

What is this study about?

- Effects of ending long-term overdraft from California's intertidal water system is studied using CALVIN model
- Delta water operations, such as outflow and exports, are examined with several hypothetical "no overdraft" cases
- Adaptations to reduce water scarcity and costs are evaluated

Overdraft in Central Valley

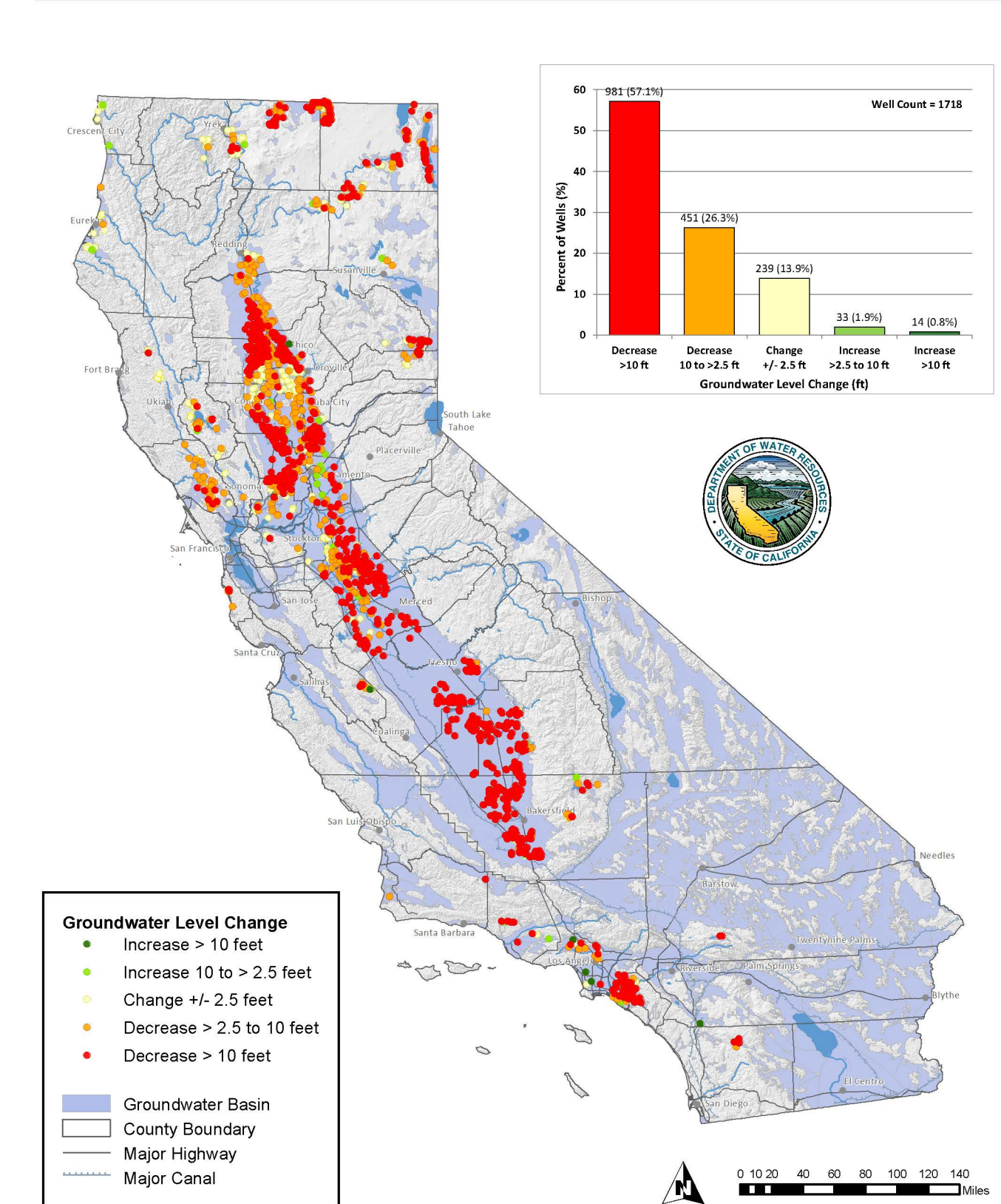
Definition

- Overdraft is the case where groundwater extraction through pumping exceeds recharge over a long period

Consequences

- Higher pumping cost
- Water quality degradation
- Land subsidence
- Salt intrusion in coastal areas
- Flow reduction in streams, wetlands, and springs that are hydraulically connected to underlying aquifer

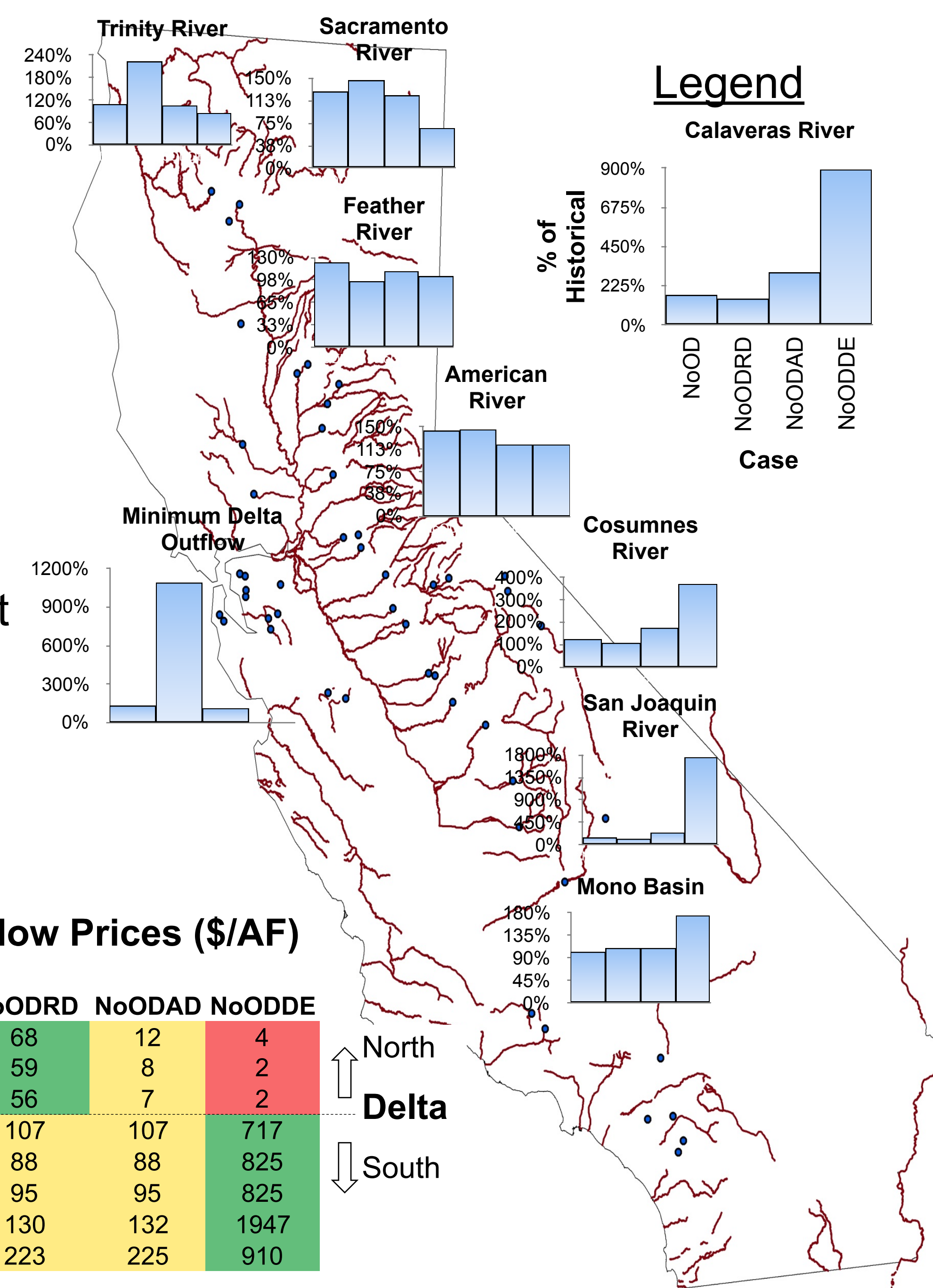
Groundwater Level Change* - Spring 2006 to Spring 2016



source: http://www.water.ca.gov/groundwater/maps_and_reports/

Opportunity Costs of Environmental Flows

- Opportunity cost is a good indicator of water scarcity
- As water scarcities increase, environmental flows become more valuable
- Environmental users can sell water at high prices for other investments, such as improving habitat or infrastructure.
- Water is more valuable south of Delta



Regional Water Scarcity Cost

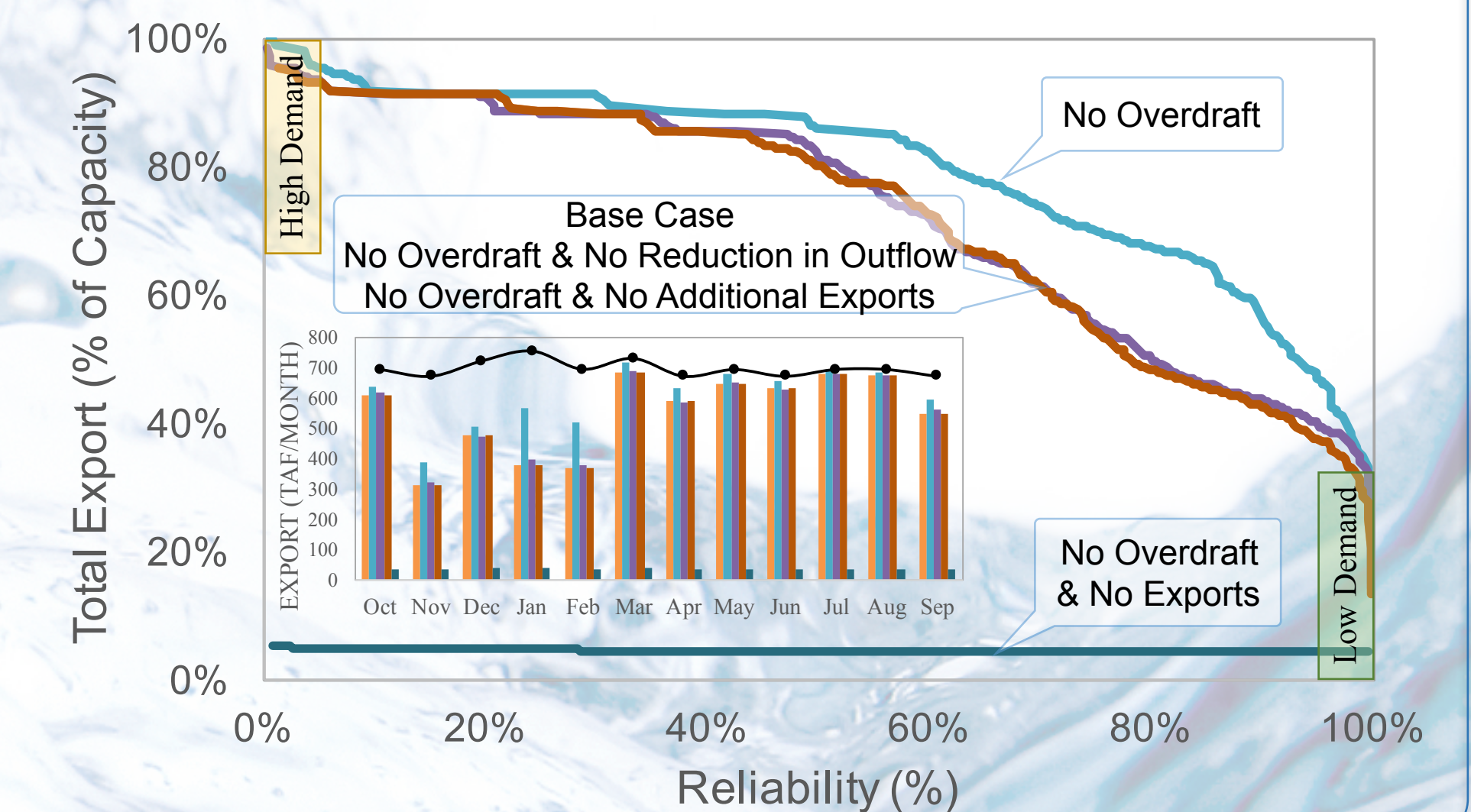
- "No Overdraft" policy increases agricultural scarcity costs, especially in San Joaquin Valley and Tulare Basin
- Costs are higher when no reduction is allowed from Delta outflow in addition to no overdraft
- Relatively small numbers compared to California's economy (\$2.5 trillion in 2015 source: https://en.wikipedia.org/wiki/Economy_of_California)

Annual Average Agricultural Water Scarcity Cost (\$M/year)

Region	Base Case	NoOD	NoODRD	NoODAD	NoODDE
Sacramento Valley	7	10	19	10	16
San Joaquin Valley	1	9	12	12	864
Tulare Basin	13	22	35	35	1791
Total Central Valley	21	41	66	57	2671

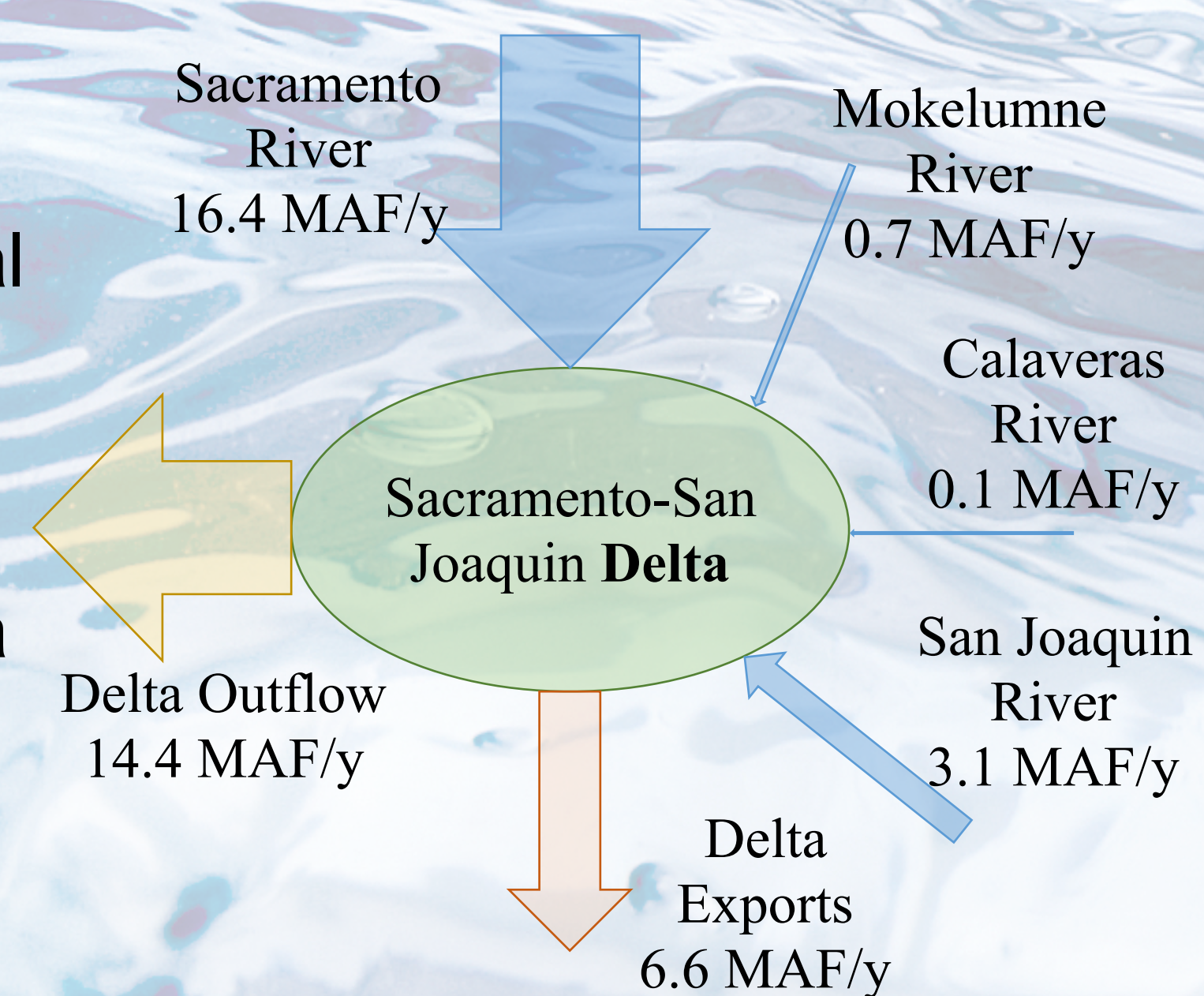
Delta Exports

- Water transfers from Banks and Tracy pumping plants
- Demand is high in dry season, low in wet season
- About 50% of time, exports are greater than 80% of allowable capacity



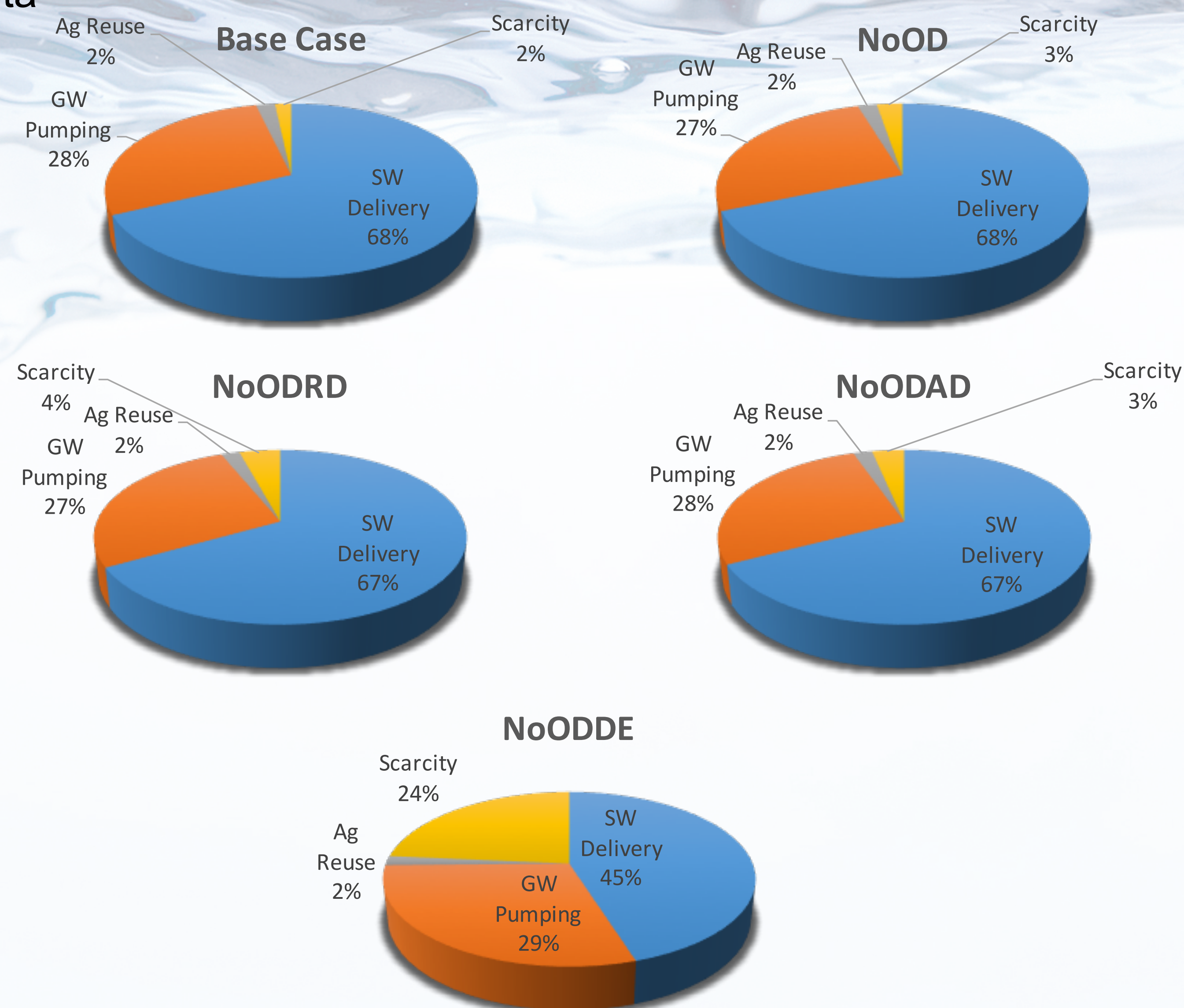
Policy Scenarios

- Base historical operations with overdraft (Base Case)
- No long-term overdraft in the Central Valley (NoOD)
- No overdraft and no reduction in Delta outflow (NoODRD)
- No overdraft and no additional Delta exports (NoODAD)
- No overdraft and no Delta exports (NoODDE)



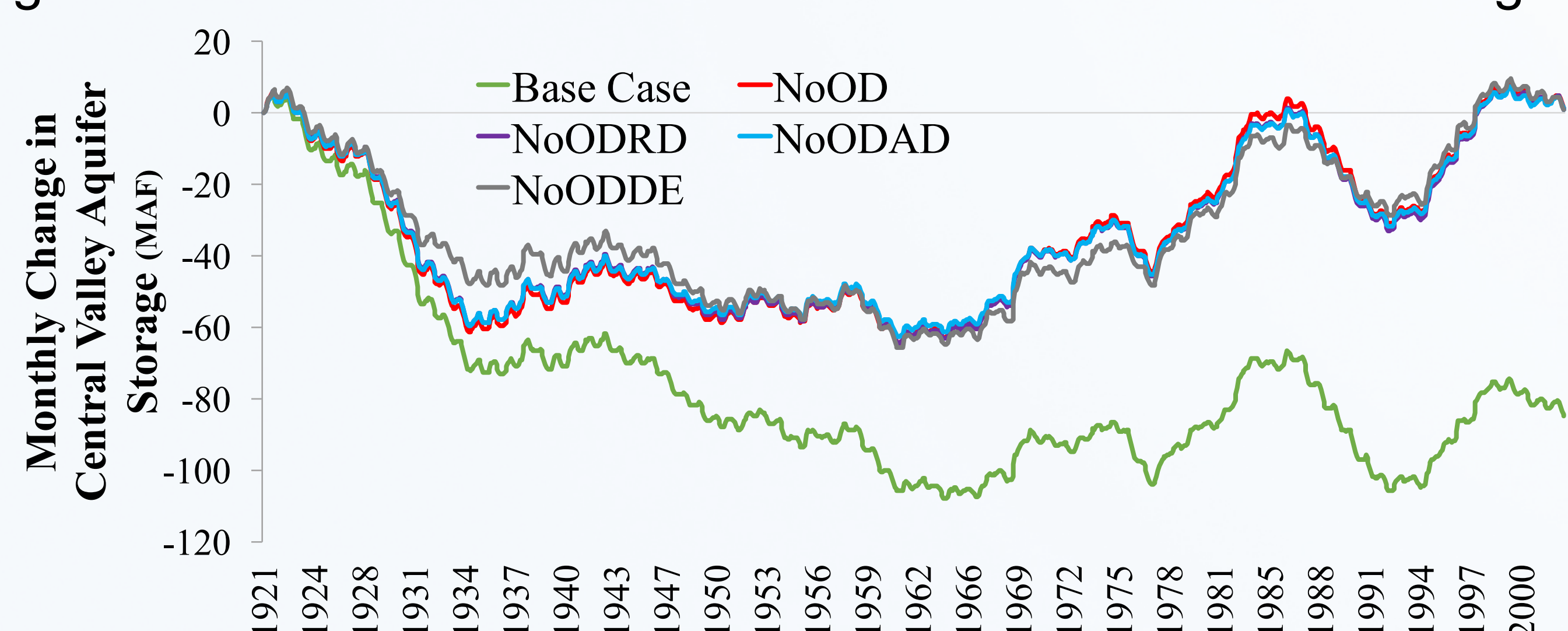
Statewide Agricultural Water Supply Portfolios

- No overdraft policies do not have significant effects on water supply portfolios
- Only 1% increase in scarcity due to less groundwater availability in no overdraft (NoOD) case
- Prohibiting Delta exports results in considerable water scarcities south of Delta



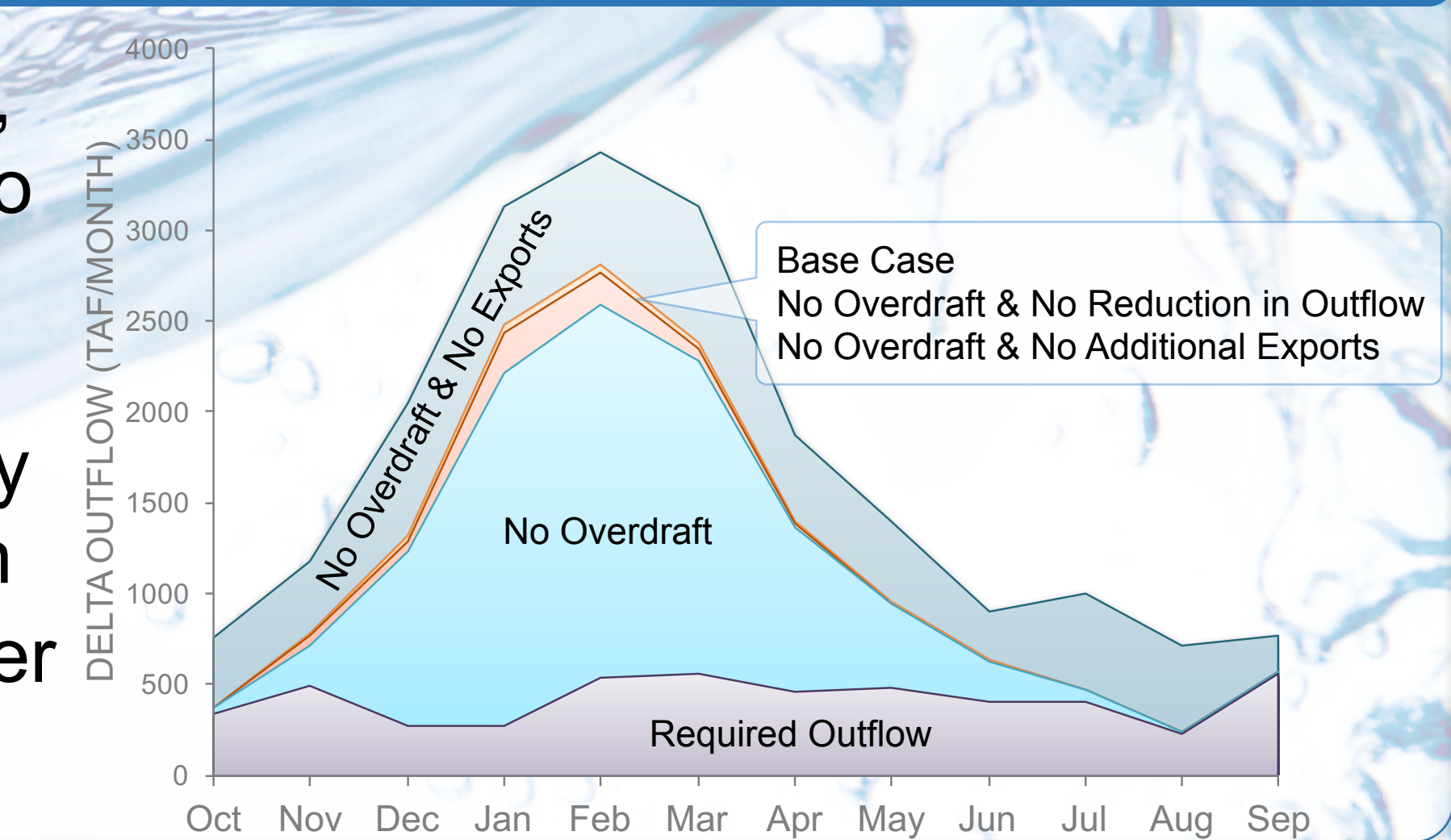
Central Valley Groundwater Storage

- Short-term overdraft can be useful to reduce scarcity costs, but the long-term overdraft must be eliminated for sustainable management



Delta Outflow

- Monthly average Delta outflow, drained from Central Valley into San Francisco Bay
- "No Overdraft" policy diverts more water from outflow mostly between December and March
- More water is available in winter months



Conclusions

- Ending overdraft increases water scarcity for human and environmental uses, and changes operations
- Delta exports, water trading, and groundwater banking are useful adaptations
- Conjunctive use of surface and ground water is essential to meet water demand and reduce scarcities
- Winter has best prospects for increasing Delta exports

For more results:

<https://watershed.ucdavis.edu/shed/lund/CALVIN/>

Contact: Mustafa Dogan, msdogan@ucdavis.edu