

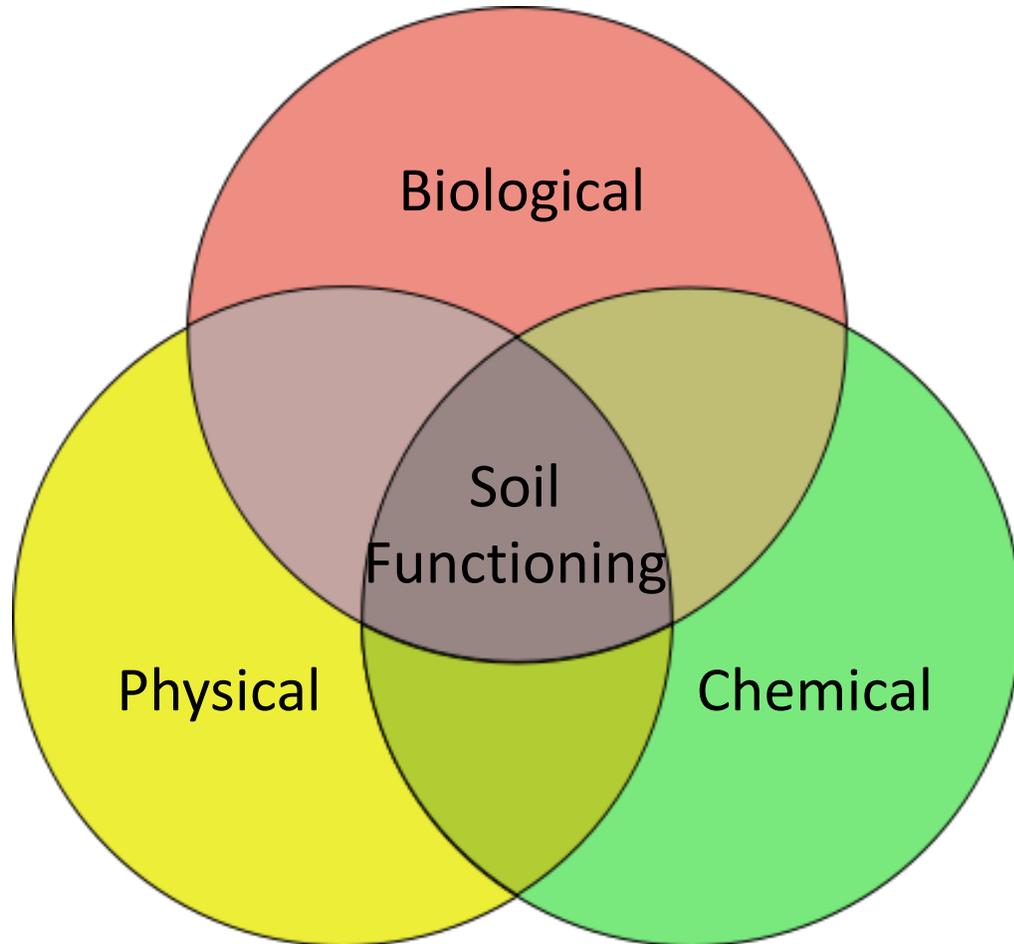
Soil and Water Resources in the Delta – Drought Management Considerations

Michelle Leinfelder-Miles
Delta Crops Resource Management Advisor

SJC and Delta Field Crops Meeting
January 12, 2023



What is soil health, how is it influenced by land management?



Warm-season legume cover cropping

CA Department of Food and Agriculture Healthy Soils Program (CDFFA-HSP)
Demonstration Project

Project team: M. Leinfelder-Miles, B. Aegerter, S. Stoddard, S. Light, A. Vinchesi-Vahl, J. Mitchell, W. Horwath, and V. Suarez-Romero

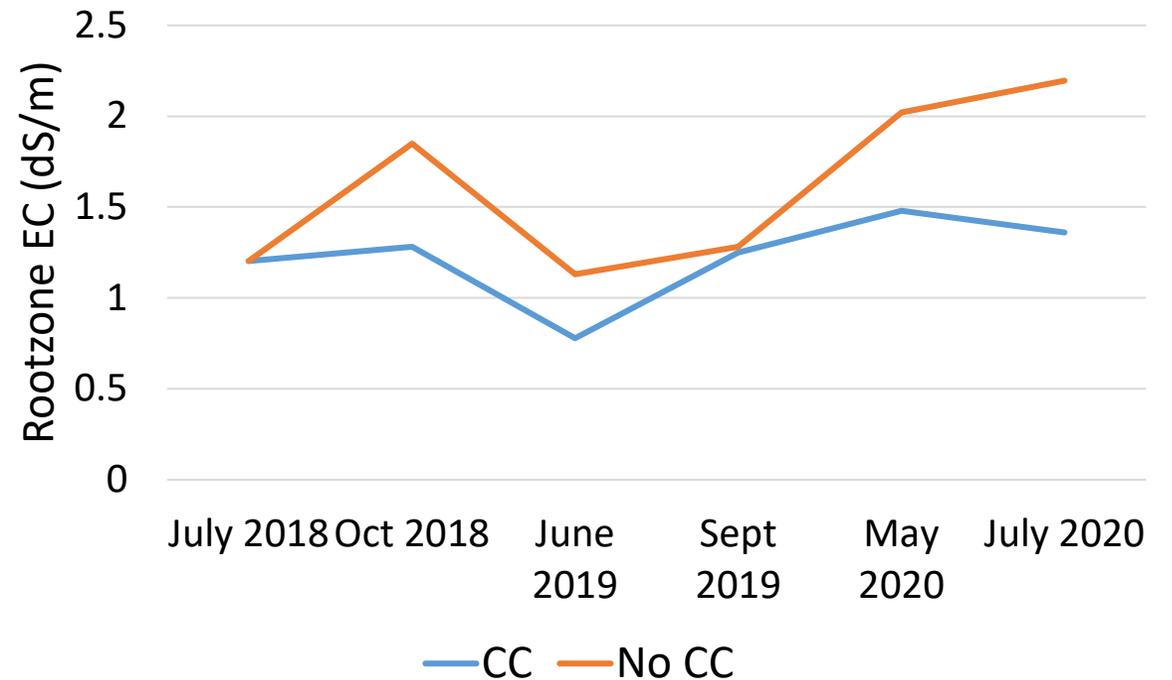
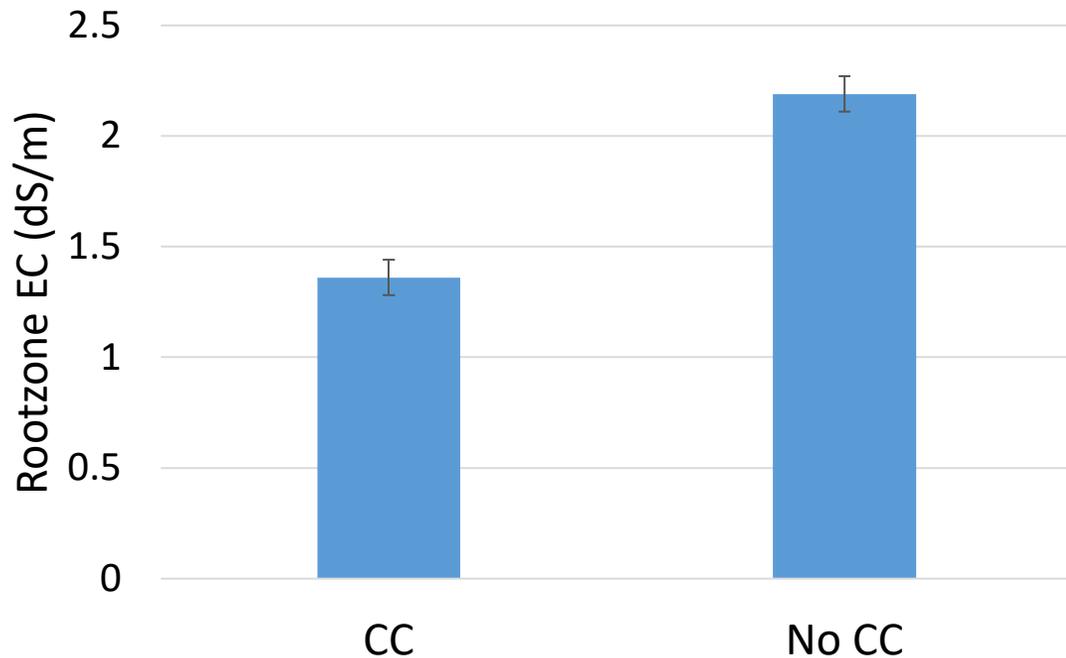




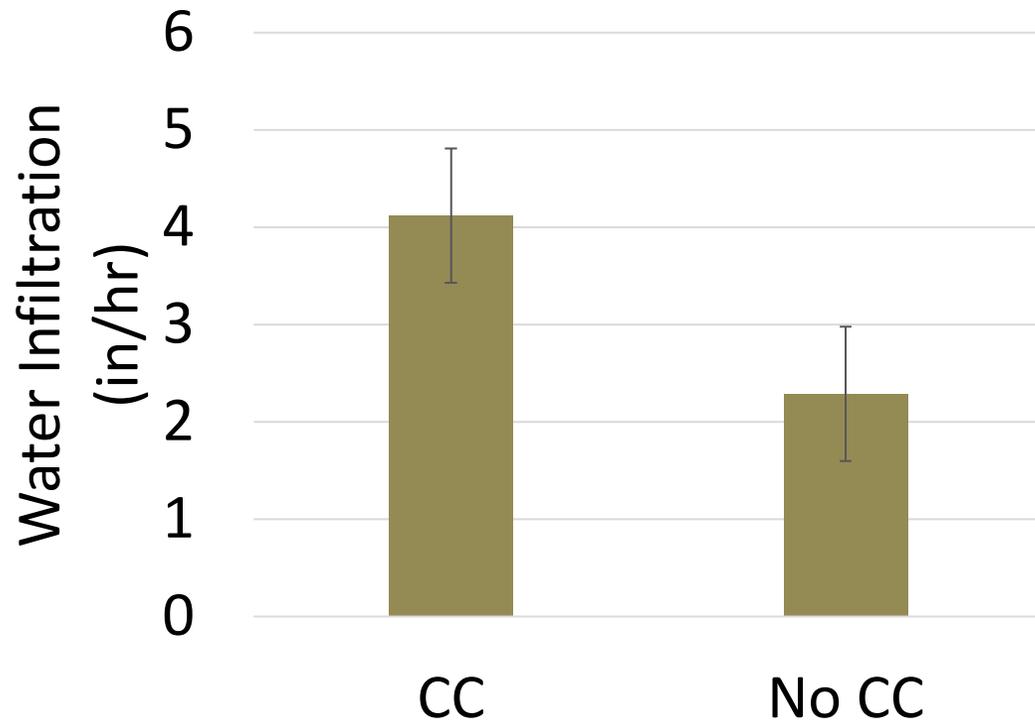
Project background and objectives

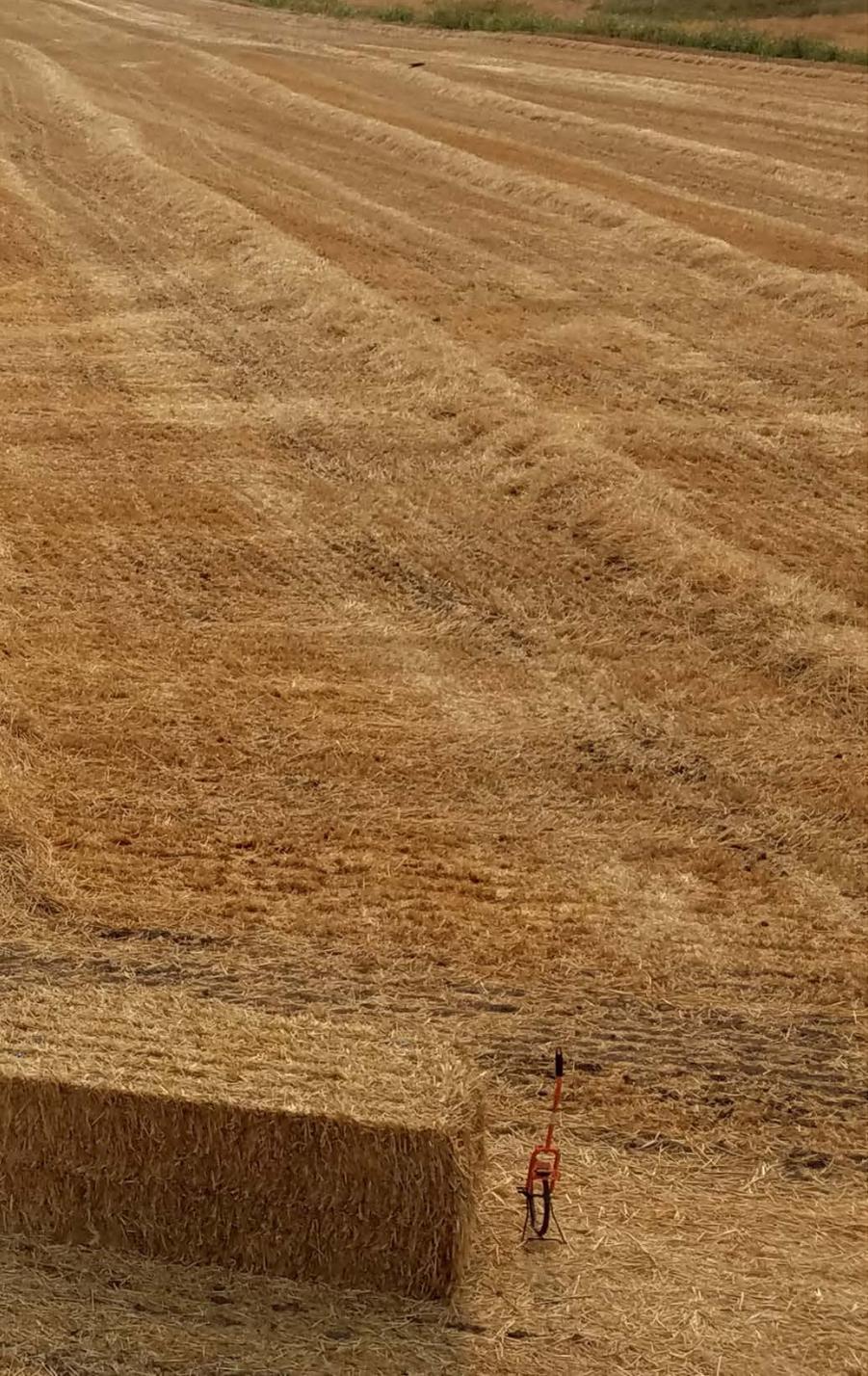
- Cover cropping is not a typical practice in the annual crop rotations in the Delta.
- Surface waterways can provide water for irrigating a summer cover crop.
- ***Can a summer cover crop improve soil tilth at a time of year when the soil would have otherwise been fallowed and dry with no soil cover?***
- ***Are there agronomic practices that might make summer cover cropping more feasible for farmers?***

Three years of cover cropping mitigated soil salinity



Cover cropping improved water infiltration





Lessons learned and grower guidance

- Timing of operations (i.e. earlier planting and termination) and irrigation method makes a difference.
- Cowpea stand establishment and weed competition were the biggest challenges to growing a summer cover crop at this site.
- The potential benefits of cover-cropping may not be realized in the first few cover crop cycles, which could hinder long-term adoption.
- Results may also depend on the cover crop biomass obtained and other site-specific factors.
- Longer-term studies are needed to better understand impacts from summer cover cropping.

Evaluation of carbon and nitrogen cycling in CA rice cover crop systems

CA Department of Food and Agriculture Healthy Soils Program (CDFFA-HSP)
Demonstration Project

Project team: W. Brim-DeForest, M. Leinfelder-Miles, S. Rosenberg, B. Linquist, L. Espino, S. Light, C. Pittelkow



Project background

- In CA rice systems, the typical winter practice is for fields to be either dry- or flood-fallowed.
- Cover cropping is not widely implemented, particularly on soils with high clay content and/or limited drainage.
- Potential benefits of cover cropping include:
 - Introduces crop rotation into the rice system
 - Increases soil organic matter
 - Reduces nitrogen losses and inputs
 - May improve rice straw decomposition
- The objective of this trial is to evaluate whether winter cover cropping improves soil health or rice yield



Project objectives

- The objective of this trial is to evaluate whether winter cover cropping improves soil health or rice yield.
- Also evaluating different cover crop species and mixes.
- Project will be implementing on three sites in Butte, Colusa, and San Joaquin counties from 2022-2025.
- Data collection will include soil sampling for organic matter, total nitrogen and nitrate-nitrogen; cover crop stand establishment and end of season biomass carbon and nitrogen inputs; and rice yield.

Soil health under deficit irrigation

Financial support from the South Delta Water Agency

Project team: M. Leinfelder-Miles, D. Putnam, I. Kisekka, D. Geisseler, W. Horwath, U. Gull, and V. Suarez Romero

Project background and objectives

- During the 2012-2015 drought, water shortages and regulatory curtailments meant that growers had to make tough decisions on how to apply scarce water resources.
- Some growers opted to cut irrigation to alfalfa since it is a deep-rooted crop that can scavenge water and nutrients from the soil profile.
- Research has shown that, while yield may be impacted, alfalfa is resilient during drought.
- ***Does soil health degrade under deficit irrigation (a proxy for drought)?***
- ***How might different levels of deficit and timing of deficit during the cropping season impact soil properties?***

Trial design

Treatments

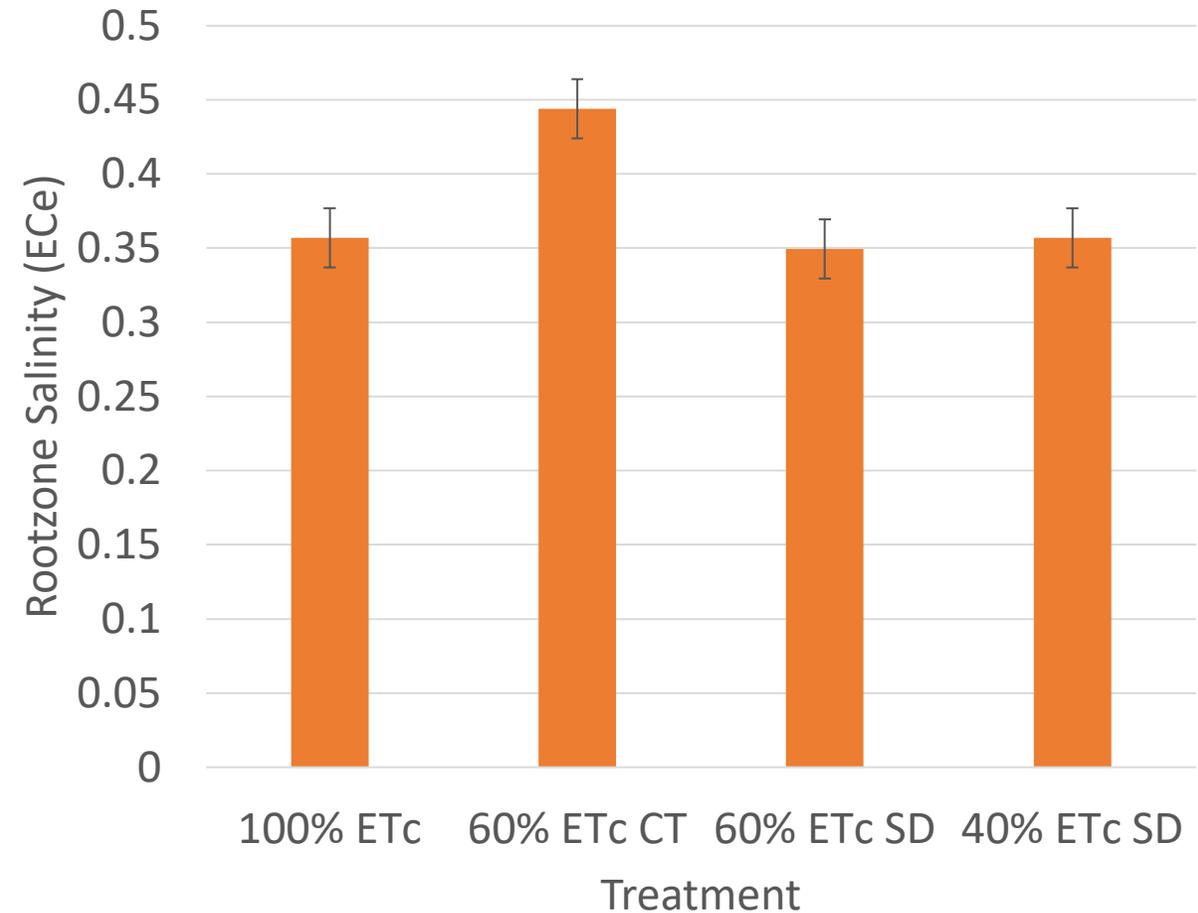
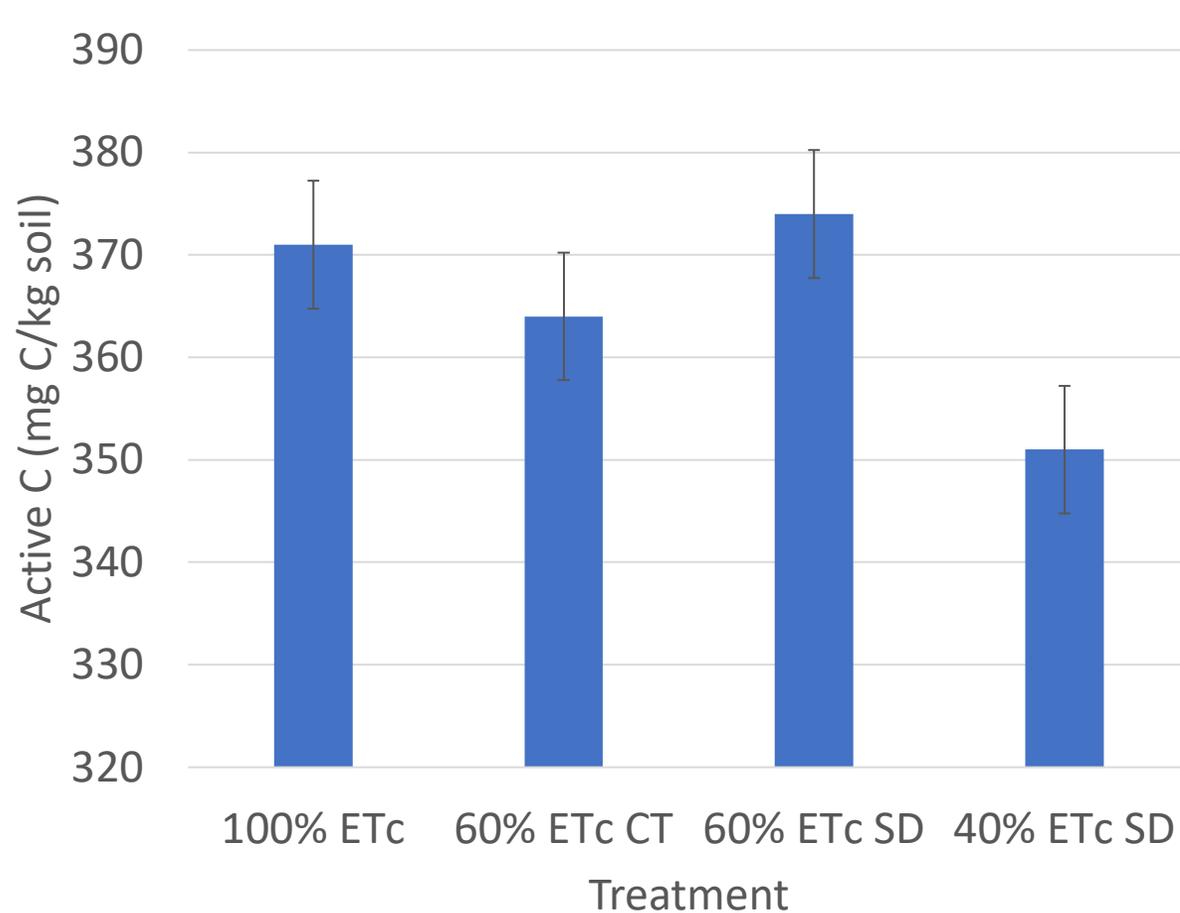
Full irrigation (100% ET_c)

Full early-season irrigation with a sudden cutoff later in the season
(60 percent ET_c, CT)

Sustained deficit where each irrigation imposes restriction
(60 percent ET_c, SD)

More-severe sustained deficit throughout the season
(40 percent ET_c, SD)

Deficit irrigation appears to negatively impact some soil health properties



(Preliminary results)



Lessons learned and grower guidance

- Soil health may not be resilient under deficit irrigation/drought, even if alfalfa is.
- The timing of deficit may be more important than the amount of deficit.
- Conundrum: annual alfalfa yield is better with cut-off treatment compared to sustained deficit.
- Policy implications of this work: water use prioritization may have implications for soil health.

Delta Drought Response Pilot Program (DDRPP)

A collaboration of state agencies and Delta water users/managers

Background

- The Delta experiences drought differently from how the rest of the state experiences drought.
- Rather than a physical shortage of water, the Delta is challenged by diminishing water quality (i.e. increases in salinity)
 - Reduced river (downstream) flows means the tidal influence comes further upstream
 - Recirculation of salts from state and federal project water deliveries and returns via the San Joaquin River.
- Other impacts may include levee integrity, sediment-filled channels, and harmful algal blooms

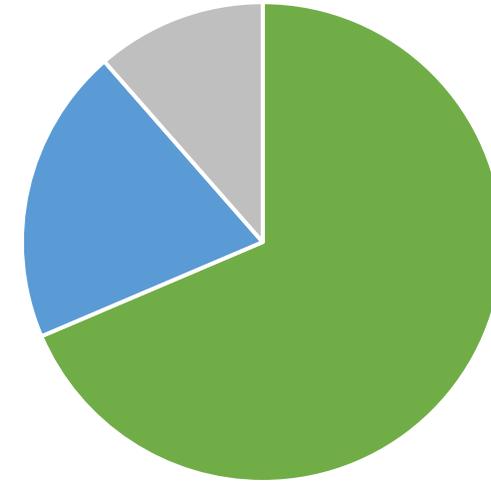
Project objectives

- In the face of continued drought, a group of Delta water users/managers/advisors and state agency representatives were organized to develop a program.
- Overall objective was to implement a variety of water conservation actions and monitor consumptive use compared to 'business-as-usual'
 - Participation was voluntary
 - Conservation actions were proposed by water users
 - Needed to propose at least 100 contiguous acres
 - Consumptive use data would be gathered through an open-source modelling platform called OpenET
 - Program required certain soil health practices

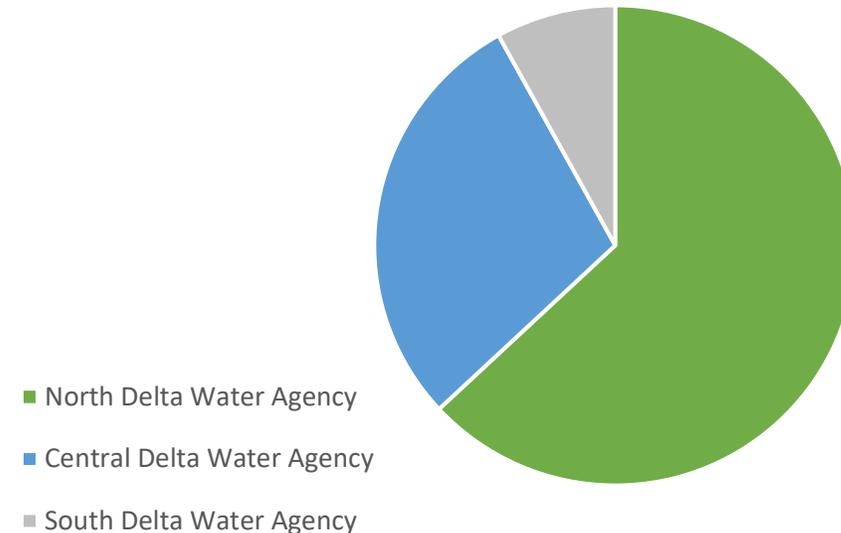
DDRPP Selected Projects

- 35 Projects Enrolled
 - 8,250 acres
 - Users estimated 20,000 ac-ft water savings
 - Per-acre fixed price
- \$10 Million Budget
 - \$1.6 Million to UC Davis for Monitoring
 - \$0.4 Million for Administration
 - \$8 Million for Grants to Farmers
- The Delta Conservancy administered the program.
 - Appointed a Selection Committee and Oversight Committee

Number of DDRPP Applicants by Delta Region



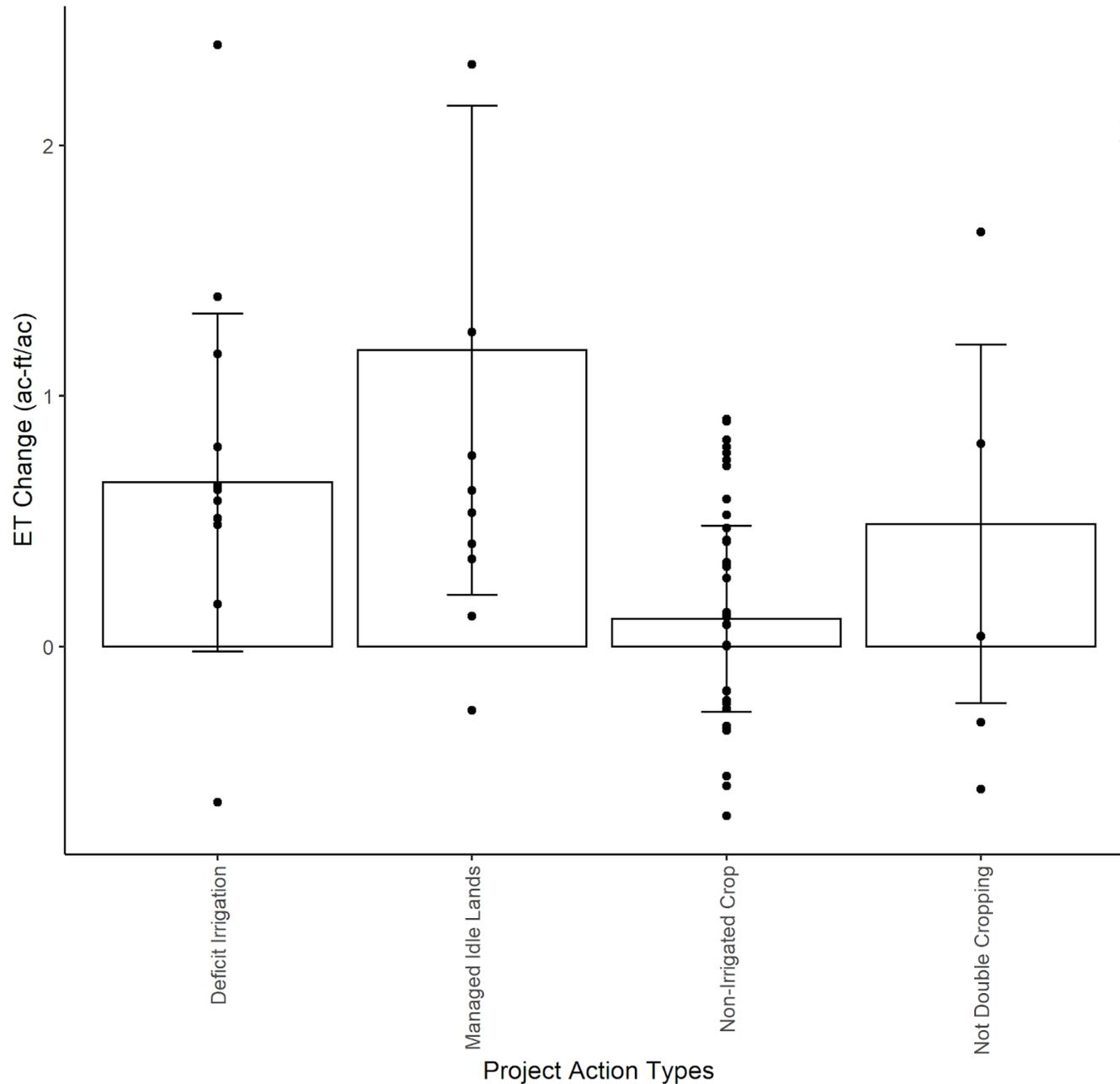
DDRPP Grantee Acreage by Delta Region



Project actions

# of Projects	Total Acres	Type	Example	Comparison Field
32	4987	Non-Irrigated Crops	Plant safflower instead of Corn	Planted w/ non-DDRPP crop
12	1474	Deficit Irrigation	No or minimal applied irrigation on alfalfa	Same crop type, irrigating normally
9	1390	Managed Idle Lands	Instead of planting corn, farmer is spraying or mowing weeds, to prevent bare soil	Planted to planned crop/use
5	549	Single Crop instead of Double Crop	Harvest winter crop but forego planting summer crop	Double cropped with same crop type

Same Field Change ET Change



Estimated water savings (ac-ft/ac)

- Deficit irrigation: 0.70 +/- 0.73
- Managed idle land: 1.18 +/- 0.98
- Non-irrigated crop: 0.11 +/- 0.98
- Not double cropping: 0.49 +/- 0.72
- Approximate total water savings: 3,694 ac-ft
- Program achieved water savings, but not at the scale that was estimated.

Continuing activities

- DDRPP 2022 summary report will be available soon.
- DDRPP was funded again for 2023.
 - 64 bids accepted
 - 16,492 total acres
 - Used a bidding process instead of a flat rate
 - Bid price ranging from \$500-695/acre
 - Grants are currently being executed
 - OpenET estimates will be compared with ground measurements

Thank you!

Michelle Leinfelder-Miles

(209) 953-6100

mmleinfeldermiles@ucanr.edu

<http://ucanr.edu/sites/deltacrops/>

<http://ucanr.edu/blogs/sjcfieldcrops/>

UC
CE