

Updates to Central Valley WEAP Model for California Water Plan Update 2028

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Acknowledgement

DWR

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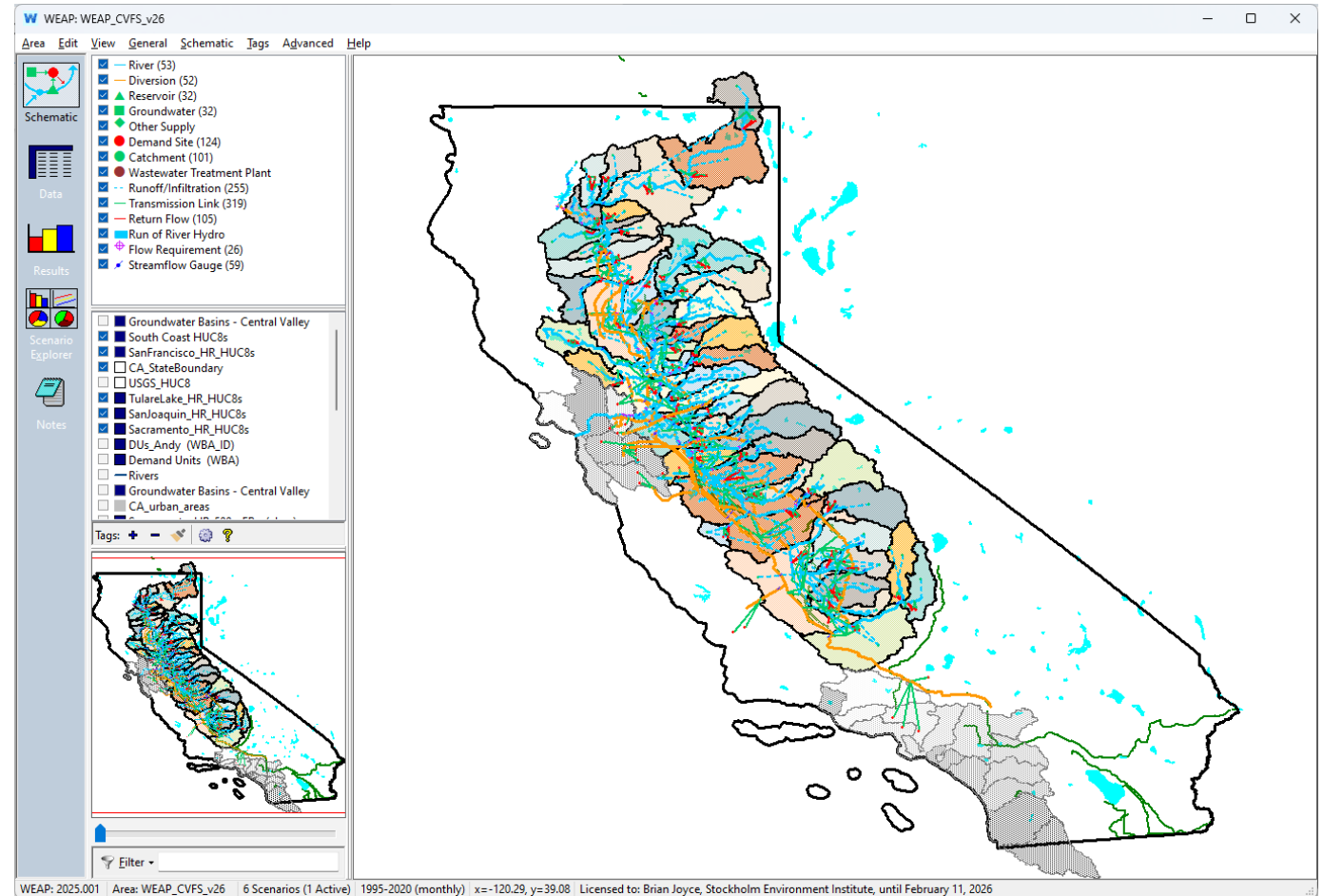
Charles A. Young
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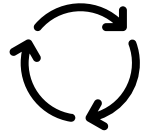
Saquib Najmus
Frank Qian

Presentation Overview

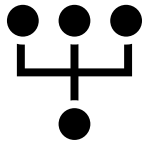
- Modeling Objectives
- Model Design
- Model Calibration
- Next Steps



Modeling Requirements for Water Plan



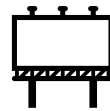
Fully integrated model structure



Easy Scenario Management



Short run time for screening analysis



Easily Communicable



Regional and Statewide Coverage

Assessment Capabilities of the Model

Key Uncertainties:

- Changes in Climate/Sea level
- Changes in Population
- Changes in Land Use
- Changes in Regulations and Policy

WEAP-FS

Example Management Strategies:

- New Infrastructure (e.g. reservoirs, strategic interties, conveyance)
- System rehabilitation (e.g. canals)
- Re-operation (e.g. MAR, SGMA)
- Wastewater reuse
- Demand management

Vulnerability
Assessment

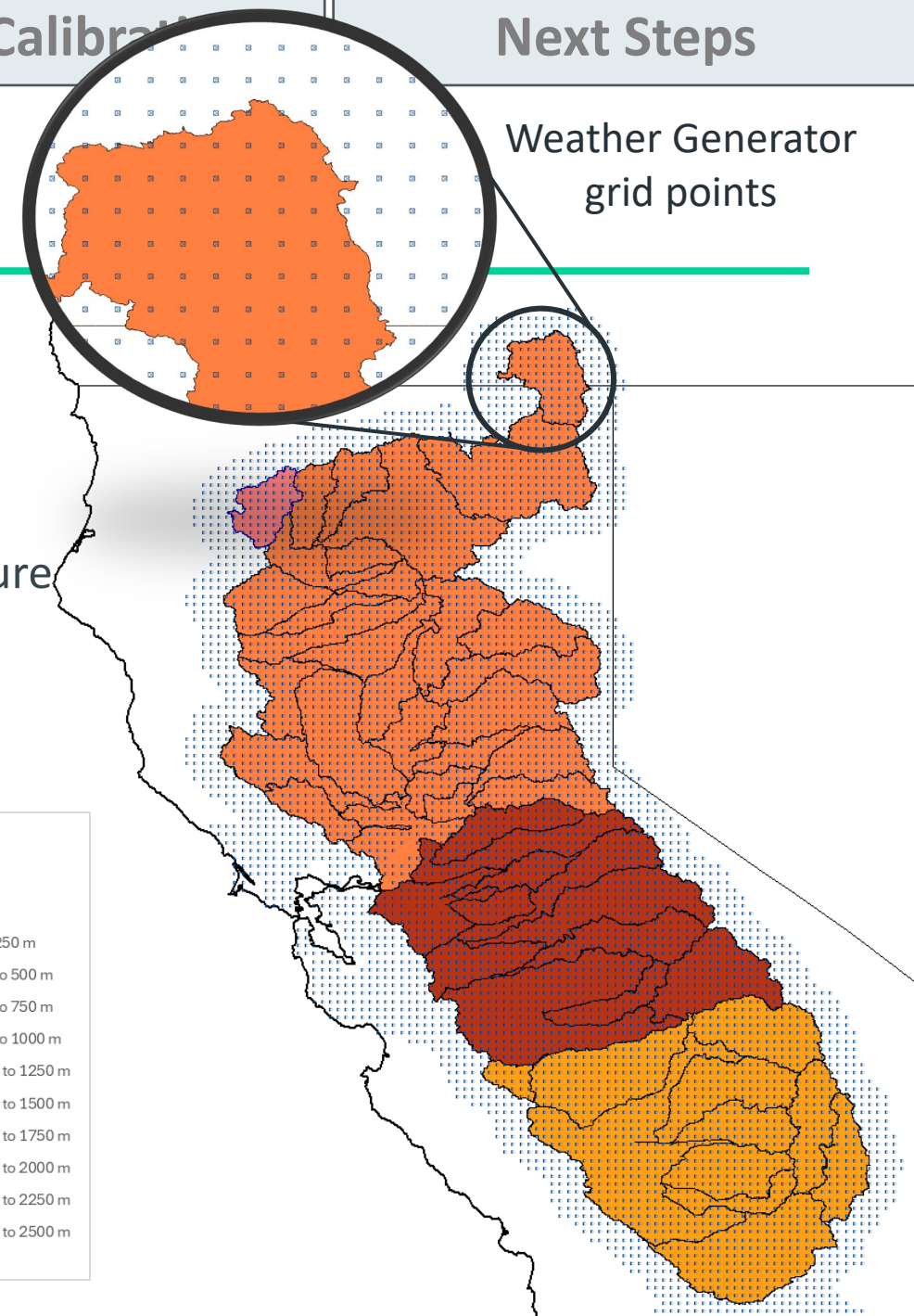
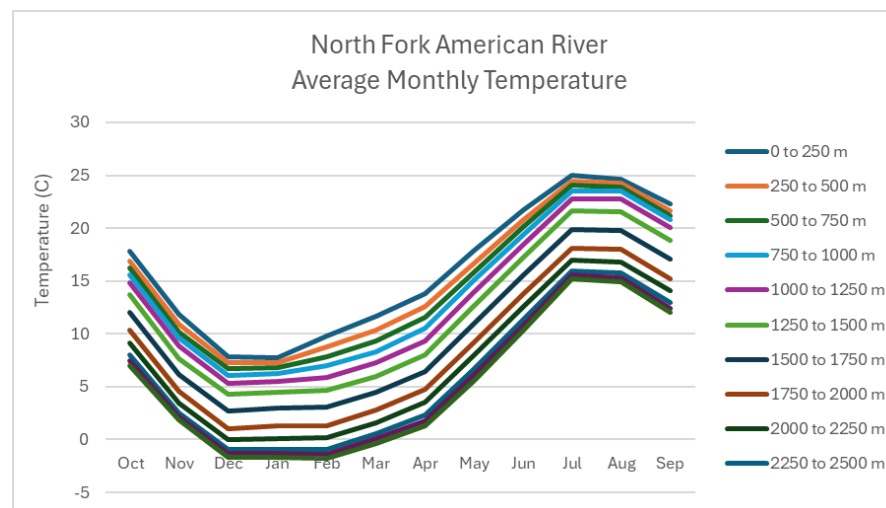
Scenarios
Analysis

Key Outcome Metrics:

- Delivery reliability
- Unmet demands
- Long-term water supply targets
- River flows & diversions
- Groundwater & surface water storage
- Operational costs (optional)
- Crop yields (optional)

Spatial Disaggregation

- Hydrologic Regions divided into USGS HUC8 units
- Each HUC8 is further divided by:
 - 250 m elevation bands, to capture snow accumulation/melt
 - Land cover (using USGS National Land Cover Dataset), to capture rainfall-runoff response
- Monthly precipitation and temperature inputs from Weather Generator
 - Each 250 m elevation band has unique precipitation and temperature timeseries.



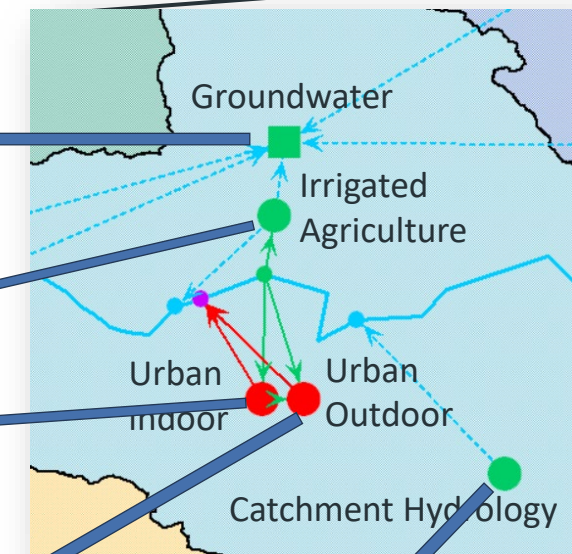
Water Supply and Demand

Modeled for 30 subbasins in Central Valley

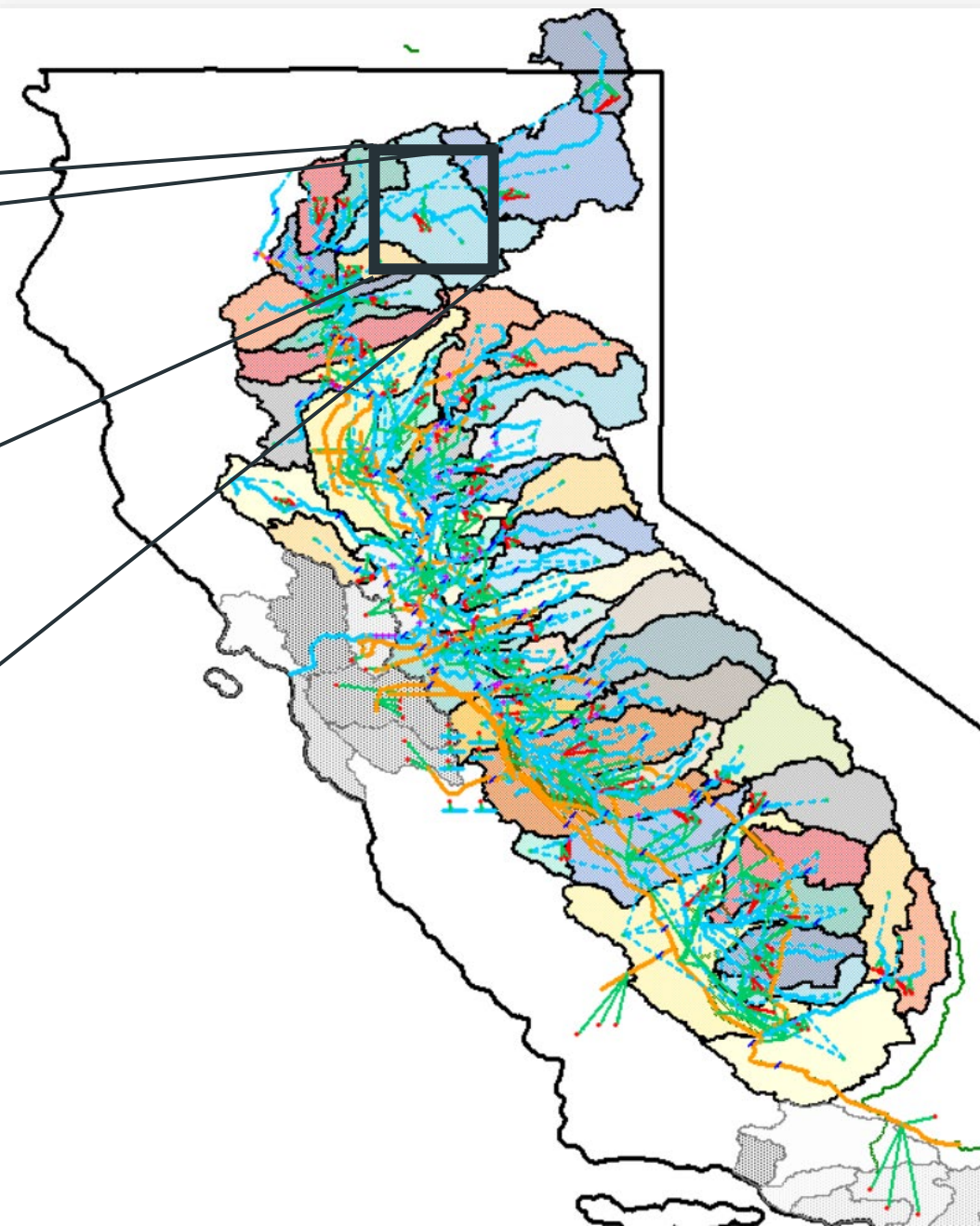
Includes 21 major crop types

Includes single family, multi-family, commercial, and industrial

Includes single family, multi-family, and large landscape

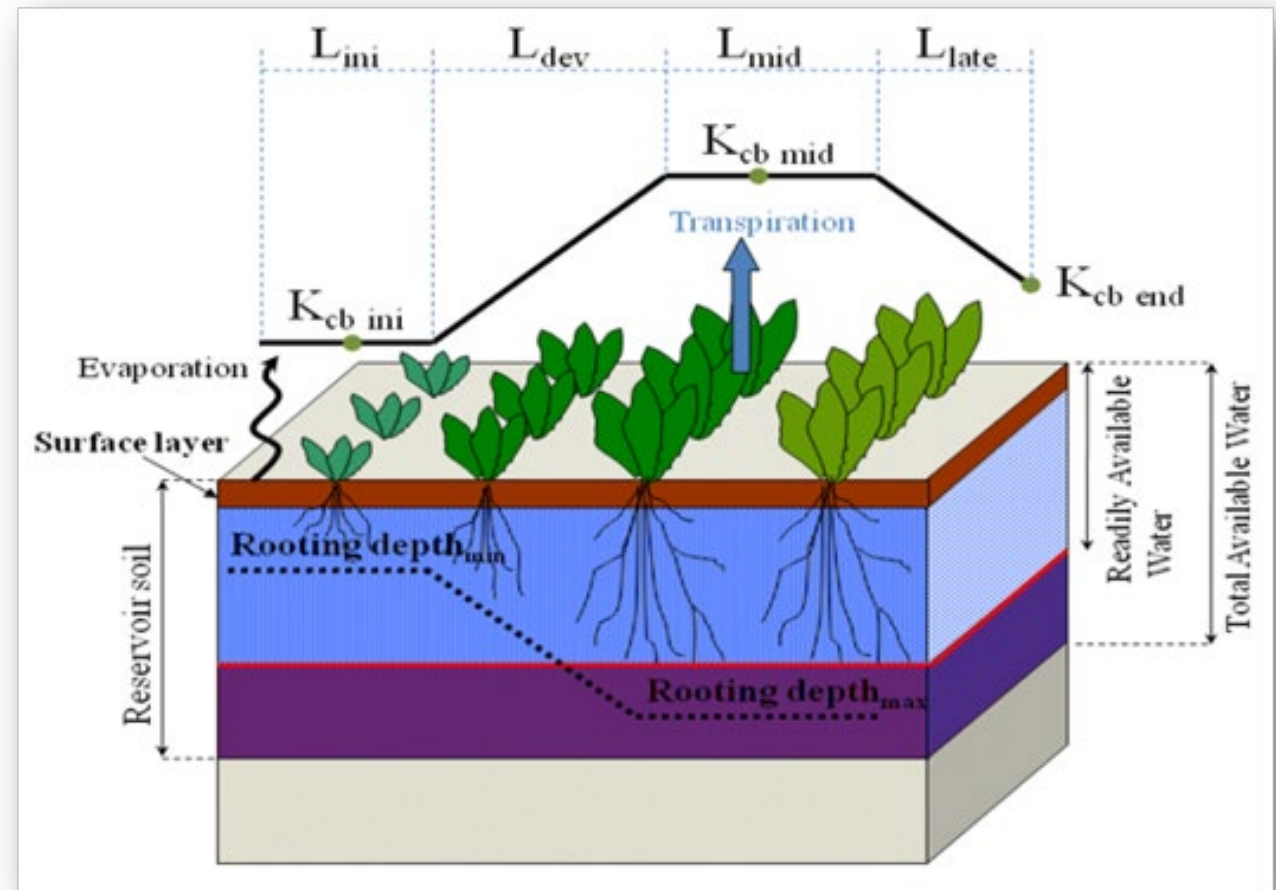


Divided into 250-meter elevation bands with each band having unique climate sequence and land use classes: forest, non-forest, barren, urban, and open water



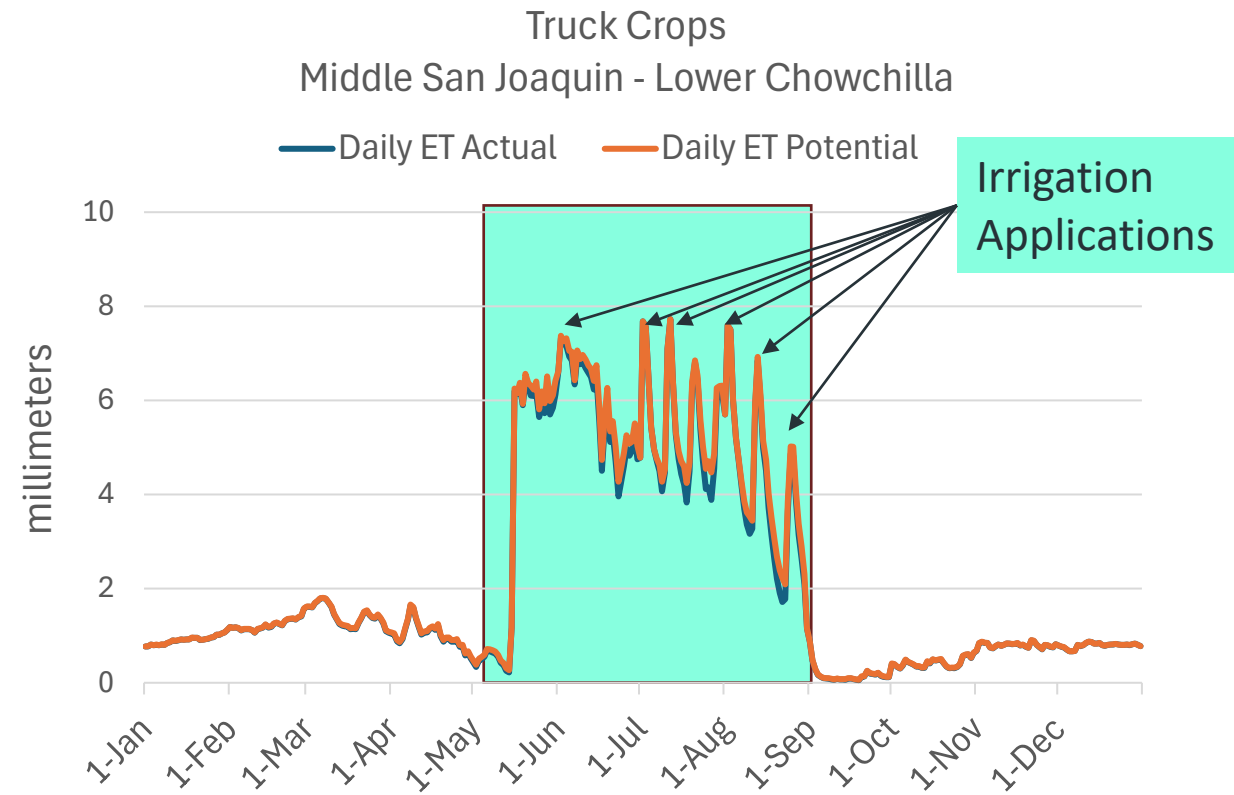
Irrigation Scheduling

- Crop water needs estimated using standard methods (FAO 56)
- Enables scenarios that consider:
 - Irrigation efficiency
 - Altering irrigation schedules
 - Effect of climate on crop production
 - Shifting planting dates
- Provides easier linkage to economic modeling tools



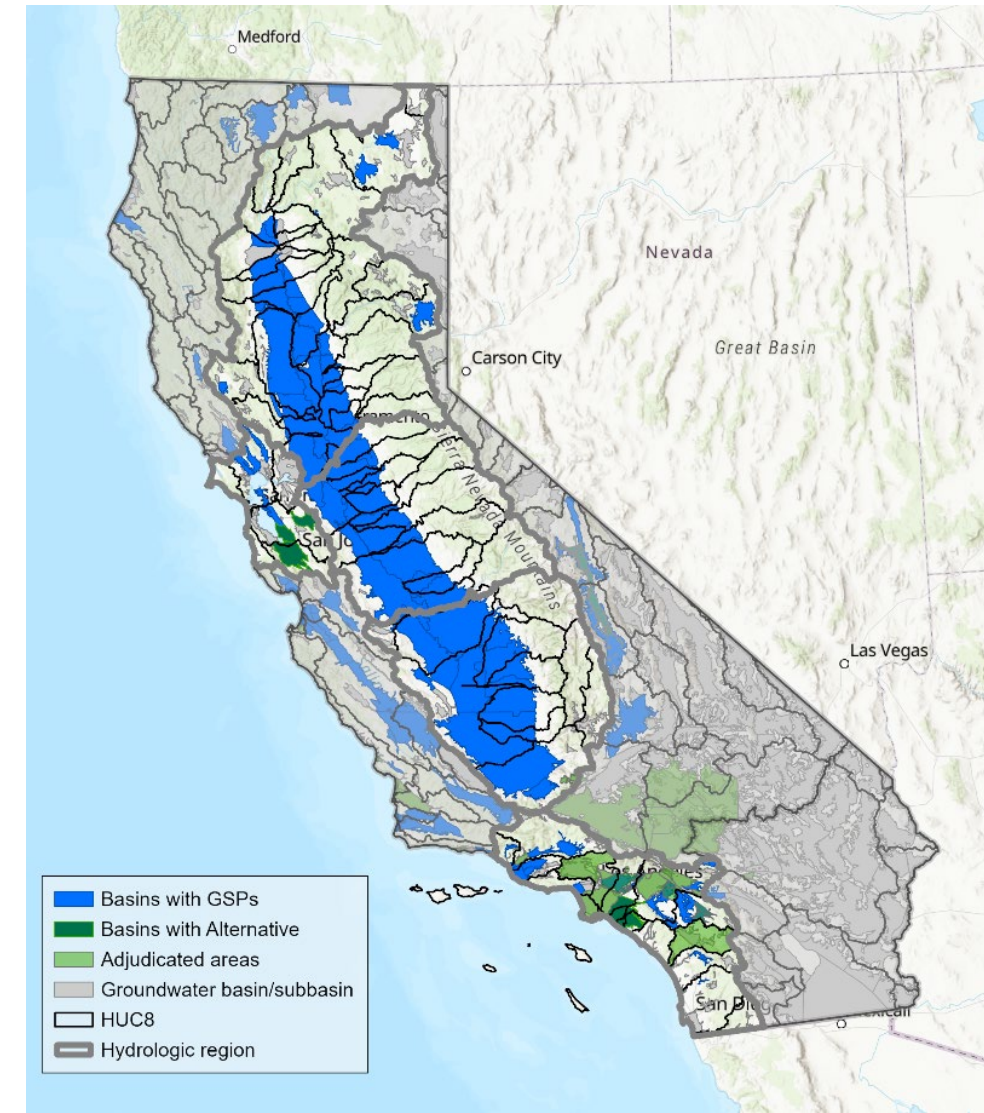
Irrigation Scheduling

- Irrigation scheduling module (MABIA) uses a daily timestep
- Applications are based on soil water depletion. May also be scheduled at regular intervals, depending on location and crop type



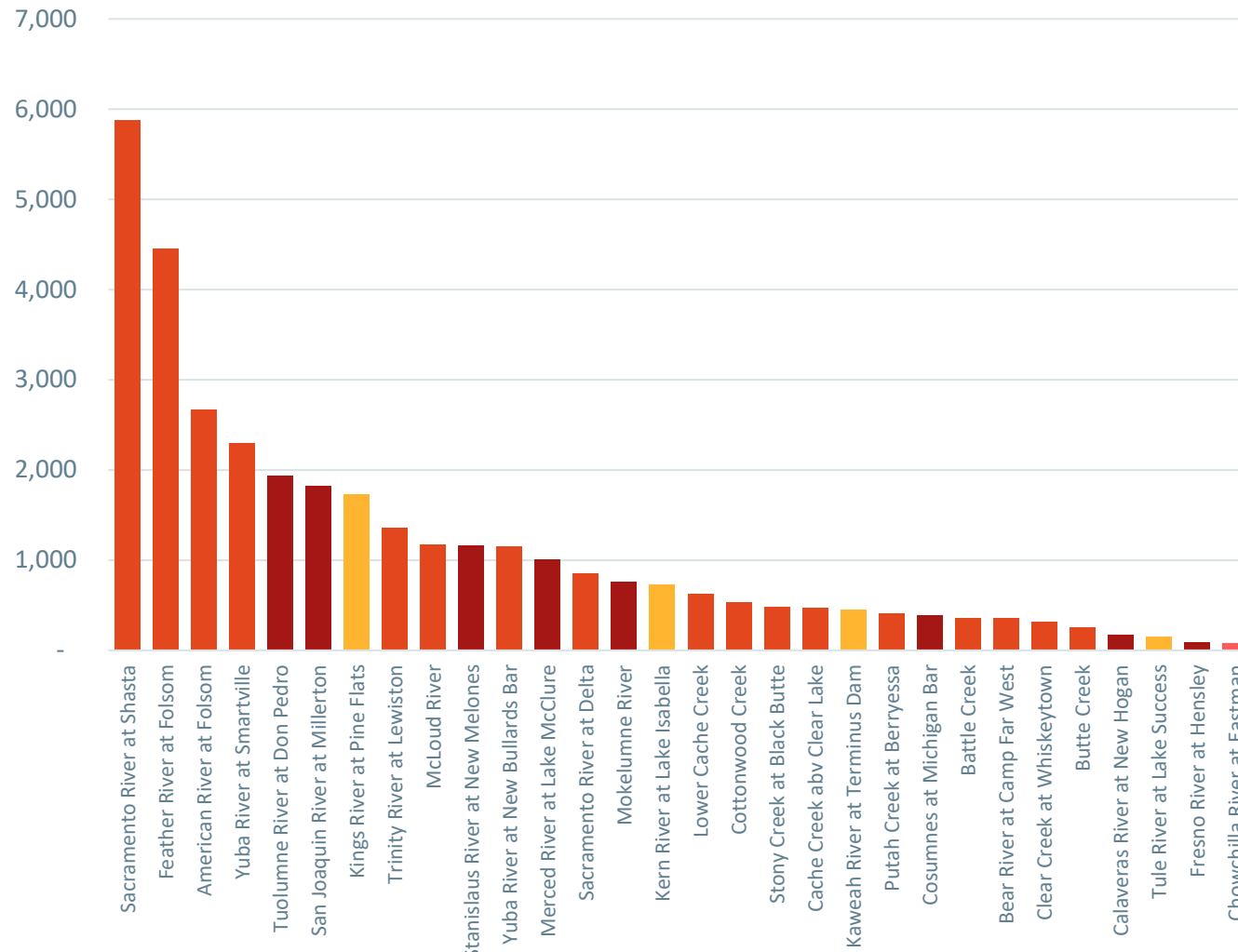
Groundwater

- Simulation of basin operations by B-118 basin
 - Data from:
 - GSPs
 - Alternatives
 - Adjudicated Areas
- SGMA Representation
 - PMAs considered for adaptation strategies
 - Sustainable management criteria incorporated into long-term operations
- Recharge Efforts
 - Historical recharge compiled from GSPs, Alternatives, and Adjudicated Annual Reports



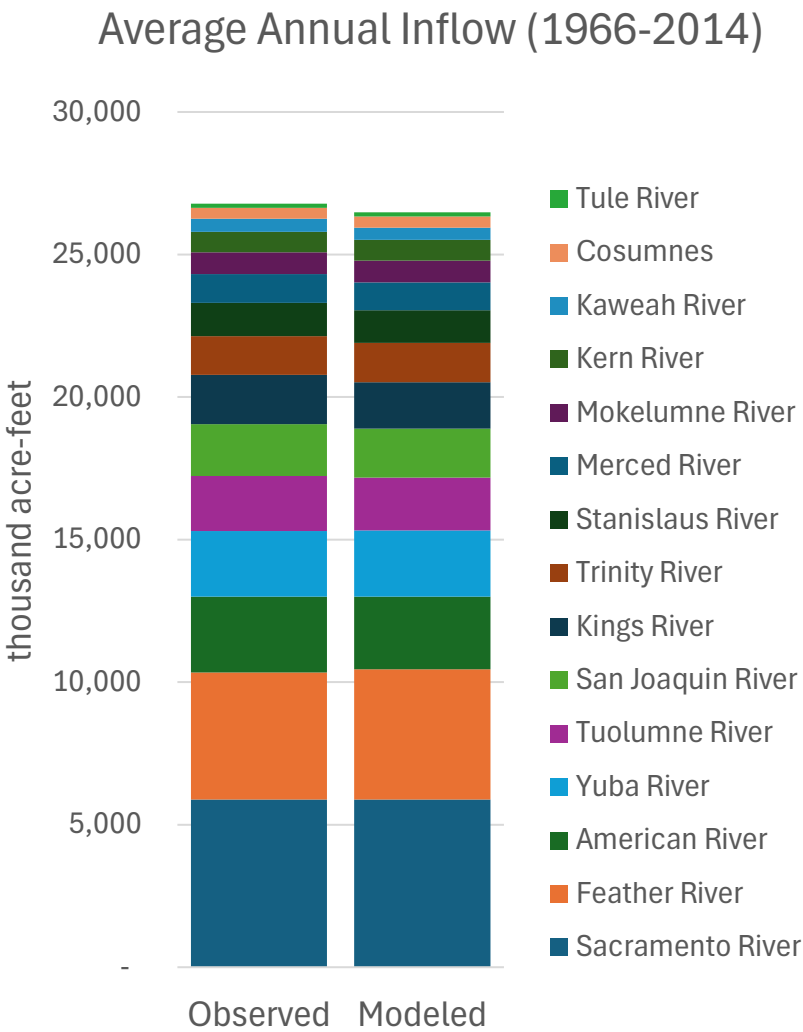
Upper Watershed Inflows

Average Annual Inflow (TAF)



Upper Watershed Inflows

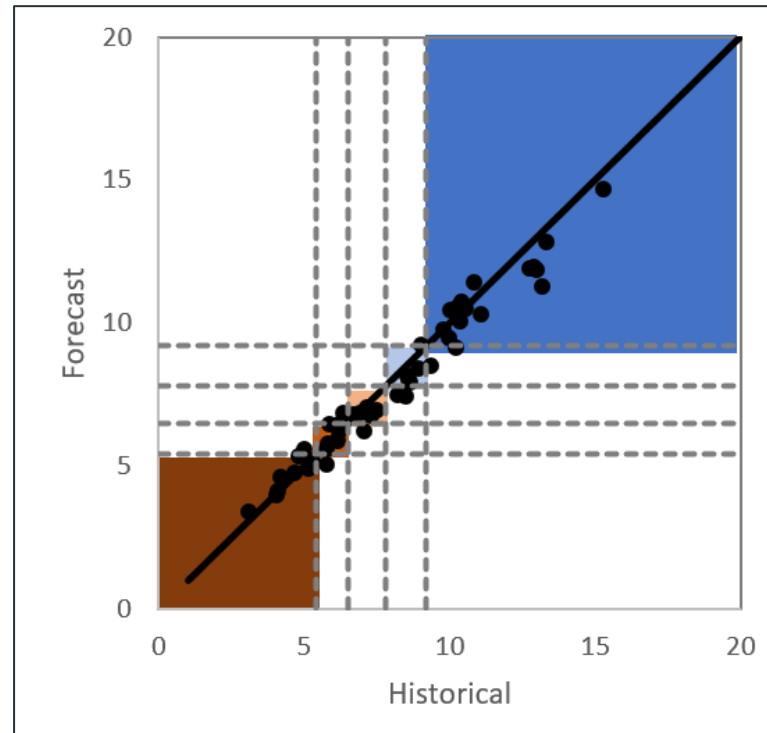
River	NSE	PBIAS	SDR
Sacramento	0.91	0.05%	1.00
Feather	0.75	2.49%	0.84
American	0.75	-4.34%	0.89
Yuba	0.72	1.37%	0.99
Tuolumne	0.77	-4.65%	1.10
San Joaquin	0.75	-5.66%	1.05
Kings	0.67	-5.44%	1.09
Trinity	0.62	1.49%	0.96
Stanislaus	0.78	-2.33%	1.03
Merced	0.80	-2.82%	0.99
Mokelumne	0.70	0.29%	1.07
Kern	0.44	0.45%	1.39
Kaweah	0.63	-5.85%	0.95
Cosumnes	0.89	2.12%	1.00
Tule	0.68	2.07%	0.88
Target	1	0	1



Predicting Water Year Types

Water Year Type	Sacramento Valley Index (MAF)
Critical	< 5.4
Dry	5.4 – 6.5
Below Normal	6.5 – 7.8
Above Normal	7.8 – 9.2
Wet	> 9.2

- WEAP matches Observed in 39 of 49 years
 - WEAP estimates 1 step wetter in 4 years
 - WEAP estimates 1 step drier in 6 years

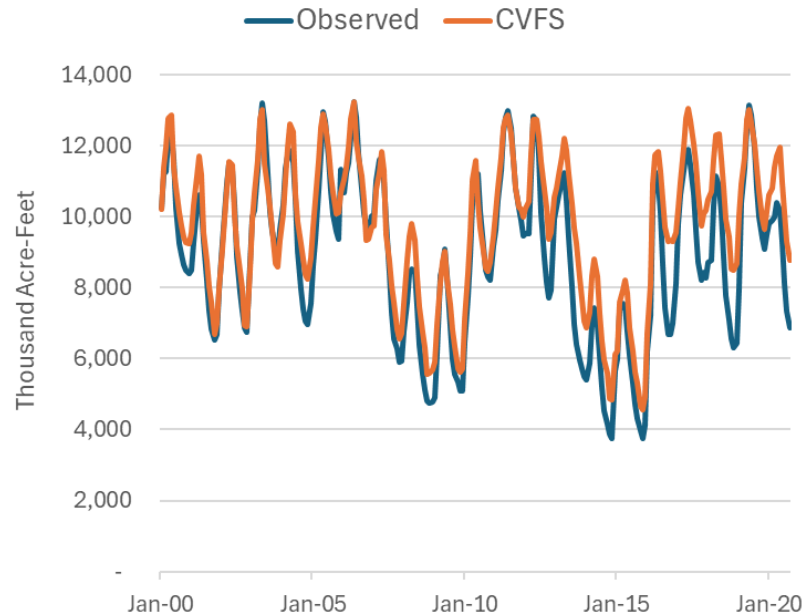


Forecast	W	0	0	0	1	15
AN	0	0	0	4	2	
BN	0	2	6	2	0	
D	1	6	1	0	0	
C	8	1	0	0	0	
	C	D	BN	AN	W	
	Historical					

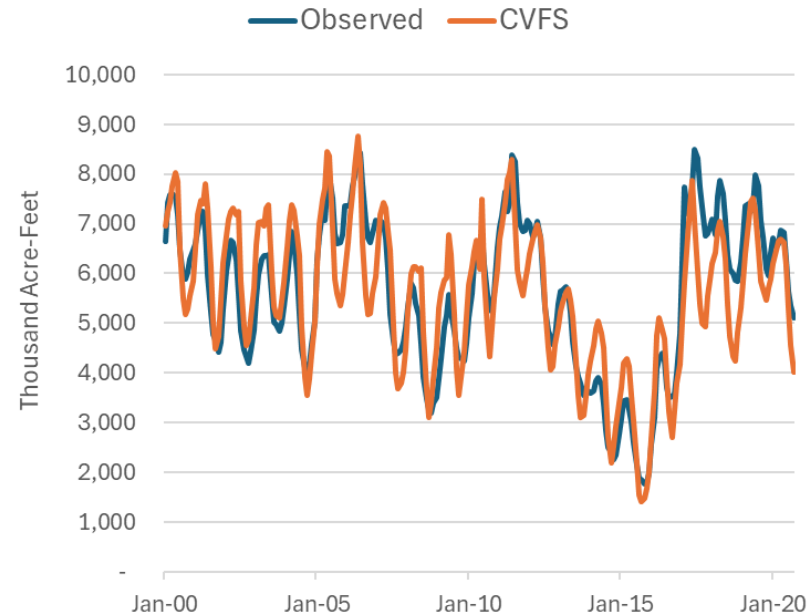
Reservoir Storage

- Model calibrated to historical storage, 2000-2020
- Focused on annual and inter-annual variability of aggregate storage and individual reservoirs

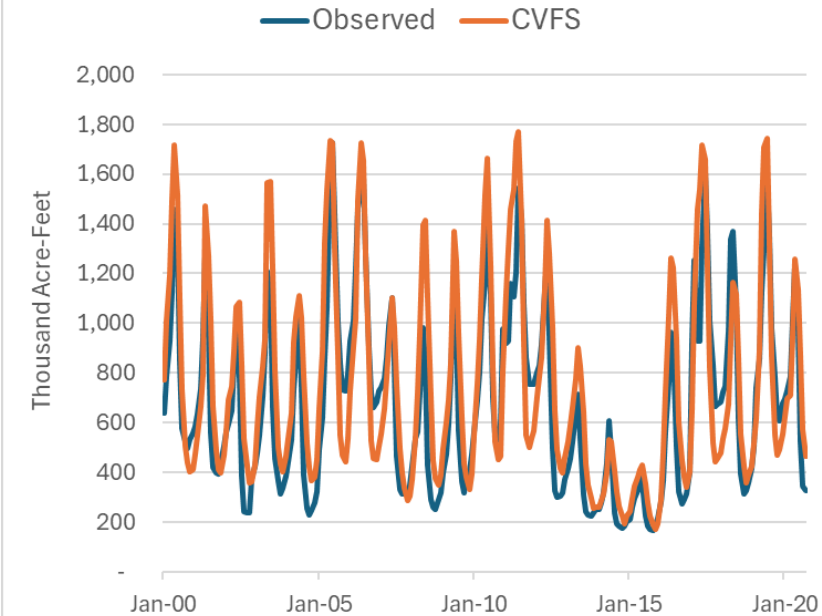
Sacramento



San Joaquin

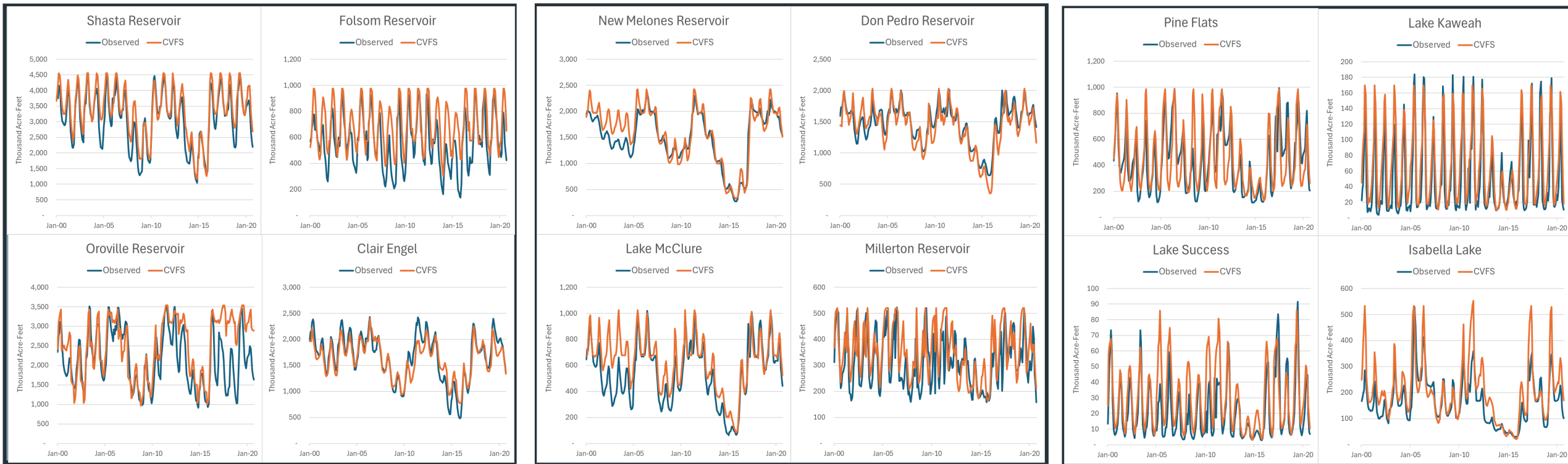


Tulare Lake



Reservoir Storage

- Model calibrated to historical storage, 2002-2020
- Focused on annual and inter-annual variability of aggregate storage and individual reservoirs



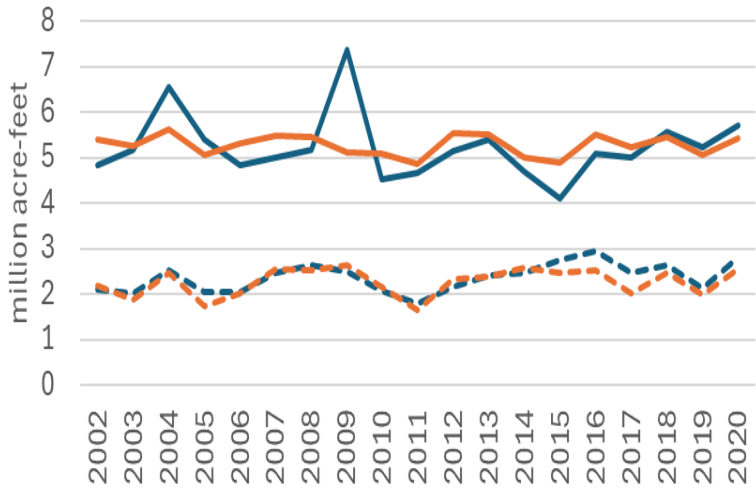
Water Deliveries to Irrigated Agriculture

Average Error

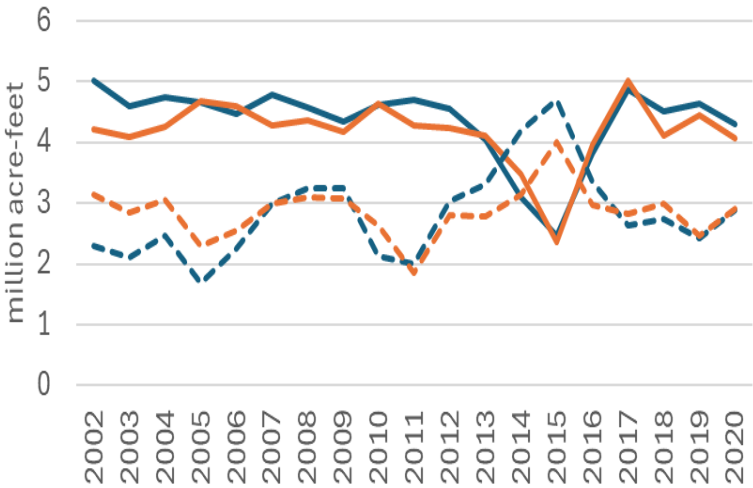
	Sacramento River	San Joaquin River	Tulare Lake
Total	1%	-2%	-2%
Surface Water	1%	-4%	-2%
Groundwater	-4%	1%	-3%

Surface - OBS Surface - CVFS Groundwater - OBS Groundwater - CVFS

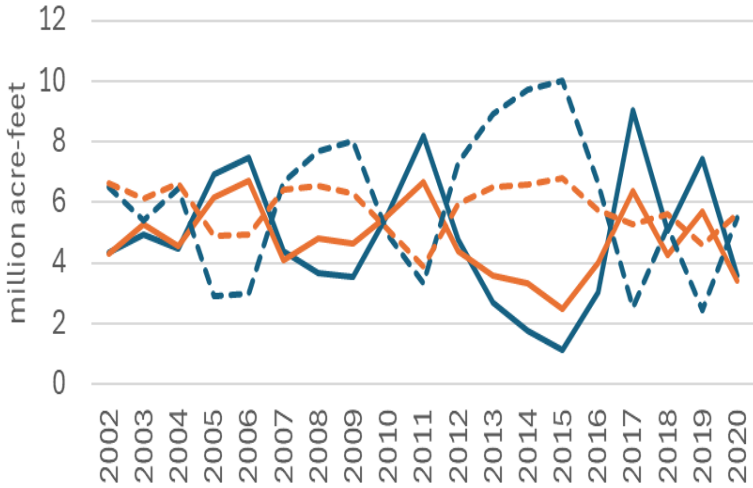
Sacramento River



San Joaquin River



Tulare Lake

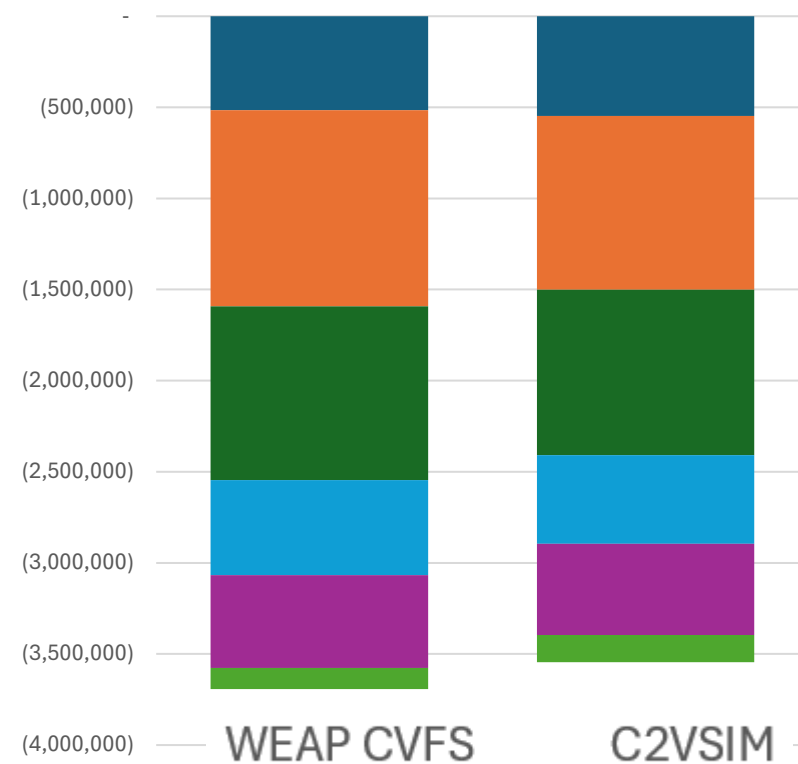


Groundwater

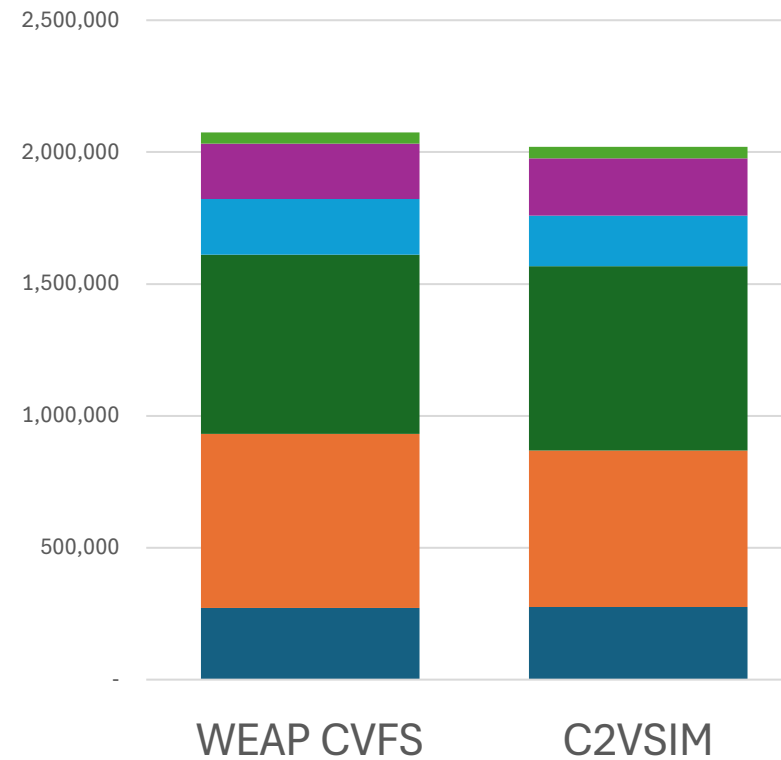
- CVFS compared to C2VSIM model results for period 2000-2020

■ Kaweah ■ KernCounty ■ Kings ■ TulareLake ■ Tule ■ Westside

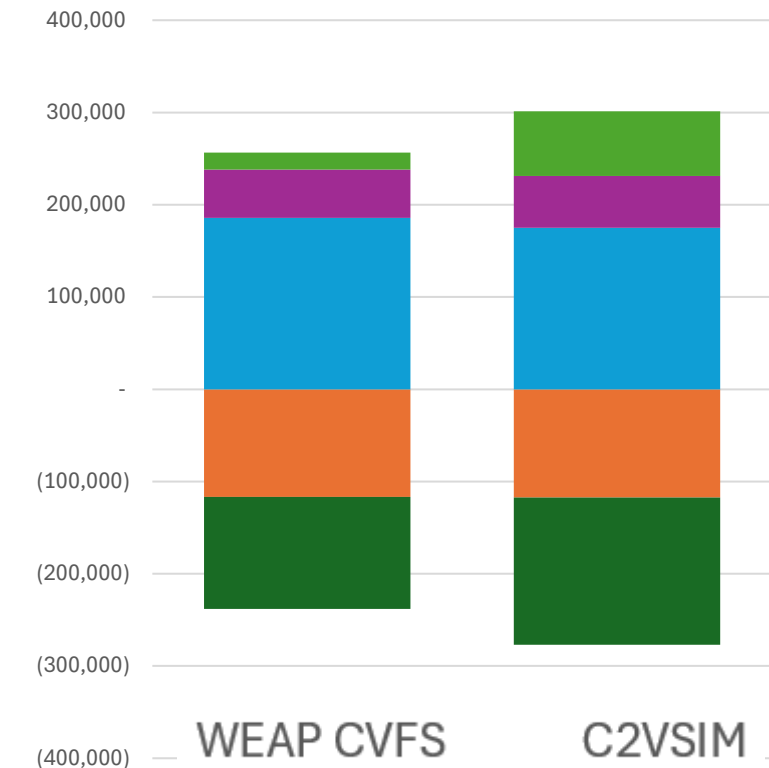
Net Vertical Stress



Gain from Streams and Canals



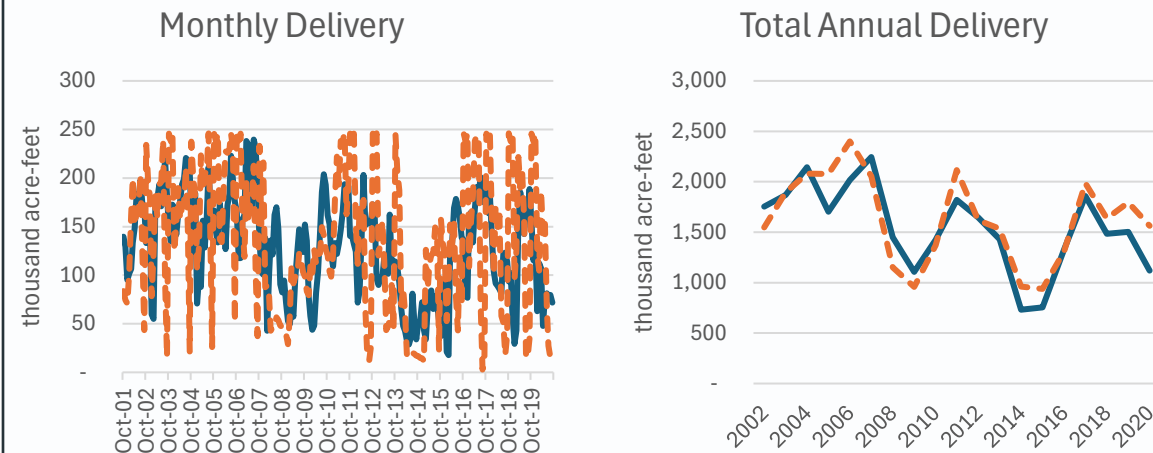
Subsurface Inflows



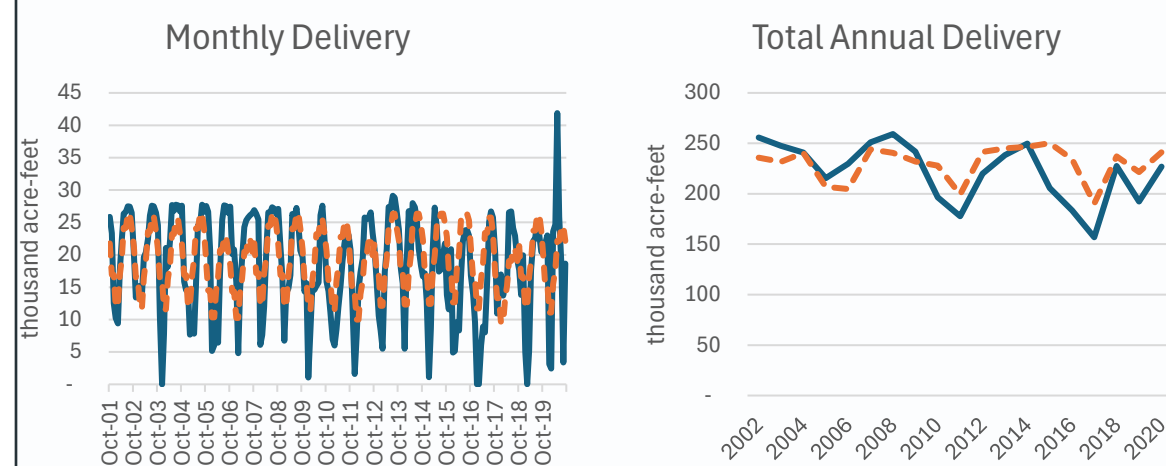
FS Model Connections

Transfer	Receiving FS Model
California Aqueduct	South Coast FS Model
Hetch Hetchy Aqueduct	San Francisco FS Model
Mokelumne Aqueduct	San Francisco FS Model
South Bay Aqueduct	San Francisco FS Model
North Bay Aqueduct	San Francisco FS Model
Contra Costa Canal	San Francisco FS Model
Santa Clara Conduit	San Francisco FS Model
Putha South Canal (partial)	San Francisco FS Model
Coastal Branch of CA	Central Coast FS Model (future)

California Aqueduct to South Coast



Hetch Hetchy Aqueduct to San Francisco



Update 2028

Key Uncertainties:

- Changes in Climate/Sea level
- Future Levels of Development

WEAP-FS

Example Management Strategies:

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Key Outcome Metrics:

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- River flows & diversions
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Update 2033

- Expand coverage of WEAP-FS models to include other five hydrologic regions: Colorado, Central Coast, North Coast, North Lahontan, South Lahontan
- Explore linkage of WEAP CVFS model and CALSIM3
 - Obviate the need to update regulatory requirements in WEAP CVFS

Thank You
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