Decision Support Tools and Technologies for Urban Water Resilience

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SIWI WORLD WATER WEEK

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theEARTH GENOME
REVEALING THE POSSIBLE

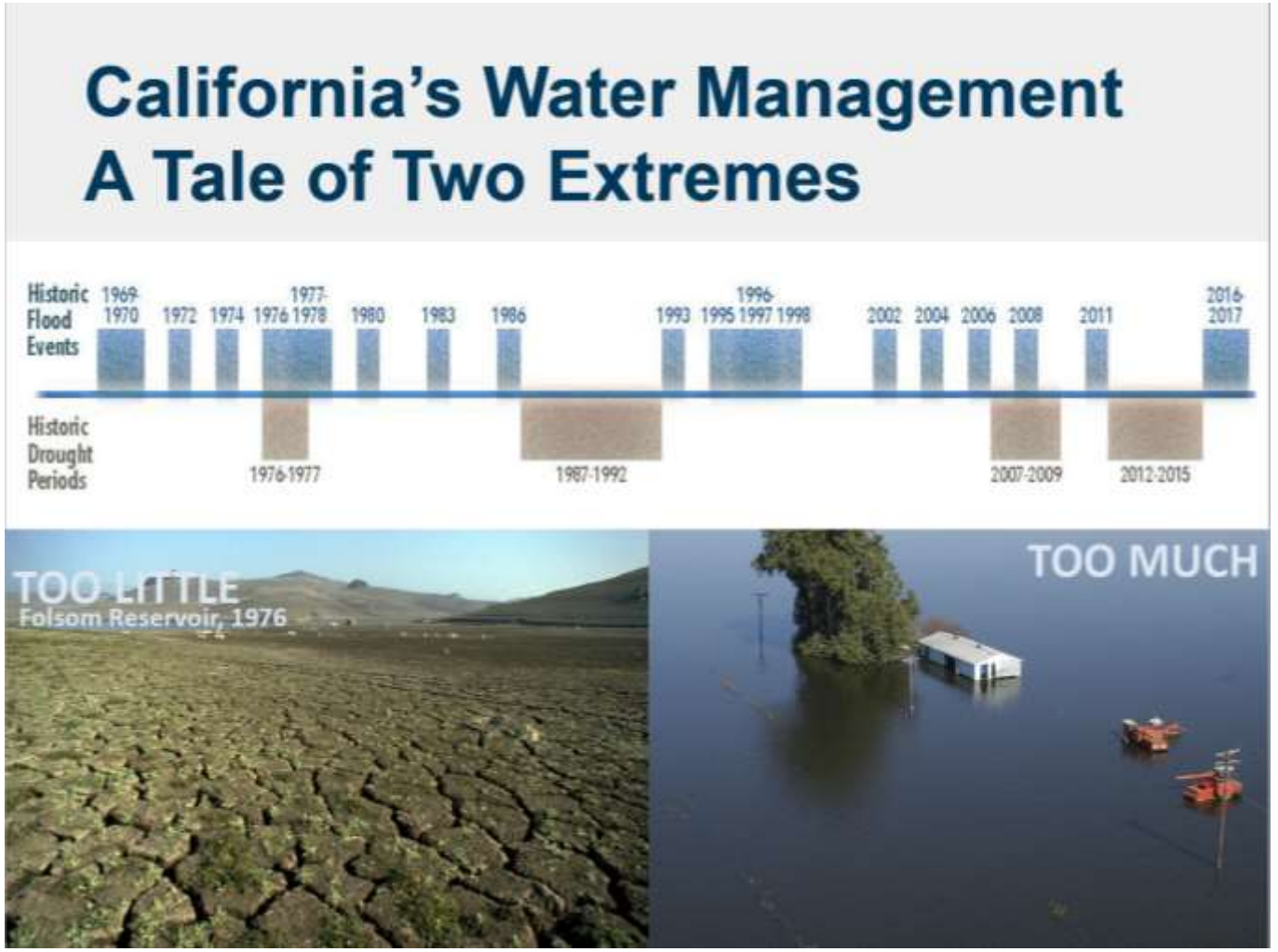
State of the Art = ?

Co-created an innovative decision support tool with California water authorities

Critical premise:
It's not really about water tools or technology, it's all about the local decision maker

…put better environmental insights into the hands of the world's most consequential decision makers

CALIFORNIA DEPARTMENT OF
water resources



Too little. Too Much.

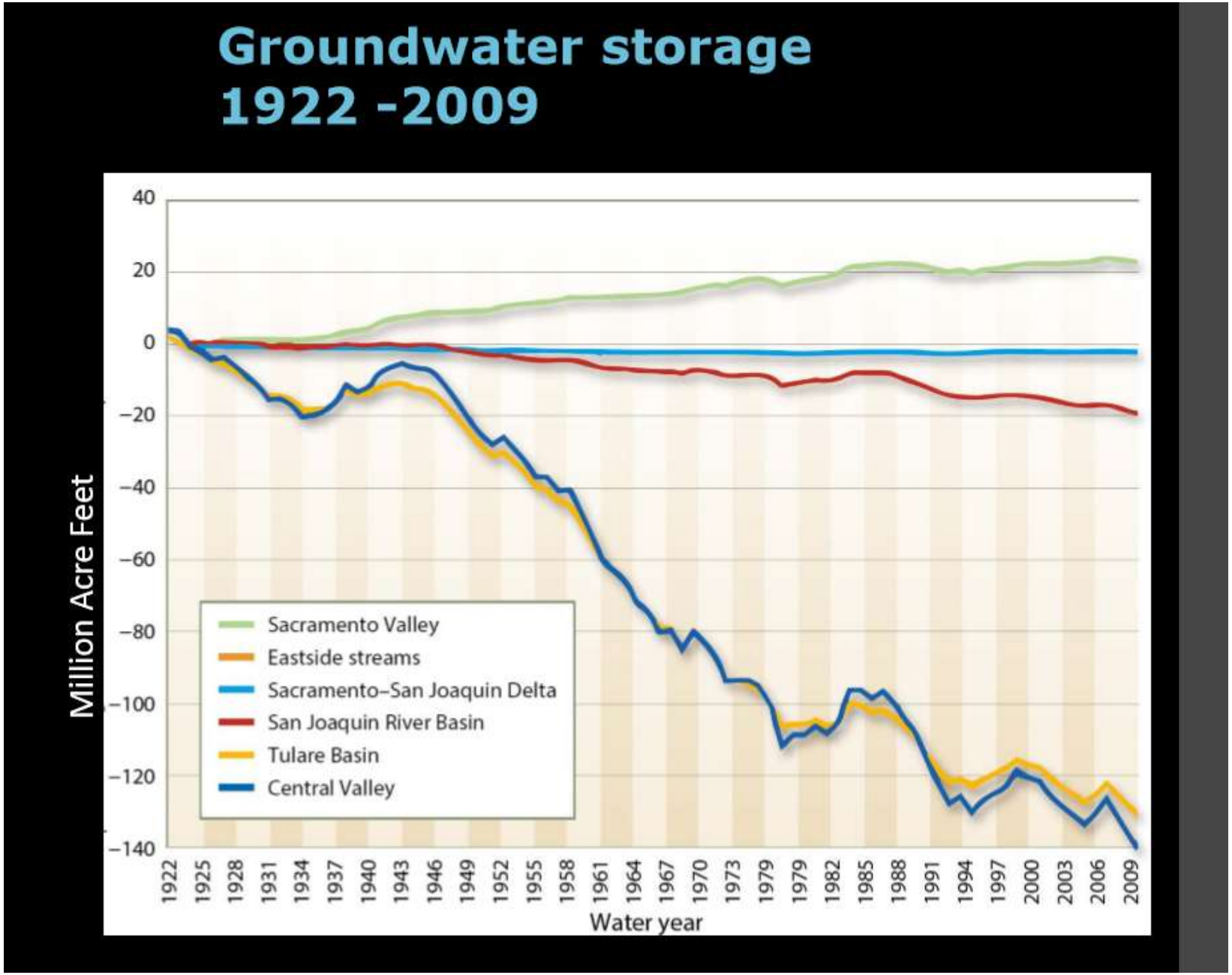
Last five years = 4 driest years on record, followed by wettest year on record

CA Agriculture

¼ of all food grown in the United States

CA Cities

~40M people.
Most populous state



Last ~70 years: Groundwater has declined over 140M acre feet (170 B liters) in each of the two critical regions

Financial Losses of Recent Drought

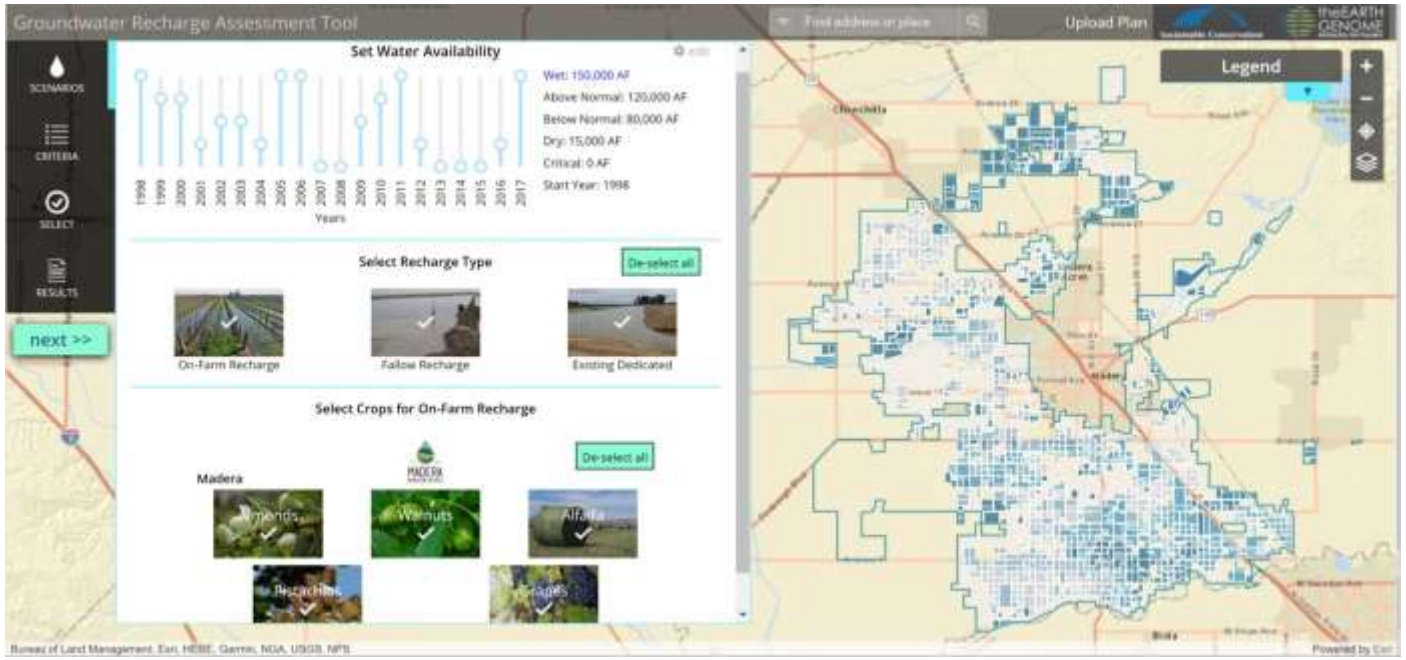
$2.7B in ag losses

$700M in water utility losses

Solution = more storage (decentralized, green)

Enable water authorities to store more water, increasing water supply resilience for farms and cities

On-Farm Recharge Pilot in the Central Valley of CA



GRAT – Groundwater Recharge Assessment Tool

GRAT Focus: Felt need by water users

- **Where** is recharge best done?
- **When? What** type? **How much**?
- What are the **most cost effective investments**?

Schematic: Tool functions inspired by a watermaster

Source Water

- Surface water availability
- Excess flood flows

Conveyance

- Conveyance infrastructure
- Available to direct water to fields

Site Suitability

- Recharge suitability: slope, soil type, clay layers, underlying geology, depth to GW
- Rainfall
- Crop and land use suitability

On-Farm and Fallow Recharge

- Infiltration potential (crop compatibility calendar)

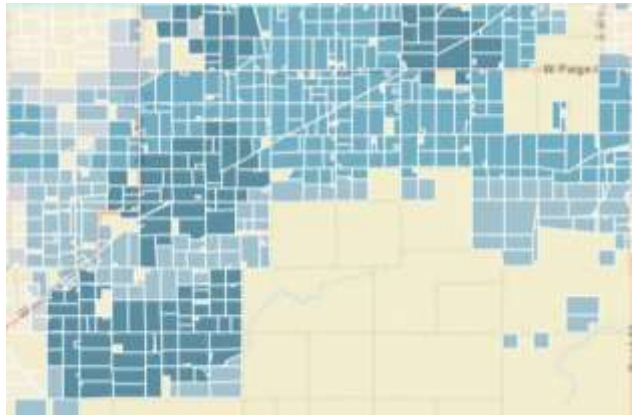
Dedicated Basins

- Existing dedicated recharge basins

Recharge Benefit/Cost Analysis

- Cost of implementing recharge
- Relative cost per acre foot ($/AF)
- Increased groundwater recharge

Field: Estimating $/AF



Field Unit: Key Variables

- Field size
- Crop type
- Irrigation systems
- Water applied by week
- Rainfall

Existing Dedicated Basins

1. Mechanical weed control
$55/acre for every year
2. Chemical weed control
$16/acre for every year
3. Earthwork
$31/acre for every year
4. Operations
$156/acre for years when basin used
(assuming a regulating basin)

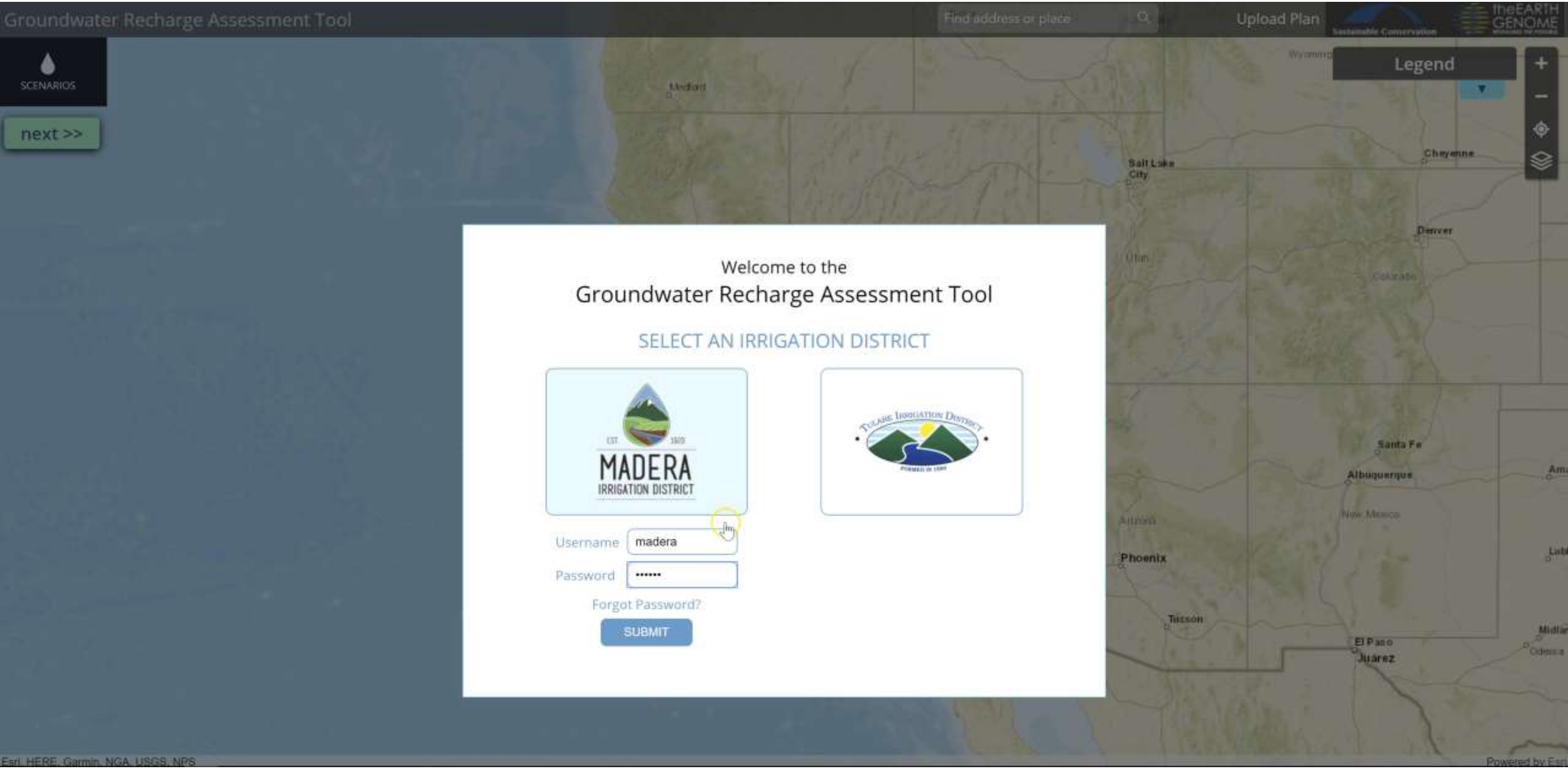
On-Farm Recharge

1. Berm construction
$30/acre per construction
2. Irrigator labor
$15/hour with 0.3 hours needed per acre for every week when recharge is done
3. Gypsum
$60/acre
4. Pest management and weeds/herbicide
$30/acre for pest, $8.25/acre for weeds

Fallow Lands

1. Berm construction
$15/acre per construction
2. Irrigator labor
$15/hour with 0.075 hours needed per acre for every week when recharge is done
3. Gypsum
$60/acre
4. Weeds/herbicide
$20/acre for weeds

Goal: better cost/acre-foot
→ more investment, more water stored


Groundwater Recharge Assessment Tool
Find address or place
Upload Plan
SCENARIOS
next >>
Legend
Welcome to the
Groundwater Recharge Assessment Tool
SELECT AN IRRIGATION DISTRICT
MADERA
IRRIGATION DISTRICT
Tulare Irrigation District
Username
madera
Password
Forgot Password?
SUBMIT
Medford
Salt Lake City
Cheyenne
Denver
Utah
Colorado
Santa Fe
Albuquerque
New Mexico
Arizona
Phoenix
Tucson
El Paso
Juárez
Esri, HERE, Garmin, NGA, USGS, NPS
Powered by Esri

GRAT already informing local decisions

Current uses

- **Evaluating sites:** Selecting farmers for recharge and evaluating offers for farmland lease options
- **Develop recharge strategy:** Evaluating water balance and possible need for pumping restrictions
- **Building Groundwater Sustainability Plans (GSPs):** Estimate % of overdraft addressed over 20 yrs

Tulare Irrigation District
Formed in 1889

"TID sees GRAT as an integral tool to employ with GSPs to identify project and management actions."

Est. 1920
Madera Irrigation District

"GRAT is really valuable to optimize our investments in recharge. We need to know how options compare for us to best achieve groundwater balance."

New possible GRAT features …
being requested by California water stakeholders

New dedicated basins, etc.

Water quality

Aquifer storage recovery

Expanding conveyance

Flood Mitigation

Subsidence prevention

Reservoir reops

Environmental flows

Floodplain optimization

Groundwater dependent ecosystems

Farmer incentives

Market transactions

Habitat connectivity

Accessible and valuable tool = End-user driven innovation

Advanced Technologies

4IR Fourth Industrial Revolution

Sample technologies:

Potential for 4IR Water Technology for Cities

- Lower the cost of data acquisition, everywhere
- Enable near-real time decision making
- Better estimates of local risk and available solutions
- Improved monitoring of resilience indicators
- Increase data driven decision making in city planning

NOT just about technology. Human driven process.
Collaborative investments (public/private partnerships)

Technology enabled investments in city resilience solutions

Possible “state of art” for urban water resilience

Data **visualization**	→	**Decision** making
Global risk	→	**Local** risk
Single solution	→	**Multiple** solutions (portfolio)
Static analyses	→	**Dynamic** modeling (“what if”)
Hydrologic only	→	**Multi-benefit**, with financials

Local, dynamic decision making replicable to many cities




Summary: Technology for urban water resilience

Every city, every basin, has unique local context

Innovation comes from the city end-users, not driven by data or technology

As such, technology must be “fit for purpose” enabling new collective action and better investment decisions

That’s the promise of advanced tools and technologies…that we all make better decisions and our cities become much more resilient as a result.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