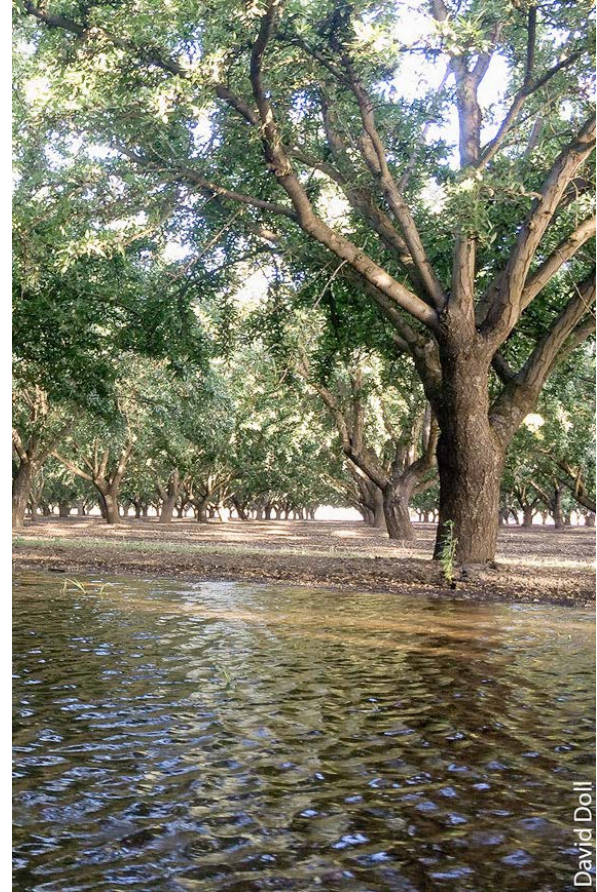


Groundwater Recharge on Agricultural Land: Feasibility, Water Availability and Cost

Helen Dahlke, Tiffany Kocis, Andrew Brown, Jose Luis Rodriguez Arellano, Samuel Sandoval-Solis, Thomas Harter, Dan Putnam

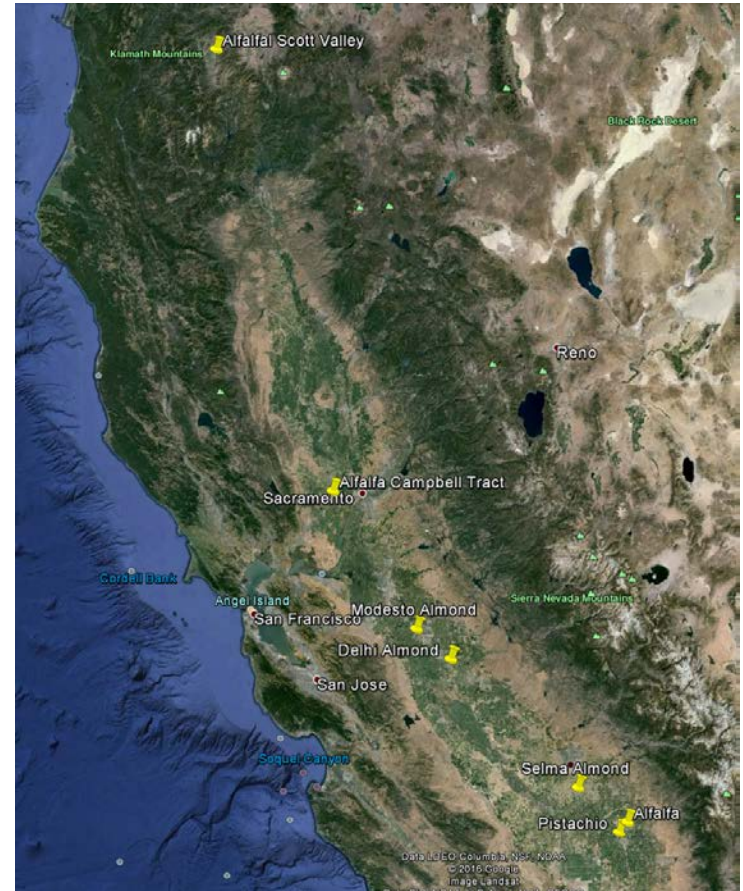
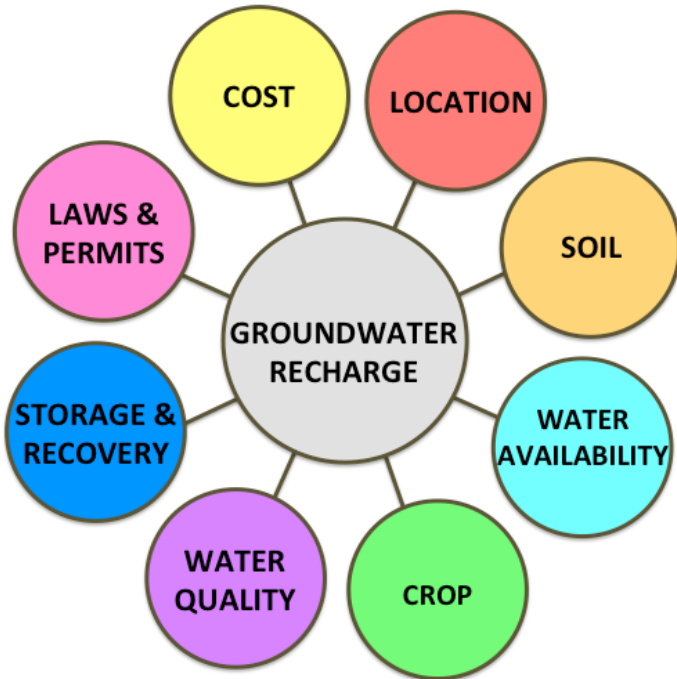
APRIL 4, 2016

EMAIL: hdahlke@ucdavis.edu



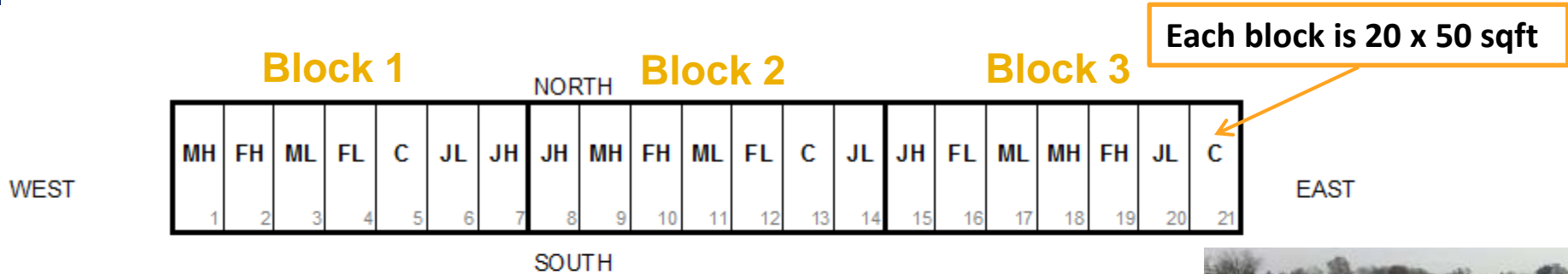
Groundwater Recharge Wheel of Questions

- Utilize flood flows and agricultural lands for recharging groundwater during winter months



Flooding Tolerance Studies

Experiments on Flooding Tolerance of Alfalfa



Block Experiment with three Replicates

- Timing (Jan, Feb, March)
- Applied water (4 ft, 6 ft)
- Control

Estimates

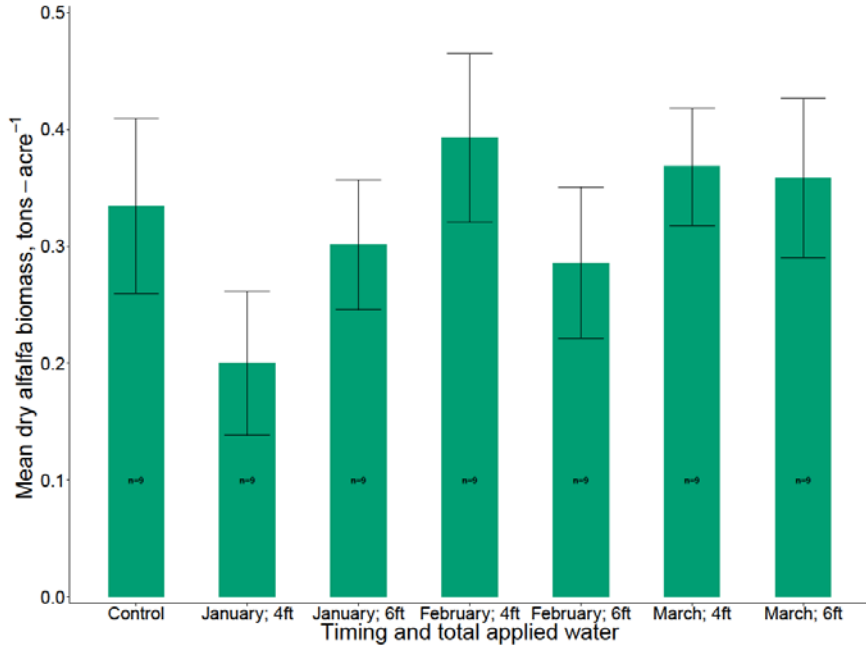
- Recharge fraction, biomass effect



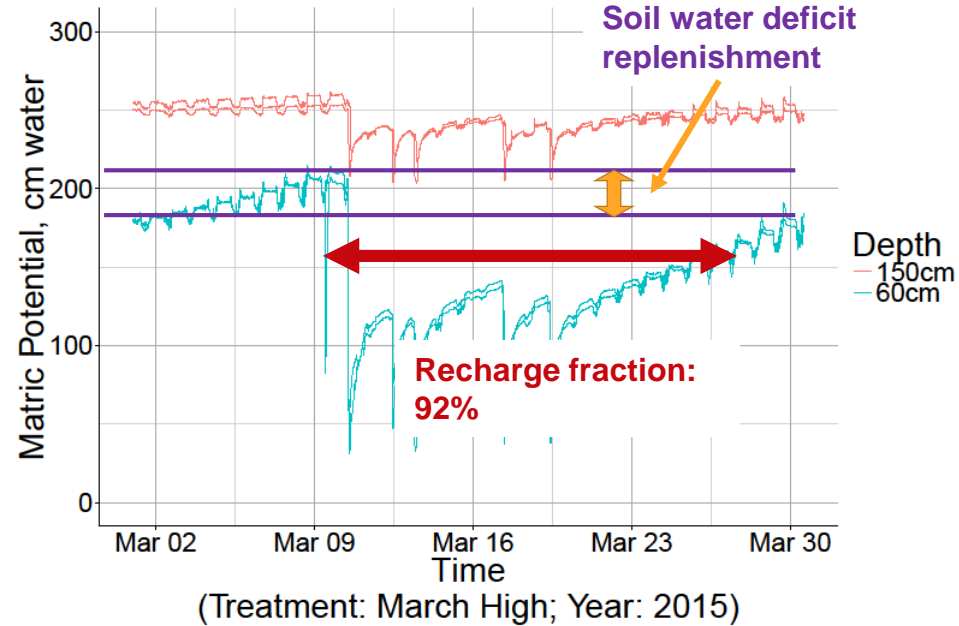
Brown et al., in prep.

Experiments on Flooding Tolerance of Alfalfa

BIOMASS



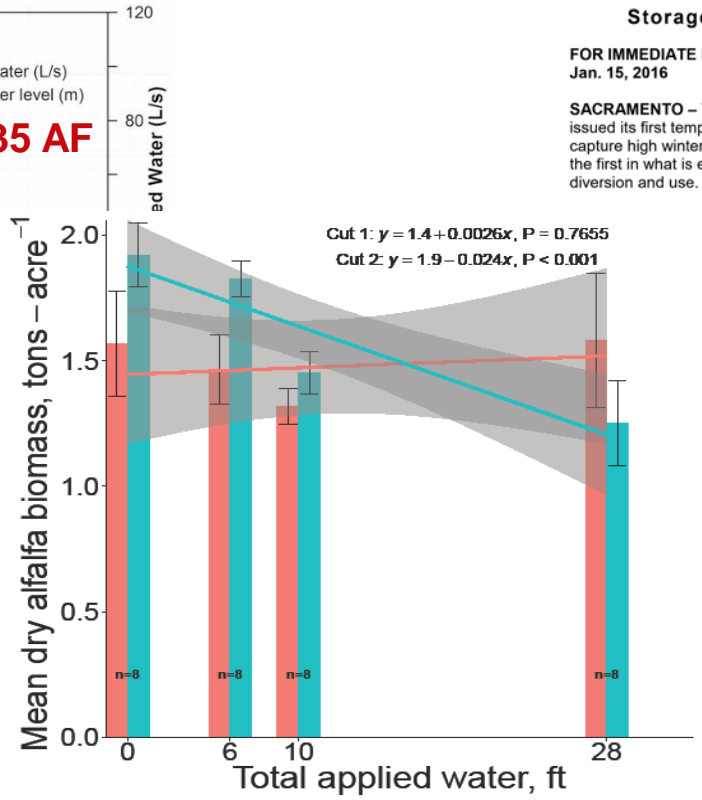
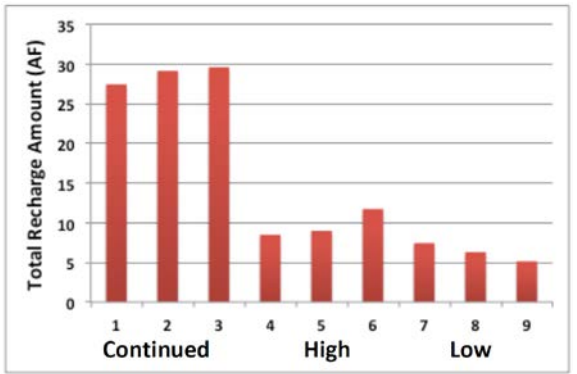
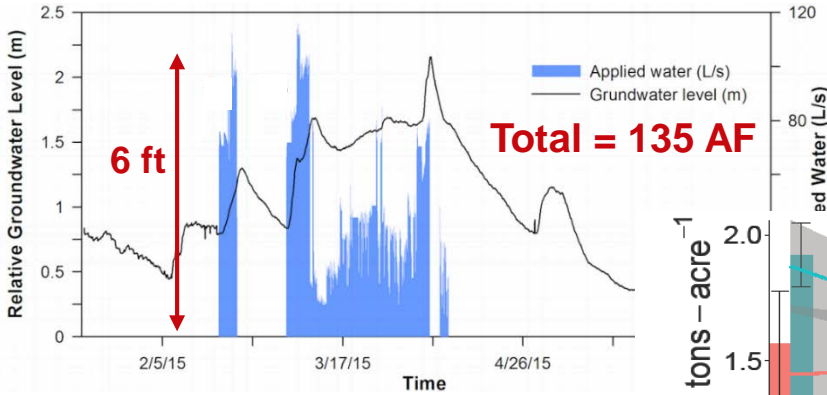
SOIL WATER BALANCE



High Biomass → later timing, more applied water

Brown et al., in prep.

Experiments on Flooding Tolerance of Alfalfa

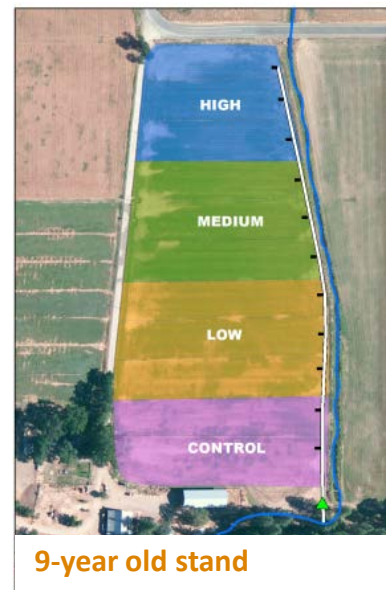


State Water Board Issues its First Temporary Groundwater Storage Permit to Capture Rain Season High Flows

FOR IMMEDIATE RELEASE
Jan. 15, 2016

Contact: Miryam Barajas
miryam.barajas@waterboards.ca.gov

SACRAMENTO – Today the State Water Resources Control Board (State Water Board) issued its first temporary groundwater storage permit to the Scott Valley Irrigation District to capture high winter and spring flows for local groundwater storage and recharge. The permit is the first in what is expected to be a series of temporary permits issued for this type of water diversion and use.



Scott Valley, Siskiyou County

Tolerance of Almonds to Winter Irrigation and Recharge

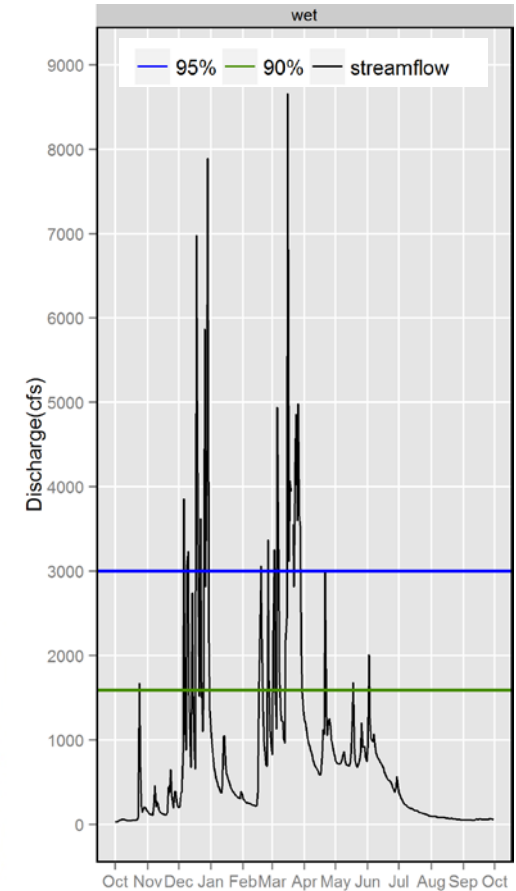
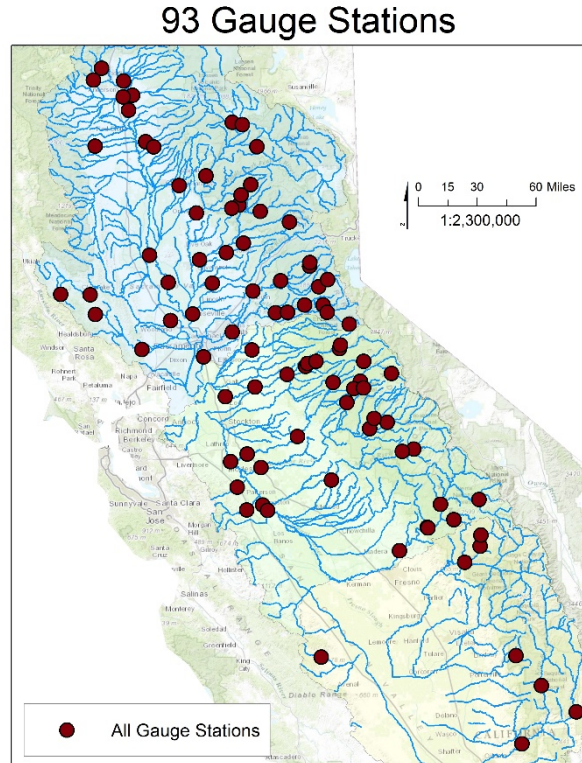
- *How much water is too much?*
- Is excess winter irrigation detrimental to root and tree health?
- Standing water can cause the loss of almond and other fruit trees on poorly drained soils
- May have no effect on tree health during dormancy (e.g. low root growth activity; might be beneficial for leaching salts)
- Crop, soil and water analysis on three orchards:
 - Duration of waterlogging of the root zone due to on-farm flood flow capture
 - percolation rates passed the roots zone
 - nitrate leaching risk



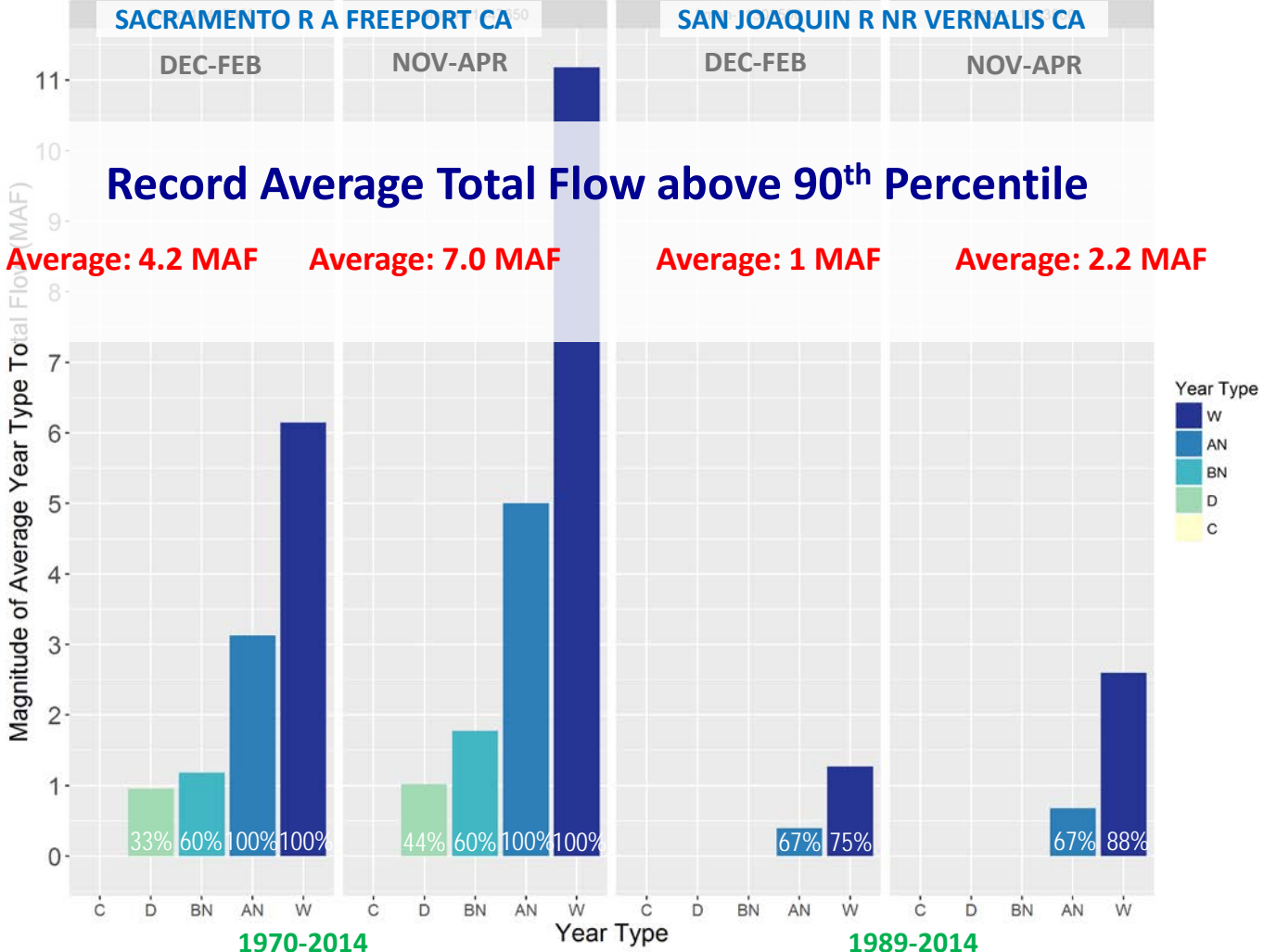
Surface Water Availability for Recharge

Flood Flow Availability Analysis for Recharge

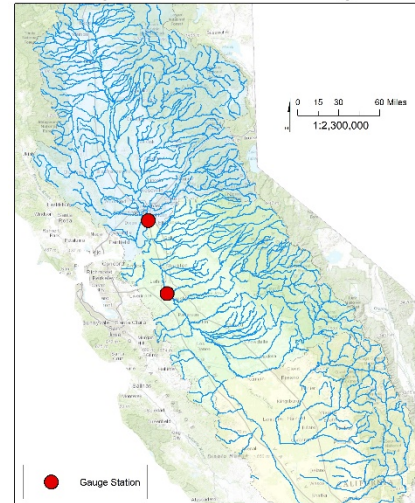
- **“Excess” streamflow:**
Flood flows or flows above 90th percentile of the hydrograph
- 90th percentile threshold is determined from full historical record
- Historic daily streamflow records for 93 stream gauges (19 unimpaired, 74 impaired) on streams within the Central Valley



Total Flows Above 90th Percentile For Average Year Type with Non-Zero Flows



Gauge Stations Used in Figure



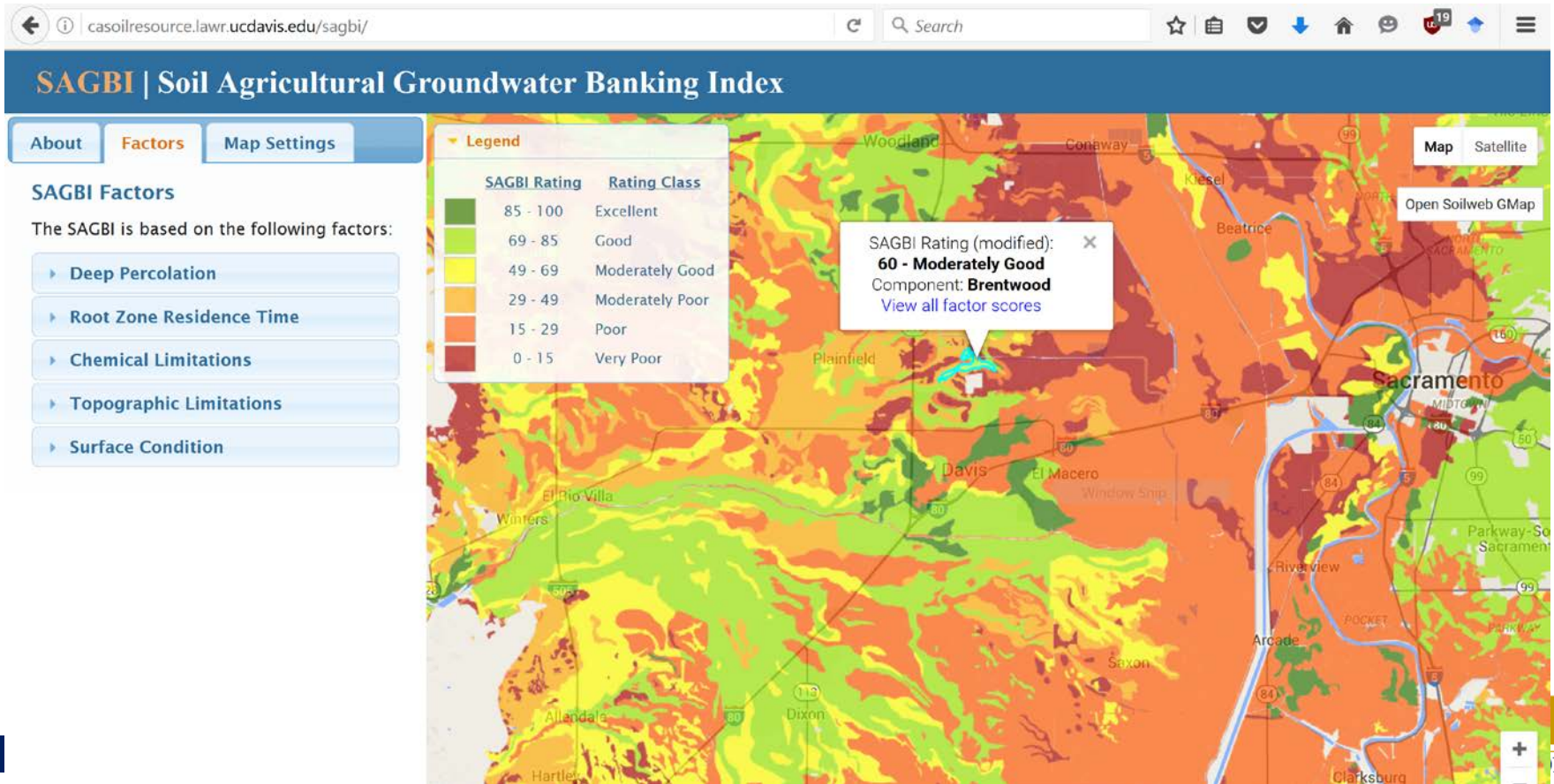
Water Year Type (Sacramento and San Joaquin Valley Water Year Hydrologic Classification Indices) as defined in SWRCB Decision 1641

Kocis and Dahlke, in prep.



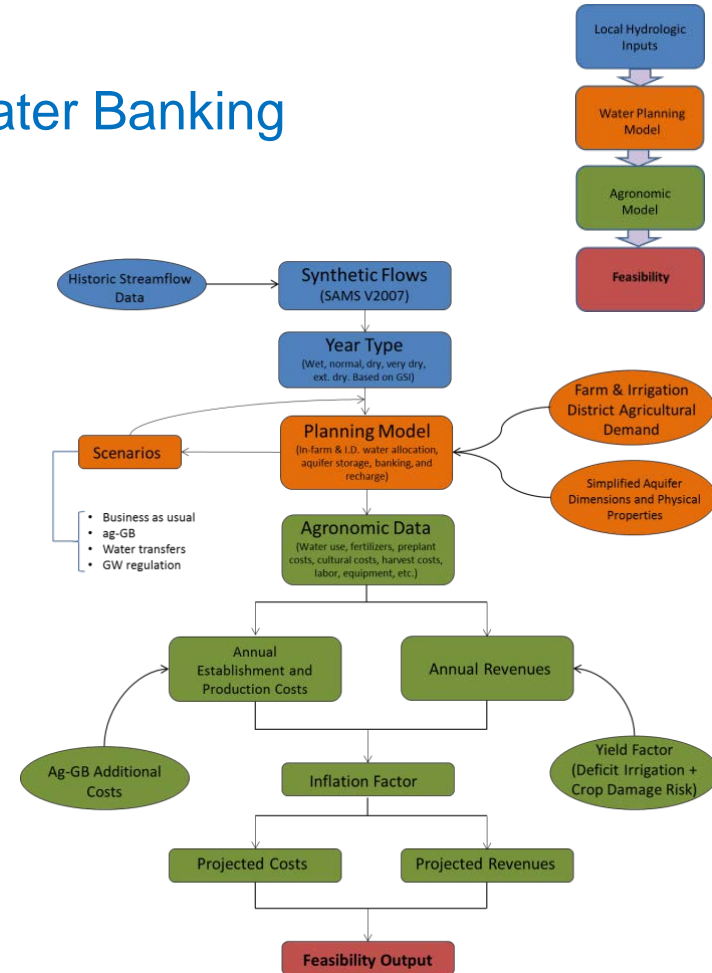
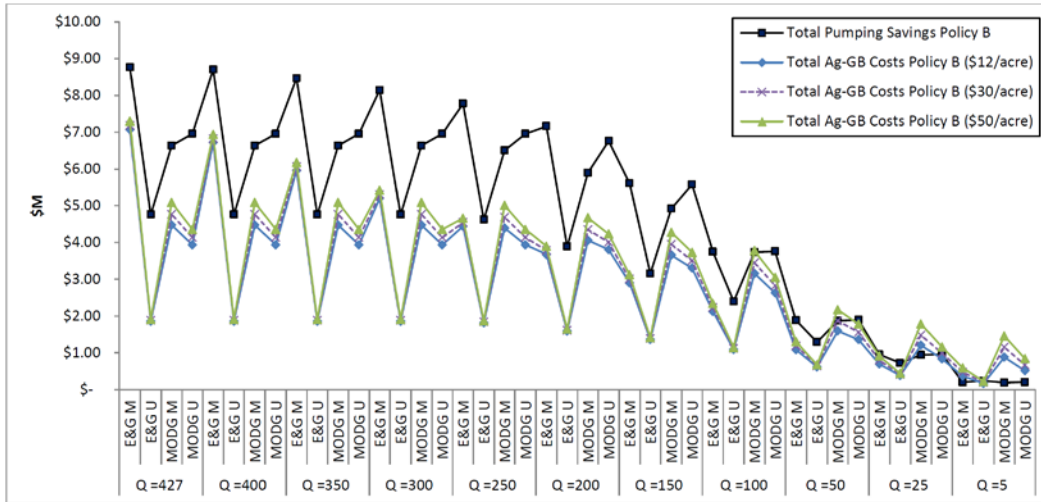
Decision Support Tools

Soil Agricultural Groundwater Banking Index (O'Geen et al. 2015, CalAg)



Cost-Benefit Analysis of Agricultural Groundwater Banking

- **Goal:** evaluate costs and benefits to determine economic feasibility
- **Beneficial:** if all growers in overlying area (e.g. almond growers) pay for cost of recharging landowners (e.g. alfalfa growers)



Ongoing and Future Work

- Compare “excess” surface water estimates to:
 - **infrastructure capacity** at points of diversion to assess what fraction of flood flows can be diverted locally onto agricultural land
 - **eWRIMS data** (Electronic Water Rights Information Management System, SWRCB) to determine what fraction of flood flows can be allocated for groundwater banking in addition existing allocations
- **Field experiments and modeling:**
 - Crop physiology studies of almonds, pistachio, alfalfa
 - Nitrate leaching and water quality impairment
 - Groundwater-surface water interactions











Thanks!

Legend

SAGBI Rating

Rating Class

	85 - 100	Excellent
	69 - 85	Good
	49 - 69	Moderately Good
	29 - 49	Moderately Poor
	15 - 29	Poor
	0 - 15	Very Poor

