

# A Study Comparing Ways to Estimate Crop Evapotranspiration in the Delta

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# Overview

Origin and Purpose of the Study

Study Sponsors and Participants

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Primary Findings

Potential Implications and Applications

What's Next?



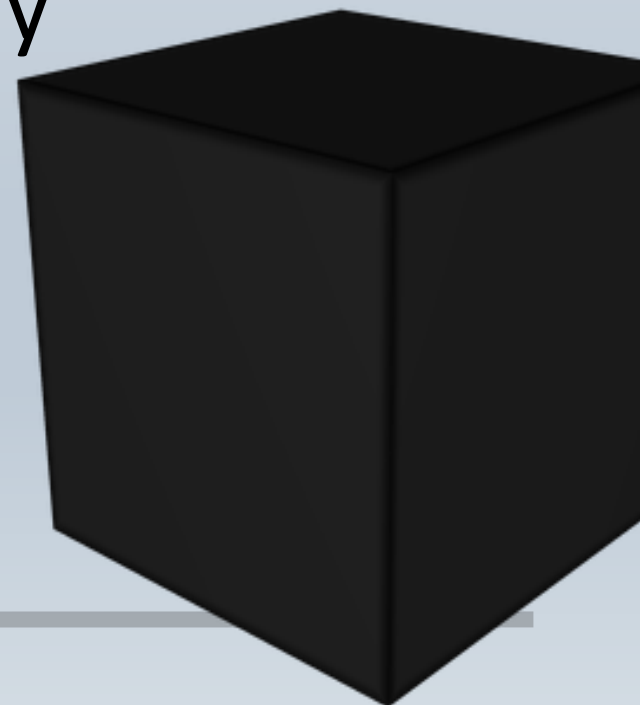
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# The Challenge

Lack of Accurate and Timely Understanding of Crop CU  
Hampers Water Management and Regulation

Estimating Crop Consumptive Use is Inherently Difficult in the  
Complex Setting of the Delta

- It's Big and Varied (Elevations, Soils, Winds, Water Quality, etc.)
- Land Uses and Crop Covers Evolve Constantly
- Most Models Treat the Delta as a Black Box



# Crop Consumptive Use Is Important

CU is Most Critical in Shortage Conditions (like 2015)

- “Delta Island Consumptive Use” Estimates
- Delta Mass Balance (Water Volume and Quality)



- Export Project Management
- Water Rights Administration and Transfers
- Agricultural and Restoration Planning

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# Origin of Study Proposal

The SWRCB Convened Interested Parties in February 2015

The “Coalition of the Willing” Surveyed the Current State of the Science

- Reviewed Proof-of-Concept Research
- Surveyed Challenges Faced by Proposed Transfers
- Recognized Impact of Microclimates
- Identified Seven Reported Estimation Methods

Volunteers Agreed to Collaborate to Meet the Challenge

# Organizing Principles

- Include a Broad Array of Stakeholders
  - ✓ Maintain Neutrality and Credibility
  - ✓ Assure Representation of Multiple Perspectives
  - ✓ Attract Funding, “Skin-in-the-Game” and Consistent Review of Progress
- Focus on Practical Application and Informative Comparisons (not Pure Science)
- Improve Utility of all Methods Through Peer-to-Peer Collaboration (not a Beauty Contest to Pick a Winner!)



# Financial Sponsors

- State Water Resources Control Board
- Department of Water Resources
- Delta Stewardship Council
- Delta Protection Commission
- Delta Conservancy
- North Delta Water Agency
- Central Delta Water Agency
- South Delta Water Agency



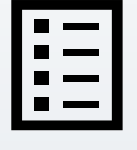
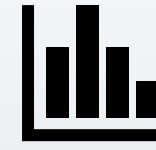
# Research Participants





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# Organizing the Research



- Sponsor for Each Method Subject to Comparison
  - ✓ Two Department of Water Resources Models
  - ✓ Five Energy Balance Methods Relying on Analysis of Satellite Images
- Campaign to Capture Field-level Calibration Data
- Central Team to Collect, Organize and Maintain Data
- Land Use Survey (supported by “ground truthing” and independent QA/QC team)
- Combined Blind Tests, Common Datasets and Collaborative Interaction

# Primary Findings

The Ensemble Mean of all Methods Confirms Delta Crop CU at  $\pm 1.4$  Million Acre-feet/Year

Accuracy of All Methods Improved with Collaboration (All Methods Were Brought within 11% of Mean)

*Study Process Illuminated some Systemic Differences Between Methods*

**Remote Sensing Methods Provide Reasonably Reliable Basis for Accurately Estimating Crop ET**



# Additional Insights

- The Science of Remote Sensing and the Frequency of Observation are Both Advancing Rapidly
- Applications of Estimation Methods Vary Widely in Cost, Expertise, Invasiveness, Frequency, and Consistency
- A Significant Portion of CU in the Delta is from non-Agricultural Uses



# Policy Implications and Applications

## **Study Demonstrates Capacity to Estimate Crop ET at the Field Level**

- Are Estimates “Close Enough for Government Work”?
- What is the Process/Value of Government Converging on a CU Method across Agencies?
- How Will Scientific Research be Adapted to Practical Use?
- How Can Policy Encompass Uncertainties in Estimates?
- How Closely Does Crop CU Correlate with Diversion Measurement?



# What's Next?

- Further Explore Prospects for Improvements and Convergence Among Methods
  - ✓ Fodder for Ph.D. Theses
- Need More Research to Develop Useful Comparison of CU in Fallow Fields
  - ✓ Pilot Field Study is Currently Underway
- This Study Should Boost Parallel Research in Adapting Remote Sensing to non-Crop Water Use
  - ✓ May 3 - Brown Bag Presentation

# What's Next?

- Moving Scientific Research to Practical Field Application
  - ✓ Open ET
- Evaluation of Hypothesis that Remote Sensing Could Augment Diversion Measurement in the Delta
  - ✓ Still Out on the Horizon



An aerial photograph of a winding river flowing through a lush green landscape. The river is a deep blue color and curves through the scene. On the left bank, there is a paved path and a grassy area. The surrounding land is a mix of green grass and some brownish patches, possibly indicating a dry or semi-arid environment. A blue semi-transparent box is overlaid on the left side of the image, containing white text.

Conclusion:

We've Made Important Progress on  
a Gnarly Problem...and Still Have  
Work to Do

An aerial photograph of a winding canal or waterway cutting through agricultural fields. The water is a light blue-green color. In the center of the canal, there is a small island or peninsula with a marina containing several boats. The surrounding fields are in various stages of cultivation, with some appearing brown and others green. The overall scene is a mix of natural waterways and human-made agricultural infrastructure.

# Questions?

Complete Crop CU Study Information  
Available Here

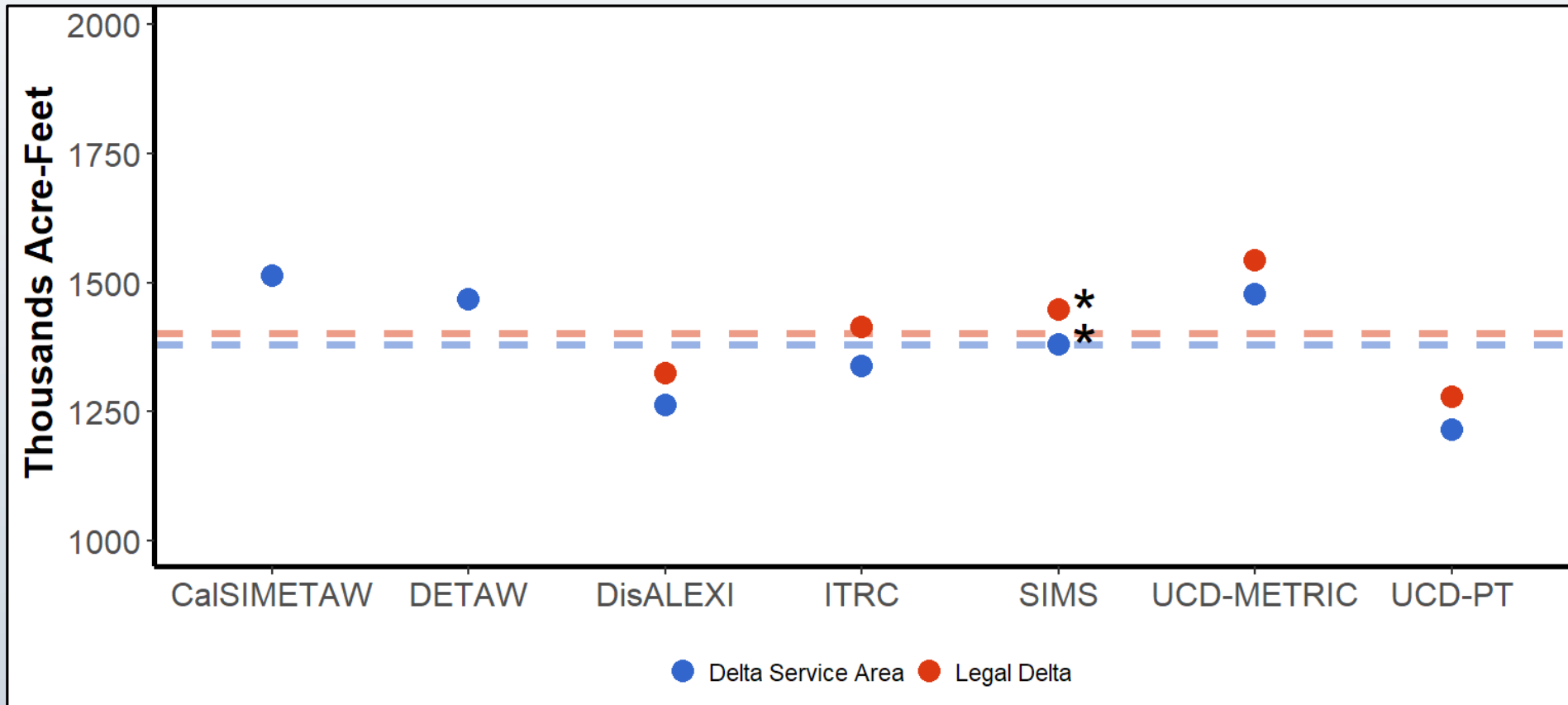
[https://www.waterboards.ca.gov/water\\_issues/programs/delta\\_watermaster/crop\\_c\\_u\\_study.html](https://www.waterboards.ca.gov/water_issues/programs/delta_watermaster/crop_c_u_study.html)



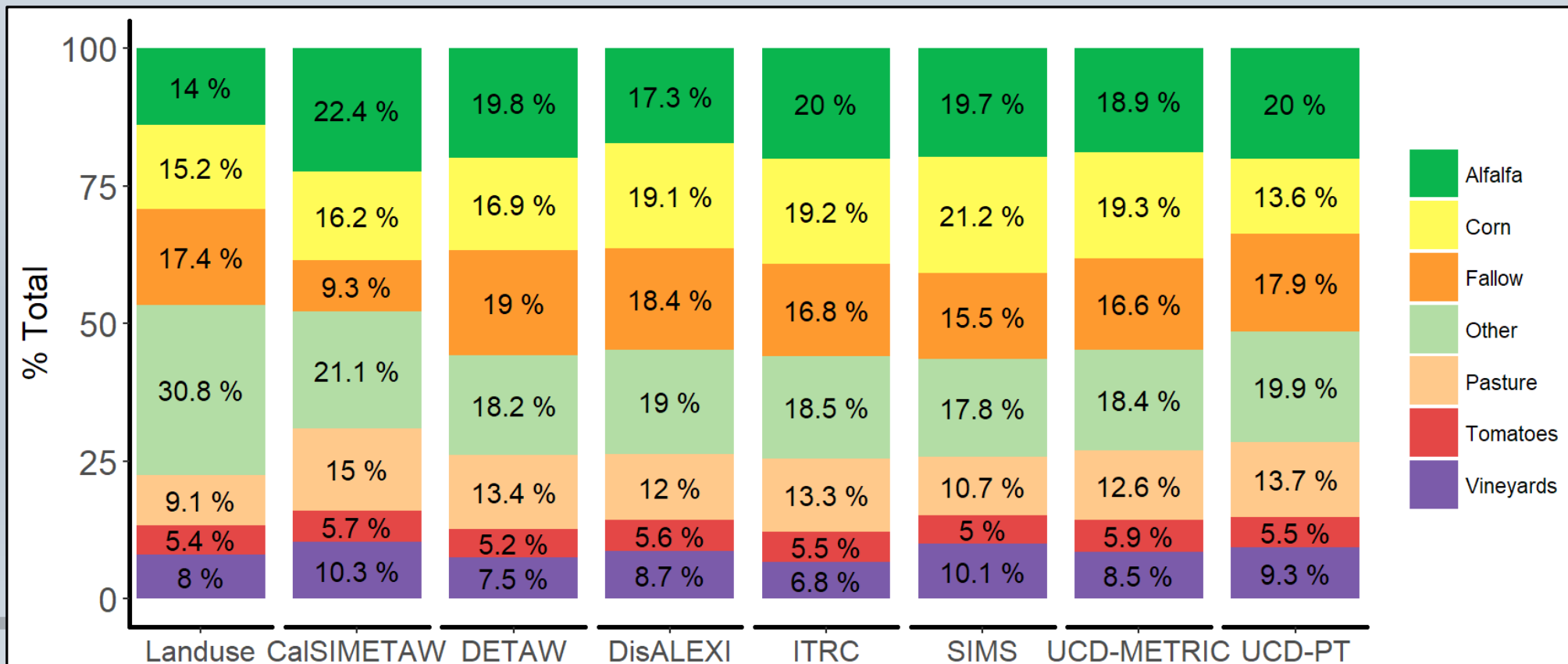
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# Extra Slides

# Primary Findings



ET from  
Agricultural  
Lands



# Primary Findings

## Land Use and Mean ET

