Getting the most from Water Conservation in California

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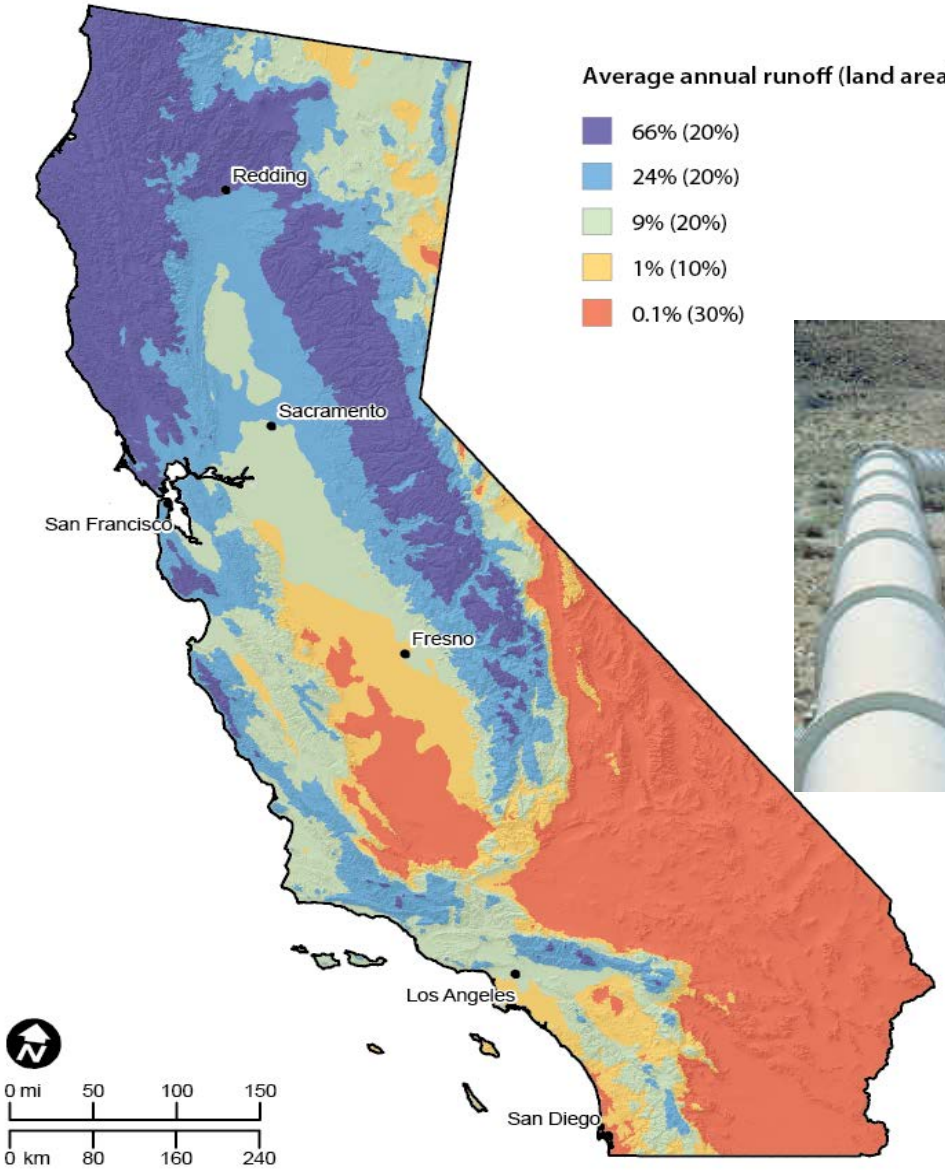
Outline

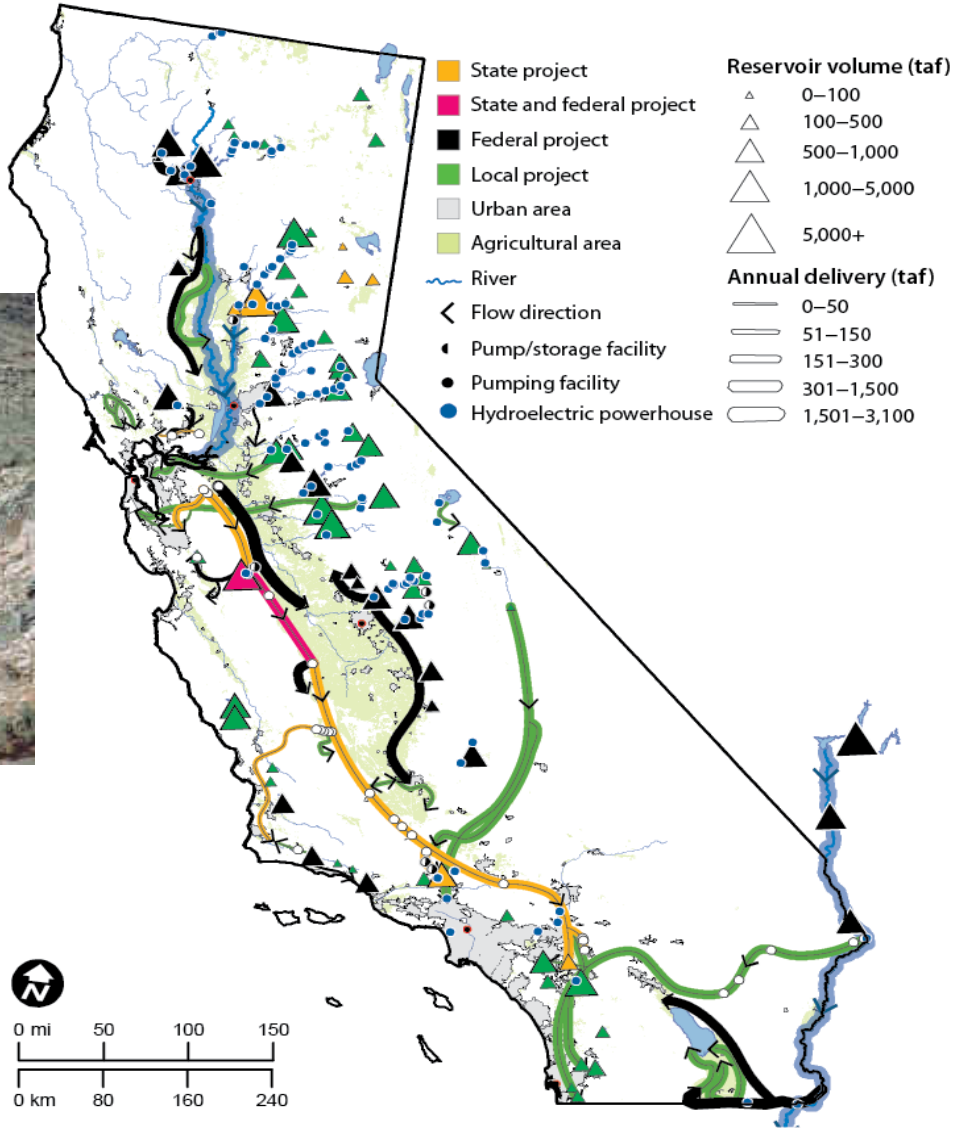
- California's water system
- Net and gross water use - return flows
- Conservation – technology and behavior
- Conservation
  - that saves water
  - that saves little water, but is useful anyway
  - that increases water use
- Conclusions

But they don't all count the same.

So let's count every drop right.

Water and People in California





California's gross and net water use

Region	Agriculture		Urban		Environmental	
	Gross	Net	Gross	Net	Gross	Net
N. Coast	0.8	0.6	0.2	0.1	21.0	21.0
SF Bay	0.1	0.1	1.2	1.0	0.6	0.6
Central Coast	1.0	0.8	0.3	0.2	0.1	0.1
S. Coast	0.8	0.7	4.1	3.5	0.2	0.1
Sacramento R	8.3	6.6	0.9	0.7	14.0	7.6
San Joaquin R	7.0	6.0	0.6	0.4	3.7	1.0
Tulare Lake	10.0	7.7	0.7	0.3	1.6	0.1
N Lahontan	0.5	0.4	0.0	0.0	0.4	0.2
S Lahontan	0.4	0.3	0.3	0.1	0.1	0.1
Colorado R.	3.9	3.7	0.7	0.5	0.0	0.0
California	**33.0**	**27.0**	**8.7**	**6.6**	**41.0**	**31.0**

DWR data 2010

Urban Savings in California from Australian water use levels

	Coastal (25m)	Inland (11m)	Av. total
California Use	79	164	105
Indoor	59	71	63
Outdoor	20	93	42
Australia today	54	54	54
Indoor	42	42	42
Outdoor	12	12	12
Savings total	25	65	37
Indoor	17	0	12
Outdoor	8	65*	25

: 65 = 0.8(93-12)

Statewide:

Reduced use = 2.1 maf/yr

Savings = 1.5 maf/yr

Cahill and Lund 2013

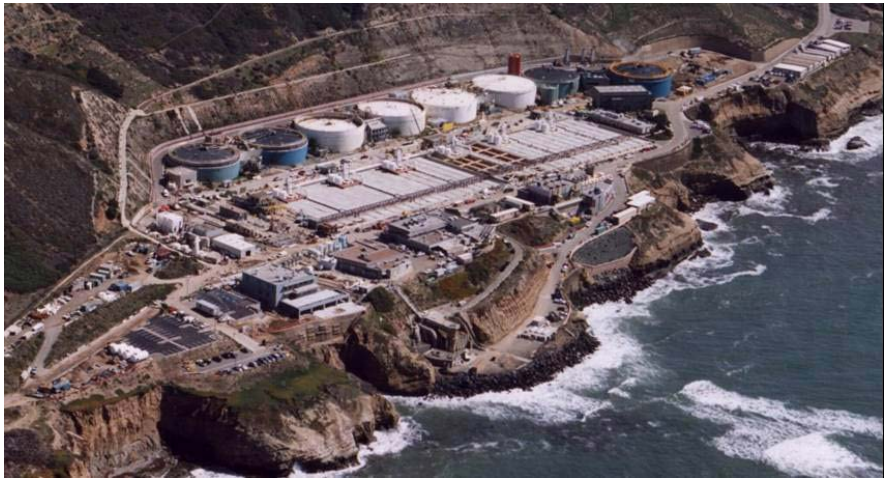
Water Conservation Benefits

Tighter control	Reduced Gross Use	Saved Water
Better water accounting	Reduced operating costs - pumping, water and wastewater treatment, discharge	More water for other uses – demand growth, environmental flows
Better crop yield and quality	Reduced return flows – salt and nitrate loads	Reduced water acquisition costs
	Less user shortage, but region might have more	Fewer regional water shortages

- Reduced use ≠ Savings
- Values of conservation will vary with locally
- Behavior, technology, economics, & values interact

Water Conservation that Saves Water

- Anything that reduces ET (evapotranspiration)
  - Reduced lawn watering
  - Land fallowing and longer fallowing rotations
- In coastal areas – anything that reduces wastewater outflow

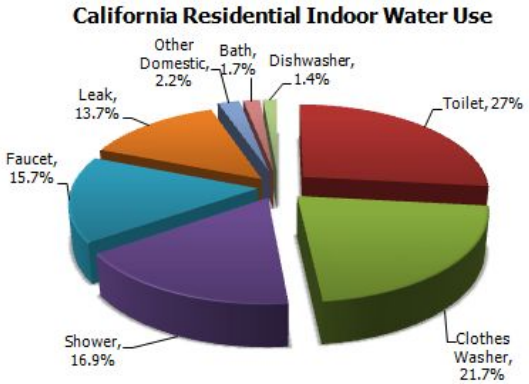


Saves Little Water, but might be useful anyway

- Improving irrigation efficiency
  - Improved crop yields and quality
  - Reduced salt and nitrate loads to receiving waters
  - Oops! But reduces groundwater recharge!

- Inland indoor water conservation
  - Reduced operating and local capacity costs
  - Reduced hydraulic loads for wastewater treatment

Inland return flows are usually already reused.



Increases net water use

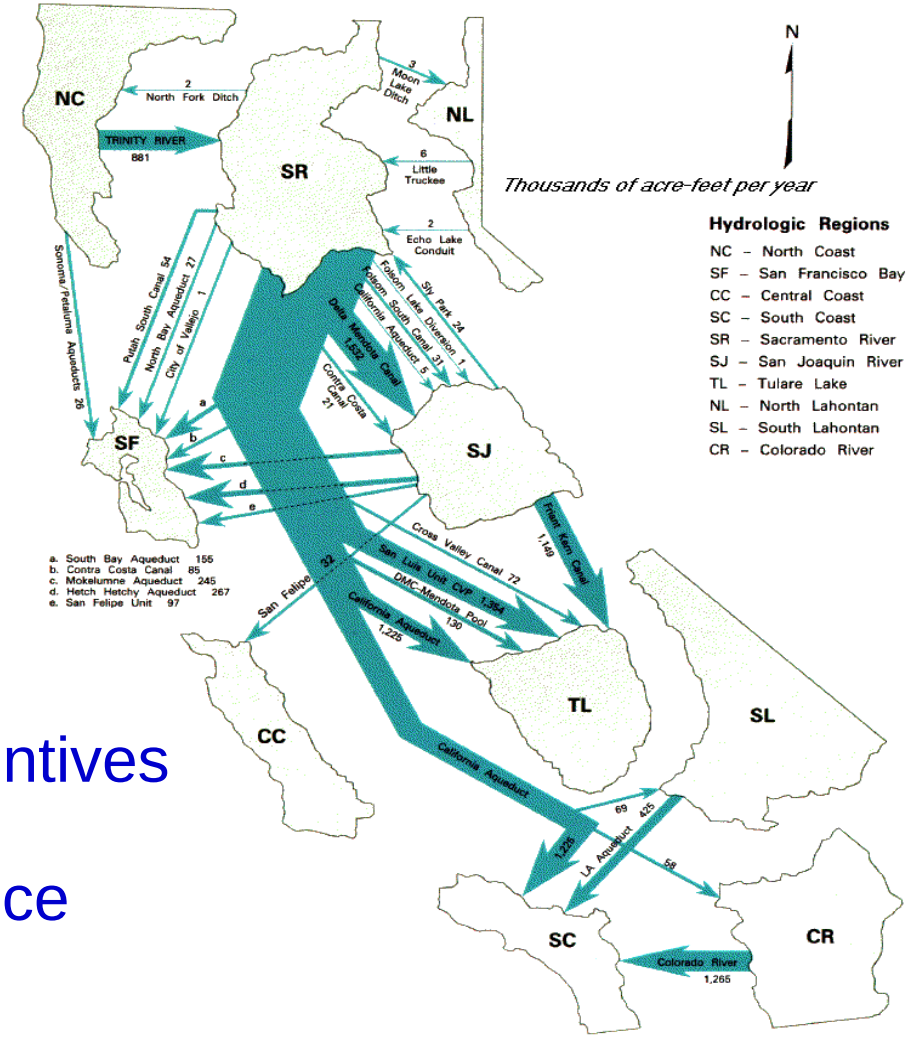
- Net water use increases with conservation
  - "Paradox of the Plains" – users expand use with higher efficiencies
  - Current water rights system particularly susceptible to this problem

William Jevons, British economist, 1835 – 1882

Local and Statewide Portfolios

Local Activities:
- Conservation and use efficiency
- Wastewater reuse
- Desalination (brackish & ocean)
- Groundwater use and recharge
- Surface reservoir operations
- Water markets and exchanges

Statewide Activities:
- Inter-regional water conveyance
- Surface reservoir operations
- Plumbing codes & conservation incentives
- Groundwater banking and recharge
- Water market support and conveyance
- Wastewater reuse subsidies



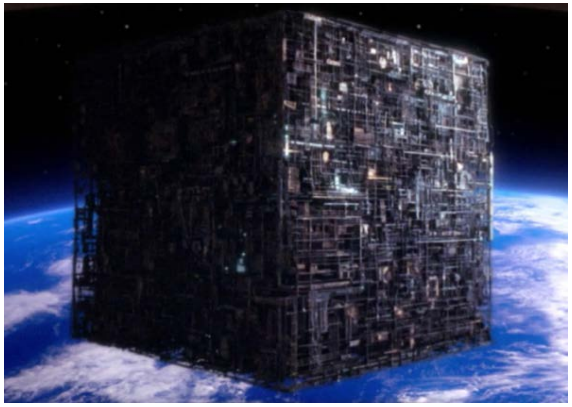
Integrating mix of actions – portfolio planning

Conservation within California's Water System

- Water use reductions needed to save water and manage water quality and economic impacts
- Use reductions don't always save water, and sometimes increase net use
- Water conservation should be part of a system
- Portfolios of actions should be used together for local, regional, and statewide water management

"Waste" = water used by others

Resistance is Futile



1) Flooding in parts of the Delta
2) Reduced Delta diversions
3) Less irrigated land in the southern Central Valley
4) Less urban water use, more reuse & storm capture
5) Some native species unsustainable in the wild
6) Funding solutions mostly local and regional
7) State's leverage is mostly regulatory, not funding
8) Nitrate groundwater contamination is inevitable
9) Groundwater will become more tightly managed
10) The Salton Sink will be largely restored

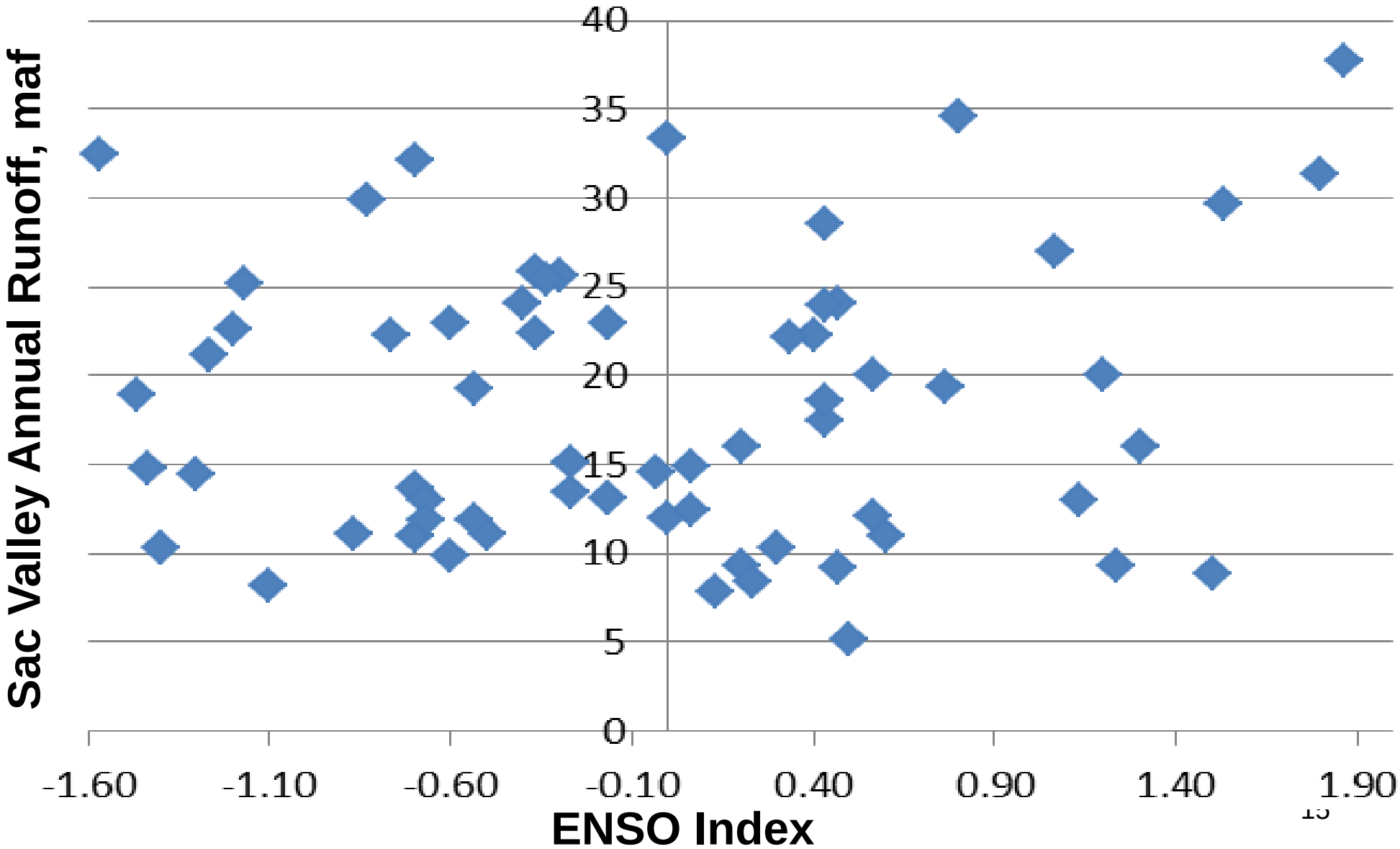
We cannot drought-proof, but we can manage better.

Further reading

- Californiawaterblog.com
  - Taking agricultural conservation seriously (2011) (Many references on agricultural water use and conservation)
  - Paradox on the plains: as water efficiency increases so can water use (2013)
  - Myth and mirage in California's drought (2014)
  - Resistance is futile (2014)

- Cahill, R. and J.R. Lund, "Residential Water Conservation in Australia and California," *Journal of Water Resources Planning and Management*, Vol. 139, No. 1, 2013

Will next year be dry? (from historical data, 1906-2013)

	Probability next year			
	Sacramento Valley		San Joaquin Valley	
Next Year	Historical	Critical now	Historical	Critical now
Critical	0.13	0.29	0.18	0.55
Dry	0.21	0.35	0.14	0
Below Normal	0.18	0.07	0.16	0.15
C,D	0.34	0.64	0.32	0.55
C,D, BN	0.52	0.71	0.48	0.7
AN, W	0.48	0.29	0.52	0.3

Streamflow and El Nino (maf)