



Statewide Economic Modeling at the Groundwater Sustainability Agency (GSA) Resolution

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Hydroeconomic Modeling

Purpose: evaluate economic responses to changes in hydrologic conditions

Model Inputs

- Water supply data
- Regional crop acreages
- Farm economic data
- Crop market data
- Urban water demand

Model Outputs

- Crop production and land use changes
- Economic benefits and losses
- Residual water demand

How do we use hydroeconomic modeling?

Policy and Infrastructure Exploration

- Where should we look to develop new infrastructure?

Project Selection

- Demand management or supply augmentation?

Regional Impact Assessment

- How do impacts ripple out into the economy?

Cost Allocation & Repayment

- Who benefits from the policy change?
- Who pays for it?

Social and Environmental Justice

- Who bears the burden of water management decisions?

Strategic Planning

- What will it cost to buy water in the future?

What is being analyzed?

Topic	Description / Examples
SGMA	Sustainable yield, recharge projects, water transfers
Infrastructure Projects	Aqueduct Subsidence, Sites, Delta Conveyance, other WSIP projects
Other Water Management	HRLA, CVP and SWP Operations
Colorado River	Drought Contingency Plan
Climate Change	Crop water use and precipitation variability
Other Agriculture Regulations	ILRP, labor, air, and other regulations that affect farming costs
Crop Market Conditions	Factors affecting supply of and demand for California commodities
Population and M&I Demand	Population, M&I water conservation, and projects

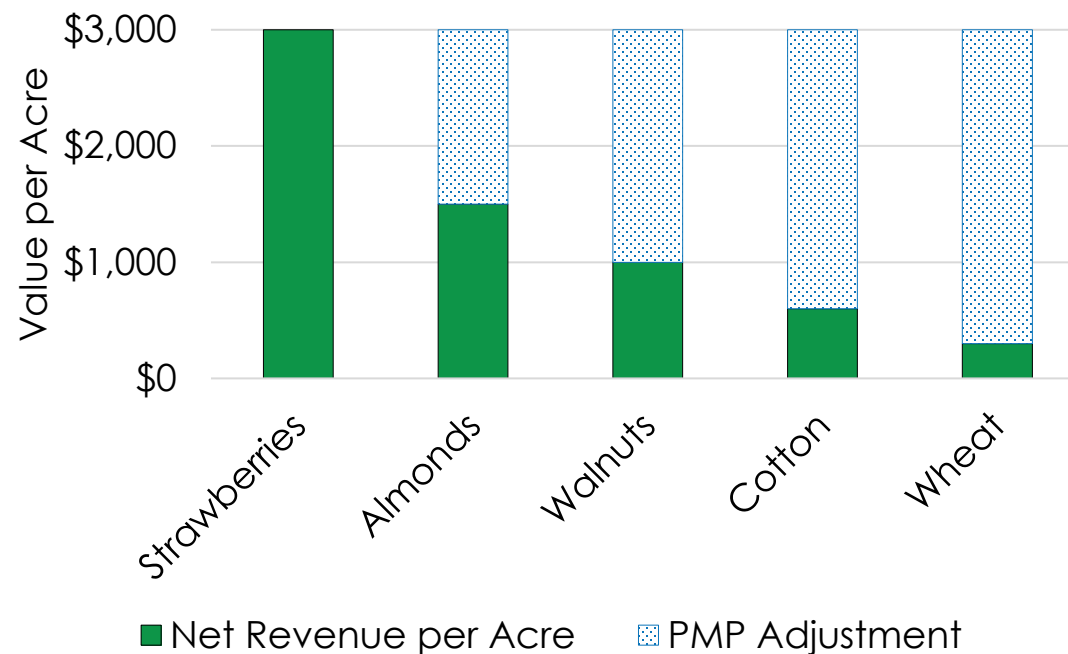
Statewide Agricultural Production Model (SWAP)

A Positive Mathematical Programming (PMP) model of California irrigated agriculture

Model Alternatives

Modeling Approach	Drawbacks
Traditional Optimization Models	Overspecialization of certain crop types
Econometric Models	Limited data
Agent Based Models	Extensive model assumptions

PMP – Calibrated Optimization



SWAP Evolution

Mathematical Refinements

- Quadratic (CVPM)
- Exponential (SWAP 6)
- Decreasing returns to scale (SWAP RTS)

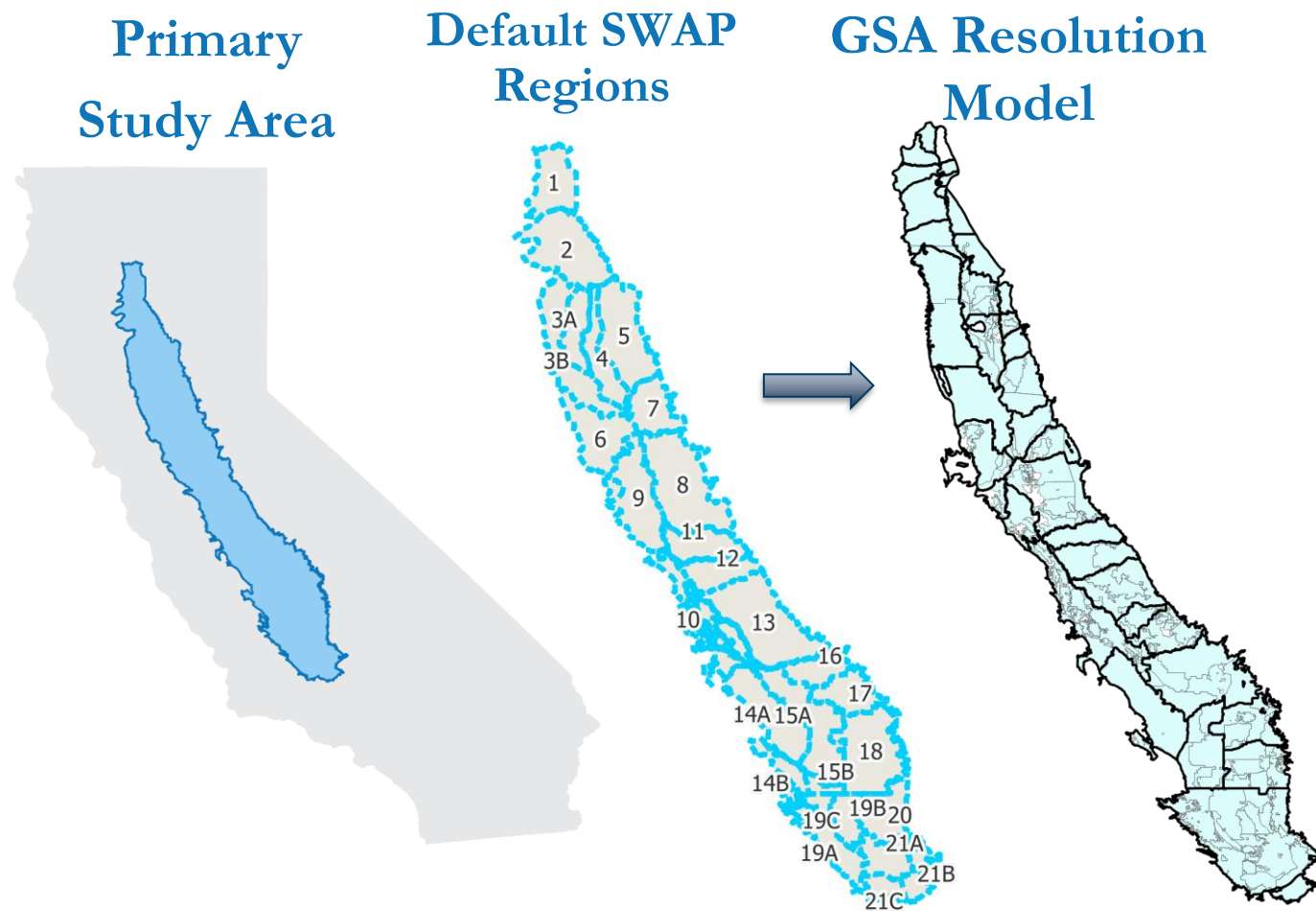
Structural Refinements

- Perennial crop module
- Dairy module
- Multi-cropping

Spatial Resolution Refinements

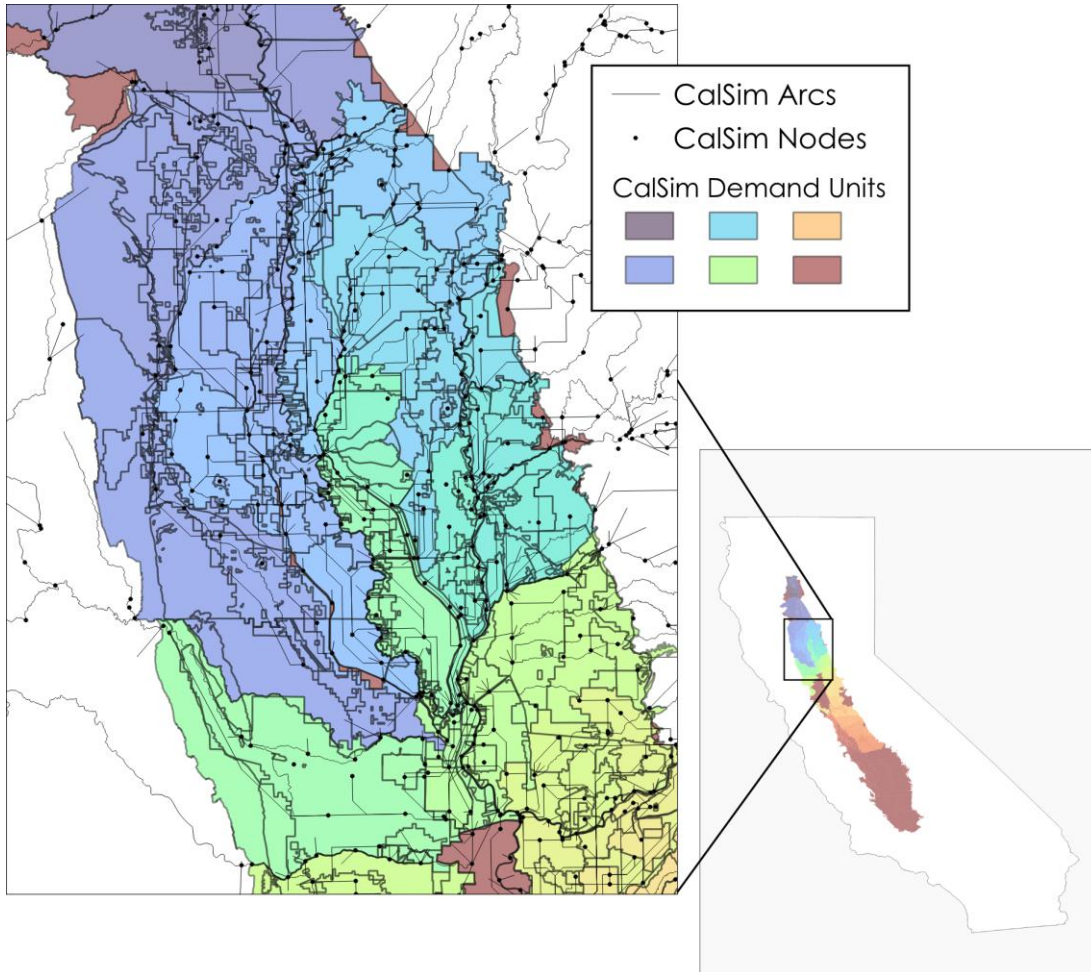
- SWAP Boundaries
- GSA Boundaries
- Farm/Field Level

Economic model coverage reflects SGMA implementation



- GSA and district boundaries (175+ modeling units)
- Linked to CALSIM model outputs

Data Sources - CALSIM



Data transformation process

1. Raw CalSim outputs to R via HEC's dssrip2
2. DUID to GSA derived translation parameters
3. Node to GSA translation parameters (non DUID regions)

GSA Data

Water Budgets

Component	Historical Condition Water Budget	Current Condition Water Budget	Projected Condition Water Budget	Projected Condition Water Budget with Climate Change
Hydrologic Period	WY 2009-2018	WY 1970 - 2019	WY 1970 - 2019	WY 1970 - 2019
Inflows				
Upstream Inflow	2,524,600	2,688,100	2,688,100	2,337,800
Tributary Inflows ¹	57,400	58,400	66,800	69,100
Groundwater Discharge	24,200	29,400	26,100	24,900
Surface Runoff	-	-	-	-
Direct Return Flow to Streams	15,800	17,800	17,800	17,800
Total Inflow	2,622,100	2,793,700	2,798,700	2,449,500
Outflows				
Infiltration to Groundwater	46,300	43,900	52,500	53,700
Surface Water Diversions	46,000	43,000	62,900	62,900
Outflow to Sacramento River	2,529,800	2,706,800	2,683,400	2,333,000
Total Outflow	2,622,100	2,793,700	2,798,700	2,449,500

*North American Subbasin

Allocation Resolutions

Madera County GSA			
Delta-Mendota Subbasin	Inches of ETAW		
Year	Sustainable Yield	Transitional Water	Total
2026	15.3	17.2	32.5
2027	15.3	16.0	31.3
2028	15.3	14.7	30.0
2029	15.3	13.5	28.8
2030	15.3	12.3	27.6
2031	15.3	11	26.3
2032	15.3	9.8	25.1
2033	15.3	8.6	23.9
2034	15.3	7.4	22.7
2035	15.3	6.1	21.4
2036	15.3	4.9	20.2
2037	15.3	3.7	19.0
2038	15.3	2.5	17.8
2039	15.3	1.2	16.5
2040	15.3	0.0	15.3

*Madera County GSA

PMA Data

6.6.2 Project 2: Cottonwood Creek Recharge

The following describes the Cottonwood Creek Recharge Project, which will capture available surface water and recharge the aquifer through the creek bed. Eventually, it may also facilitate in-lieu recharge through decreased use of groundwater wells by using the floodwater for irrigation. The length of Cottonwood Creek expected to be used for recharge is shown in FIGURE 6-3.

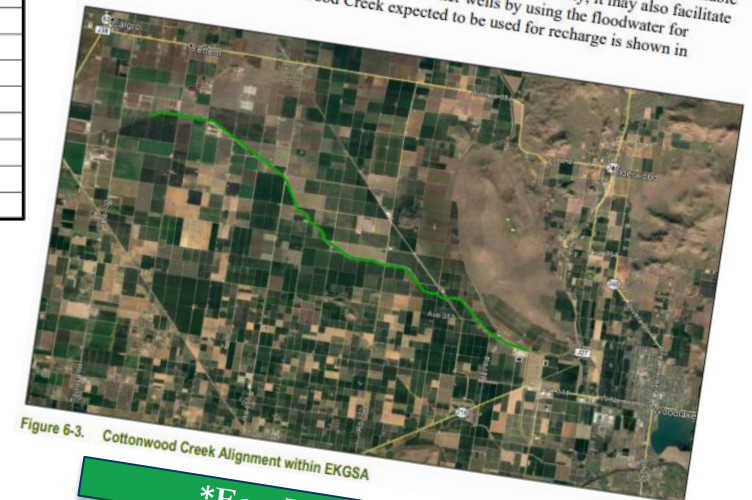


Figure 6-3. Cottonwood Creek Alignment within EKGSA

*East Kaweah GSA

SWAP 175 Data Dashboard

Integrated Water Data Management

1. Processed CalSim Outputs
2. Land use datasets
3. CalSim translation parameters
4. Local surface supply data
5. Groundwater supply data
6. Projects and management action data

Data Management

Load Custom DSS Output File
Upload a .csv file to replace the default Delivery Capability Report data used in calculations.

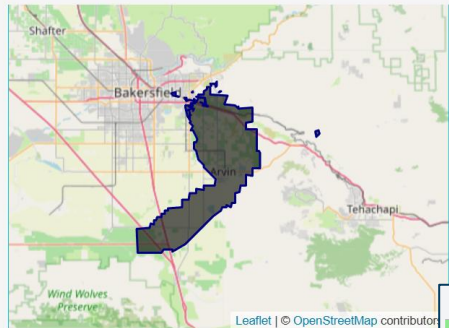
Choose CSV File

Browse...

No file selected

Note: The file must contain columns: du_id, wyt, and AW.

Visualization & Input for Arvin GSA



Local Water Supply:

	Value
W	200
AN	198
BN	142
D	107
C	61

Set Sustainable Yield:

32000

Save Sustainable Yield

Set Project Water Yield:

0

Save Project Water

crop	acres
Alfalfa & alfalfa mixtures	682
Almonds	8,711
Beans (dry)	37
Bush Berries	179
Carrots	7,731
Cherries	2,531
Citrus and subtropical	14,299

Region	DU_ID	Share
Arvin GSA	D_CAA194_KERN_PAG	9%
Arvin GSA	D_CAA194_KERN_PCO	9%
Arvin GSA	D_CAA242_KERN_PIN	0%
Arvin GSA	D_MLRTN_FRK_215	44%
Arvin GSA	D_MLRTN_FRK_C1	6%
Arvin GSA	D_MLRTN_FRK_C2	29%

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ERA Economics
Environment • Resources • Agriculture

SWAP 175 Data Dashboard

SWAP 150 DATA MANAGER

Navigation

Home: Data Summary & Export

SJV - CHOWCHILLA ▶

SJV - COSUMNES ▶

SJV - DELTA-MENDOTA ▶

SJV - EAST CONTRA COSTA ▶

SJV - EASTERN SAN JOAQUIN ▶

SJV - KAWEAH ▶

SJV - KERN COUNTY ▶

SJV - KINGS ▶

SJV - MADERA ▶

SJV - MERCED ▶

SJV - MODESTO ▶

SJV - PLEASANT VALLEY ▶

SJV - TRACY ▶

SJV - TULARE LAKE ▶

SJV - TULE ▶

SJV - TURLOCK ▶

SJV - WESTSIDE ▼

Westlands Water District GSA

SJV - WHITE WOLF ▶

SV - ANTELOPE ▶

SV - BEND ▶

SV - BUTTE ▶

SV - COLUSA ▶

SV - CORNING ▶

SV - LOS MOLINOS ▶

SV - NORTH AMERICAN ▶

SV - NORTH YUBA ▶

SV - RED BLUFF ▶

SV - SOLANO ▶

SV - SOUTH AMERICAN ▶

SV - SOUTH YUBA ▶

SV - SUTTER ▶

SV - VINA ▶

SV - WYANDOTTE CREEK ▶

SV - YOLO ▶

SVR - ANDERSON ▶

SVR - BOWMAN ▶

SVR - ENTERPRISE ▶

SVR - SOUTH BATTLE CREEK ▶

Visualization & Input for Westlands Water District GSA

SWAP Summary Table

SWAP	W	AN	BN	D	C
CVP	954	659	511	253	75
CVP215					
CVPc1					
CVPc2					
CVPS					
LOC					
SWP					
SWP21					
GW					
LOC2	0	0	0	0	0
GWcalib	230	548	902	1101	1349

Showing 1 to 11 of 11 entries

Previous 1 Next

CalSIM Summary Table

Region	DU_ID	Share
Central Delta-Mendota GSA	73_PA2	29%
Oro Loma Water District GSA	73_PA2	7%
Westlands Water District GSA	73_PA2	60%
Widren Water District GSA	73_PA2	5%
Westlands Water District GSA	90_NA	100%
Westlands Water District GSA	90_PA1	100%

Water Demand & Cut Analysis

Crop Acreage & Total Demand

crop	acres
Alfalfa & alfalfa mixtures	1,381
Almonds	81,080
Apricots	366
Beans (dry)	5,507
Bush Berries	3
Carrots	1,151
Cherries	317
Citrus and subtropical	3,616
Cole Crops (T22-T25)	285
Corn, Sorghum, or Sudan	4,816

Showing 1 to 10 of 35 entries

Previous 1 2 3 4 Next

Key Metrics:

Total Irrigated Acres: 535,015 Acres

Total Water Demand: 1,311,265 Acre-Feet (AF)

Per Acre Demand: 2.45 AF/Acre

Per Acre SY: 0.59 AF/Acre

Total Cut Relative to Sustainable Yield: 60.74% Cut Required

Set Sustainable Yield:

315000

Save Sustainable Yield

Set Project Water Yield:

0

Save Project Water

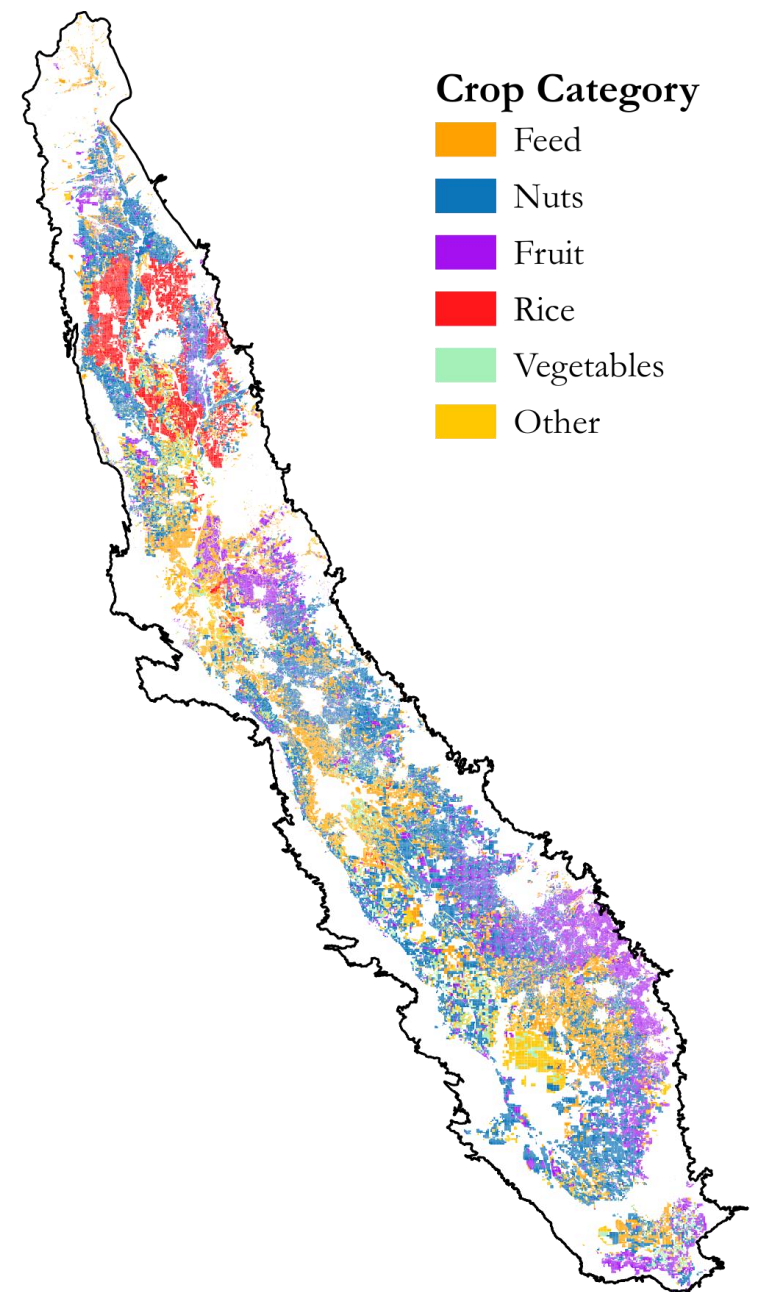
Local Water Supply:

	Value
W	0
AN	0
BN	0
D	0
C	0

Save Local Water

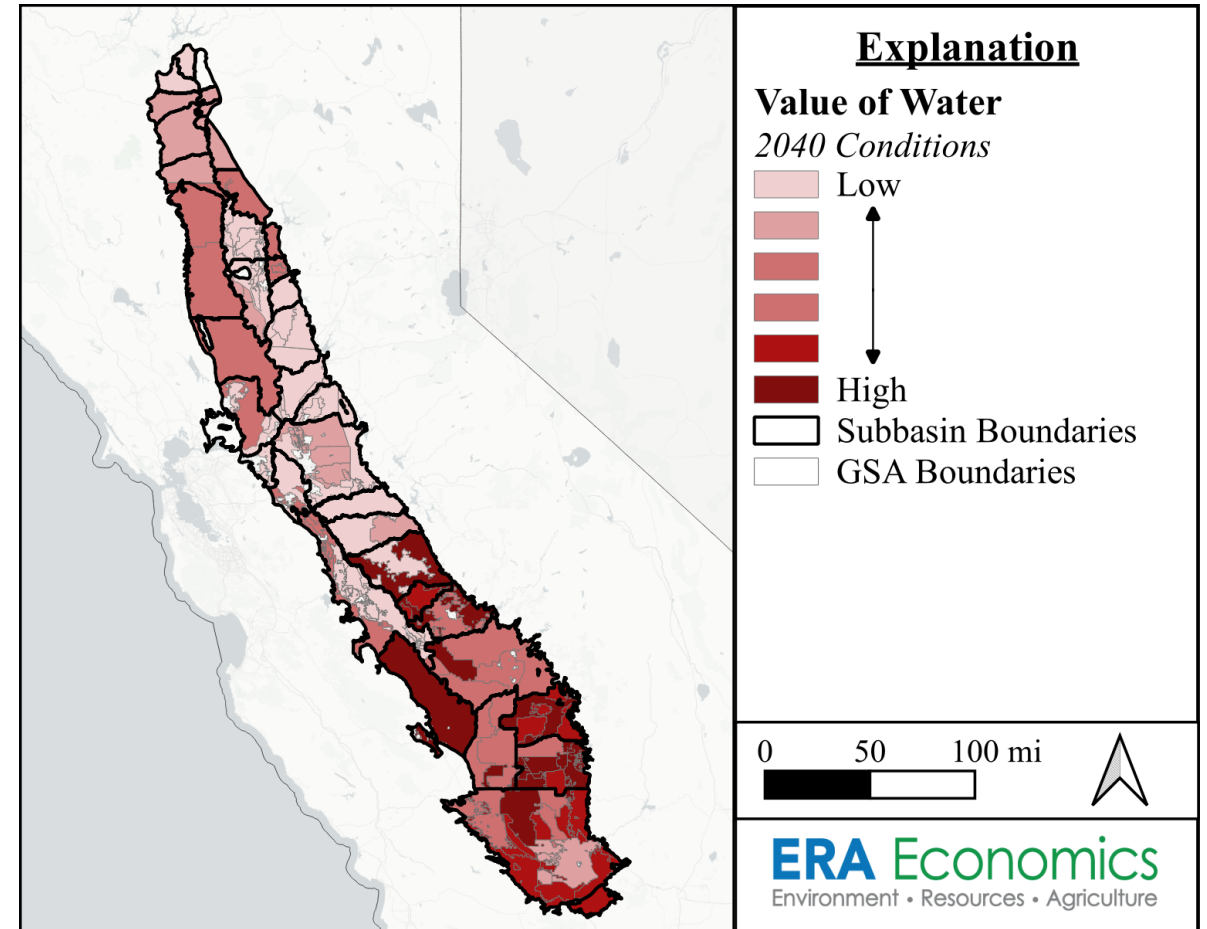
Modeling Result Implications

- Sustainable yield and SGMA project information becomes more accurately expressed within model results
 - Modeled constraints more closely reflect real-world conditions
- Acreage response accuracy compounds benefits throughout the model
 - Improvements to dairy and perennial crop modules
 - Improvements to price responsiveness
- Local variation in water values are better represented



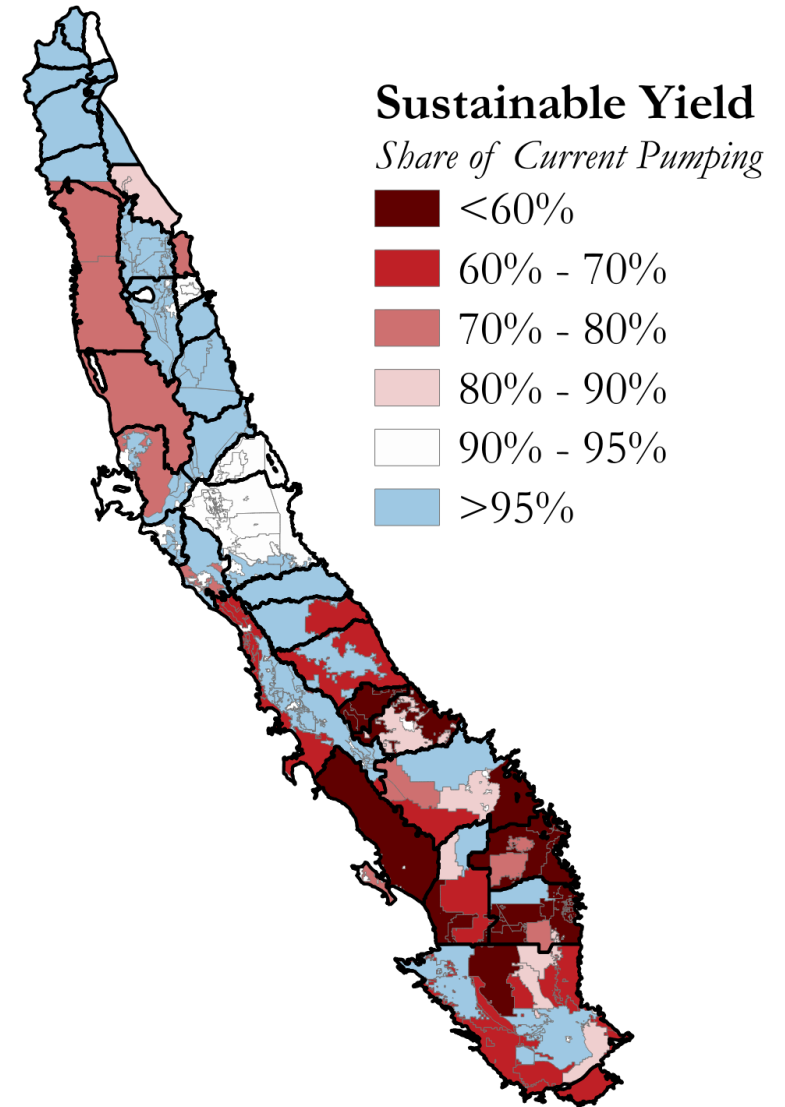
Benefits of GSA Level Modeling

- Displays results at a resolution that can support local decisions
- Water transfer market analysis
 - Ag to urban transfers
- Valley-wide PMA feasibility analysis
- Project cost allocation
- Project equity considerations



Additional Implications

- Enhances the value of other information sources
- Increased modeling consistency across subbasins and GSAs
- Brings down modeling costs enabling economic information to reach a broader audience



Summary

- SWAP is an adaptive hydroeconomic modeling framework that's been continuously improved to meet the needs of California's water users
- Spatial resolution refinements improve model accuracy, usefulness, and reach