

# Quantitative Assessments of Water and Salt Balance for Cropping Systems in the Lower Colorado River Region

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THE UNIVERSITY OF ARIZONA

Yuma Center of Excellence  
for Desert Agriculture

# External Collaborations

- U.S. Bureau of Reclamation: Water Smart
- USDA-ARS: US Arid Land Agricultural Research Center
- USDA-ARS: US Salinity Lab
- University of California Riverside: USDA/Artificial Intelligence for Agriculture
- Arizona State University and Planet Labs



# Summary of Yuma Studies 2016-2023

November 2023

## Quantitative Assessments of Water and Salt Balance for Cropping Systems in the Lower Colorado River Region

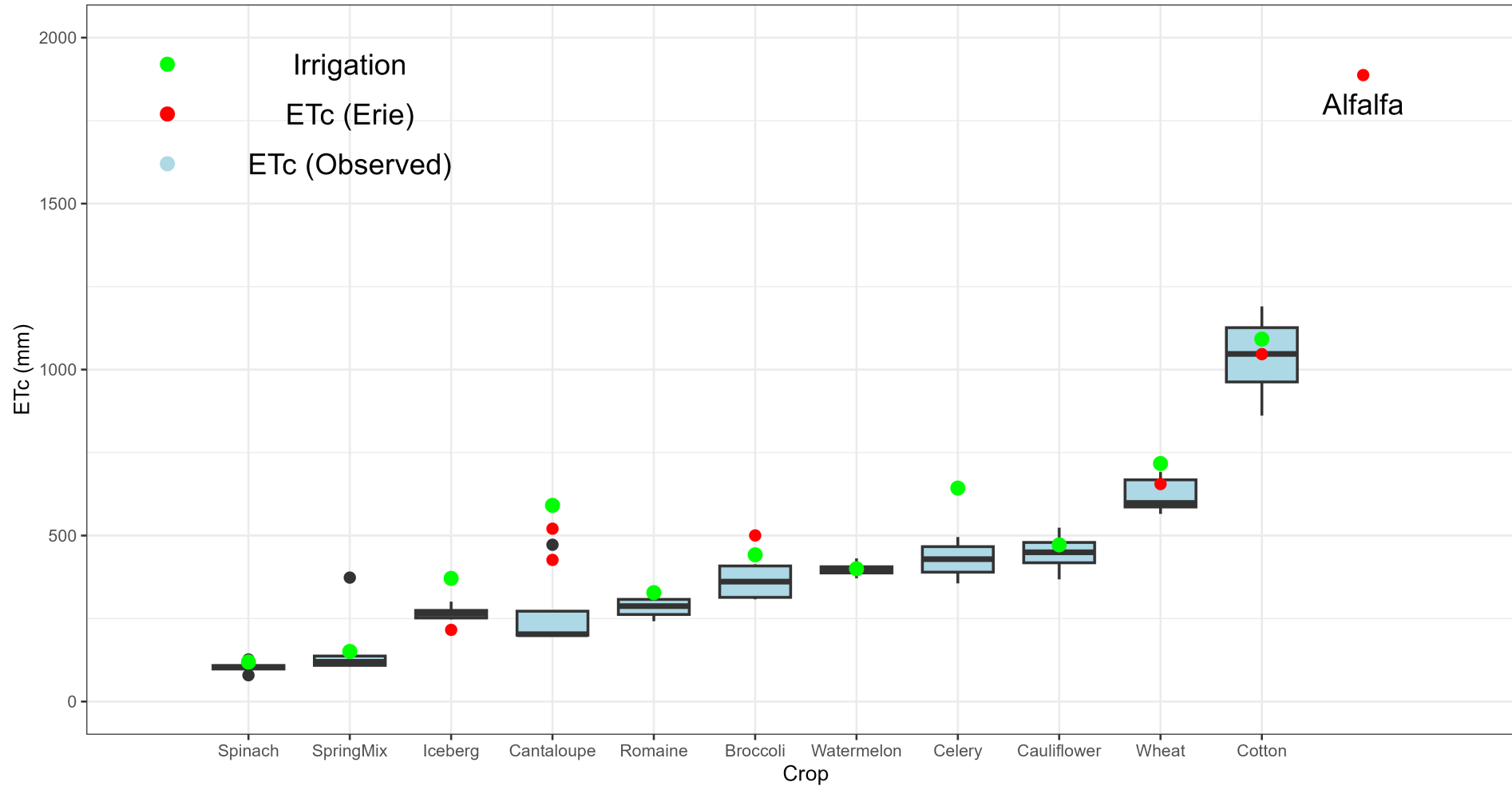


 A report for the  
Yuma County Agriculture Water Coalition

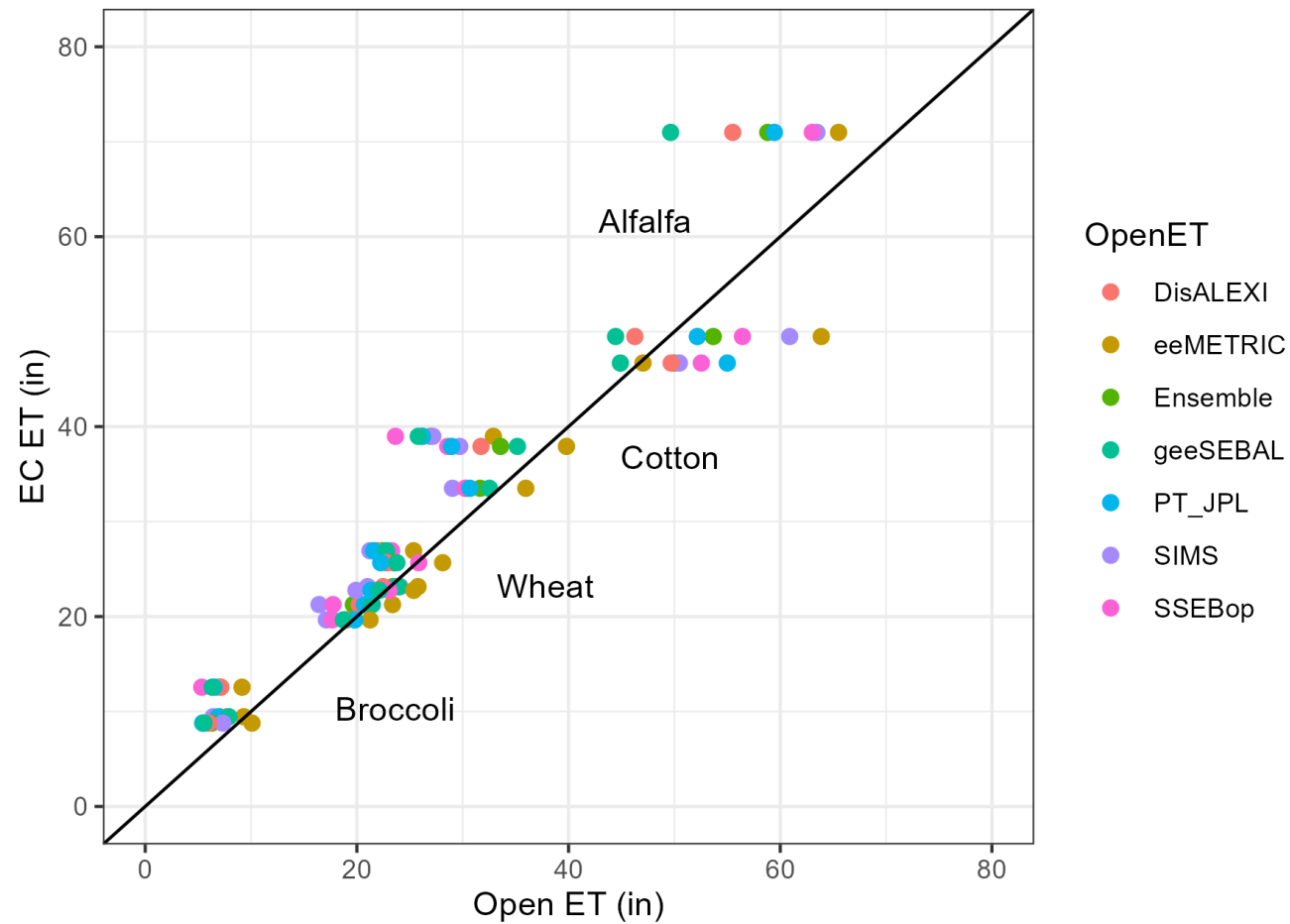
- Revised water use estimates for 14 crops
  - 5 direct comparables, 9 new
  - Broccoli, Cauliflower decreased, Lettuce increased
  - Efficiencies high, 80-90%
  - First evaluation of efficacy of current vs. drip irrigation
  - Consequences of fallowing
- Updated salt balance and salt management recommendations
  - Identified and quantified salt loading events
  - Importance of pre-irrigation
- Evaluated USBR accounting of consumptive use of water by crops
- Tested and evaluated remote sensing to monitor crop growth
- Development of irrigation and salt management App

# Consumptive Crop Water Use

Quantitative Assessments of Water

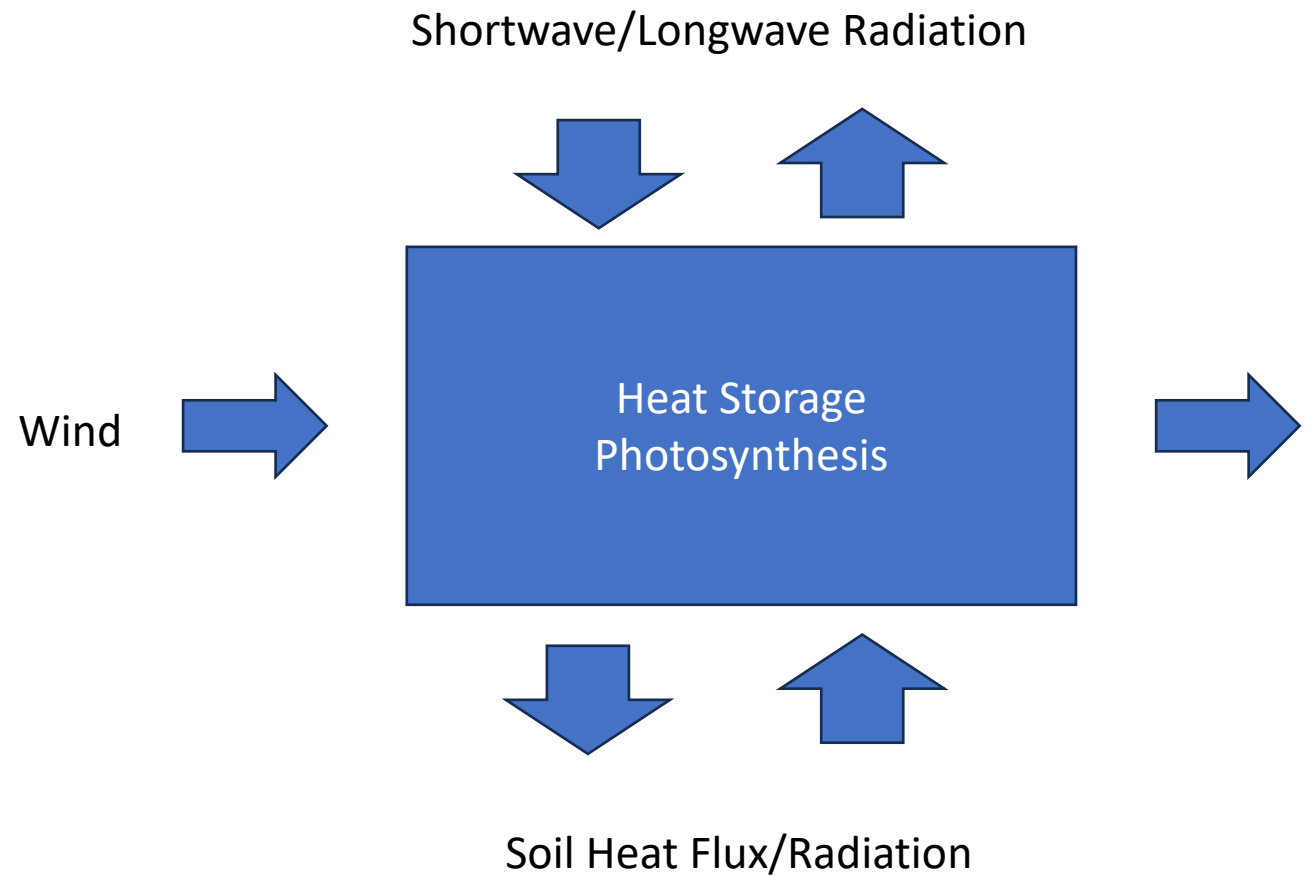
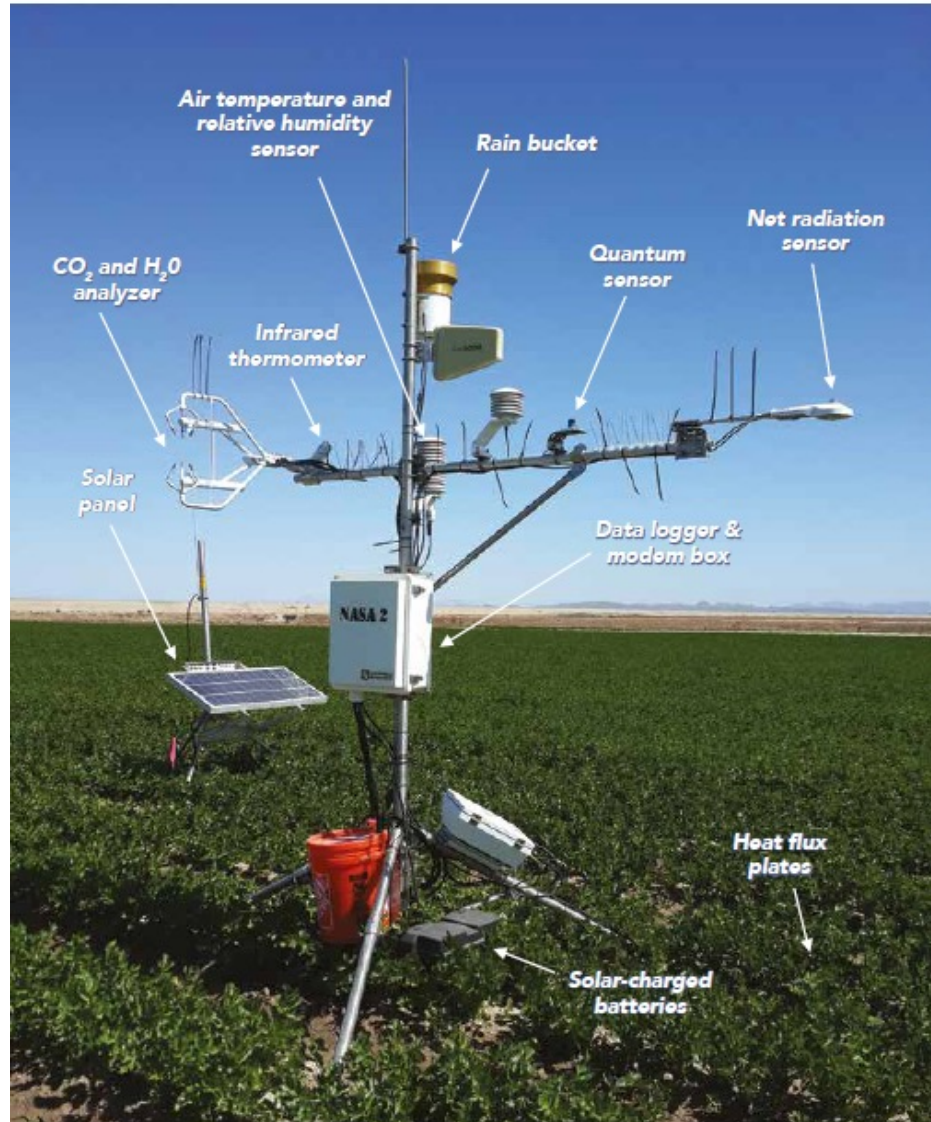


# Consumptive Water Use: EC vs. OpenET



C:/Data/rprogs/rprogs/plotOpenET\_vs\_ECET.R

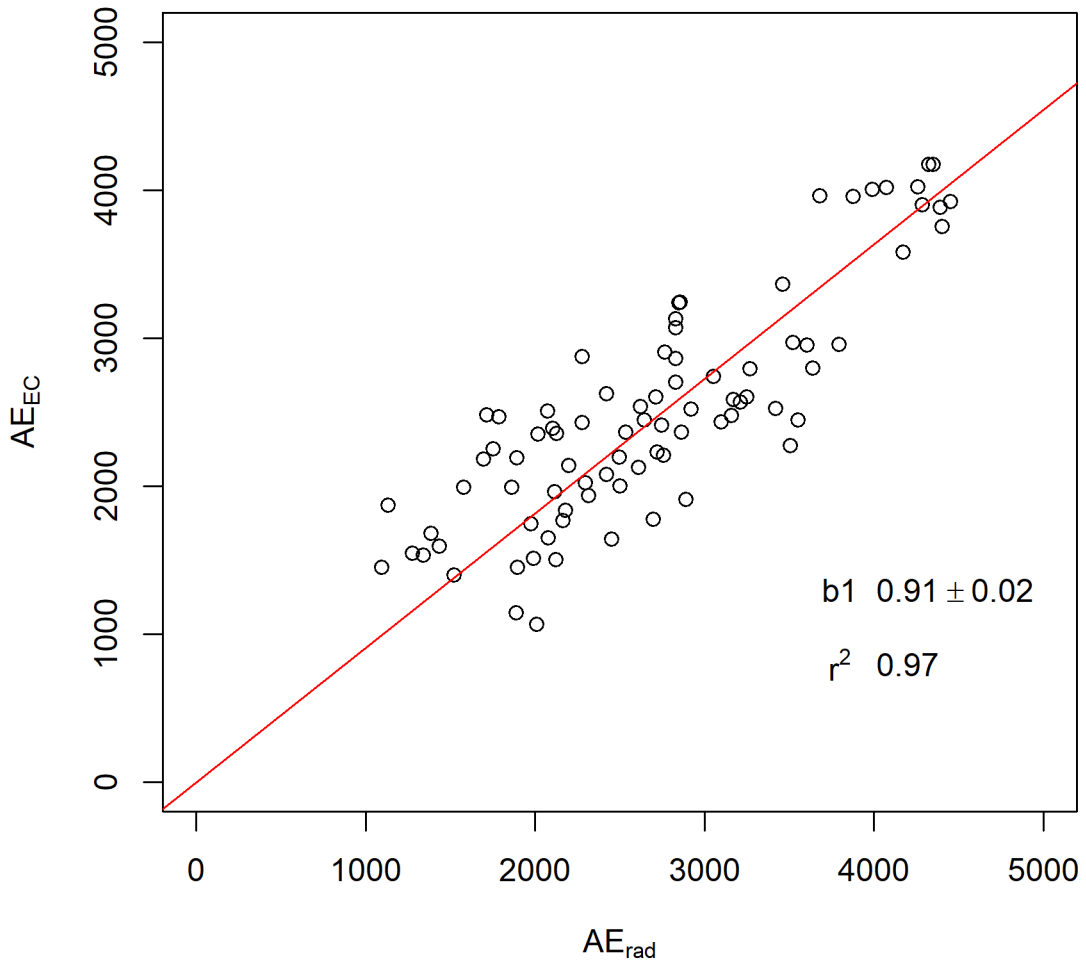
# Eddy Covariance Technique



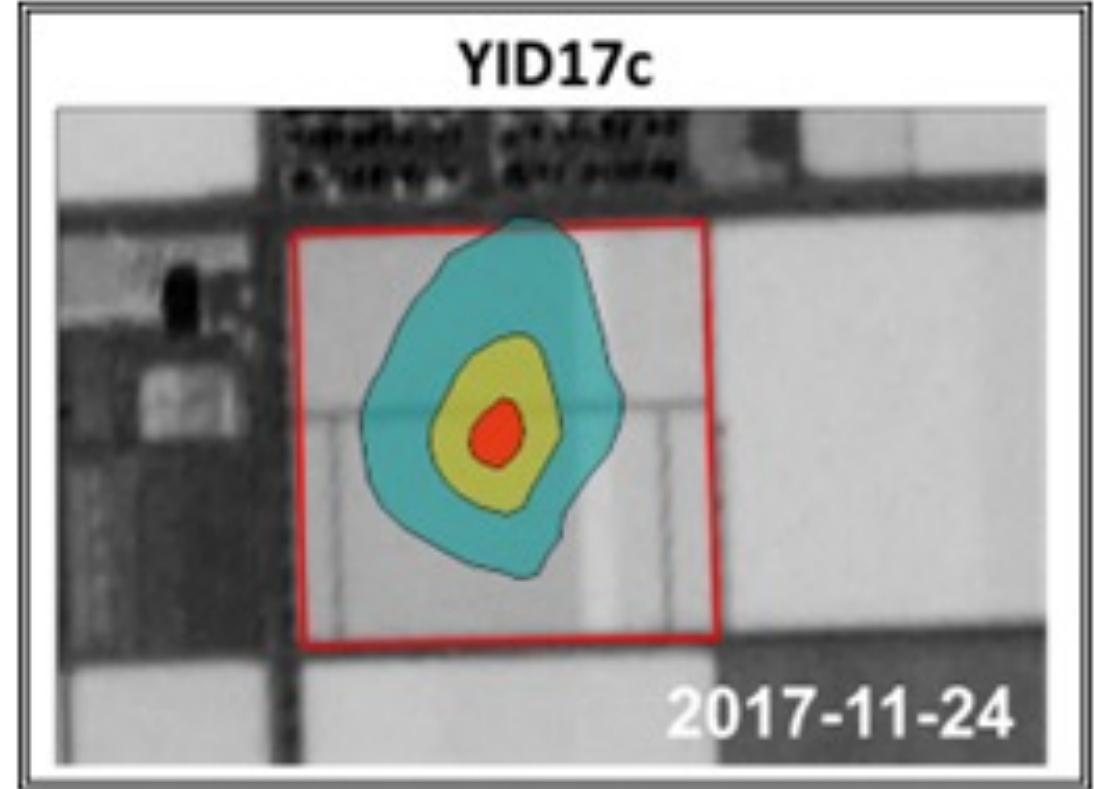
$$R_n - G = H + LE + dQ + F$$

# Eddy Covariance Errors

## Energy Balance Closure

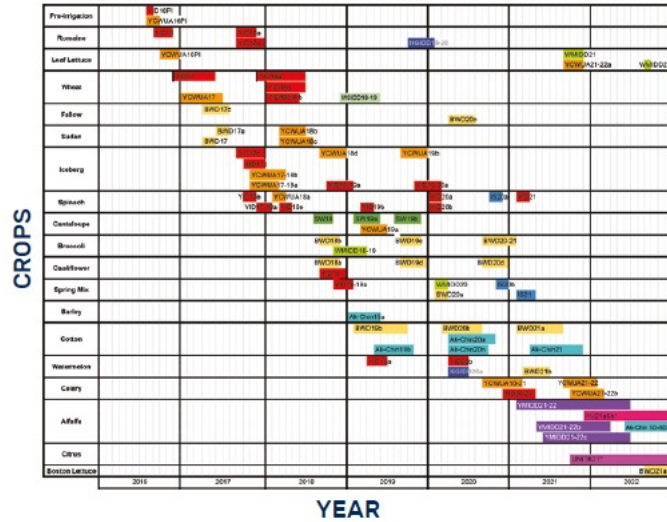


## Flux Footprint

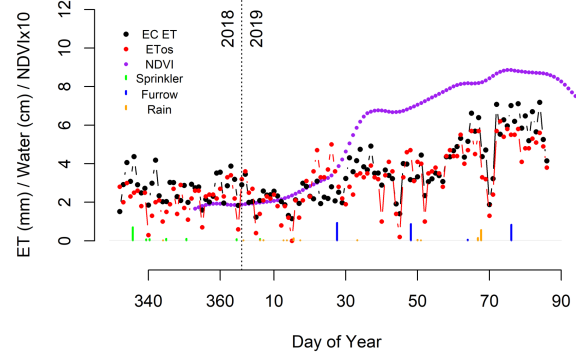


# Water and Crop Growth 2016-2023

## EDDY COVARIANCE DEPLOYMENTS

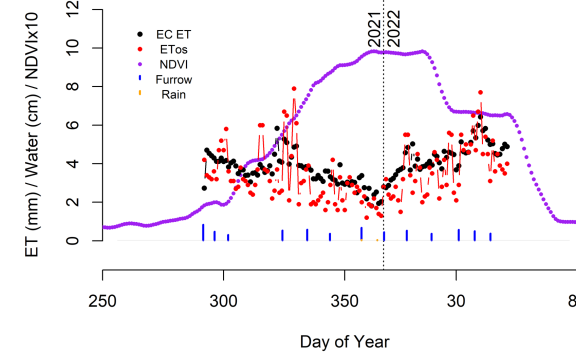


### Broccoli WMIDD18-19



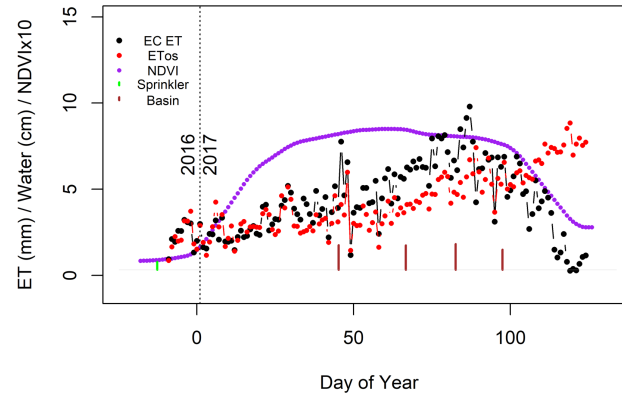
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### Celery YCWUA21-22B



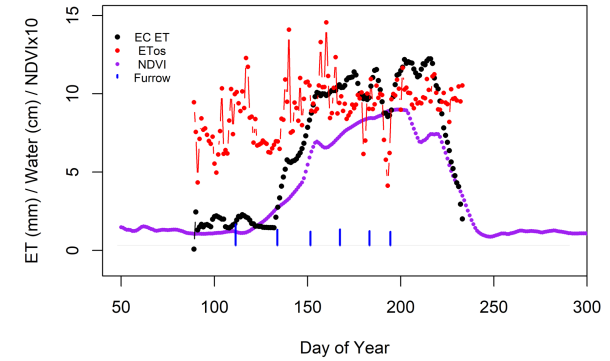
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### Wheat YID17



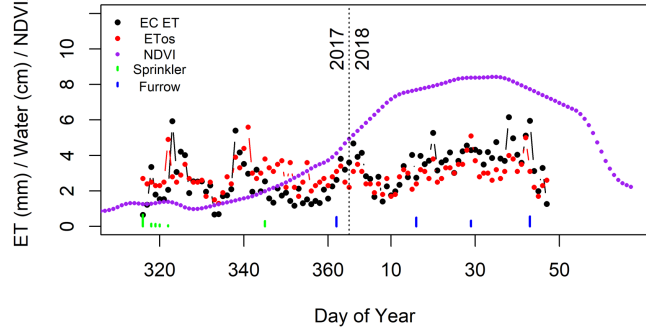
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### Cotton BWD20b



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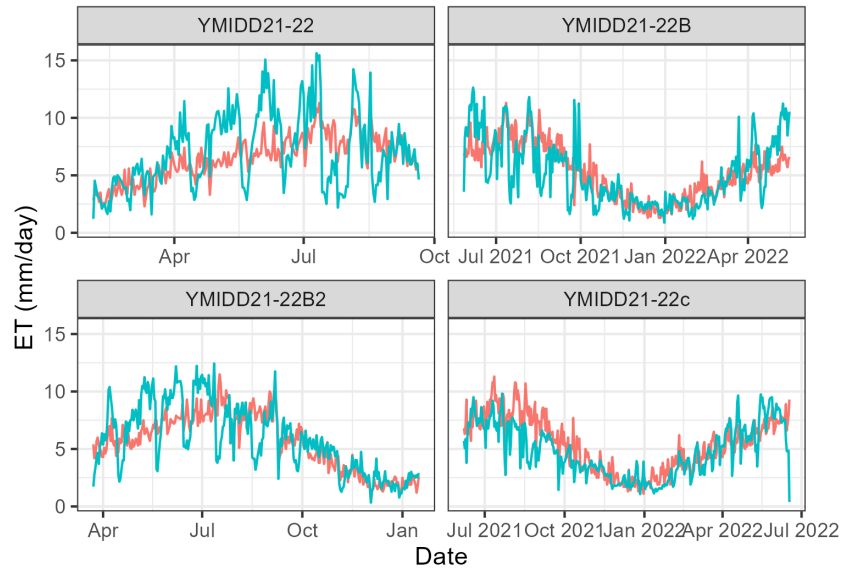
### Iceberg YCWUA17-18a





# Alfalfa

Alfalfa Yuma Mesa



Eddy Covariance Data



Drone Data

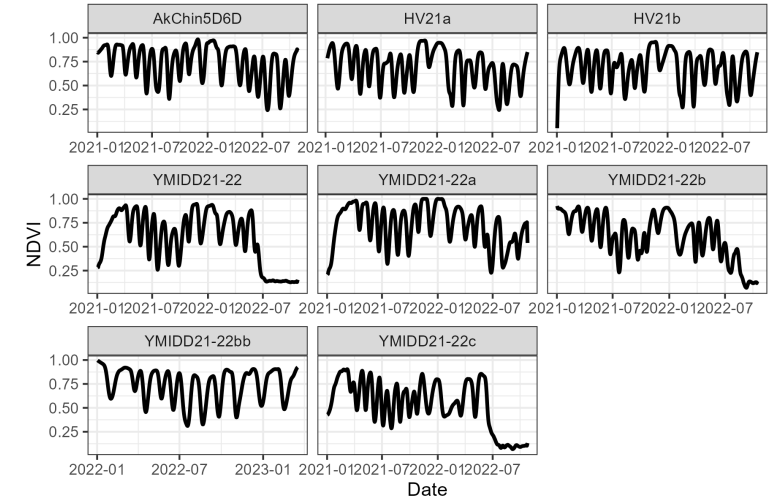


Eddy Covariance Deployment

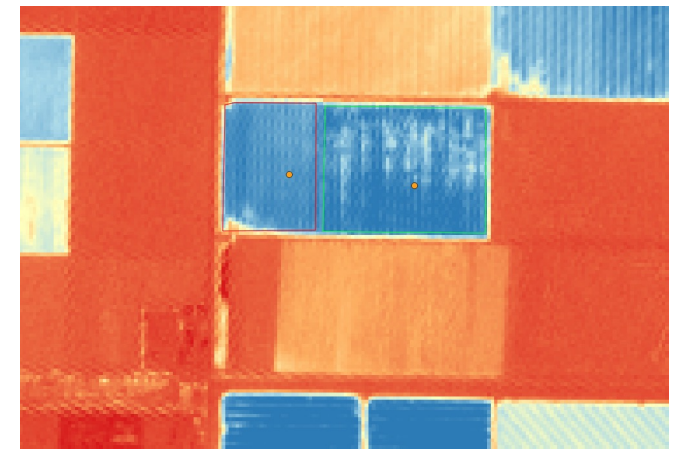


Irrigation Volume

Remote Sensing: Alfalfa



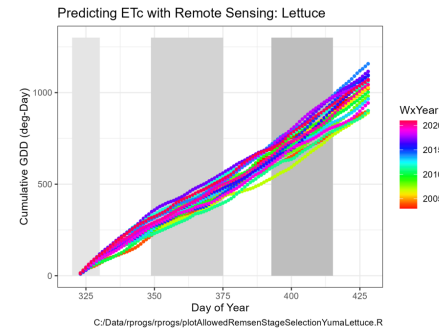
Satellite Remote Sensing



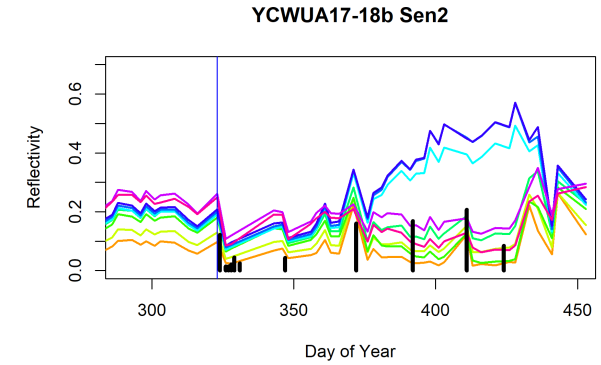
Flood vs. Drip

# Predicting Water Use: Weather & Remote Sensing

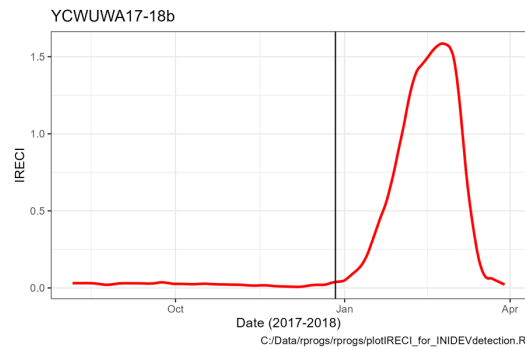
1. Heat Units



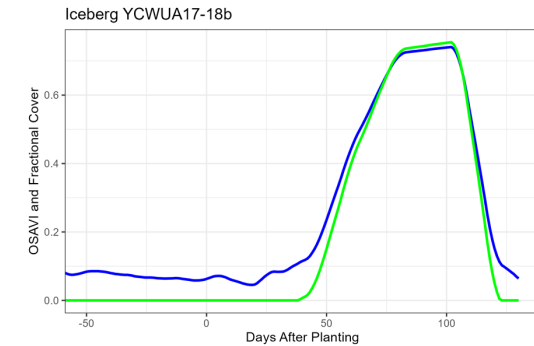
2. Irrigation detection



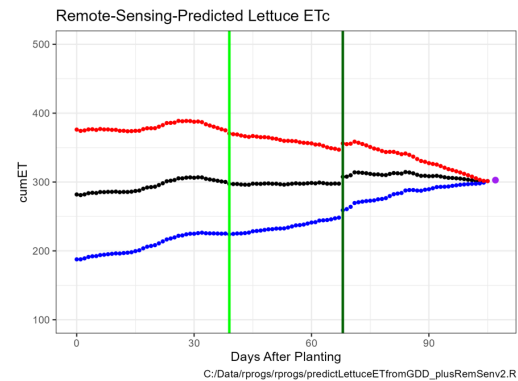
3. Plant Emergence



4. Fractional Cover

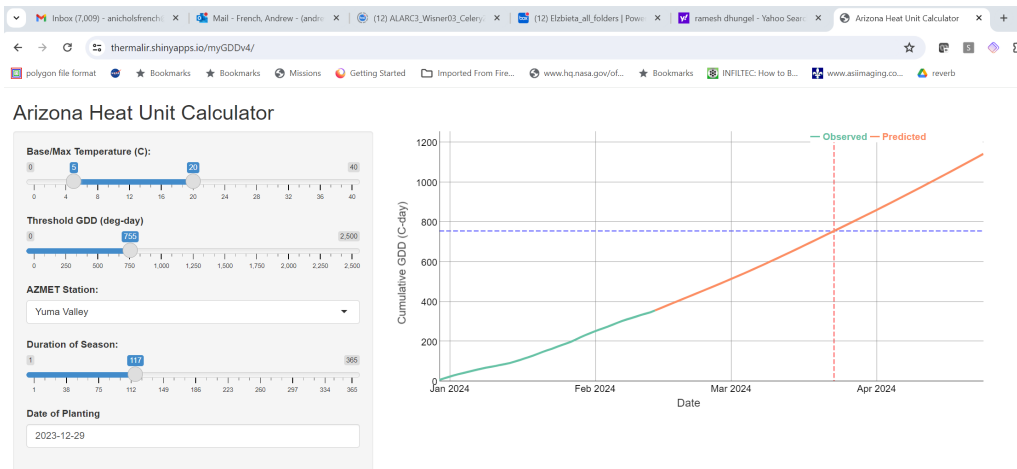


5. Crop Growth Modeling



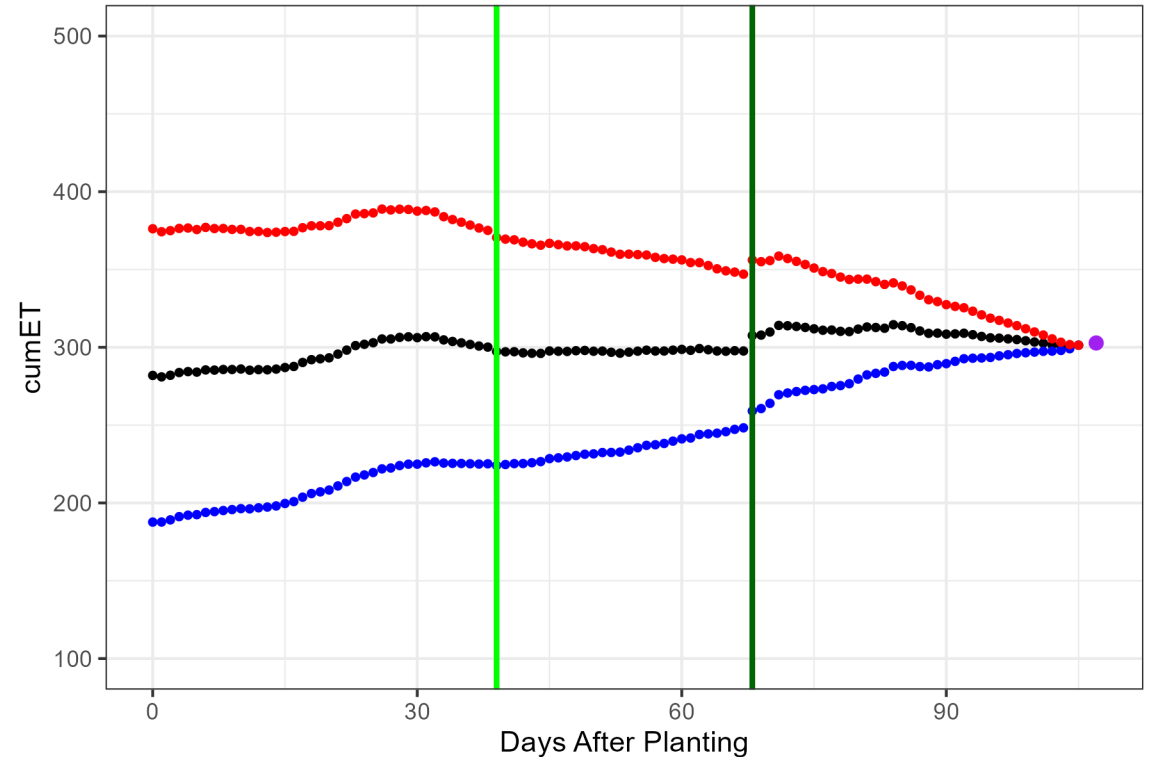
# Predicting Water Use: Heat Unit Tool & Remote Sensing

## Heat Unit Predictor for Arizona



<https://thermalir.shinyapps.io/myGDDv4/>

## Remote-Sensing-Predicted Lettuce ETc



C:/Data/rprogs/rprogs/predictLettuceETfromGDD\_plusRemSenv2.R

Error in Climatology Less than +/- 1 SD

## Summary of Studies at YCEDA



- Launched project in 2016 to fill gaps
- Collaborative project
- Quantified crop water use for 14 crops in Yuma
- Tracked where and when soil salts moved
- Published & publishing results
- Data to be archived and accessible
- Current crop studies on alfalfa and citrus
- Prediction methods using remote sensing