California's Attempts to Find a Balance Between Fish and Feathers and Farms and Folks Though the Sustainable Groundwater Management Act (SGMA)

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DAVIDS ENGINEERING, INC

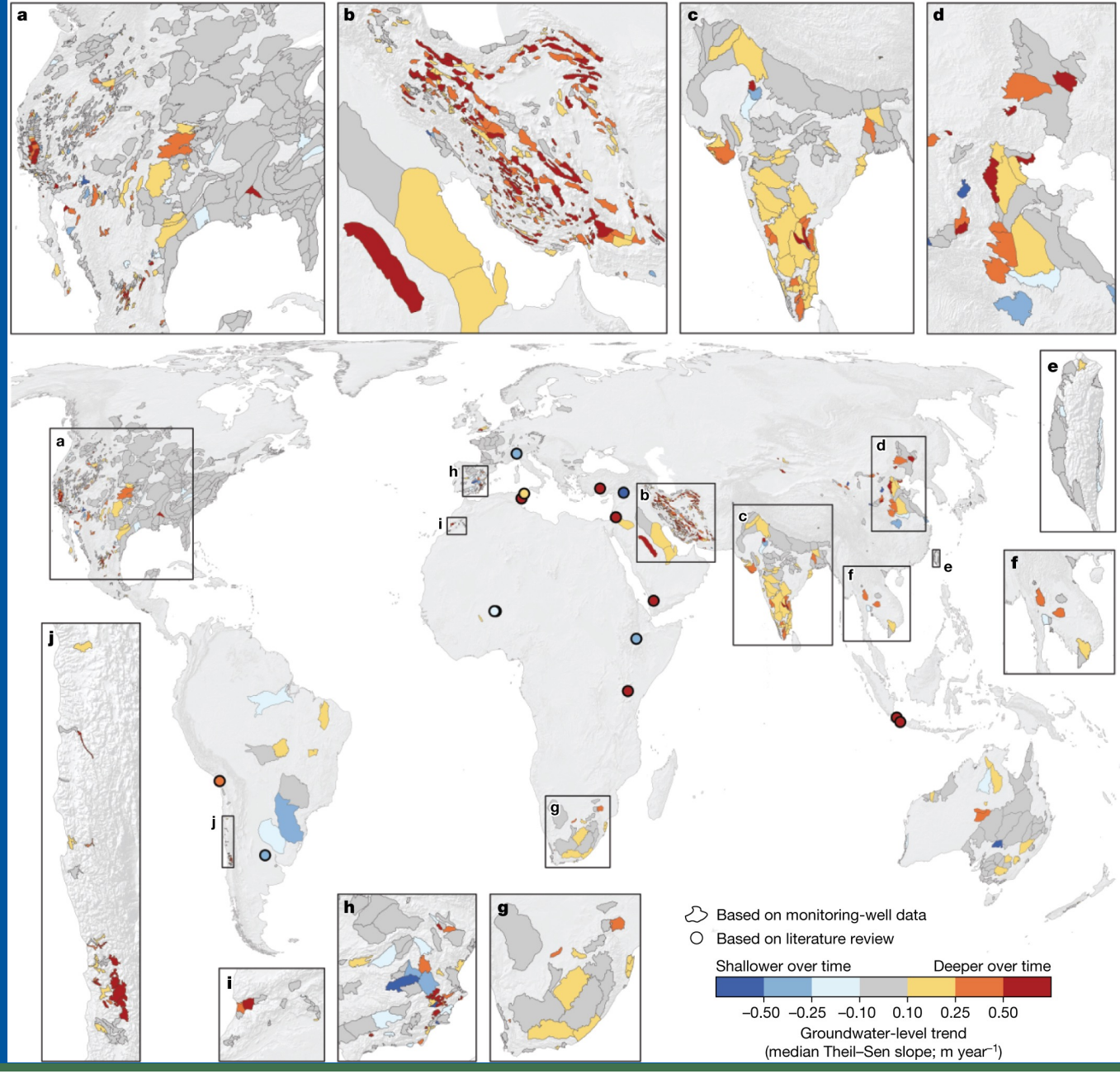
Serving Stewards of Western Water Since 1993

Groundwater has served as our global (and invisible) “get out of jail free” solution for water scarcity.

Source: ChatGPT (prompt: Make an image of an ostrich burying its head in the sand to ignore groundwater overdraft issues)

Groundwater Depletion Is A Global Issue

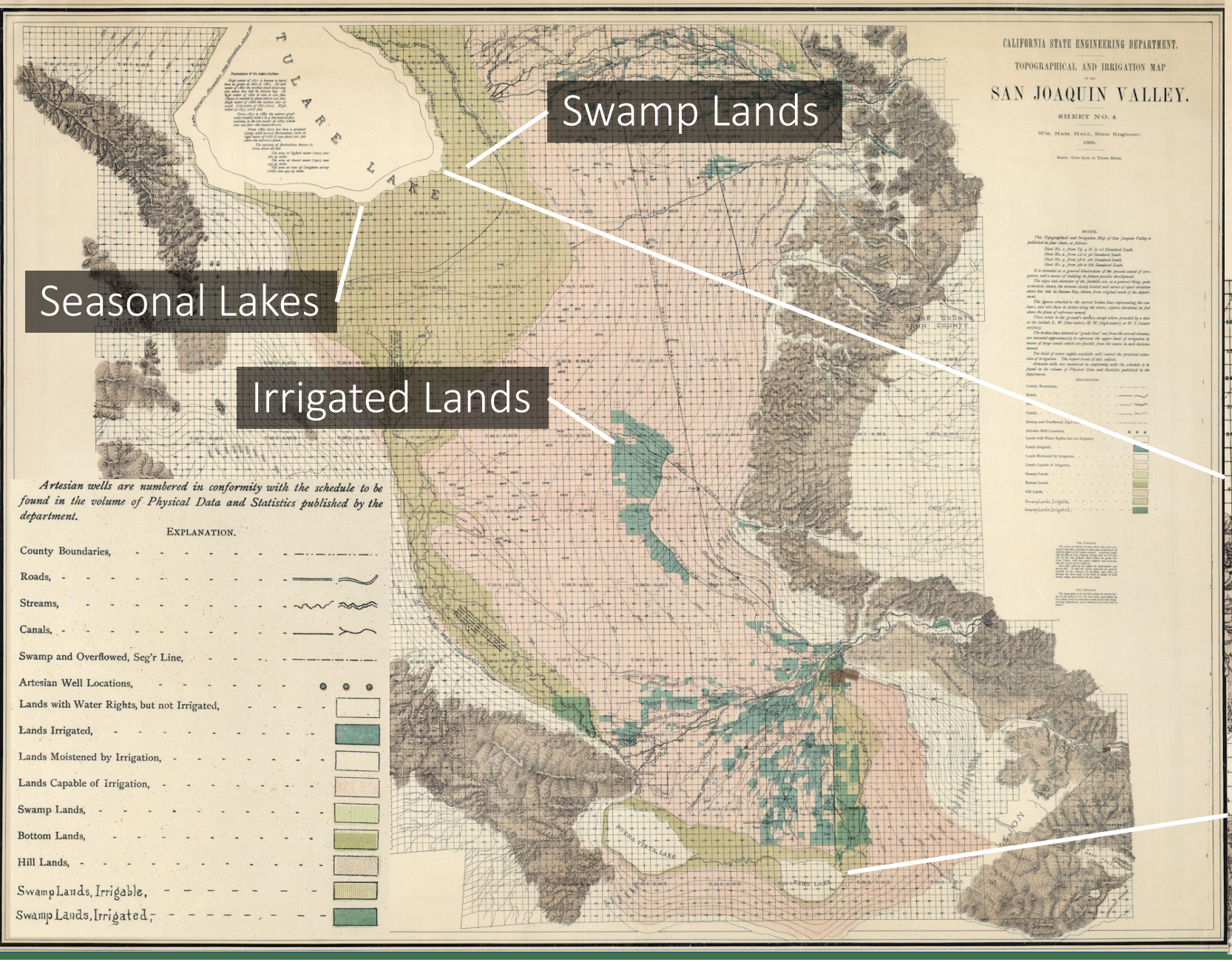
- Jasechko et al. (2024) analyzed 20th Century GW level trends in 170K wells in 1,693 aquifer systems.
- GW declines > 0.1 meters per year (M / YR) in 36 % of aquifers; > 0.5 M / YR in 12 % of aquifers.
- 30 % of aquifers have increasing rates of declines in early 21st Century relative to 20th Century

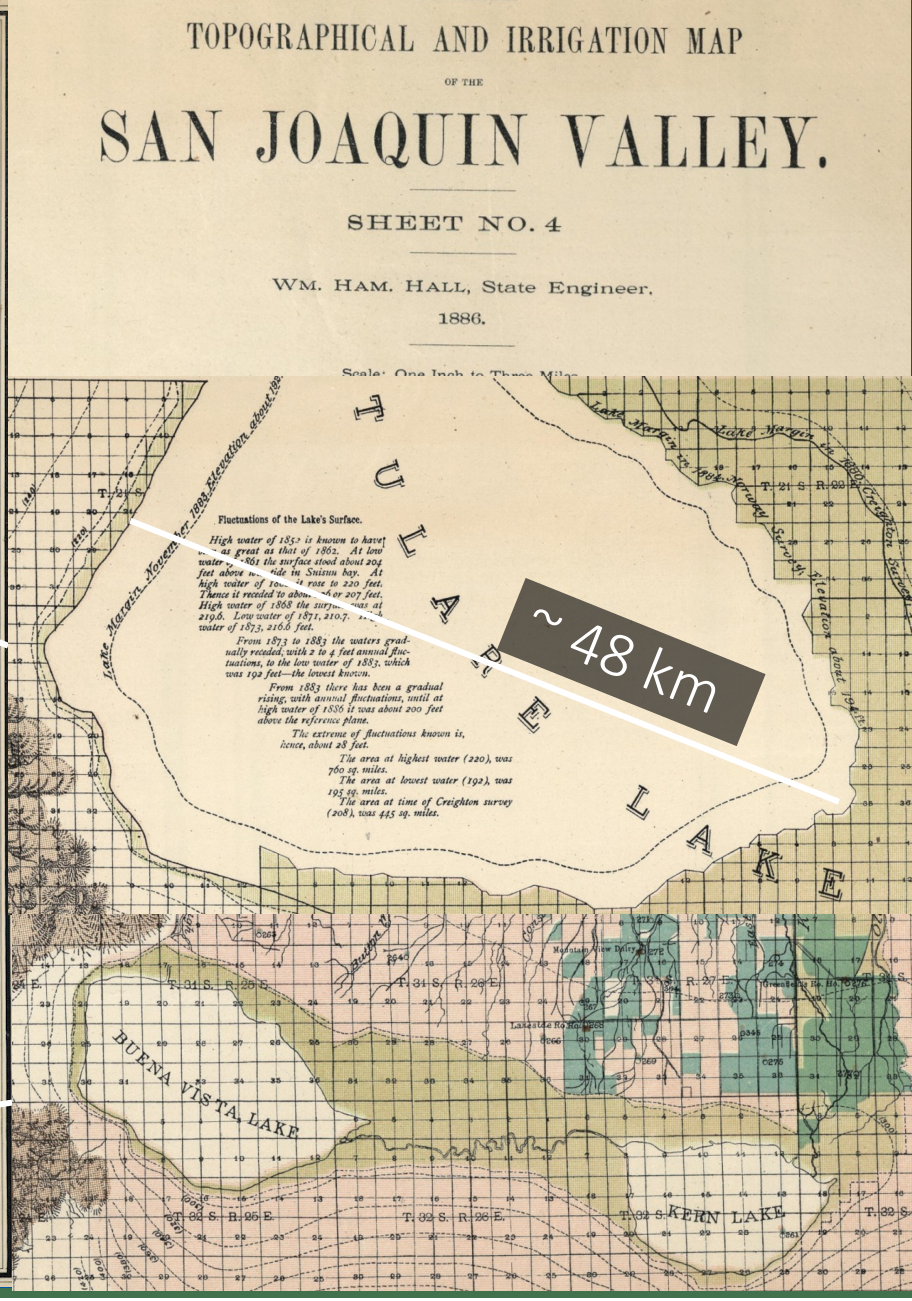


Source: https://www.nature.com/articles/s41586-023-06879-8/

How much of the world are we feeding with unsustainable groundwater extractions?

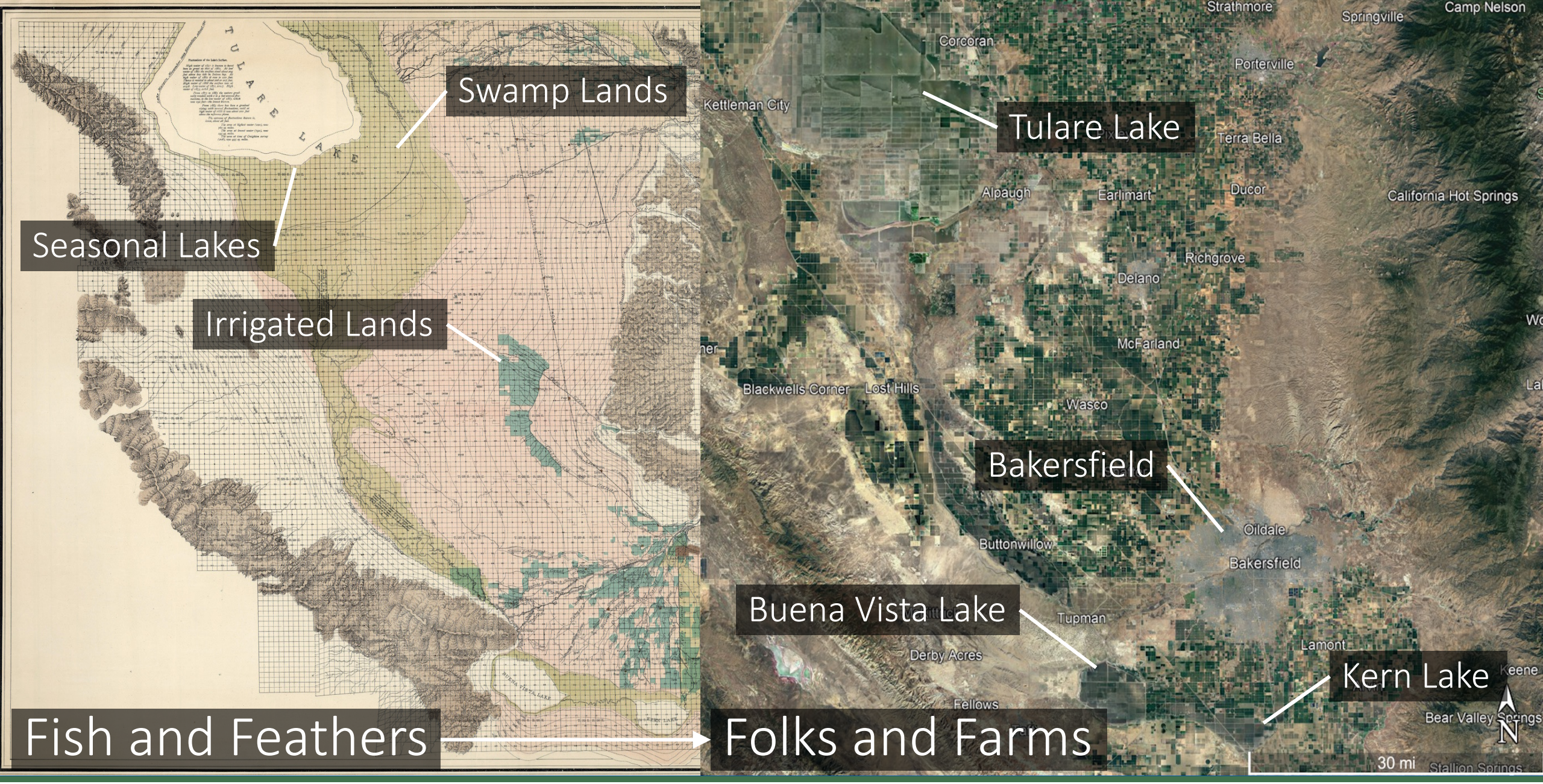
Source: https://www.agriland.ie/farming-news/g7-nations-must-work-together-to-reach-global-food-security-fao/





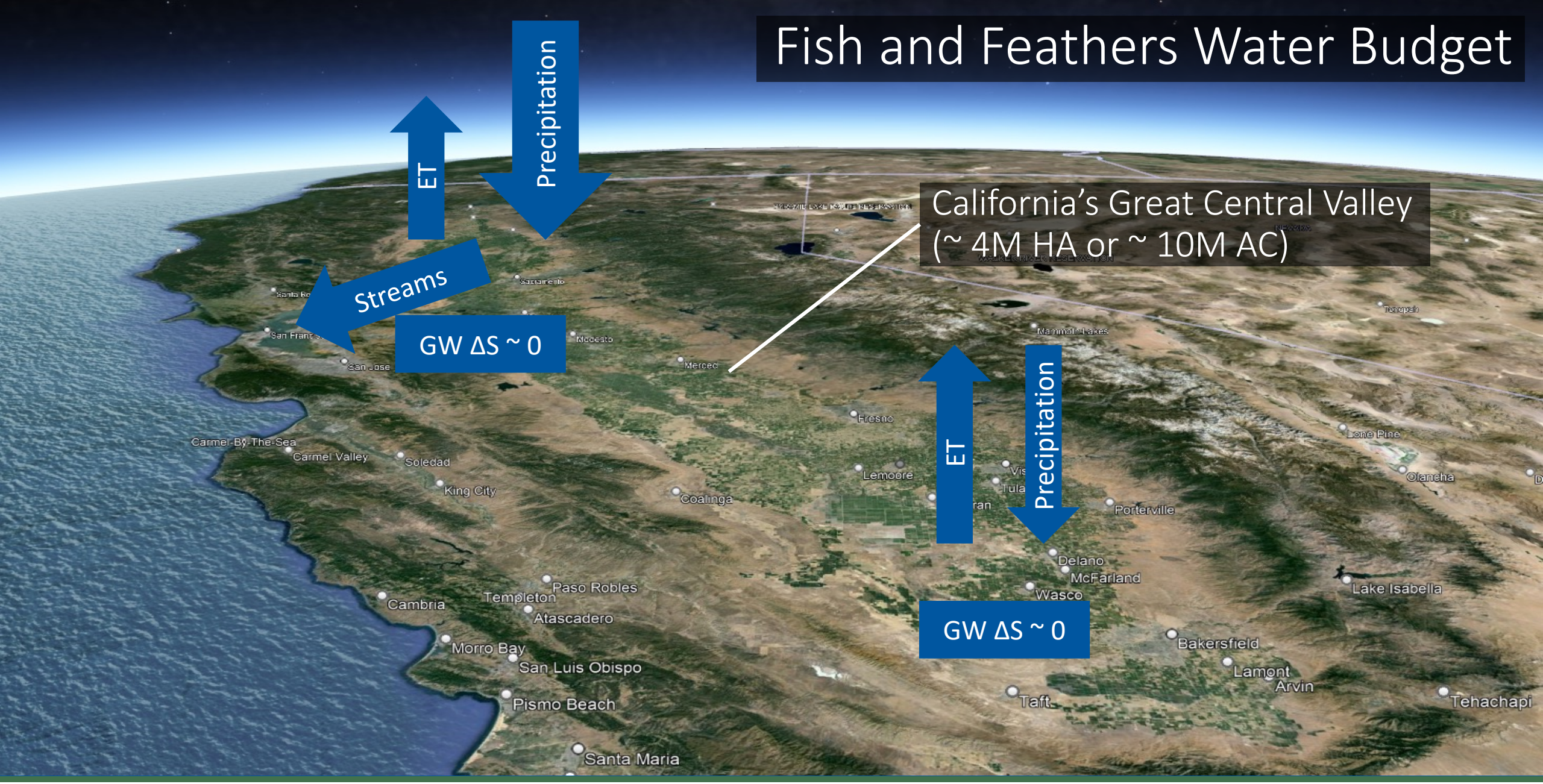
Topographical and Irrigation Map of the San Joaquin Valley, William Hammond Hall (1886)

Source: https://www.lamag.com/citythinkblog/citydig-when-gushers-sprang-from-the-los-angeles-basin/

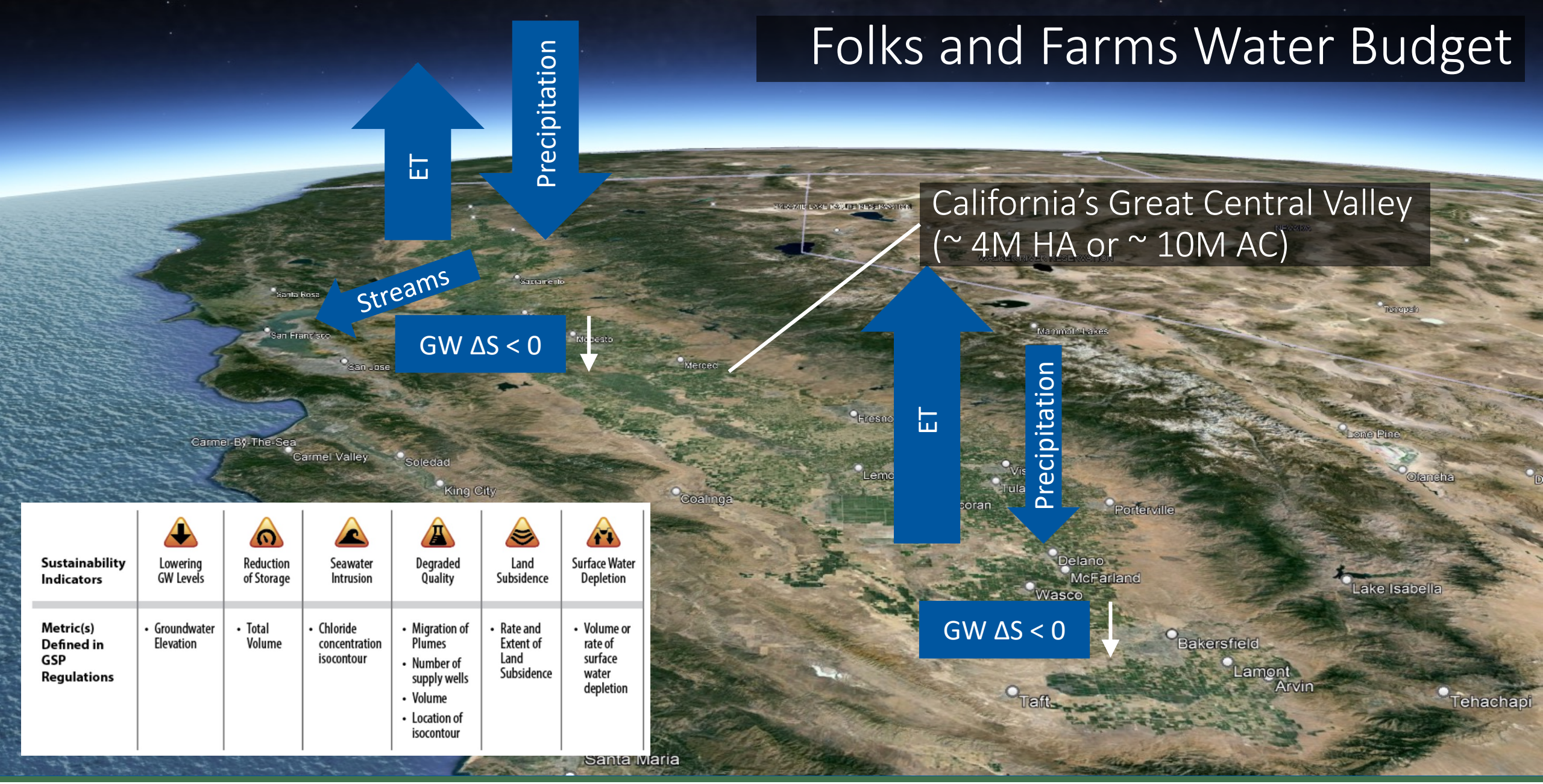

Swamp Lands
Seasonal Lakes
Irrigated Lands
Tulare Lake
Bakersfield
Buena Vista Lake
Kern Lake
Fish and Feathers
Folks and Farms
Strathmore
Springville
Camp Nelson
Corcoran
Porterville
Kettleman City
Terra Bella
Alpaugh
Earlimart
Ducor
California Hot Springs
Richgrove
Delano
McFarland
Blackwells Corner
Lost Hills
Wasco
Oildale
Buttonwillow
Bakersfield
Tupman
Lamont
Derby Acres
Fellows
Bear Valley Springs
Stallion Springs
30 mi
N


GARMIN
MANIFOLD

Fish and Feathers Water Budget

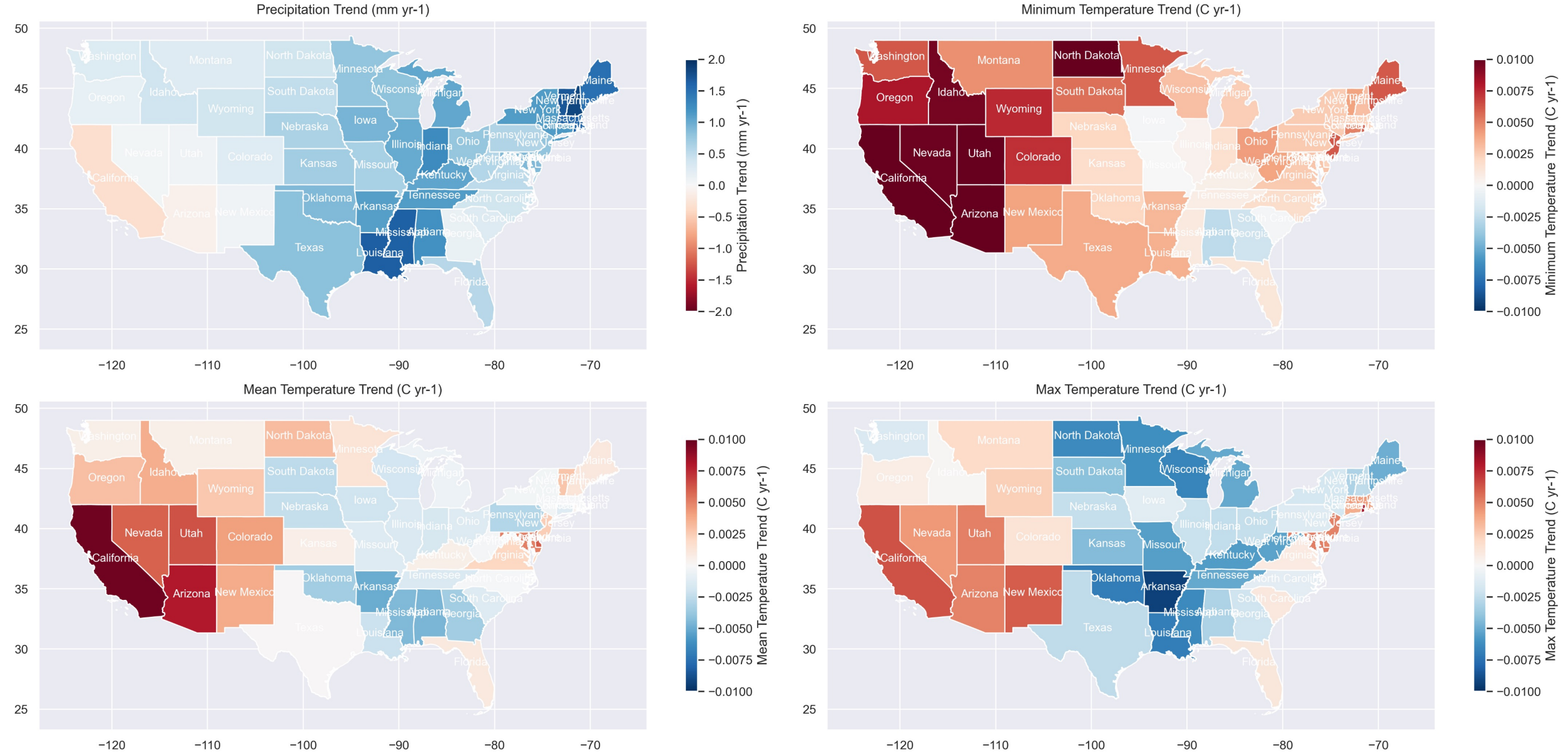


Folks and Farms Water Budget



Sustainability Indicators	Lowering GW Levels	Reduction of Storage	Seawater Intrusion	Degraded Quality	Land Subsidence	Surface Water Depletion
Metric(s) Defined in GSP Regulations	• Groundwater Elevation	• Total Volume	• Chloride concentration isocontour	• Migration of Plumes • Number of supply wells • Volume • Location of isocontour	• Rate and Extent of Land Subsidence	• Volume or rate of surface water depletion

Slopes of Mann-Kendall Trends in PRISM Climate Data (WY 1896 - 2019)



California Water Commission Act (1913)

Surface Water

Groundwater

Sustainable Groundwater Management Act (2014)

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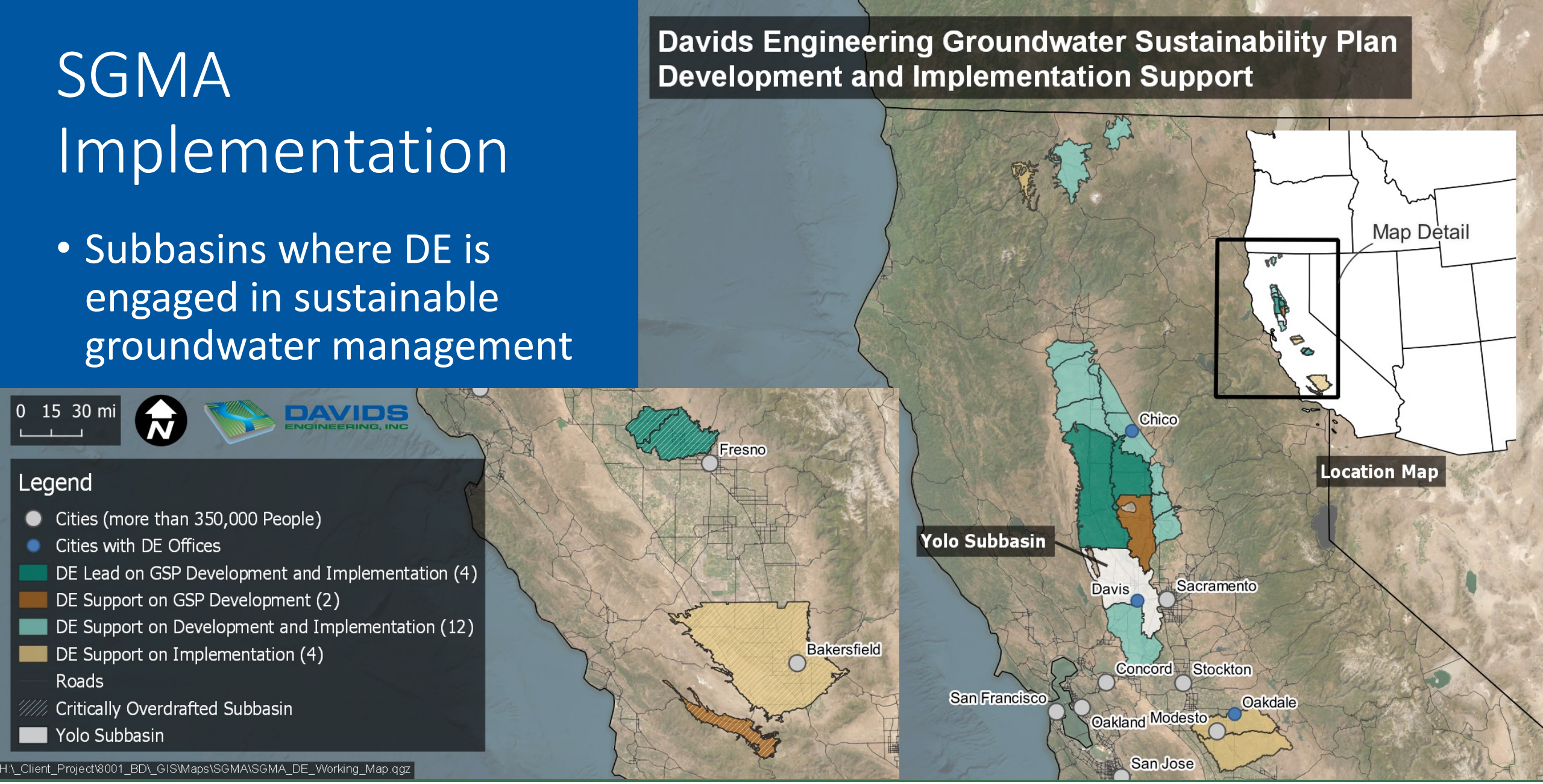
Source: Best Management Practices for the Sustainable Management of Groundwater Sustainable Management Criteria (https://water.ca.gov/)

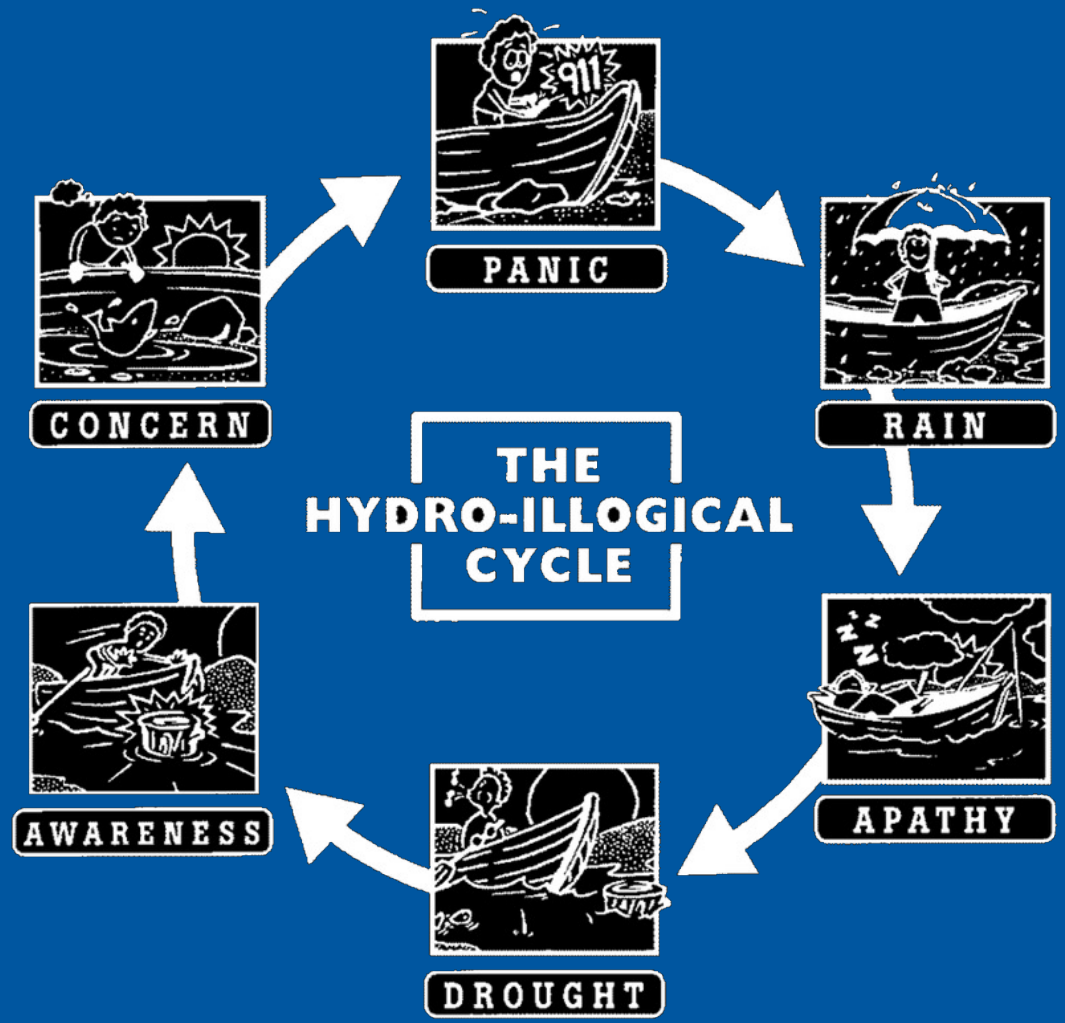
Source: ChatGPT (prompt: Make an image of an ostrich burying its head in the sand to ignore groundwater overdraft issues)

SGMA Implementation

- Subbasins where DE is engaged in sustainable groundwater management



How Should We Address Water Scarcity?



Source: https://www.researchgate.net/publication/286462849_National_Drought_Policies_Addressing_Impacts_and_Societal_Vulnerability/figures?lo=1

How Should We Address Water Scarcity?

- Start with water accounting.
- Set consumptive use limits.
  - This is SGMA's role in California.
  - Leads to Groundwater Demand Management (GDM).
- Maximize water productivity within these limits.

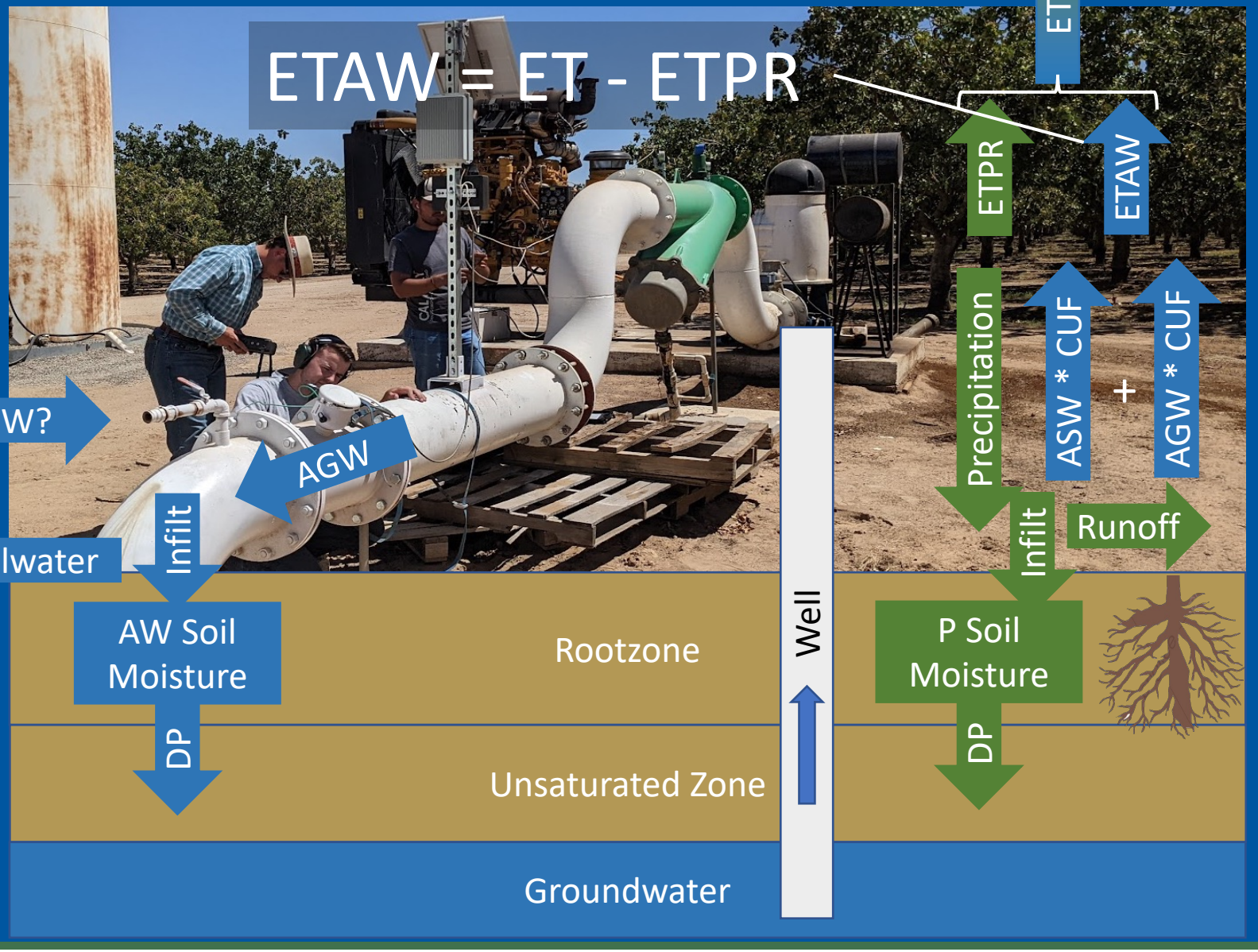
Source: ChatGPT (prompt: Make an image of an ostrich burying its head in the sand to ignore groundwater overdraft issues)

Groundwater Demand Management (GDM) - Means Different Things to Different People…

- Well permitting?
  - Potential equitability and legal challenges (this is not legal advice!)
- Land use controls?
  - Function of the County General Plans (not the GSAs' authority)
- Groundwater allocations?
  - Allocation based on extracted vs. consumed groundwater?
  - What is a sustainable allocation of groundwater?
  - How do you measure extraction/consumption against groundwater allocations?
  - How to you get from where you are to sustainability (transition)?

What Knob Should GDM Turn?

Remote sensing measures total ET (ETPR + ETAW)



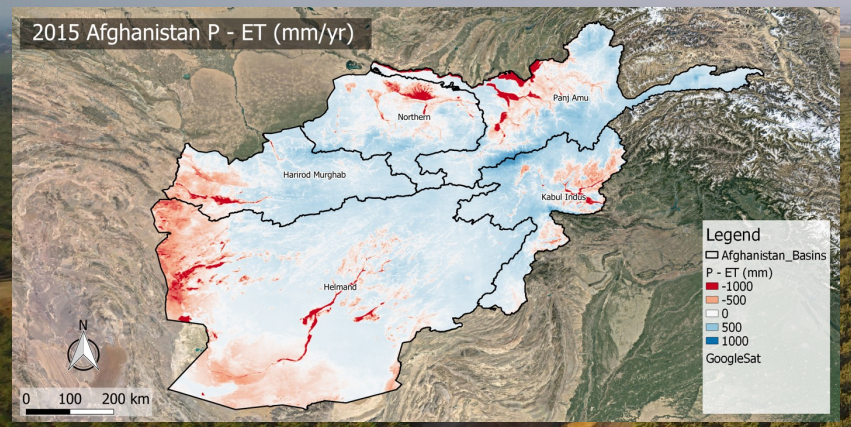
Notes

- Green arrows/boxes are precipitation related
- Blue arrows/boxes are applied groundwater related

Legend

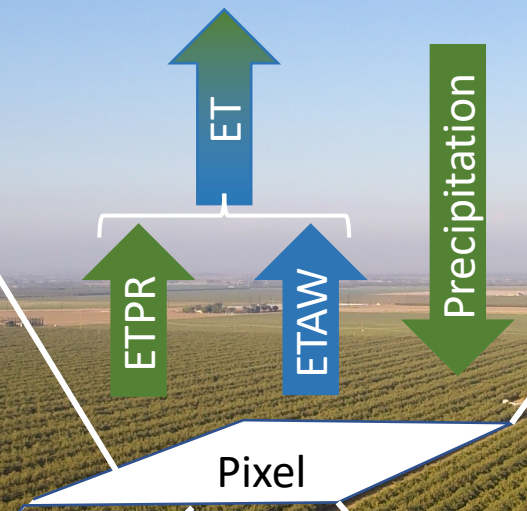
- AGW = Applied Groundwater
- ASW = Applied Surface Water
- CUF = Consumptive Use Fraction
- DP = Deep Percolation
- ET = Evapotranspiration (total)
- ETAW = ET from Applied Water
- ETPR = ET from Precipitation
- Infilt = Infiltration
- DP = Deep Percolation

ETAW (Evapotranspiration of Applied Groundwater Estimates)



Rapid Assessments of Sources and Sinks of Water (Q ~ P - ET)

A Pixel-based View of The World



Rootzone (ΔS = 0)

Unsaturated Zone

Groundwater

SWEO (Scalable Water balances from Earth Observations)

WATER INTERNATIONAL
2022, VOL. 47, NO. 6, 866–886
https://doi.org/10.1080/02508060.2022.2117896
Routledge Taylor & Francis Group
RESEARCH ARTICLE
OPEN ACCESS Check for updates

Scalable Water Balances from Earth Observations (SWEO): results from 50 years of remote sensing in hydrology

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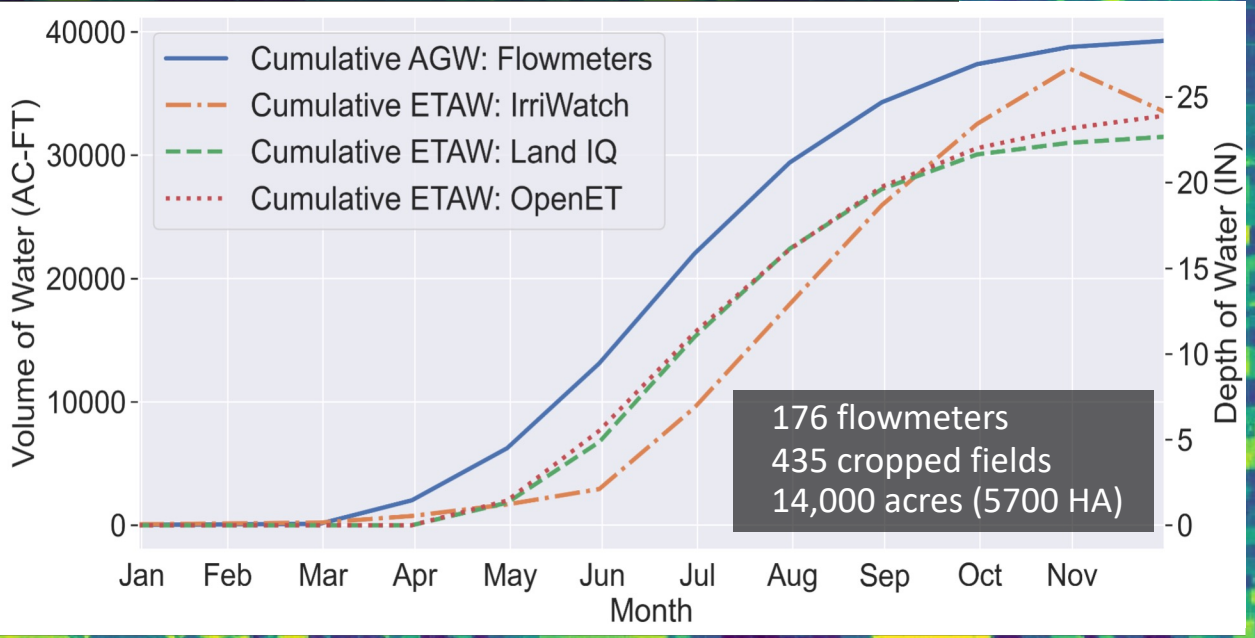
GEEEO (Groundwater Extraction Estimates from Earth Observations)

Source: https://www.tandfonline.com/doi/pdf/10.1080/02508060.2022.2117896

Administration of Groundwater Allocations

Comparison of flowmeters and remote sensing



Abbreviations

AGW – Applied Groundwater

ETAW - Evapotranspiration of applied water

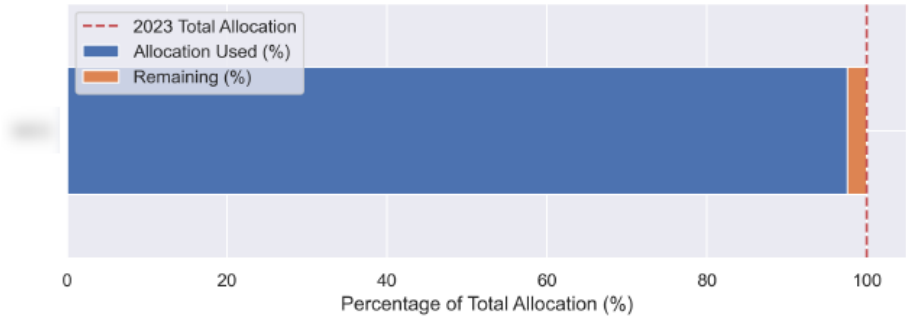
Measurement of ETAW for groundwater allocation management

Master Account Summary

Description	Value
Master Account ID:	
Master Account Name:	
Mailing Address:	
Start Date (YYYY-MM-DD):	
End Date (YYYY-MM-DD):	
Measurement Method:	

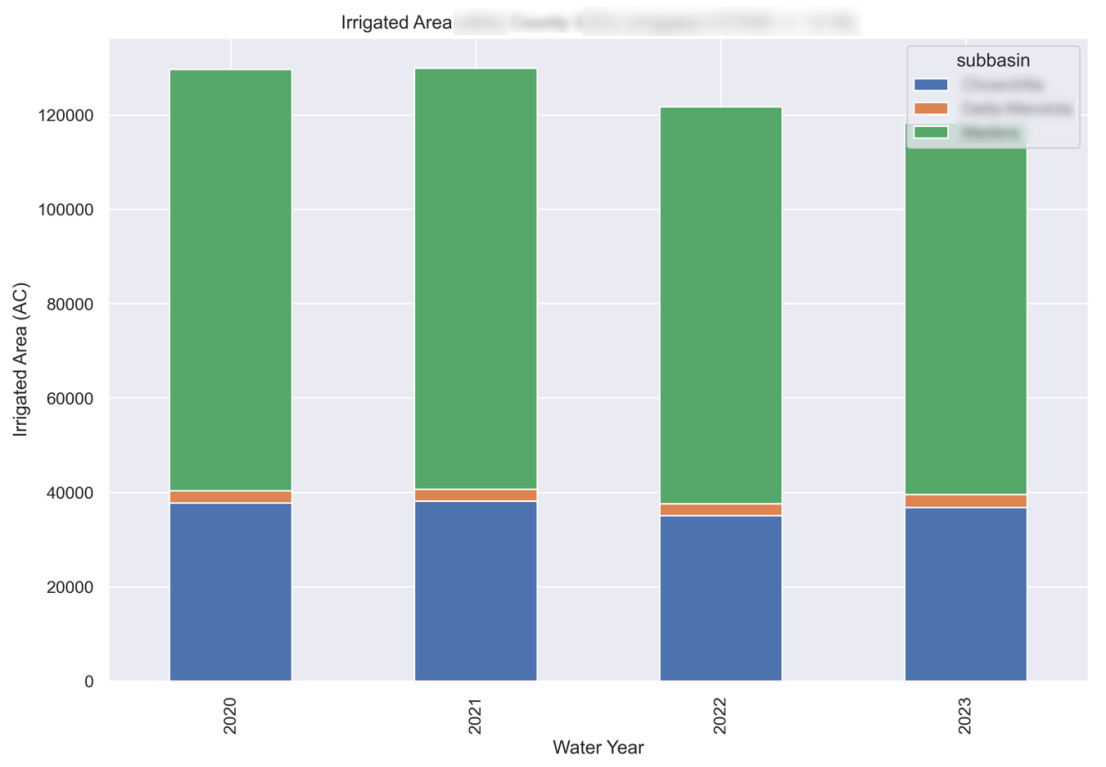
Farm Unit Summary

Farm Unit	Assessed Acreage (AC)	Irrigated Acreage (AC)	2023 Allocation (AF)	Carryover (AF)	2023 Adjustment (s) (AF)	Total Allocation (AF)	ETAW (AF)	Remaining (AF)	Remaining (%)
	420.9	391.2	971.6	0.0	0.0	971.6	948.3	23.3	2.4

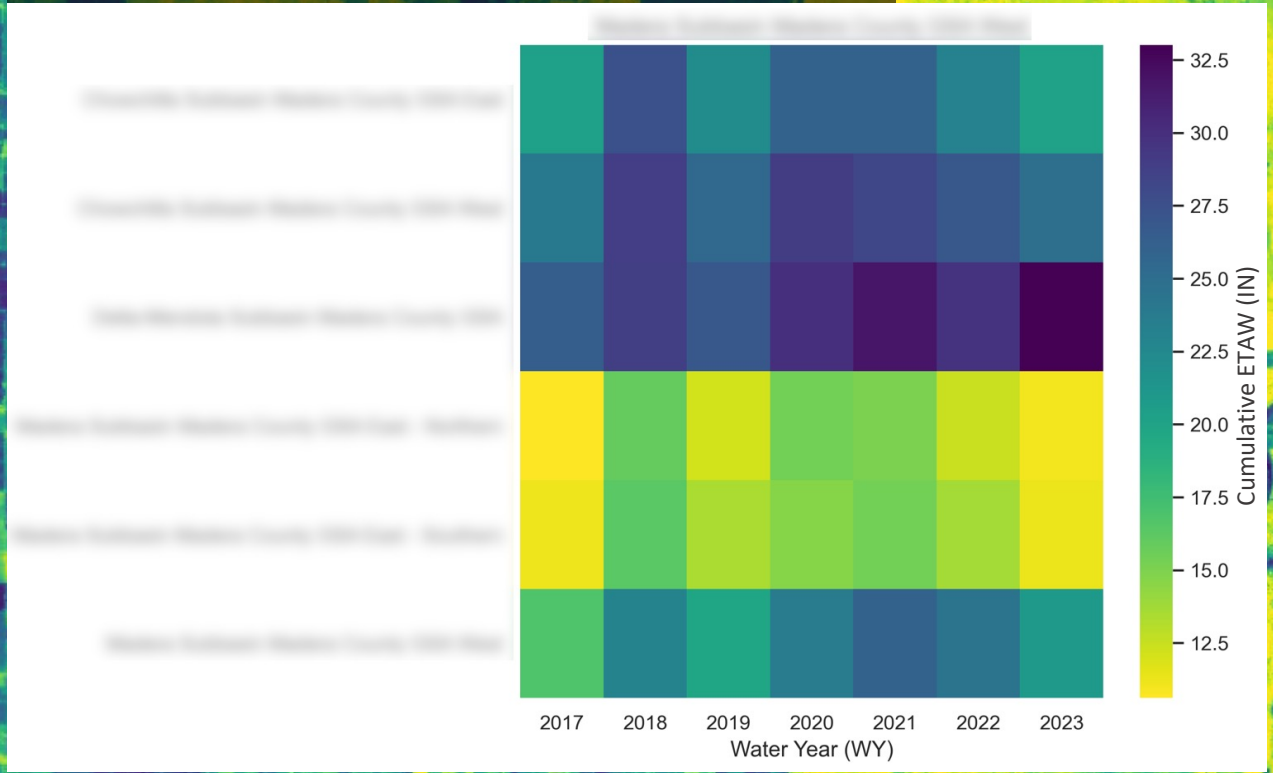


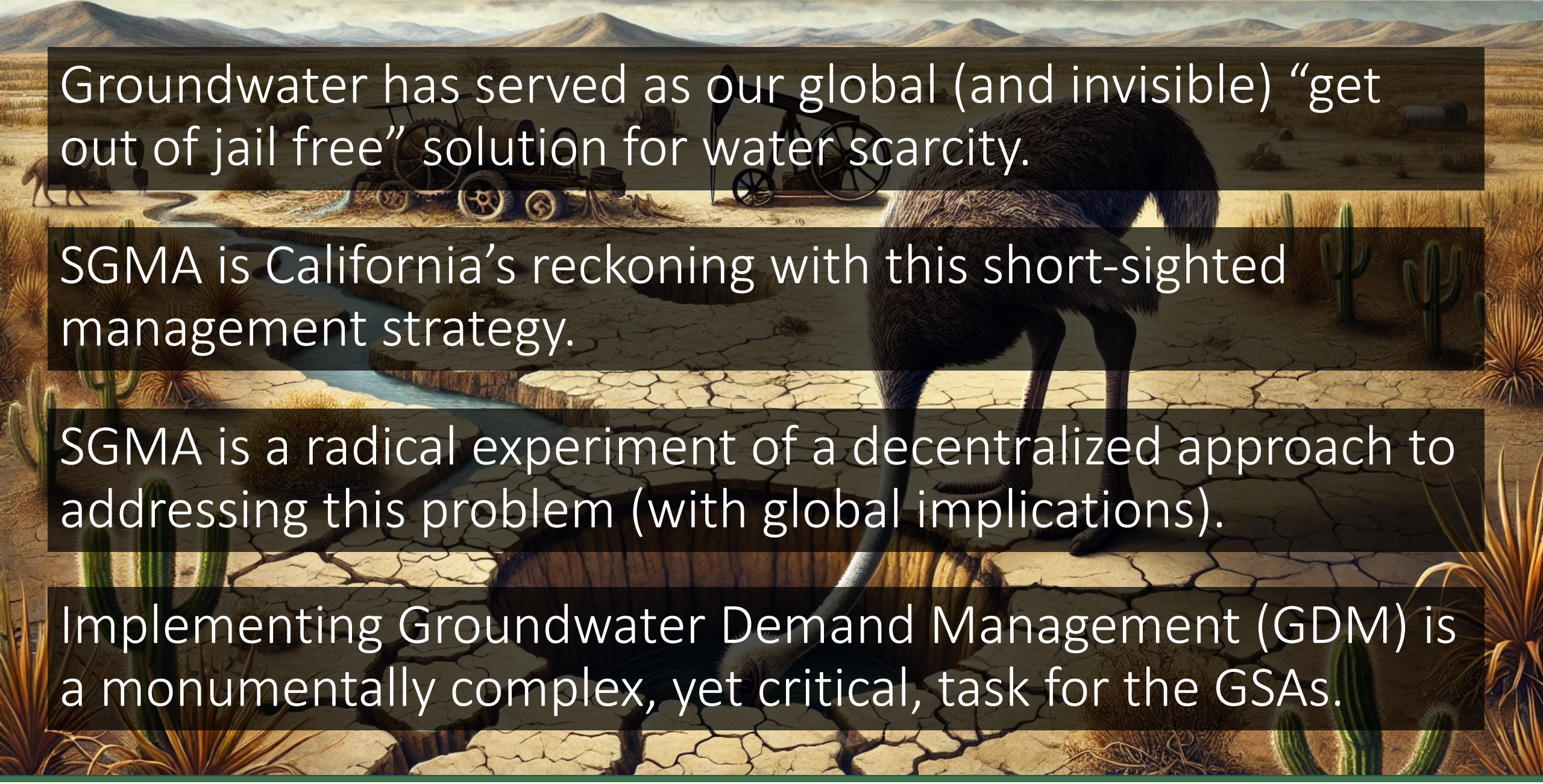
Groundwater Demand Management (GDM) is About Reducing Consumption

Irrigated area analyses



Consumptive use (ETAW) intensity analyses





Groundwater has served as our global (and invisible) “get out of jail free” solution for water scarcity.

SGMA is California’s reckoning with this short-sighted management strategy.

SGMA is a radical experiment of a decentralized approach to addressing this problem (with global implications).

Implementing Groundwater Demand Management (GDM) is a monumentally complex, yet critical, task for the GSAs.

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Questions and Discussion

???

Fish and Feathers ⟷ Folks and Farms