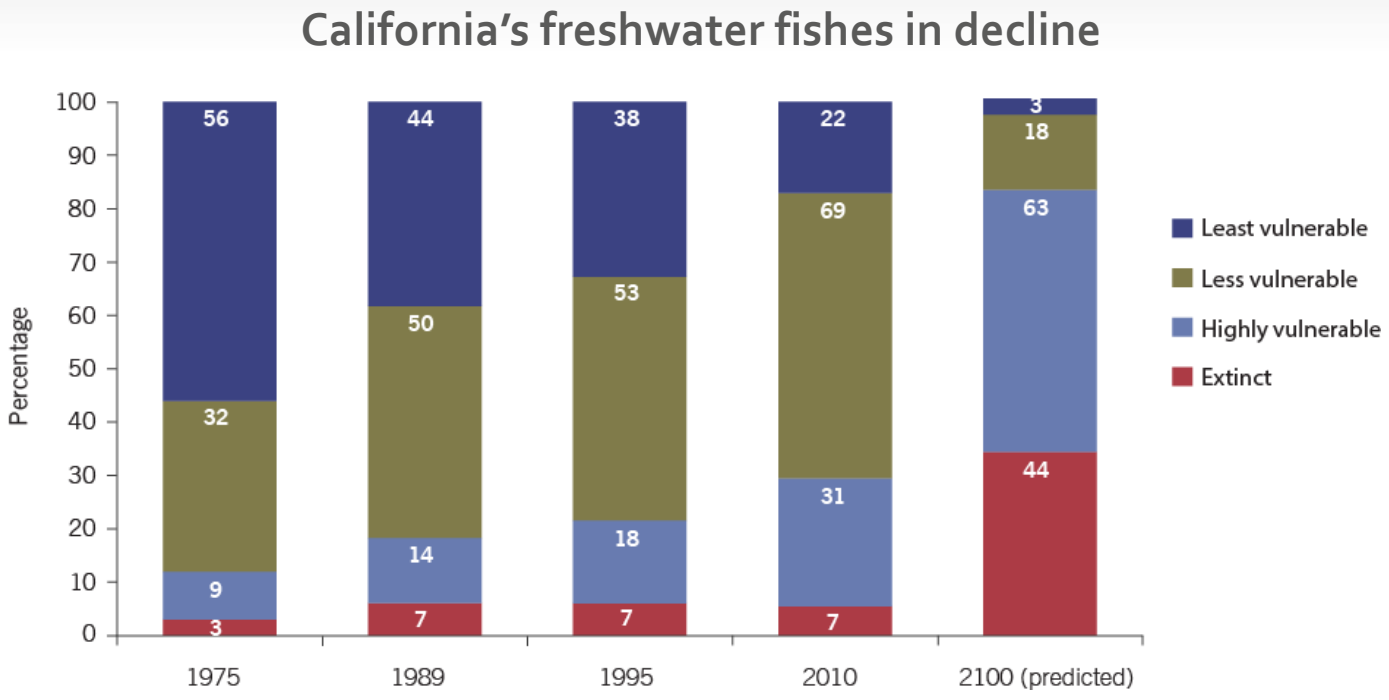
Source: *From the Sacramento-San Joaquin Delta Historical Ecology Study, available at: www.sfei.org/DeltaHEStudy (Whipple et al. 2012)*

Present-Day Delta Flows are Very Different from Historical, Natural Flows

- Seasonal flows are much less variable and encourage nonnative fish and vegetation
- Peak flows now come at lower magnitudes and occur earlier on the San Joaquin River
- As exports and upstream consumptive use have increased, current fish populations are less than one percent of 1968 levels

Source: PPIC, Hanak, E., J. Lund, A. Dinar, B. Gray, R. Howitt, J. Mount, P. Moyle, & B. Thompson, 2011

An aquatic ecosystem crisis

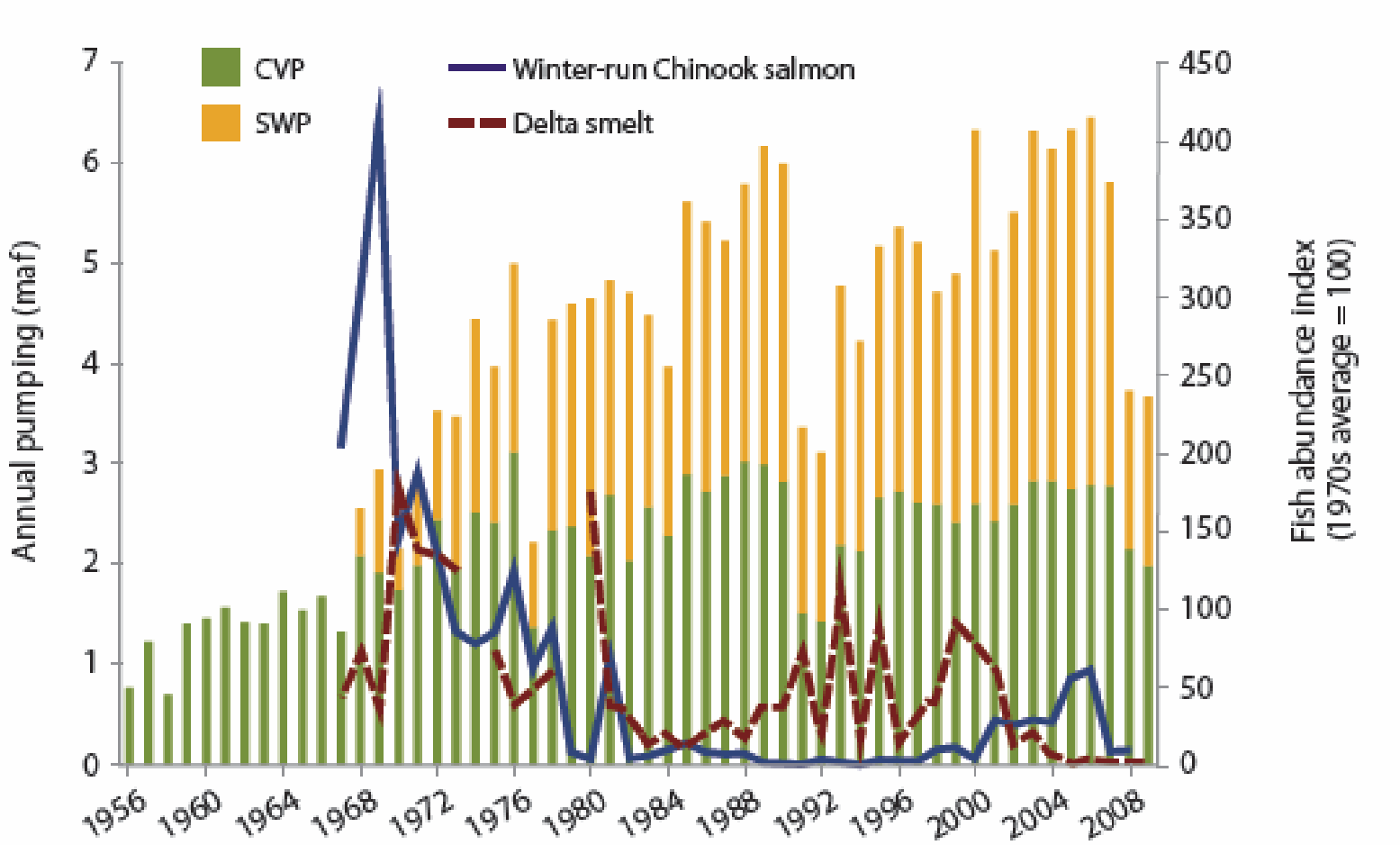


SOURCE: Water for the Environment (PPIC, 2015), from studies by P. Moyle et al. (UC Davis)

- Despite decades of well-intentioned efforts
- Efforts now threaten water supply reliability and flood protection
- Conditions will worsen with climate warming, more invasive species

AS EXPORTS AND UPSTREAM USE HAVE INCREASED, FISH SPECIES HAVE COLLAPSED

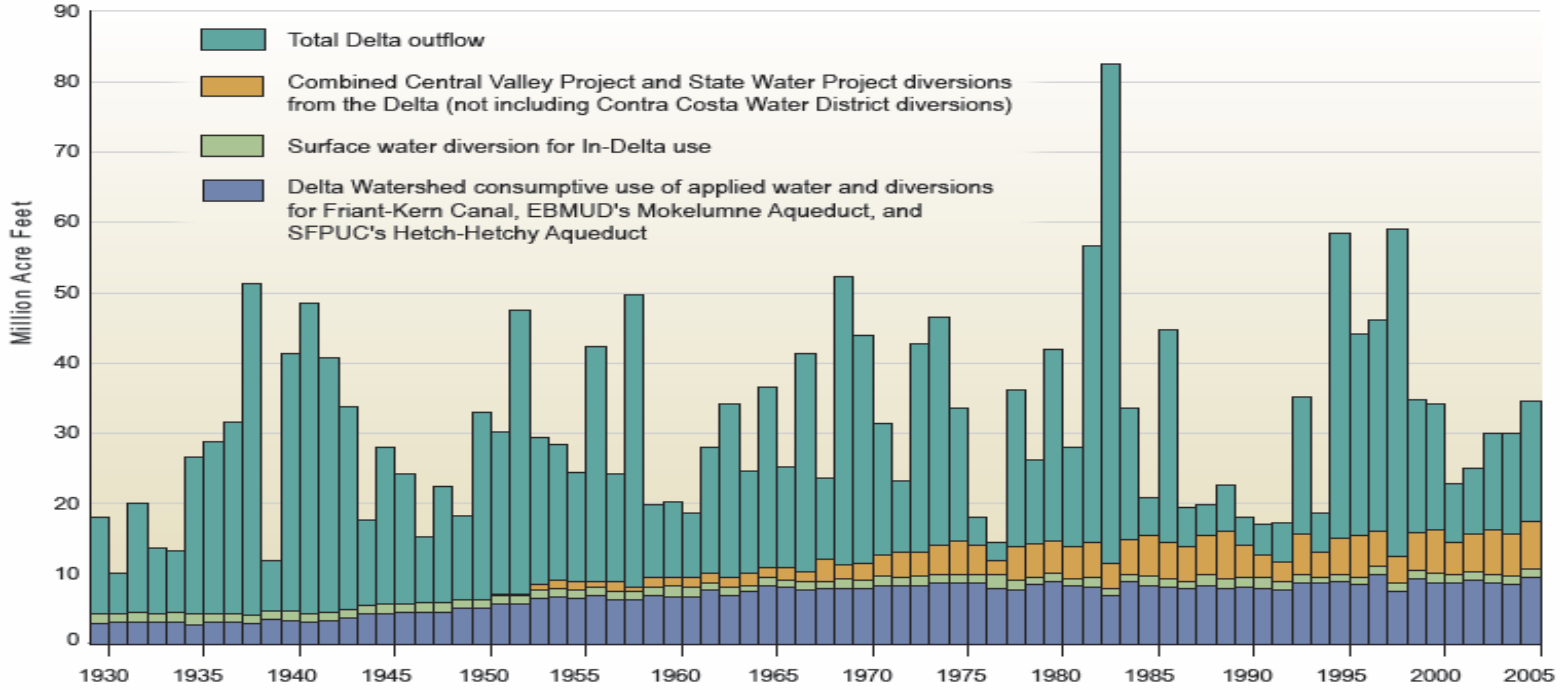
Project Exports and Fish Populations



Source: Hanak, E., J. Lund. A. Dinar, B. Gray, R. Howitt, J. Mount, P. Moyle, and B. Thompson. 2011. Managing California's Water: From Conflict to Reconciliation. San Francisco, CA. Public Policy Institute of California. Calculations by J. Viers using data from PRISM, CIMIS, and the U.C. Davis Soil Resource Laboratory. For exports, DWR Dayflow data; for fish populations, California Department of Fish and Game survey data.

FACTS AND INFORMATION ON CALIFORNIA'S WATER AND ENVIRONMENTAL DEBATES: **UPSTREAM USE, USE, AND EXPORTS HAVE REDUCED DELTA OUTFLOWS**

Delta Watershed Consumptive Use



Trends in Destinations and Uses

Period	Average Annual Total (MAF)	Outflow	in-Delta	Exports	Delta Watershed
1930 to 1949	25.80	81%	5%	0%	14%
1990 to 2005	31.71	67%	4%	4%	24%
1950 to 1969	34.34	51%	5%	15%	29%
1970 to 1989	32.85	48%	4%	17%	31%

Source: Delta Vision Blue Ribbon Task Force. Delta Vision Strategic Plan 2008. Also see California Water Plan Update 2009, Volume 3, Figure D-5. Measured, calculated, and modeled data from an array of sources as compiled by Tully and Young, Inc. with data and assistance from DWR, the Bay Institute, and the State Water Contractors.

• While exports are sometimes viewed as the sole cause for reduced outflow, upstream diversions consume about two times as much of the water that would otherwise flow out to the Bay.

• Increases in upstream diversions, in-Delta use, and project exports have dramatically reduced ocean outflows from the


WE HAVE MET THE ENEMY AND HE IS US.
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