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Effects of Ending Long-Term Overdraft on California's Water Supply System

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Outline

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  - Effects
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- Results
  - Water shortage: Agriculture, Urban & Environmental
  - Economic costs of water shortage
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- Conclusions

Overdraft (OD)

- Overdraft:
  - Groundwater extraction > recharge
  - Unsustainable use of groundwater
- Effects:
  - Higher pumping costs
  - Water quality degradation
  - Land subsidence
  - Less storage capacity
  - Flow reduction in streams, wetlands and springs

Overdraft in Central Valley

- Annual average overdraft of 1-2 MAF (CDWR)
- Cumulative overdraft of 84 MAF in 82 years
- Average years: 30%,
- Dry years: >40% from groundwater
- Some cities, Davis, Fresno and Lodi, heavily on GW for drinking
- Critically important in Tulare Basin

SGMA

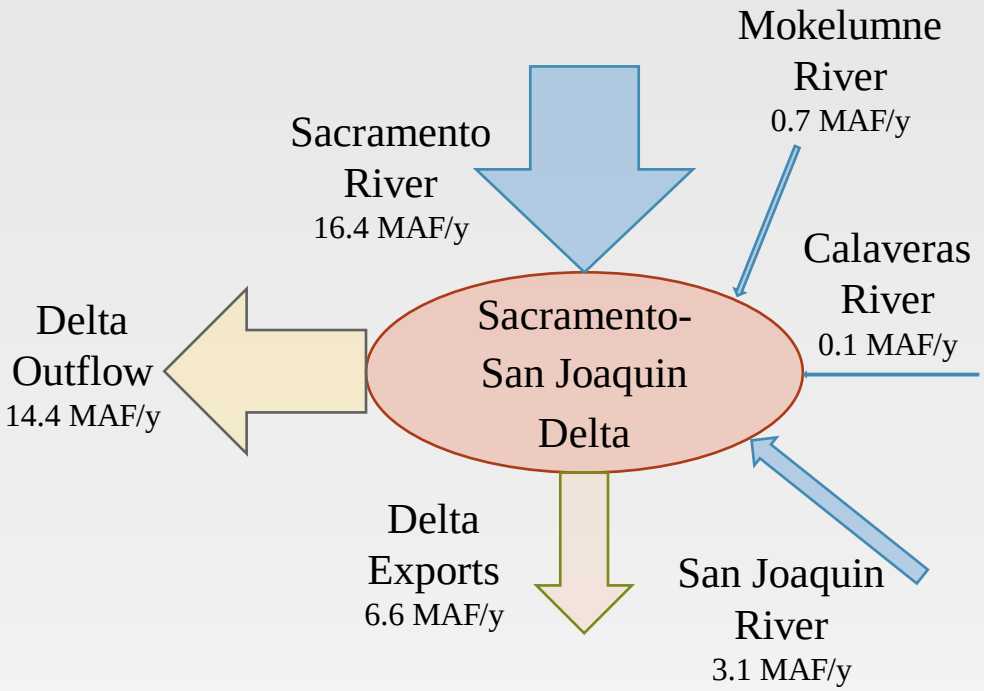
- Sustainable Groundwater Management Act
- Enacted in September 2014
- Framework for managing groundwater locally
- Aims to manage and use groundwater without causing ‘undesirable results’, such as overdraft

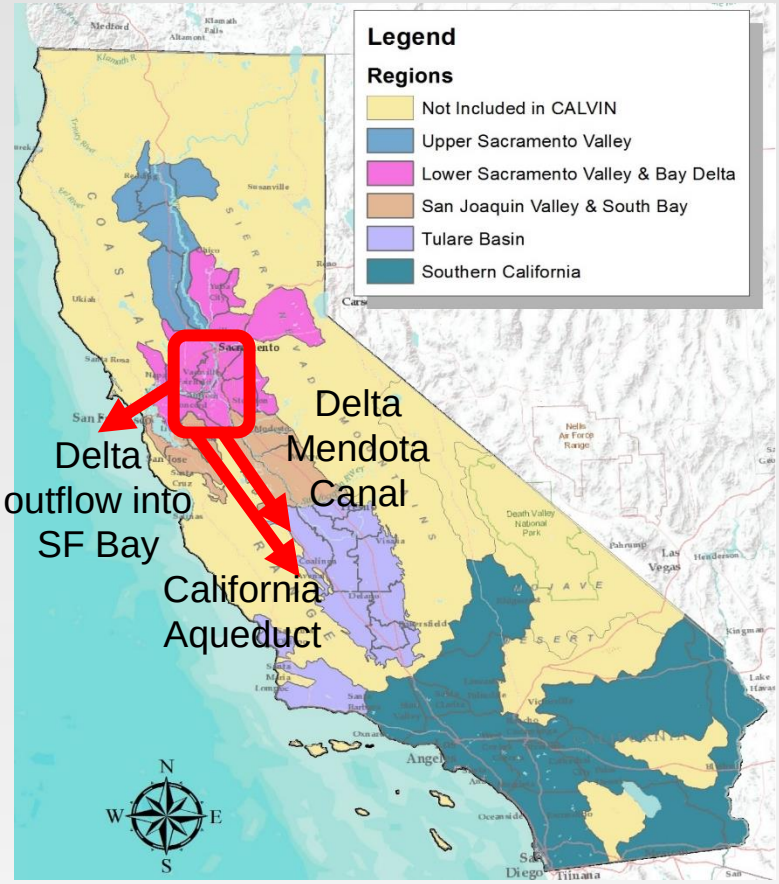
Management Cases

1. Base Case Historical CALVIN operations with projected overdraft of 84 MAF over 82-year period
2. NoOD Assumes no overdraft in Central Valley groundwater basins
3. NoODRD In addition to no overdraft, no reduction on Delta outflow than historical outflow is allowed
4. NoODAD In addition to no overdraft, no additional exports from Delta allowed to mitigate scarcities south of Delta
5. NoODDE In addition to no overdraft, no Delta exports allowed for south of Delta users (capacity reduced to 5%), fostering Delta outflow

Delta Water Operations

- Simple representation of Delta water balance





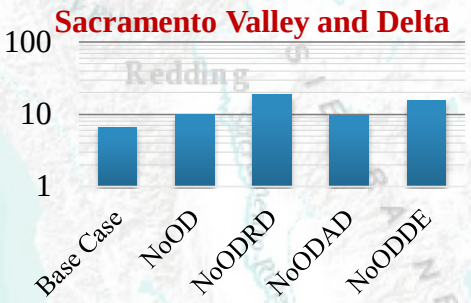
Results

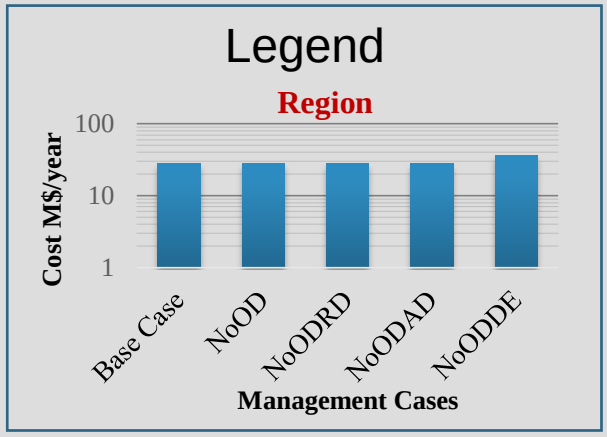
Water Scarcity - Agricultural

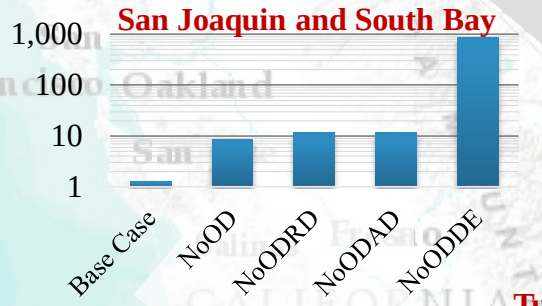
Scarcity (TAF/y)	Base Case	NoOD	NoODRD	NoODAD	NoODDE
Upper Sac.	20	32	98	21	12
Lower Sac. & Delta	89	124	277	125	155
San Joaquin & South Bay	20	122	168	168	2,085
Tulare Basin	146	242	376	376	3,650
Southern California	152	152	152	152	168
Central Valley	274	520	920	690	5,902

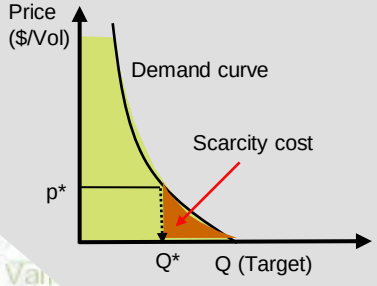
- Agricultural scarcity increases when overdraft ends
- Tulare Basin has high scarcities
- Highest increase in San Joaquin

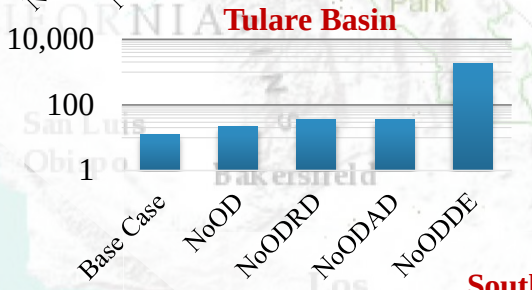
Scarcity Cost - Agricultural

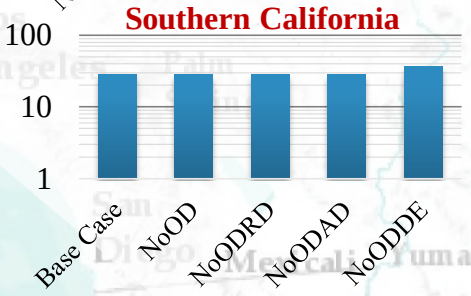












Annual average agricultural scarcity cost (M$/year)

Water Scarcity - Urban

Scarcity (TAF/y)	Base Case	NoOD	NoODRD	NoODAD	NoODDE
Upper Sac.	0	0	0	0	0
Lower Sac. & Delta	0.9	0.9	0.9	0.9	0.9
San Joaquin & South Bay	0	0	0	0	93
Tulare Basin	6.3	6.3	6.3	6.3	28
Southern California	98	102	133	133	496
Central Valley	7.2	7.2	7.2	7.2	122

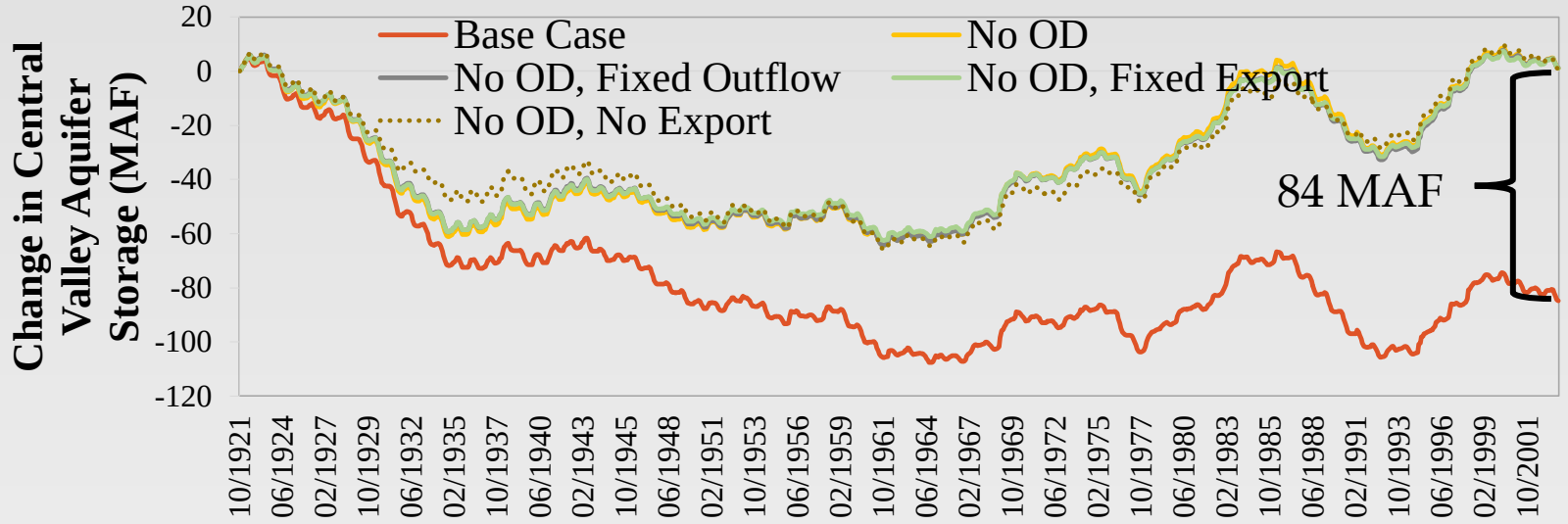
- Urban users have higher WTP
- Almost no effect on urban deliveries
- No Delta export policy creates big shortages

Environmental Deliveries

	Avg. Marginal Value (Shadow Price) ($/AF)	Base Case	NoOD	NoODRD	NoODAD	NoODDE
North of Delta	Sacramento West Refuges	11	14	68	12	4
	Gray Lodge	7	9	59	8	2
	Sutter	6	8	56	7	2
South of Delta	San Joaquin East Refuges	47	63	107	107	717
	San Joaquin West Refuges	39	45	88	88	825
	Mendota Pool	43	50	95	95	825
	Kern	68	76	130	132	1947
	Pixley	141	173	223	225	910

- Different trend in north and south of Delta
- Higher marginal values in the south
- More valuable environmental flow with scarcities

Groundwater Storage



- About 84 MAF overdraft over the 82-year period in the Central Valley
- Short-term overdraft reduces scarcity costs
- Filling and drawdown periods (conjunctive use)
  - Increases in wet years
  - Decreases in dry years

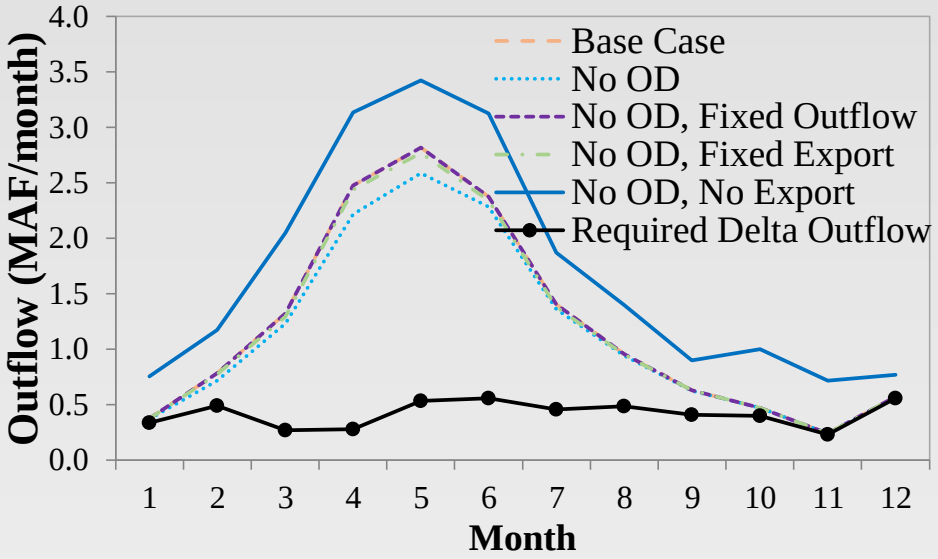
Delta Exports

Case		Base Case	NoOD	NoODRD	NoODAD	NoODDE
Export (TAF/y)	Banks	4,108	4,657	4,158	4,108	251
	Tracy	2,478	2,597	2,475	2,478	167
	Total	**6,587**	**7,254**	**6,634**	**6,587**	**418**
Marginal Values on Upper Bound ($/AF)	Banks	14	16	13	65	1,761
	Tracy	8	14	8	58	1,756

- Tracy PP (CVP) & Banks PP (SWP)
- Delta-Mendota Canal & California Aqueduct
- Increase with no overdraft
- Transfers from north of Delta users

Delta Outflow

Case	Avg. Delta Outflow (MAF/y)	Avg. Marg. Value ($/AF)
Base Case	14.4	5.9
NoOD	13.6	7.9
NoODRD	14.4	64.2
NoODAD	14.2	6.7
NoODDE	20.3	0.4



- Flow from the Central Valley into the SF Bay
- Required + surplus Delta outflow
- Lowest in no overdraft case (NoOD)

Conclusions

- Overdraft can be terminated with adaptations
- Delta exports and water trading are useful adaptations
- Delta outflow is important in reducing scarcities
- In terms of agricultural scarcity cost:

Base Case < NoOD < NoODAD < NoODRD < NoODDE

49 69 85 94 2,707

Annual avg. statewide agricultural scarcity cost (M$/y)

Thank You!

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