

Monitoring Vineyard Water Use and Vine Stress for Improved and Sustainable Water Management

Presented by:

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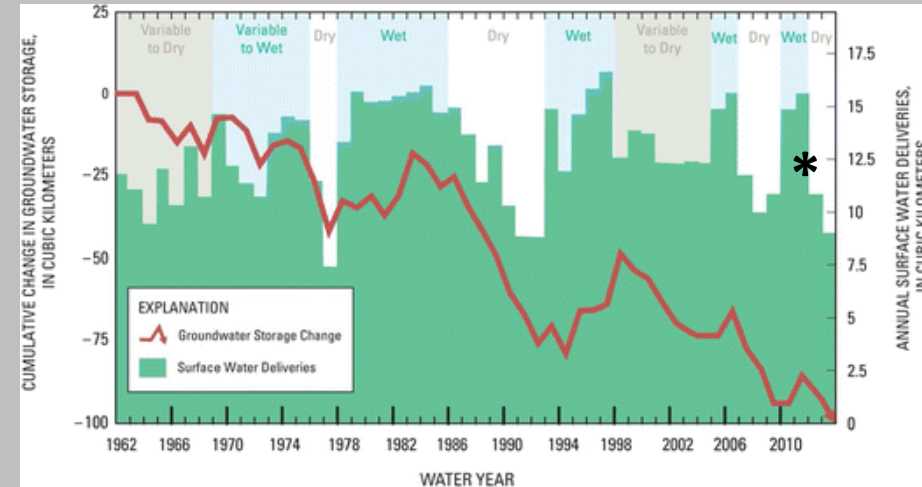
The Problem

250,000 ha

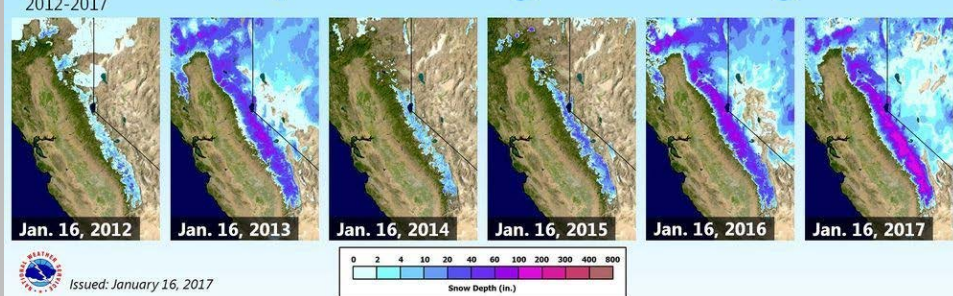
Wine Grape
Production
(13,000 ha/yr)

\$3B

Water Resources
(groundwater storage)
(snowpack)



Sierra Snowpack Through The Drought



*Faunt, C.C. et al., Water Availability and land subsidence in the Central Valley, California (2016)

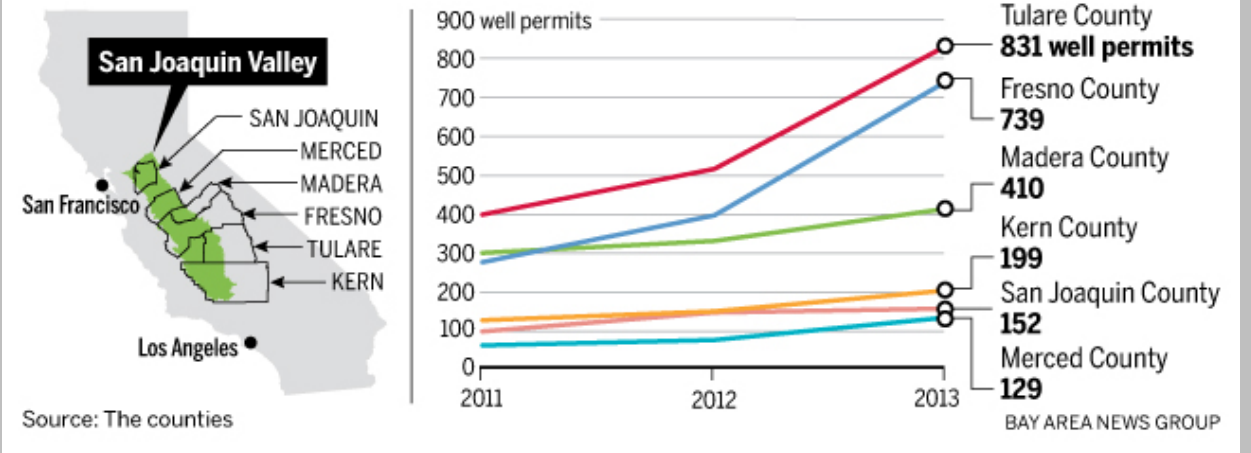
Importance / Why it Matters

Vineyards/Orchards are replacing annual crops and pastures, effectively “hardening demand” for water use.

Economics are creating a “Race to the Bottom”. Growers with sufficient financial resources are able to drill deeper wells to sustain production, forcing out other farmers that cannot afford the added expense.

Rush to drill

Because surface water is scarce, an increasing number of wells have been drilled in the San Joaquin Valley to provide reliable water supplies. California law gives landowners the right to the water under their property. But because groundwater is a limited resource, the state is growing concerned about this proliferation of wells.



Must Improve Water Management

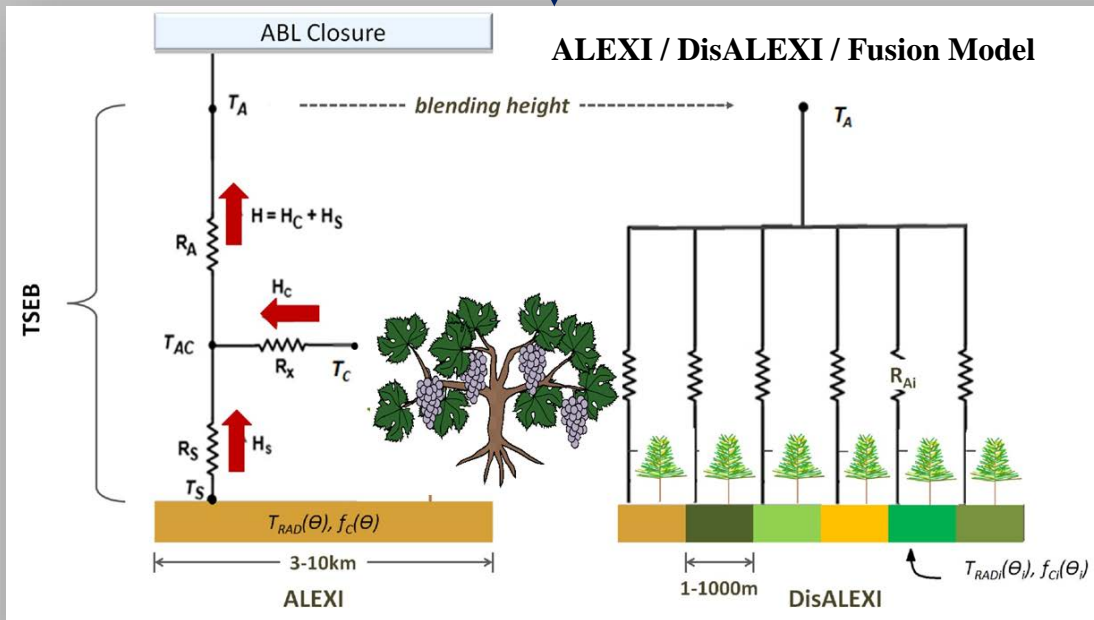
Potential Solution at Field to Regional Scale

30m ET

Provide a range of products based on satellite-derived maps of *Evapotranspiration (ET)*

Model used to estimate ET

Shown to be a critical part of improving management of water resources by providing *quantifiable values of water use and stress*.



Why?

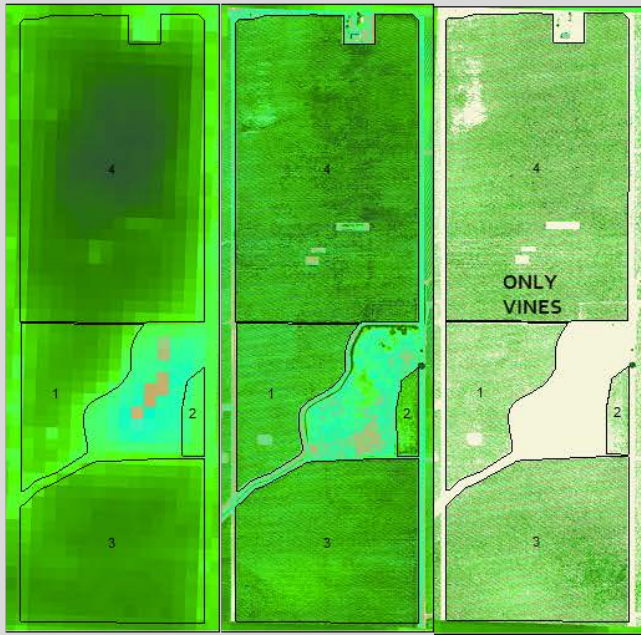
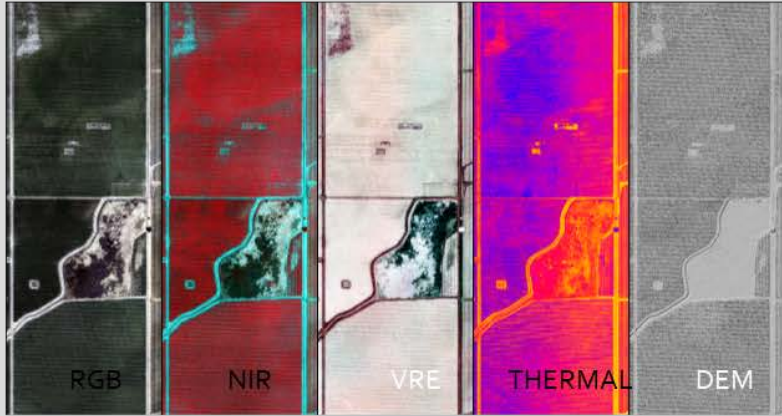
- Physically-based
- Daily / 30-m ET estimates
- Does not require ground-based inputs or Calibration
- Well tested over multiple surfaces



Incorporating UAV High Resolution Imagery

UAV imagery = Sensors-Landsat fusion / subfield characterization

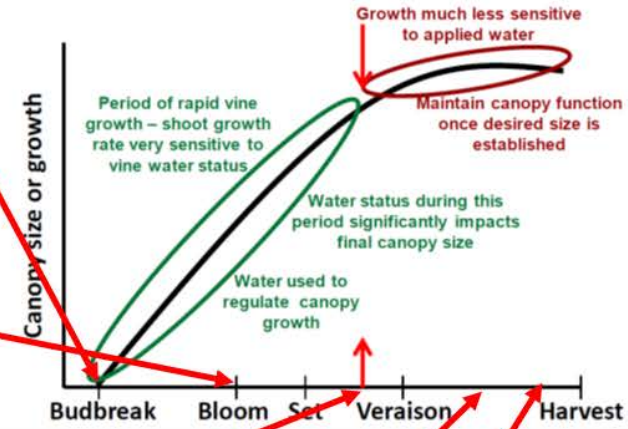
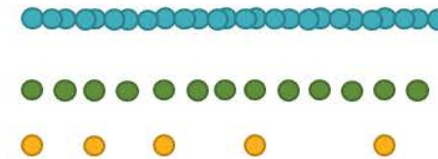
Potential Solution
at canopy scale



GOES/MODIS
Landsat
UAV/Aircraft



Overpass frequency



Optimal frequency for submeter information

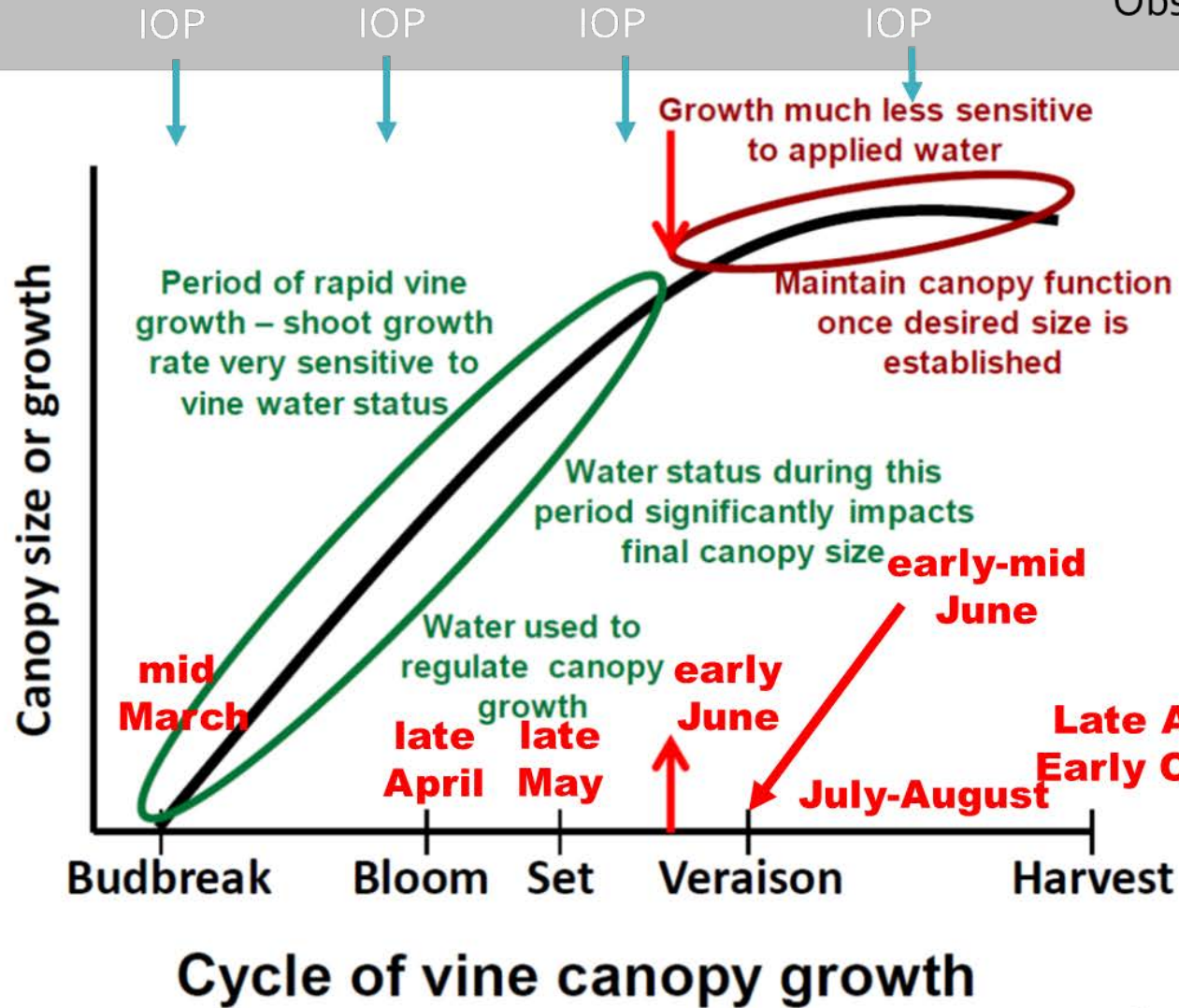
Validation of Potential Solutions

GRAPEX Approach

Vines Management / Physiological Awareness

IOP:
Intense
Observation Period

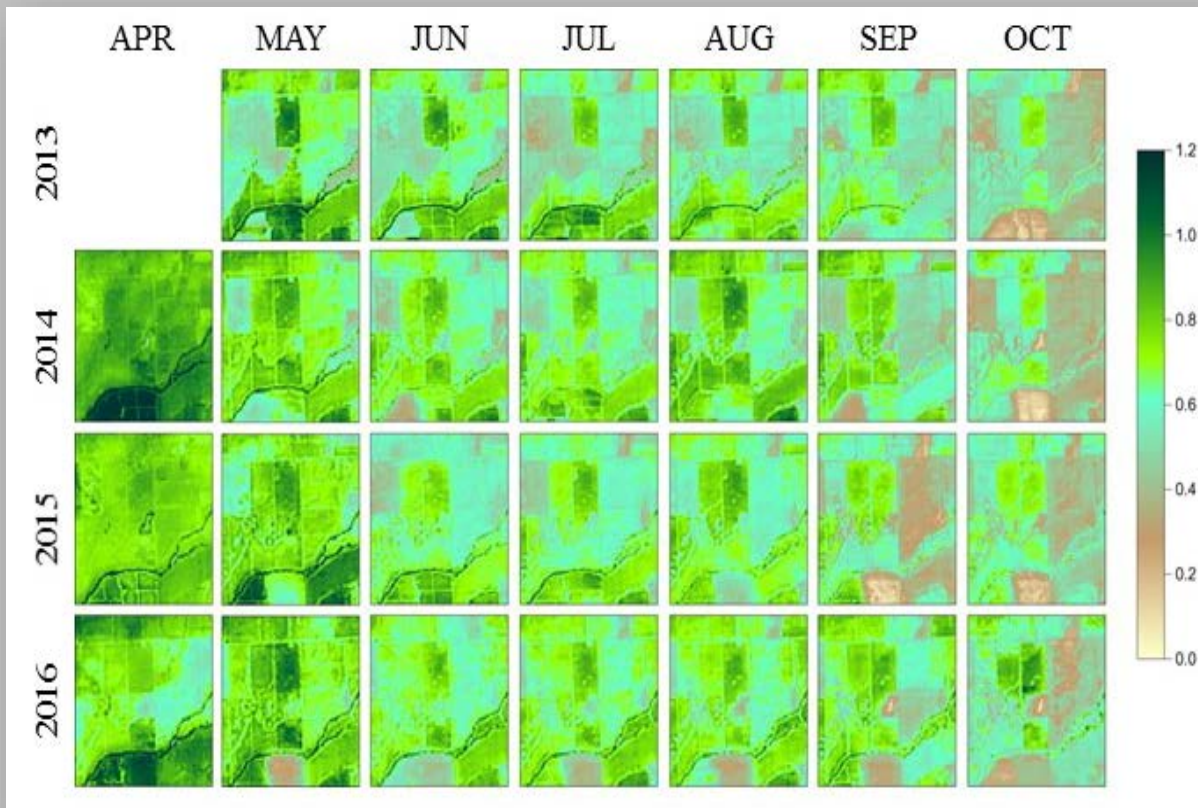
Combining ground biophysical, remote sensing, biometeorological and high resolution aerial imagery with satellite obs. and models



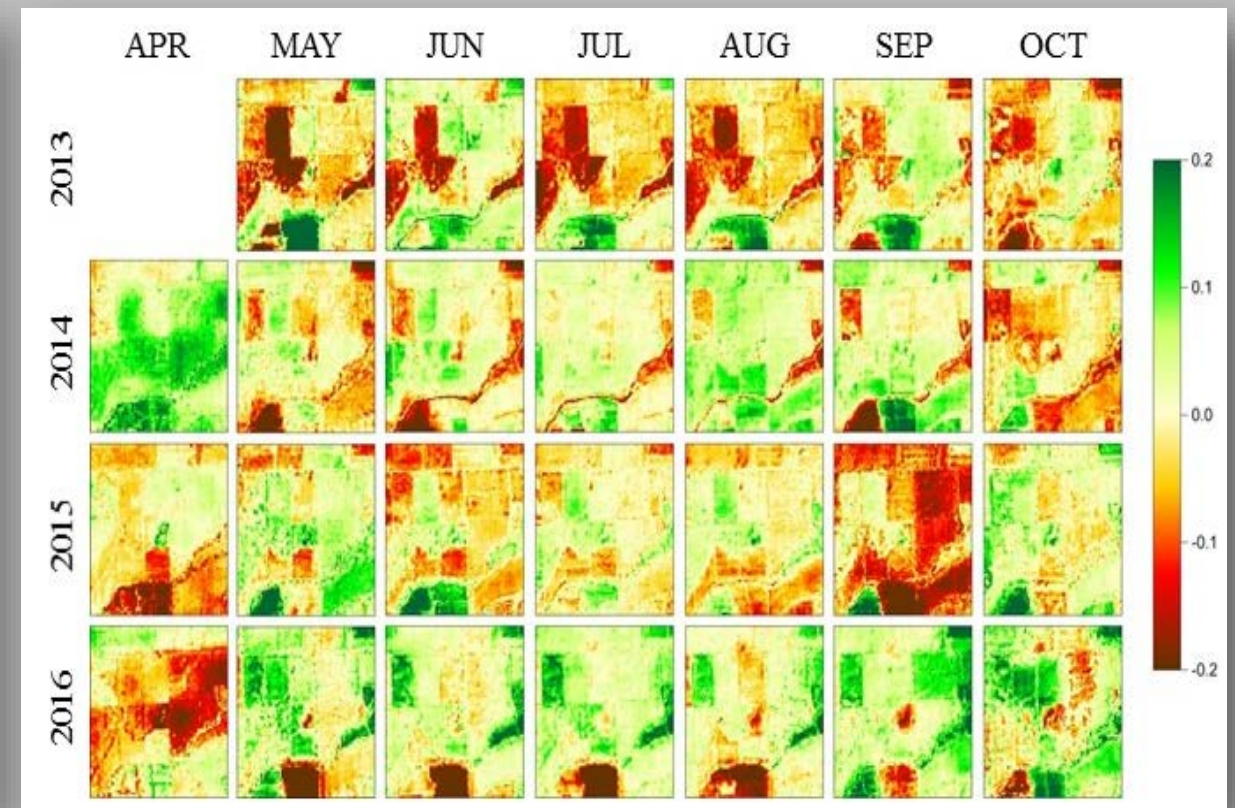
Deliverable Products to Stakeholders

Spatial and temporal monitoring of ET and stress at either field or landscape and regional scales

Monthly ET/ET_{Ref}

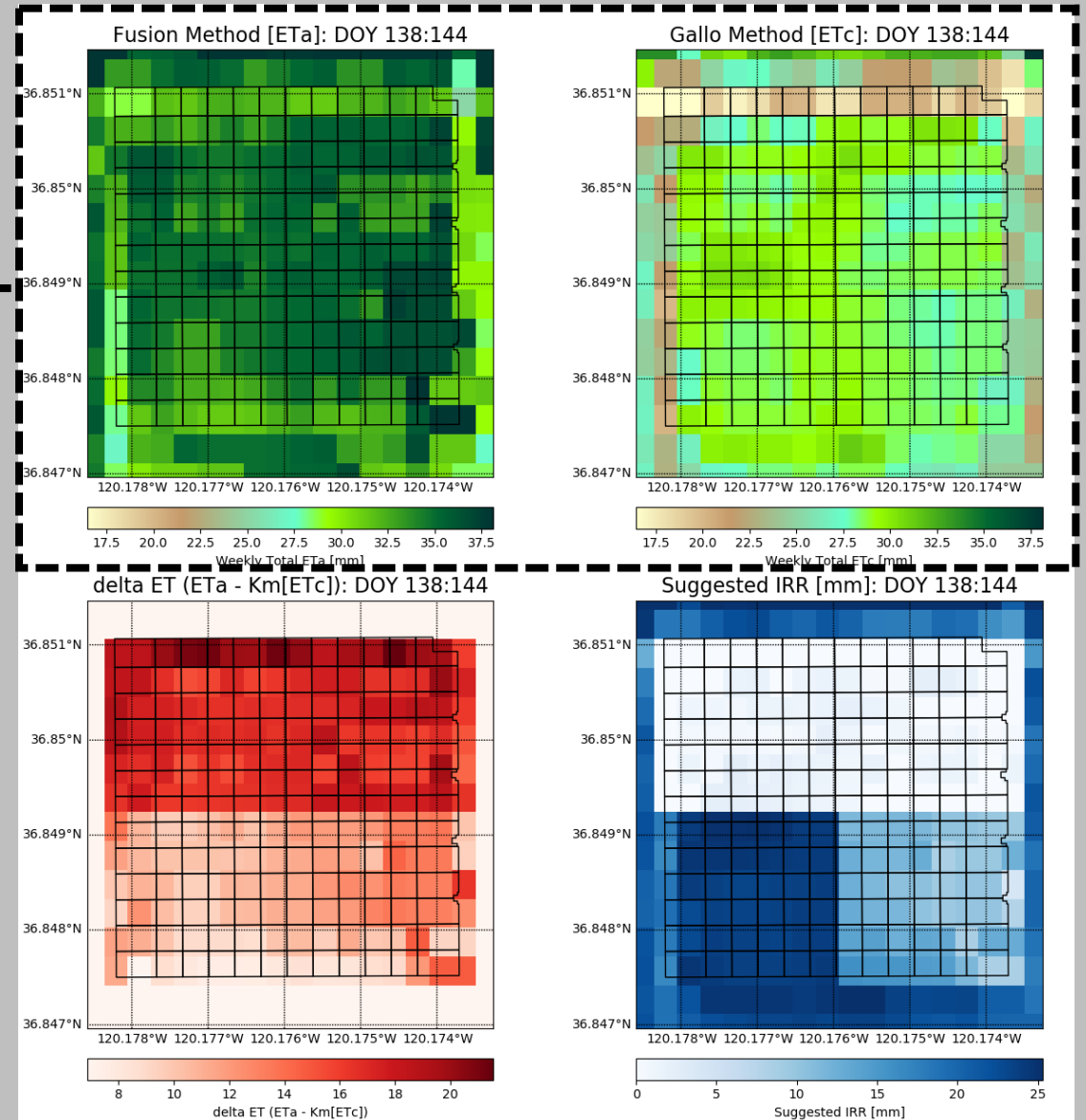


Anomaly in Monthly ET/ET_{Ref}



Deliverable Products to Stakeholders-weekly water use and irrigation amounts

- Compare to “Business-as-usual” (BAU) methods applied to a Variable Rate Drip Irrigation (VRDI) system.
- 2018 Case study: using 30 m VRDI grid with ET from BAU and Fusion Method to prescribe weekly irrigation for 4 zones with 2 crop ET management factors



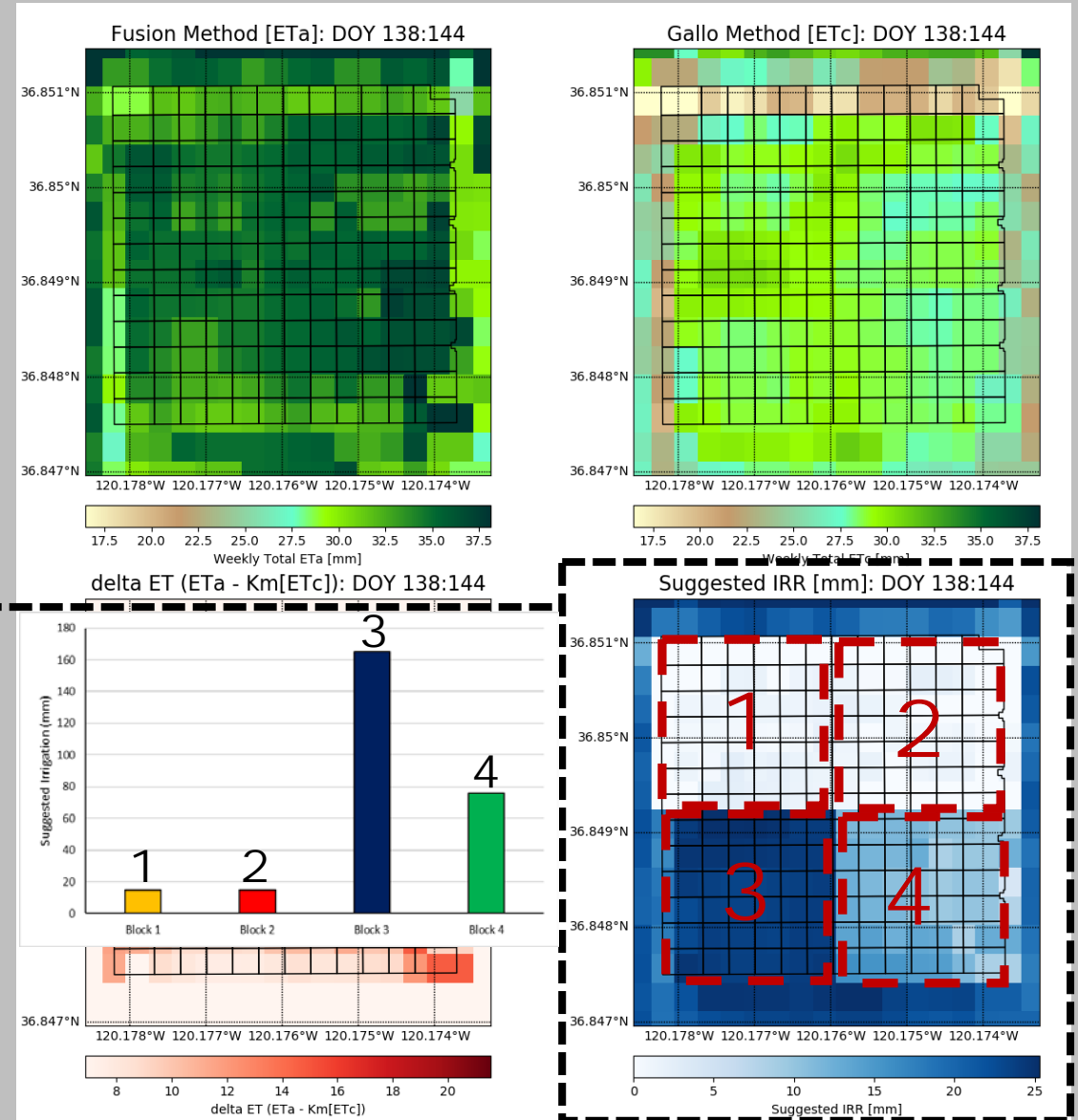
Deliverable Products to Stakeholders- Weekly Irrigation Amounts

Zones 1 & 2: Using ET_{Fusion} with deficit irrigation management factor

Zone 3: Using ET_{BAU} with best management factor

Zone 4: Using ET_{Fusion} with best management factor

- Applied on a 30m scale (same as VRDI)
- Each cell can be changed
 - Grape type, time of year, amount of stress (management factor) the manager would like to impose.

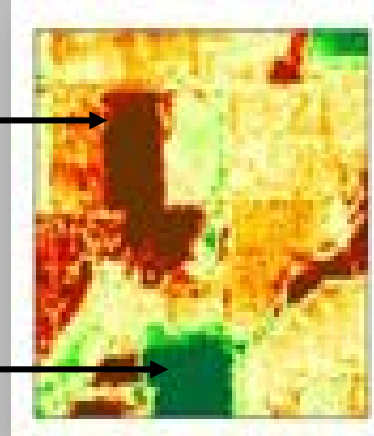


Impacts

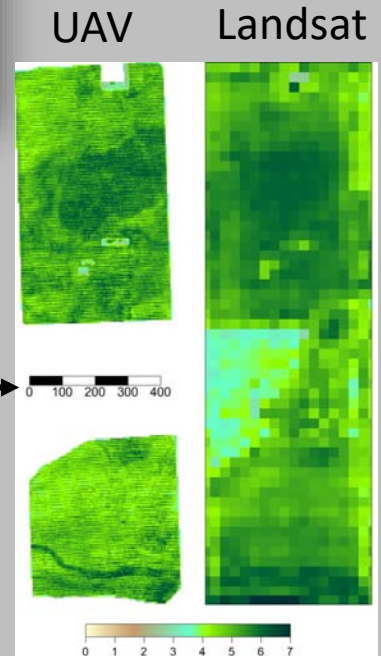
Close communication and collaboration with stakeholders (irrigation managers)



Determine regions experiencing stress in near real time



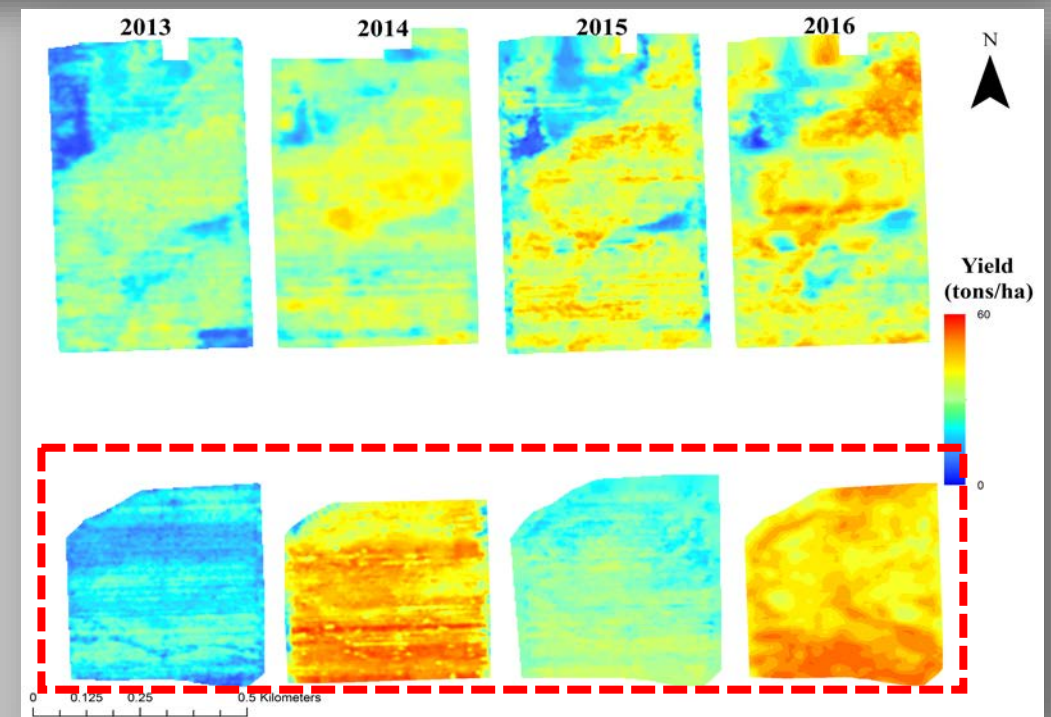
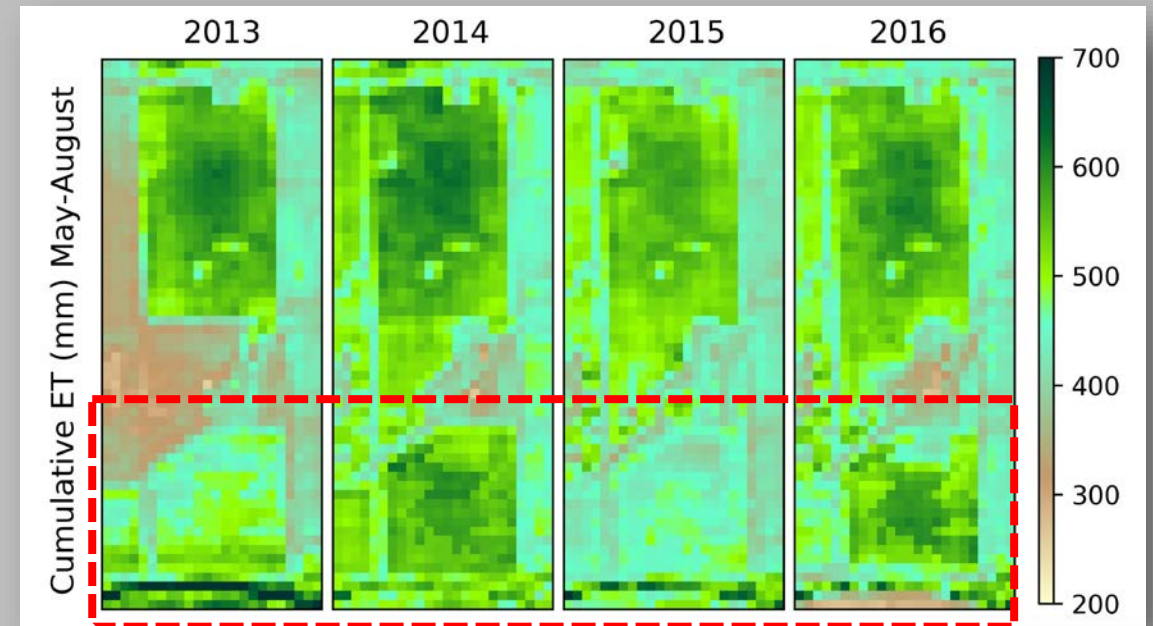
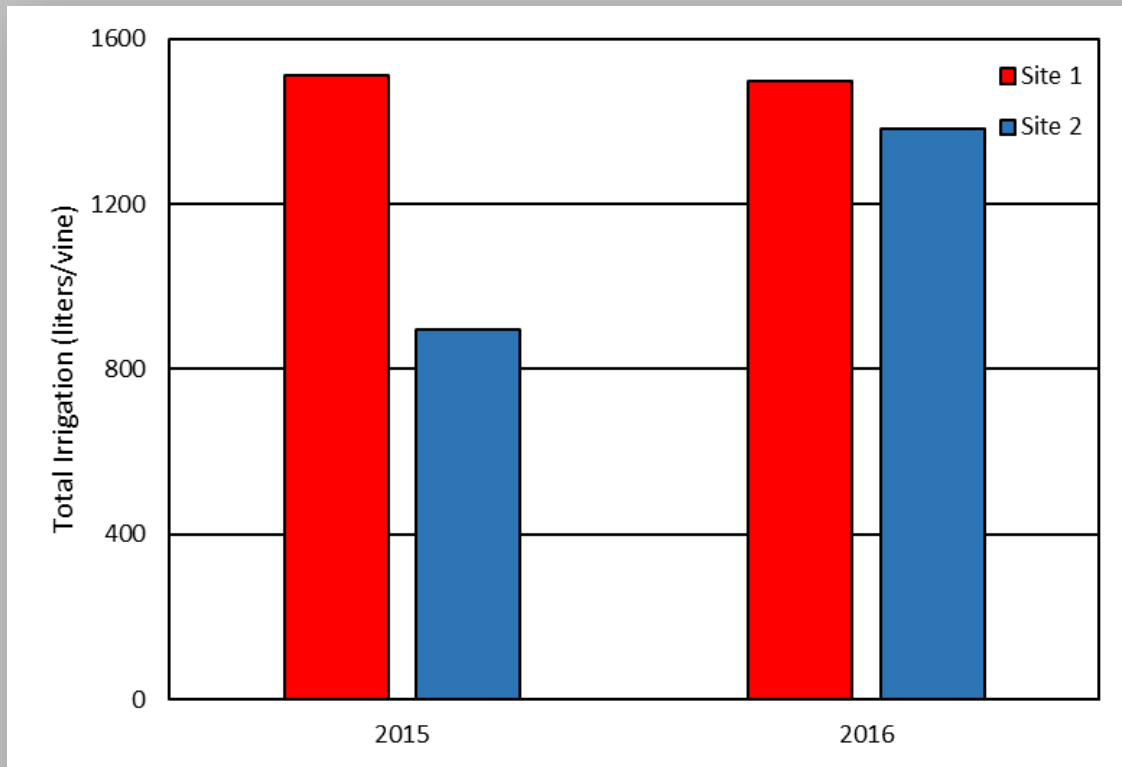
Prevent over-irrigation in regions already well watered



Combine routine satellite-based ET with periodic UAV for plant level management

Anticipated Impacts

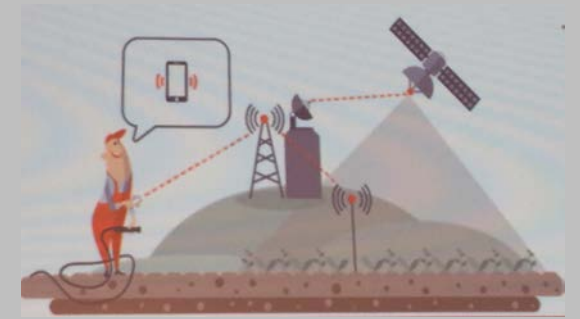
A better understanding between grape yield and ET/LAI/Irrigation



*** Maintain grape yield and quality while decreasing water consumption.**

Anticipated Impacts

Deployment of Satellite/UAV-Based applications



- Desktop and mobile based – information delivered to growers real time via mobile applications
- Use of 'Landsat web services' and cloud computing systems via:
 - Amazon S3
 - Google Earth Engine
- Custom mobile applications for:
 - Viewing
 - Editing
 - Collection
- 24-HOUR DELIVERY

