Ecosystem and Community Vulnerabilities to Drought

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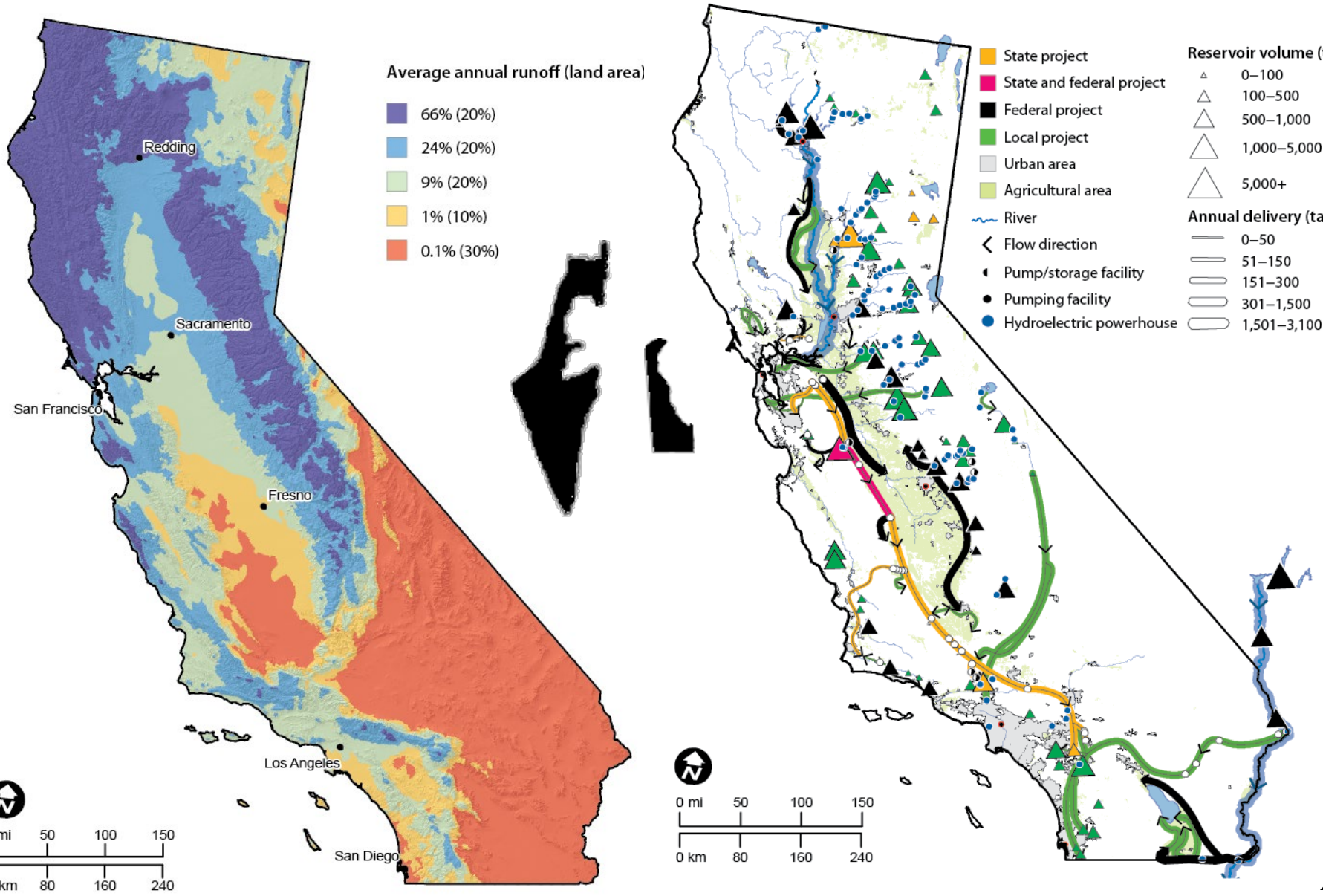
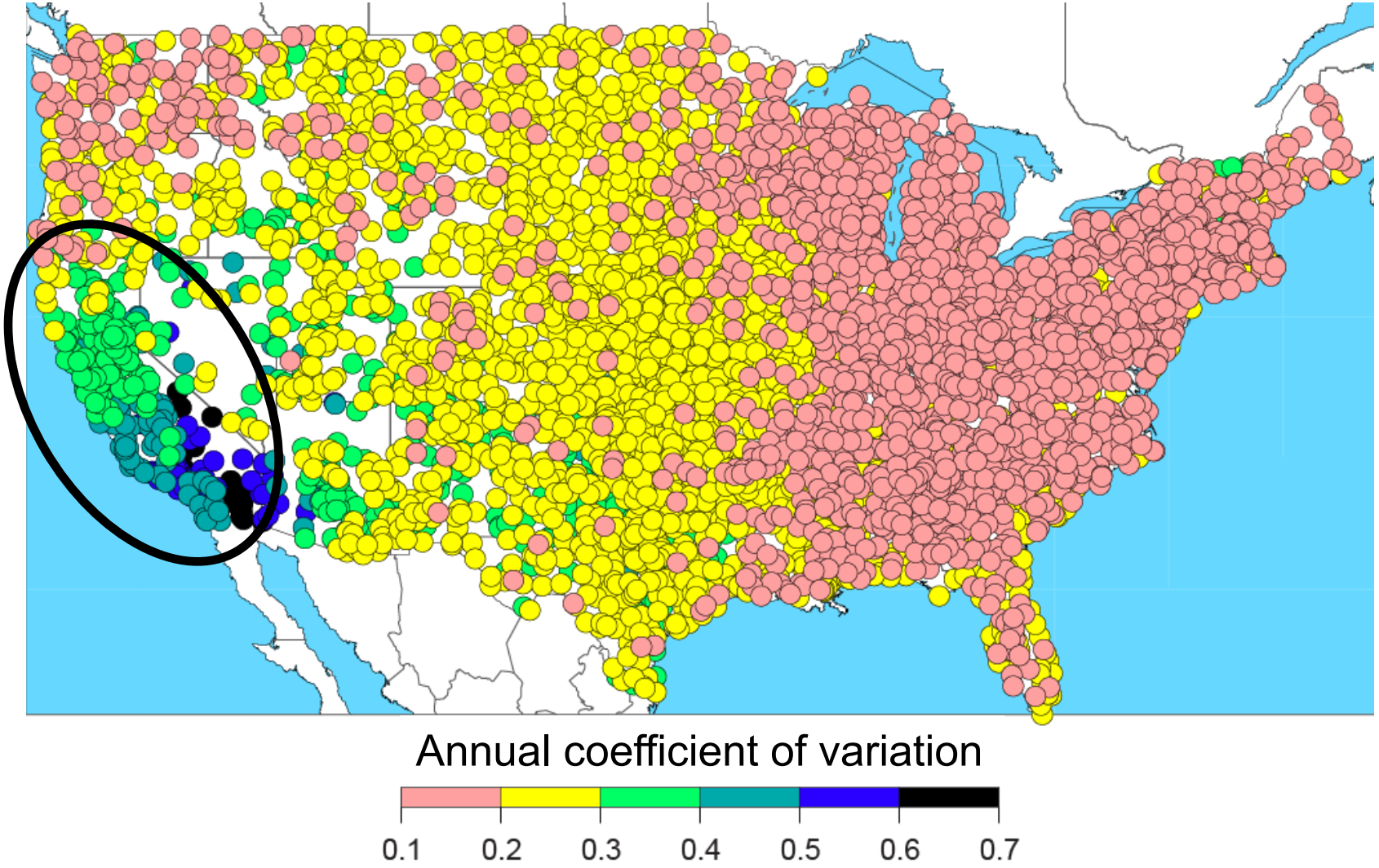
Water and People in California



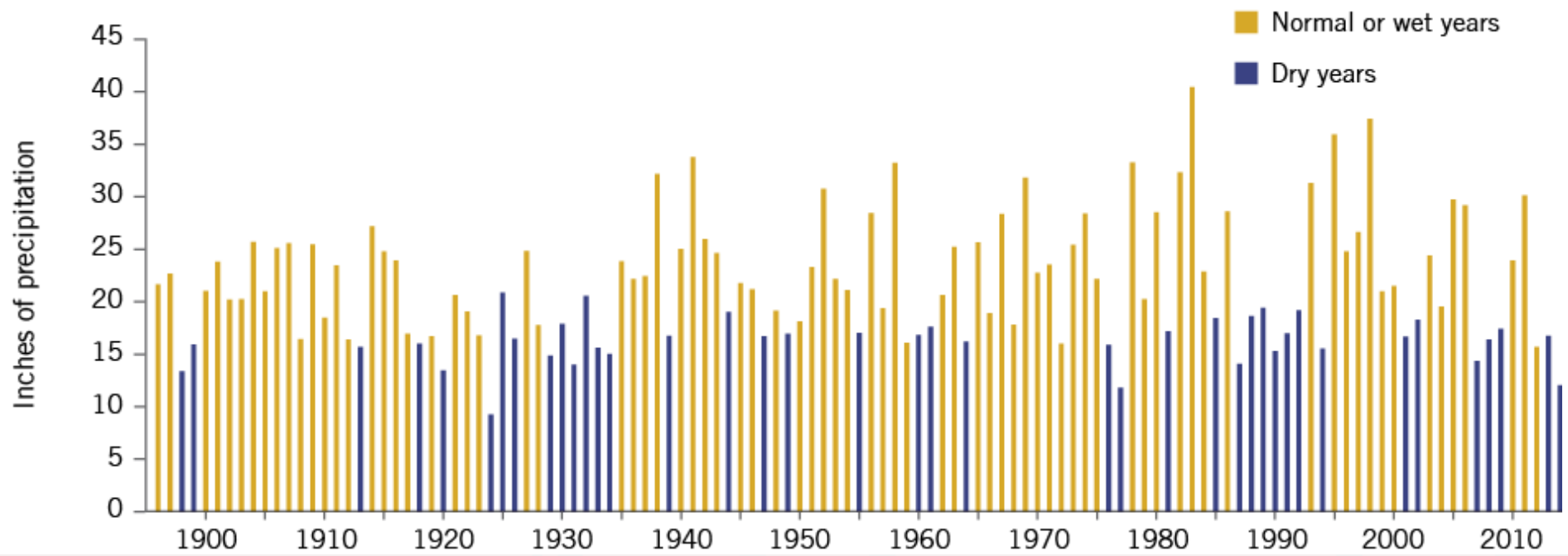
Most annual rainfall variability in US



SOURCE: Michael Dettinger, 2011. “Climate Change, Atmospheric Rivers, and Floods in California—A Multimodel Analysis of Storm Frequency and Magnitude Changes.” *Journal of the American Water Resources Association* 47(3):514-523.

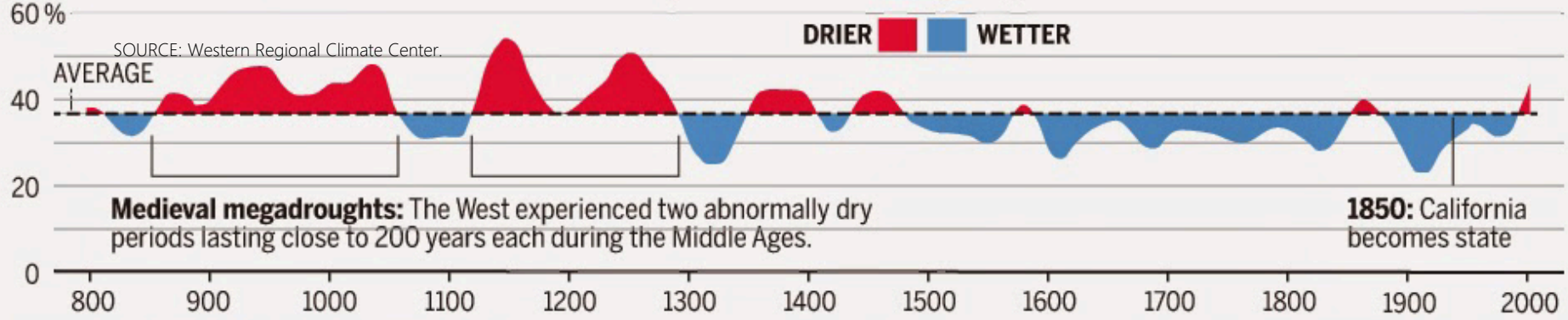
NOTES: Dots represent the coefficient of variation of total annual precipitation at weather stations for 1951-2008, Larger values have greater year-to-year variability.

California has lots of droughts



A 200-year drought?

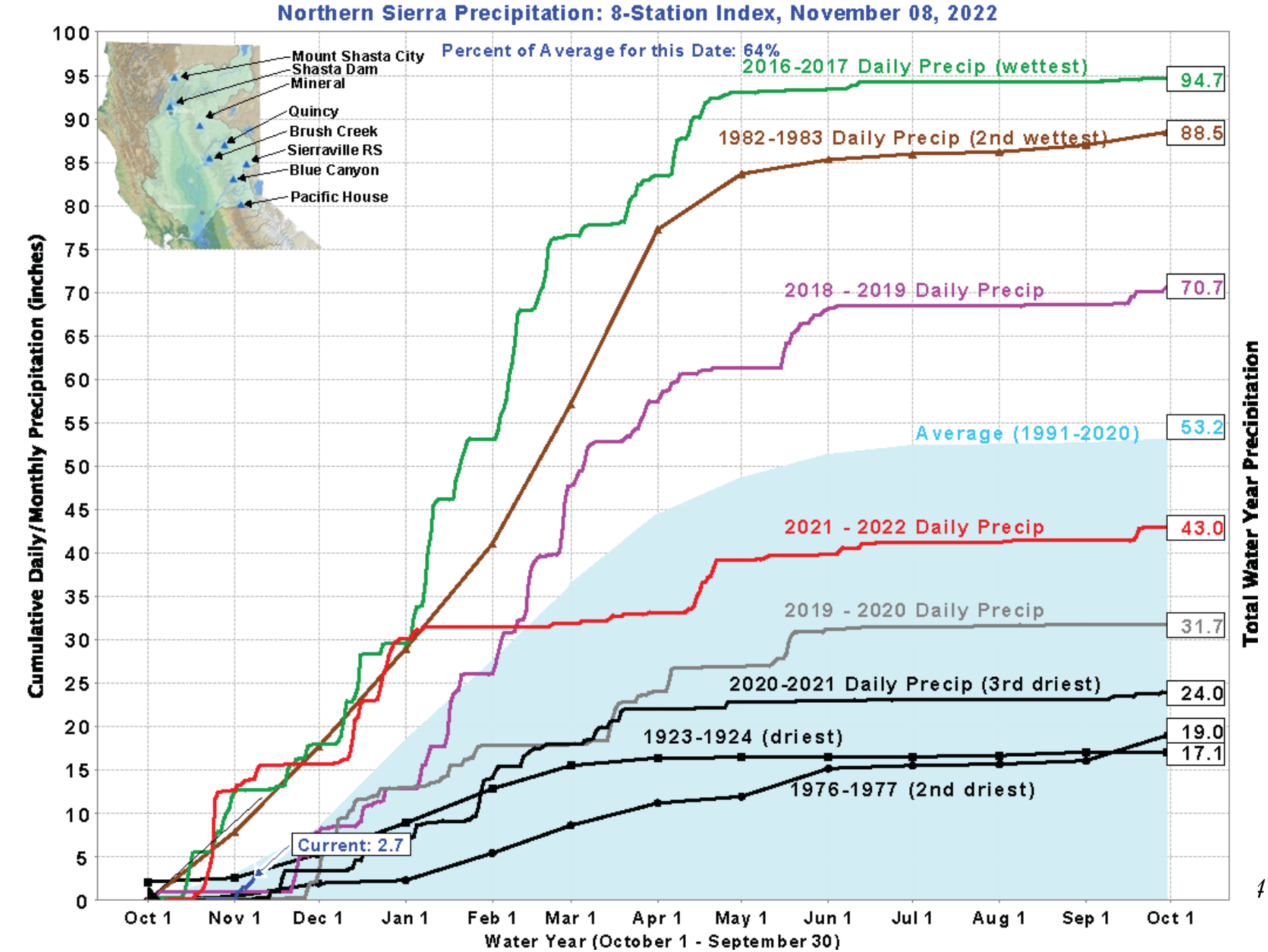
Evidence from tree rings shows that drought was historically much more widespread in the American West than now, while the 20th century was wetter than normal.
Percentage of the West affected by drought from 800 A.D. to 2000:



Source: E.R. Cook et al., Earth-Science Reviews

KARL KAHLER/BAY AREA NEWS GROUP

California's Mediterranean Climate



Climate, Droughts, & Other Changes

1. Climate is warming and sea level is rising
2. Less snow & runoff, more variability (floods-drought)
3. Less runoff, but more floods for same precipitation
4. Economic structure changes affect water demands
5. Social objectives affect water demands
6. Invasive species change ecosystems
7. Wildfires

Disasters bring decisiveness and innovation to rebalance local, regional, state, and federal actions

4 Most Drought-Vulnerable Sectors

NOT Urban and Agriculture – These are mostly well prepared and well-insulated so far. But irrigated agriculture needs to contract by 0.5-2 million acres.

Most Drought Vulnerable Areas:

1. Aquatic Ecosystems
2. Groundwater
3. Sacramento-San Joaquin Delta
4. Rural communities

We focus here on the first and last of these.

Ecosystem Problems

1. Most native species declining
2. Disruptions from massive historical land and water development and invasive species
3. Climate change worsens prospects
4. Major pollution reductions; substantial prevention/ improvements in new water & land developments
5. Continued declines from legacy dynamics and new activities
6. Impossibility of “restoration” and difficulties of reconciliation with climate change
7. Ecosystem management lacks business model and agreed objective

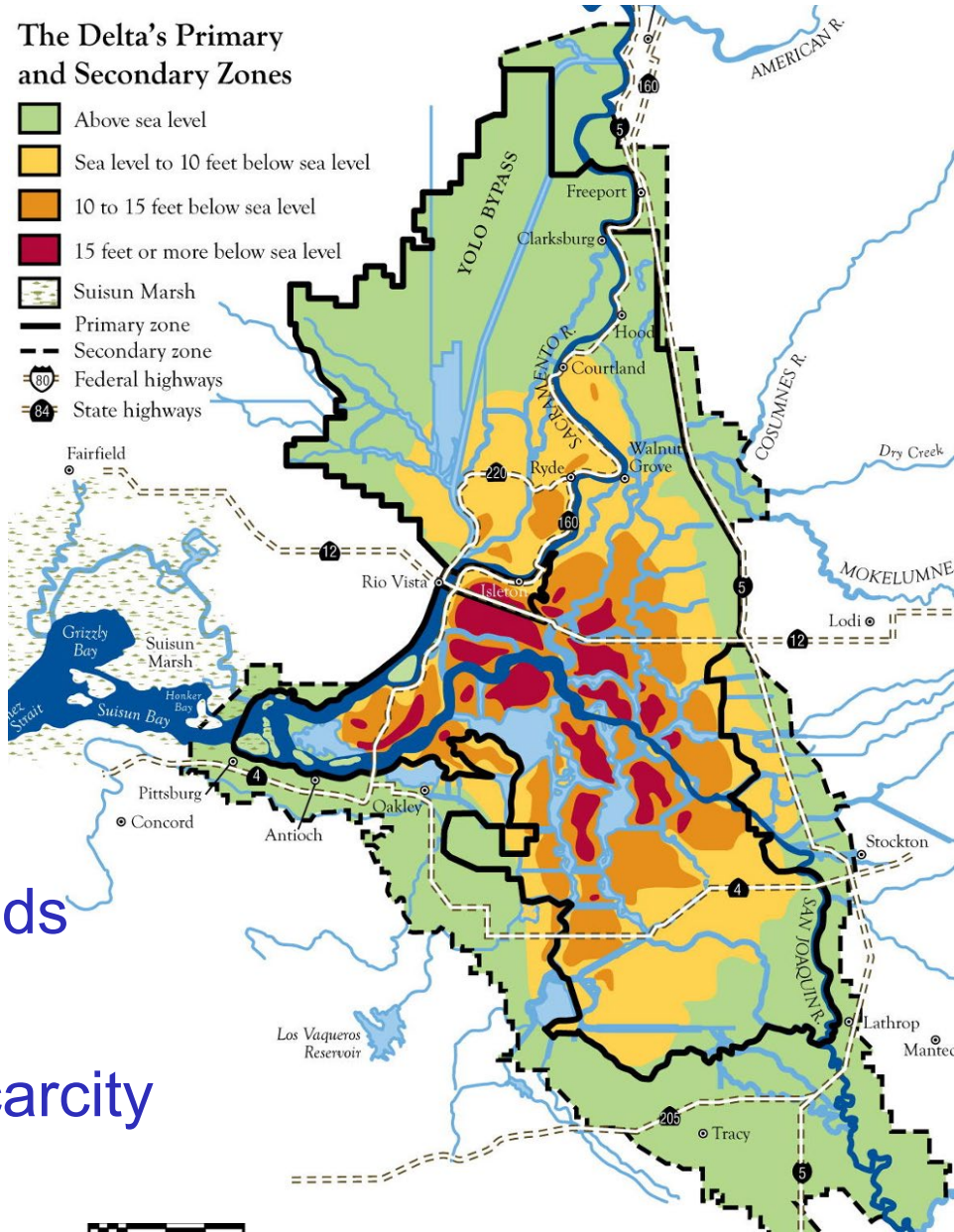
Groundwater Problems

1. Overdraft problems (dry wells, subsidence)
2. Quality problems (nitrate, salinity, others)
3. SGMA shows great promise
4. Need to fallow 0.5 – 2 million acres of irrigated land, mostly in San Joaquin Valley
5. Early progress is promising, and has large implications for other problems
6. How to retire irrigated land responsibly?

Similar to Colorado River overallocation problem.

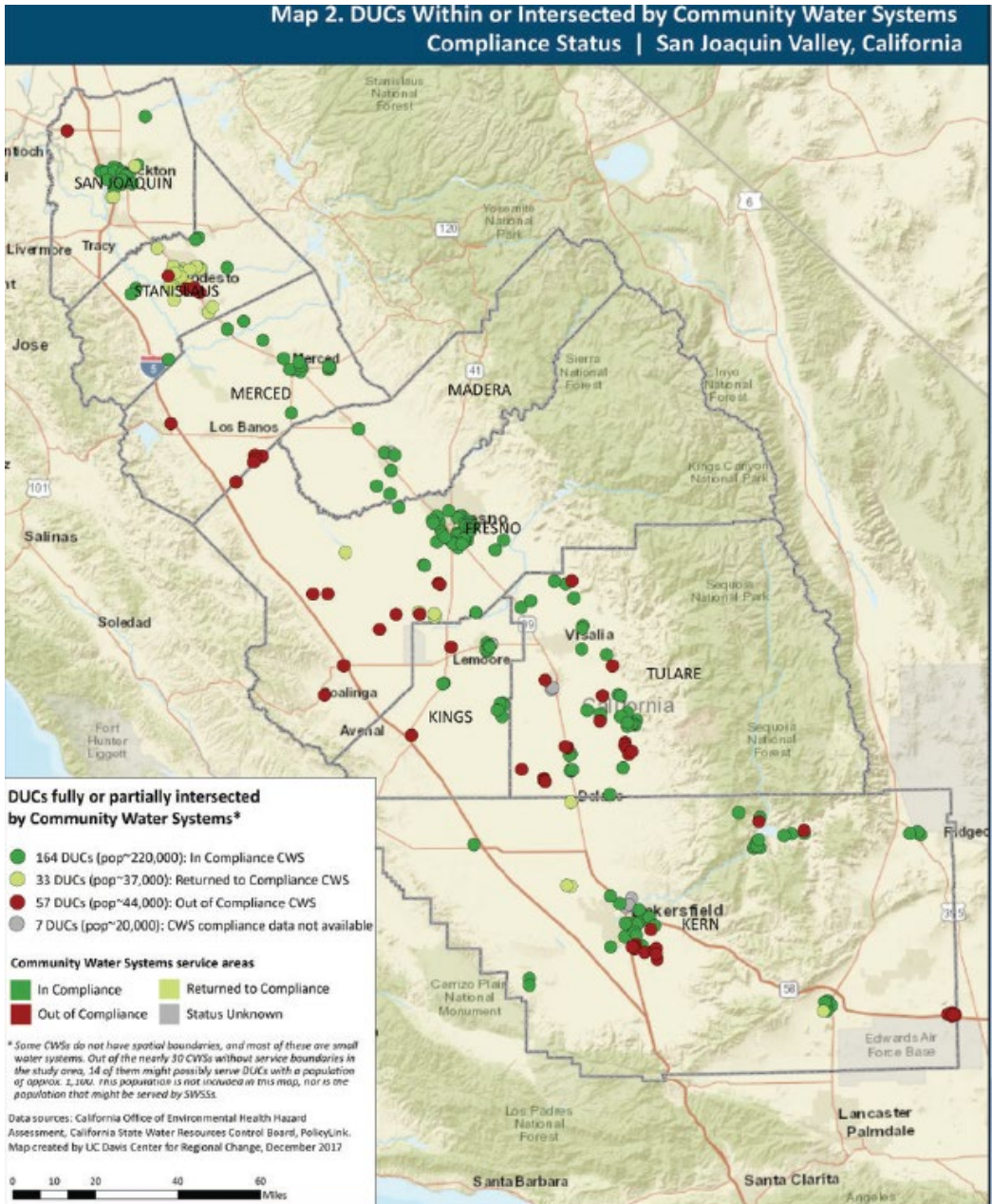
Problems of the Delta

- Physical instability
  - Land subsidence
  - Sea level rise
  - Floods
  - Earthquakes
- Ecosystem instability
  - Habitat alteration
  - Invasive species
- Economic instability
  - High costs to repair islands
  - Worsening water quality
  - Growing overall water scarcity



Rural Communities

1) Vulnerable to drought draw-down
2) Unsafe rural water systems & wells
3) Nitrate and other contaminants
4) Poor communities (poor users overall)
5) Finance and organization
6) Agriculture reduced from SGMA



What to do?

Sectors with less drought problems are cities and agriculture.

They have:

1. Focused mission
2. Reliable funding source
3. Organized authority
4. Organized expertise and knowledge
5. Accountability (voters, ratepayers, regulators)

Some notions…

What to do? – Water for Poor

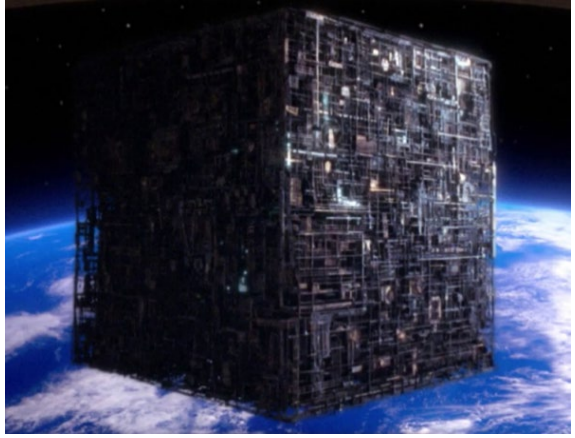
1. Mission – Ease access for poor (rural and urban)
2. Funding – Public goods charge on all urban water use (like such charges in energy and telecom)-218
3. Authority – SWRCB regulates funds to Counties by census data for rural systems and urban poor; prioritize rural consolidation
4. Expertise – SWRCB, Counties, consultants
5. Accountability – Public reporting, State and County electeds

SGMA will help many rural drinking water problems.

What to do? – Ecosystems

1. Mission – Ecosystem health, however we define it?
2. Funding – A public good charge on all water diversions (hydropower, water supply, etc.) + matching state general funds
3. Authority – Need a more coherent and accountable structure for ecosystem management, perhaps structuring state, federal, and basin authorities
4. Expertise – How to organize and apply?
5. Accountability – Annual reporting, External assessments?, State, Federal, and local electeds

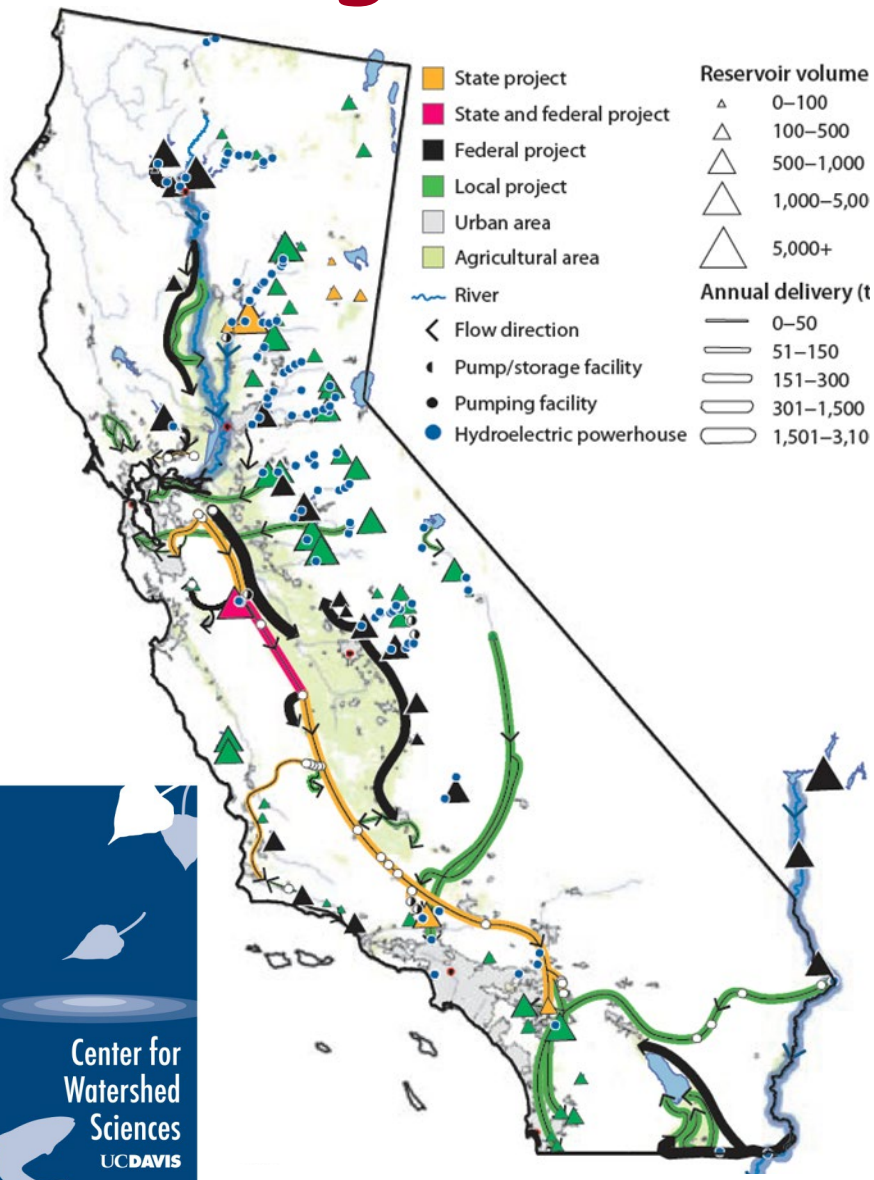
Resistance is Futile



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 be managed more tightly
10) The Salton Sink will be largely restored

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

Further Readings



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