

Assessing variability in the vineyard through a spatially explicit selective-harvest approach

A case study in Sonoma

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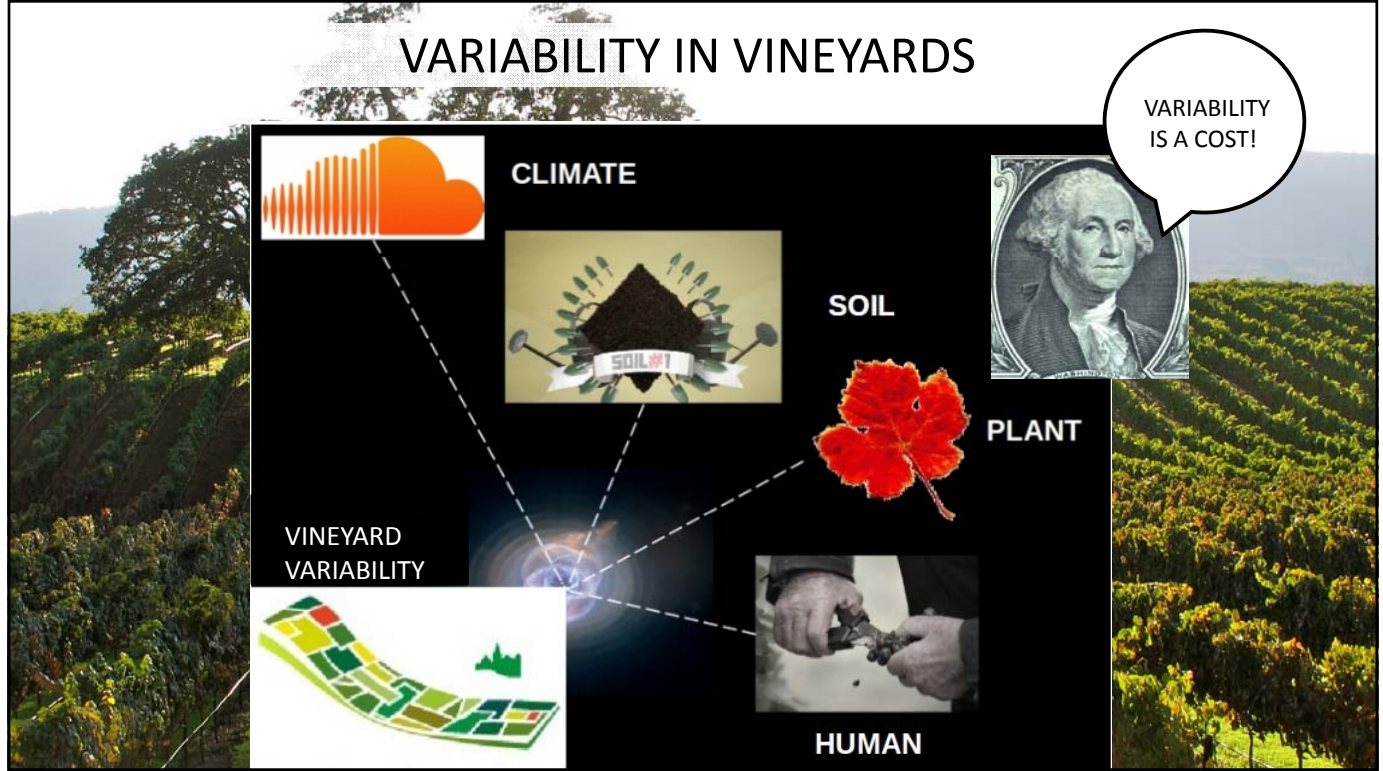
2017 Grape Day Sonoma County
February 8, 2016

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OUTLINE

- Introduction
 - Vineyards are variable in space
 - The efficient vineyard project
- The field site in Sonoma
- Results
 - Terrain analysis
 - Grapevine water status
 - Our approach to the selective harvest
 - Chemical differences between zones
- Conclusions & Perspectives

VARIABILITY IN VINEYARDS



The efficient vineyard project

Carnegie Mellon

Cornell University

USDA NIFA
United States Department of Agriculture
National Institute of Food and Agriculture

Penn State

Newcastle University

NGWI
NATIONAL
GRAPE &
WINE
INITIATIVE

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Dr Kaan Kurtural Lab
Oakville Experimental Station

UNDERSTANDING AND
MANAGING SPATIAL
VARIABILITY

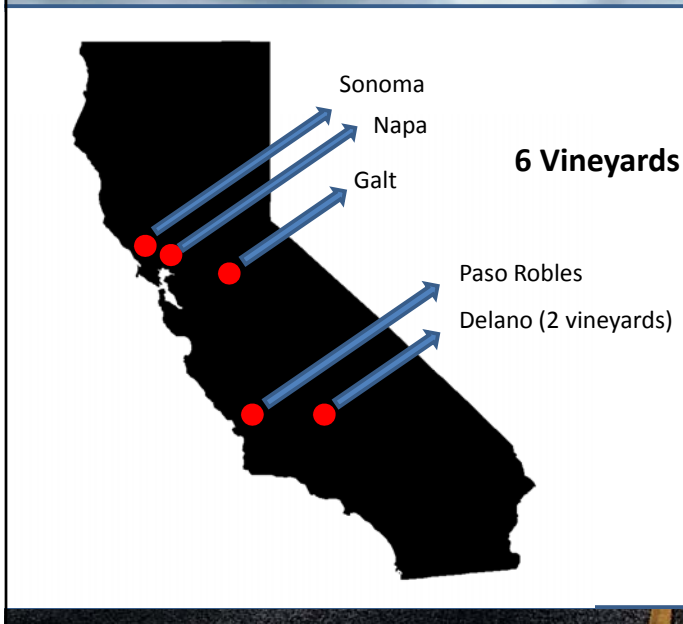


SITE SPECIFIC
VARIABLE RATE
MANAGEMENT



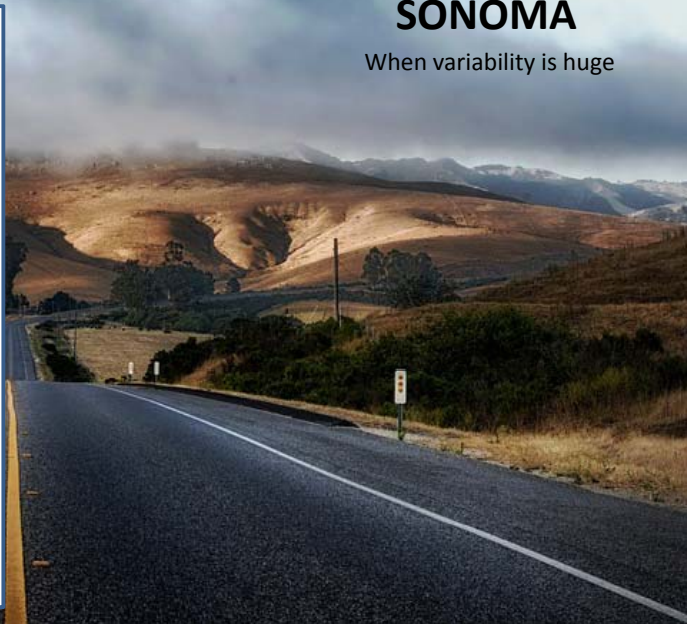
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Six vineyards across California



SONOMA

When variability is huge



The Work Flow

SENSING

- High Resolution DEM
- NDVI
- DuoLite
- Electrical resistivity
- Multiplex
- Satellite images

FIELD MEASUREMENTS

- Grapevine physiological measurements
 - Plant water status
 - Canopy microclimate
 - Net gas exchange
- Soil measurements

LABORATORY ANALYSIS

- Primary metabolism (wet chemistry)
- Secondary metabolism
 - Flavan-3-ols
 - Flavonols
 - Anthocyanins
 - Proanthocyanidins



GEOSTATISTICAL
ANALYSIS &
MODELLING



OUTPUT



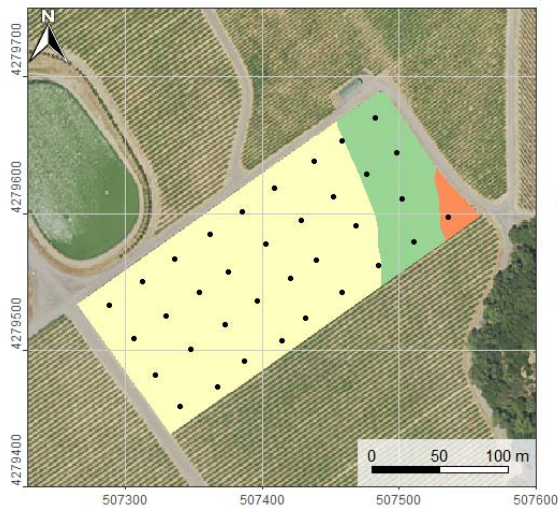
Selective harvest in Sonoma

The site

Ph. Credit = L'Unita



The site



A spatially explicit grid with 35 datapods

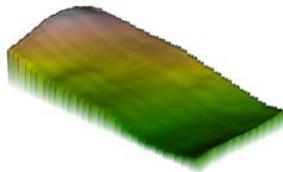
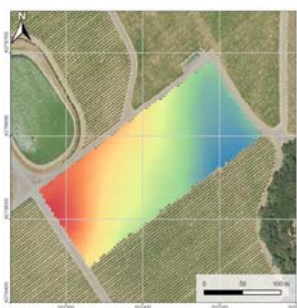
- Sensing
- Physiological measurements
- Laboratory analysis
 - (primary and secondary metabolism)
- Geostatistical analysis

- Cabernet-Sauvignon/110R
- Two single high wires in a horizontally split canopy
- Planted at 7 x 11 feet

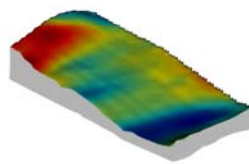
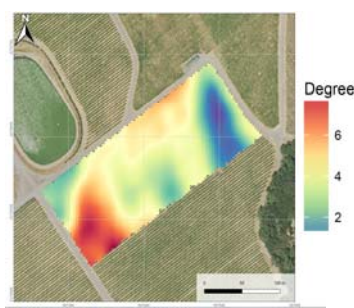
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Terrain analysis of the site

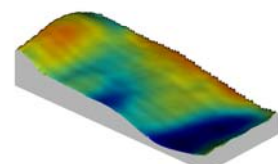
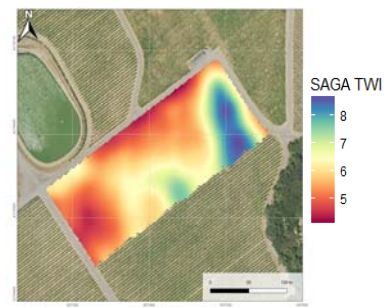
GPS DATA (Elevation)



Slope



Soil Wetness Index



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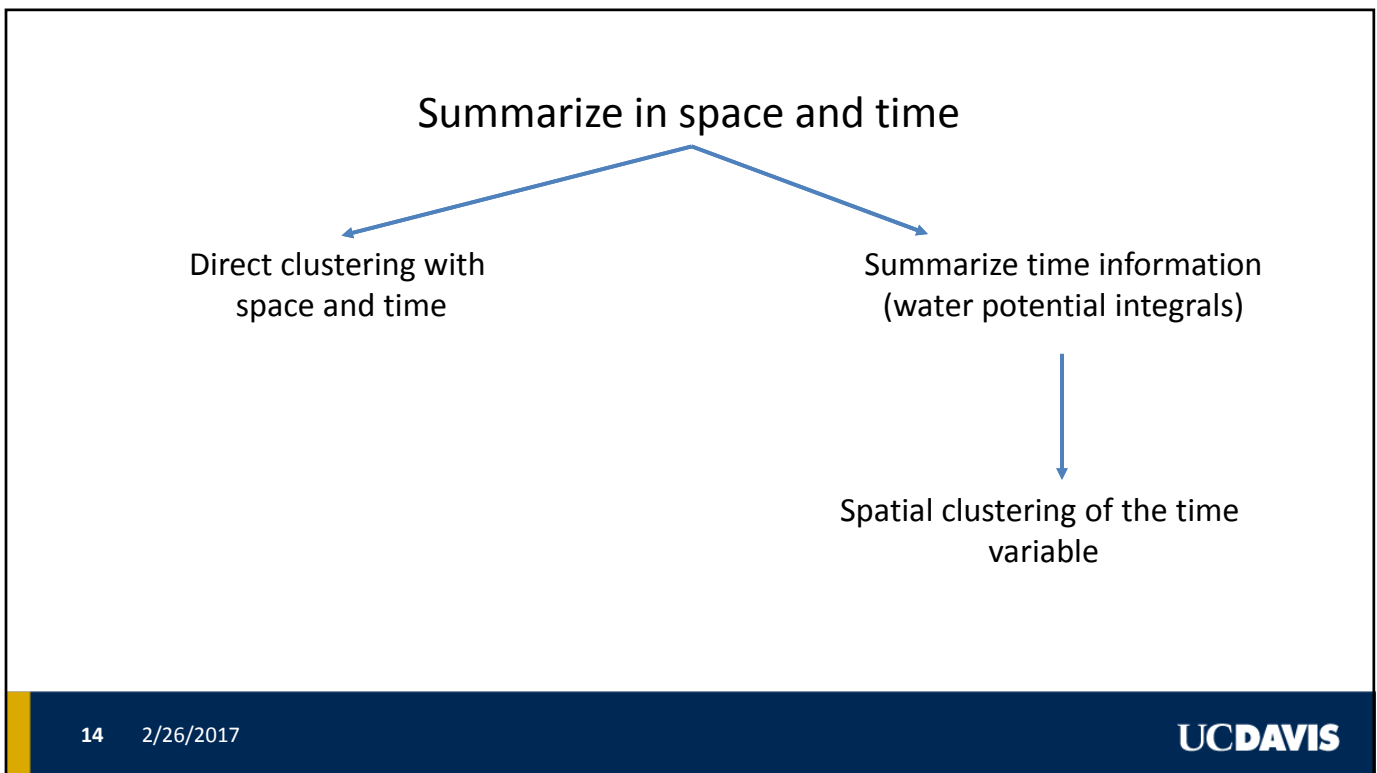
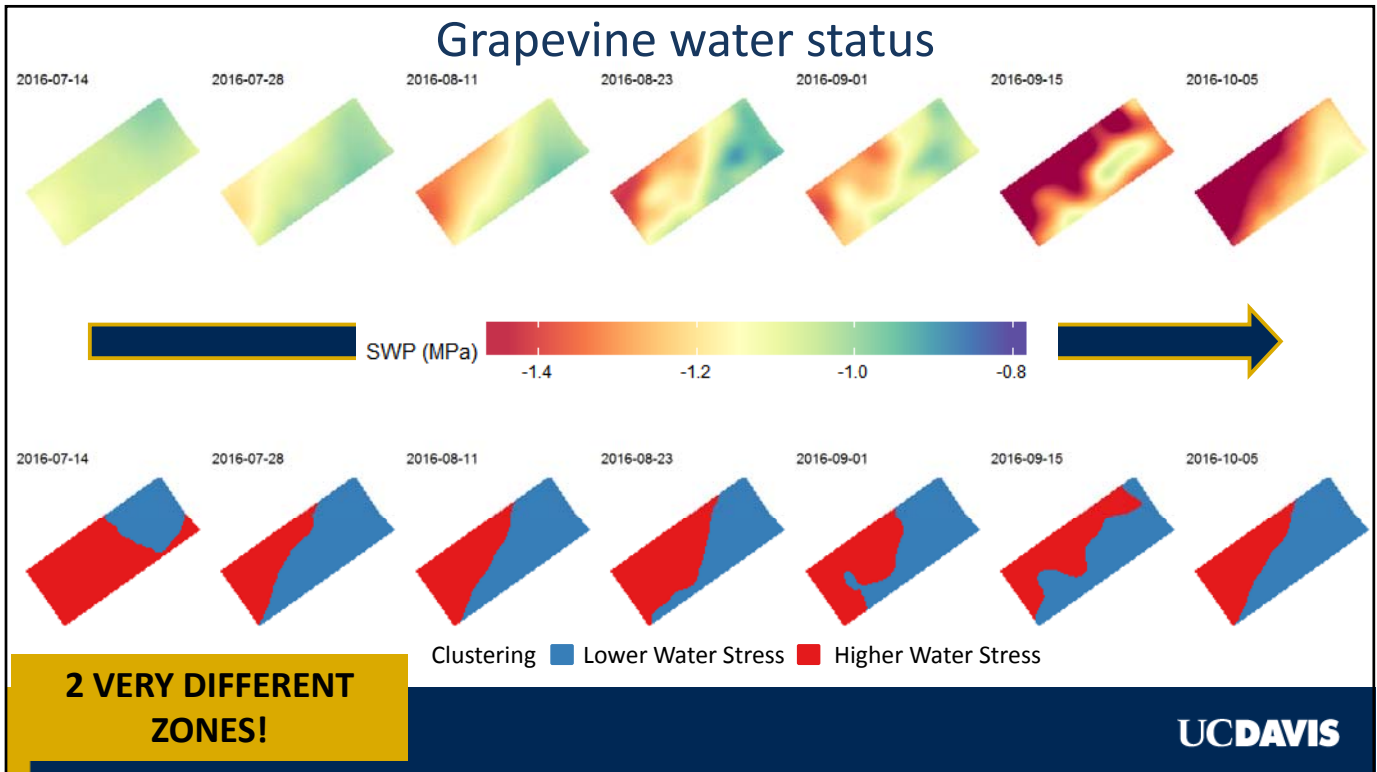
Water status



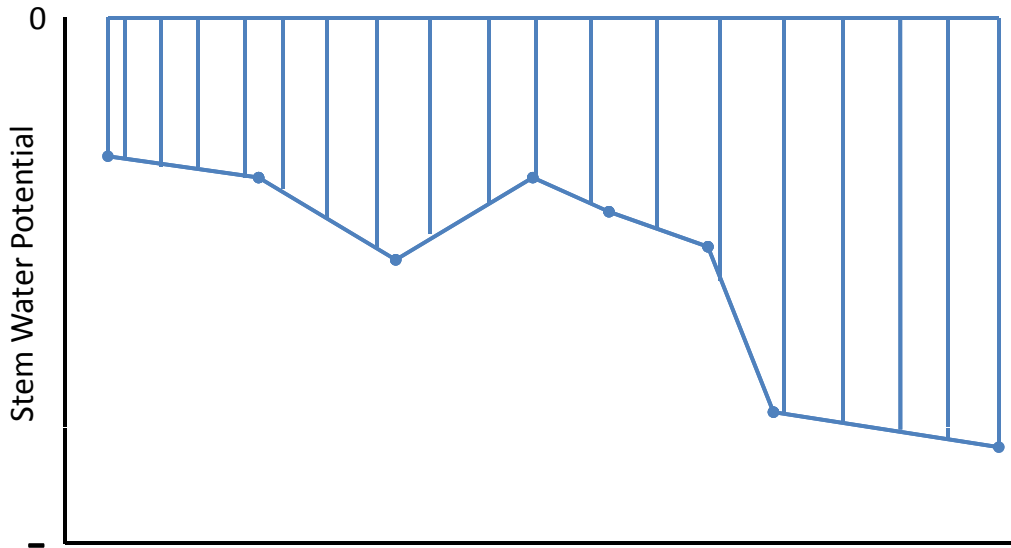
Higher Water Stress



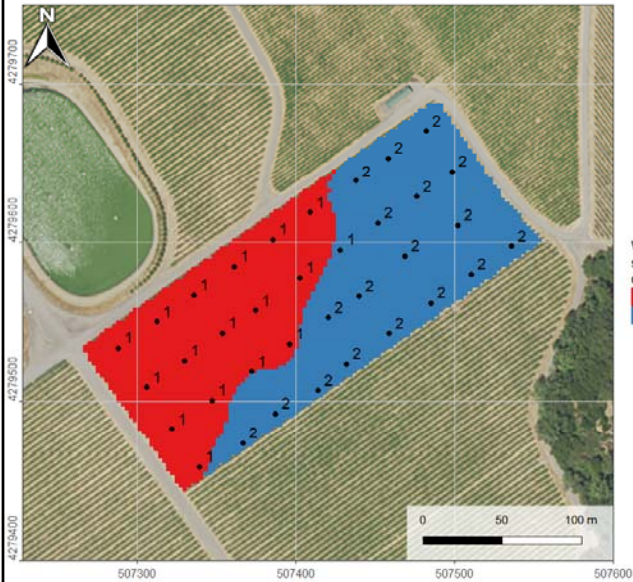
Lower Water Stress



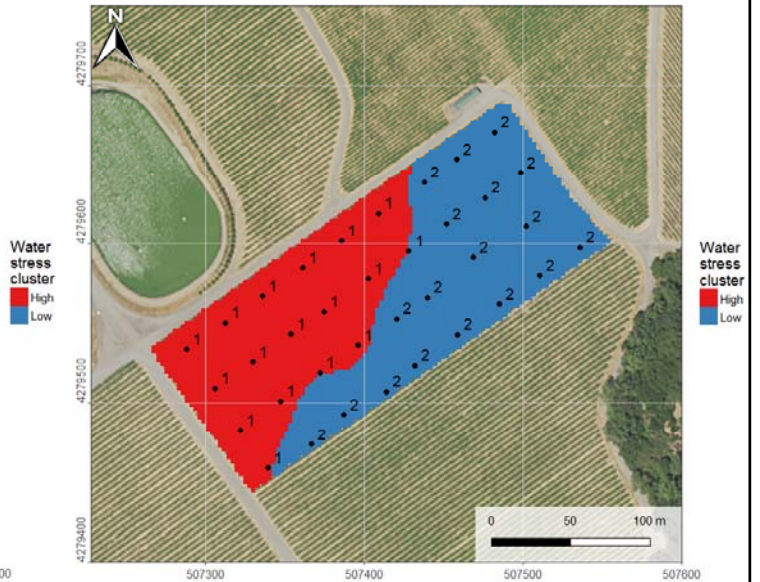
Summarize time: What is stem water potential integral



time cluster

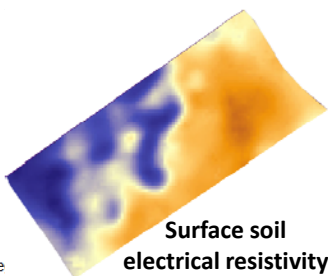
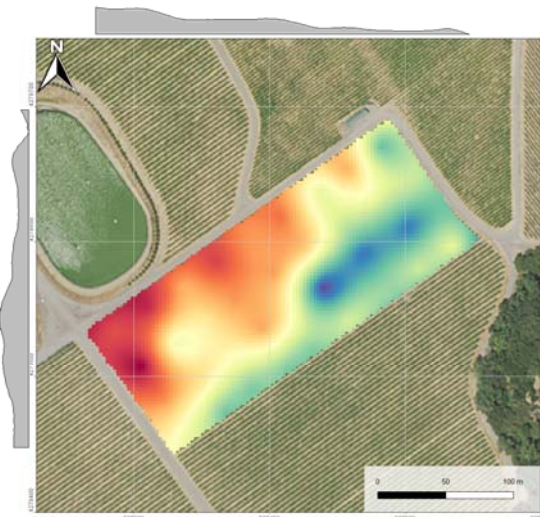


integral



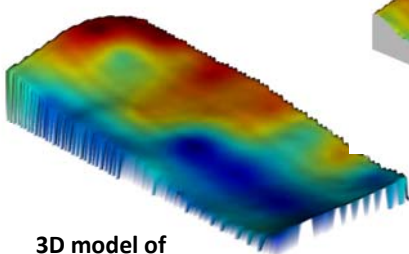
Relationships with the environment

Water Potential Integrals

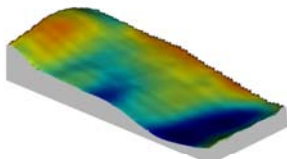


Surface soil electrical resistivity

GOOD RELATIONSHIPS WITH SOIL AND TOPOGRAPHY!



3D model of water status

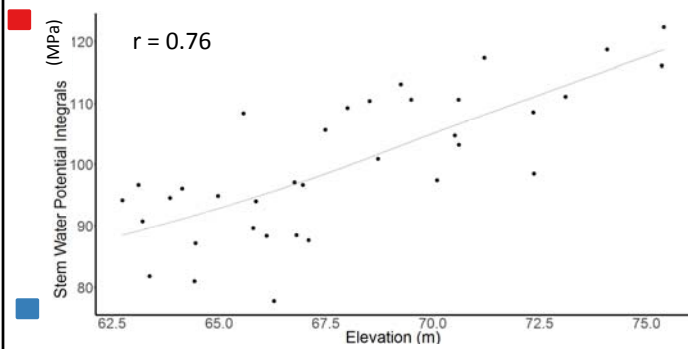


3D model of soil wetness

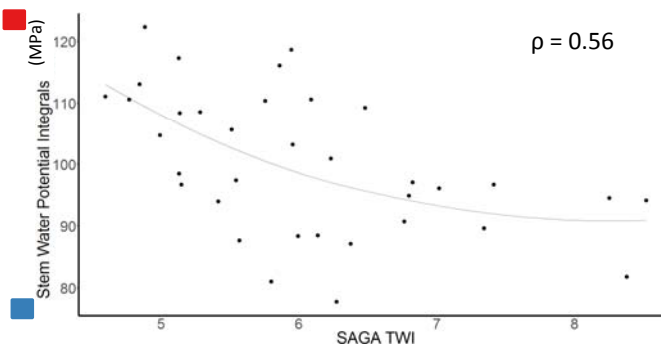
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Relationships with the environment

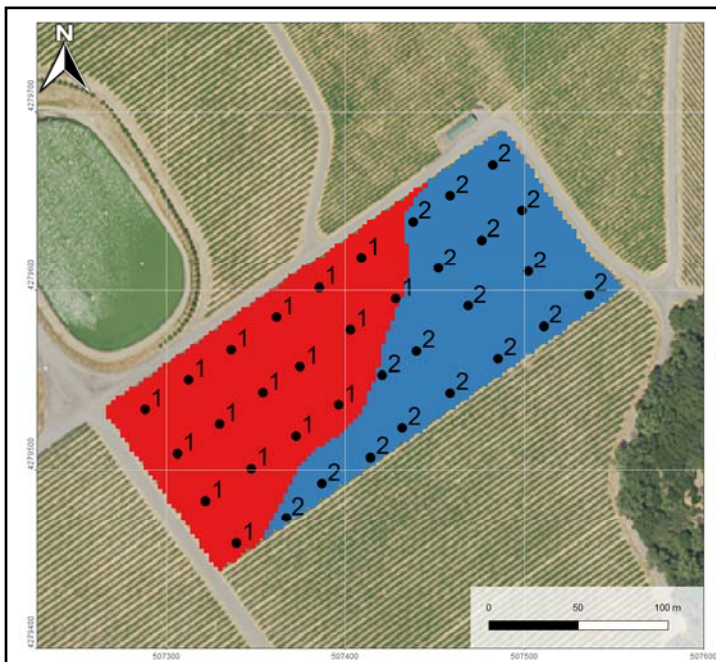
Elevation



Soil wetness index

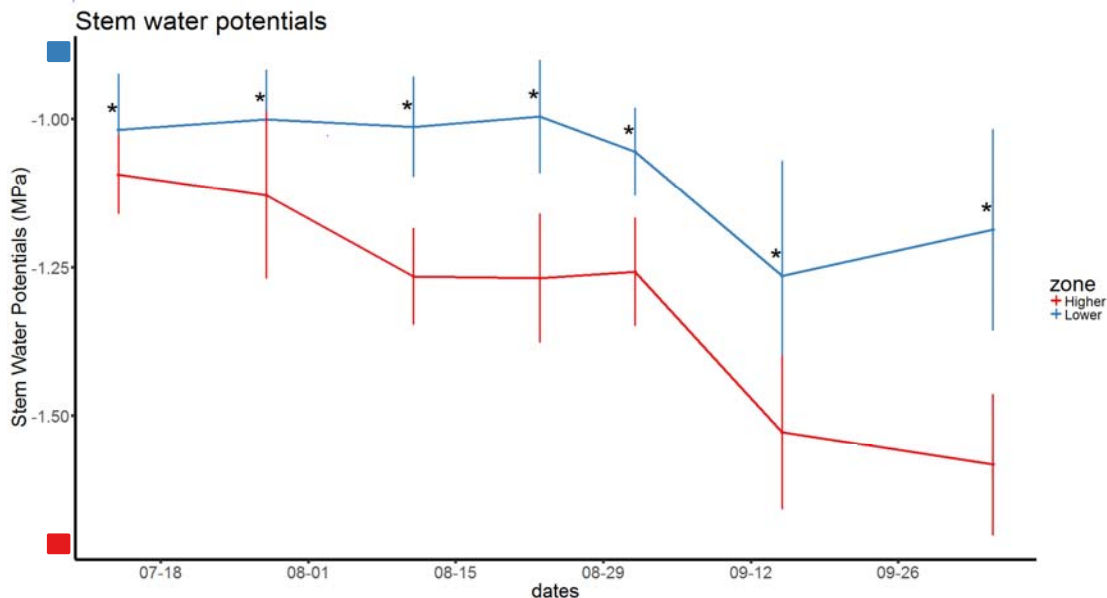


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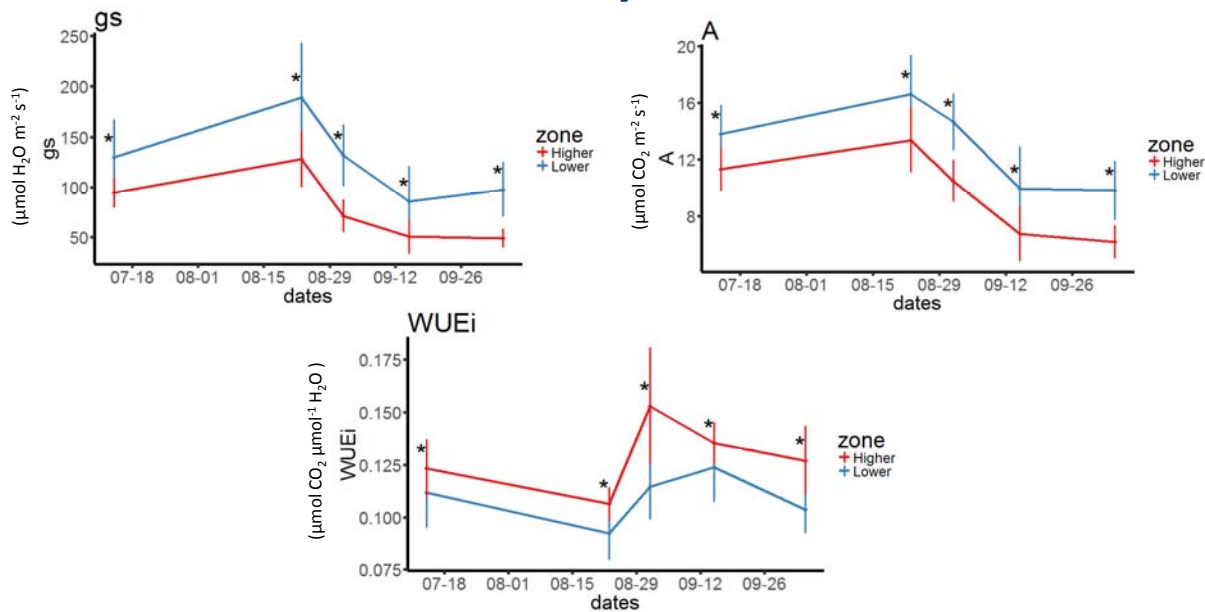
This clustering explain 70% of the observed variability in water status

Stem water potential



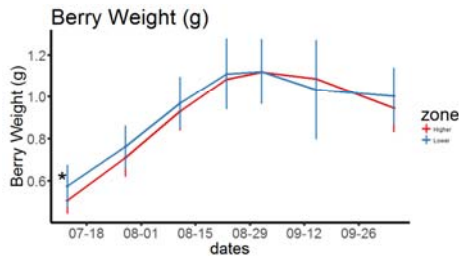
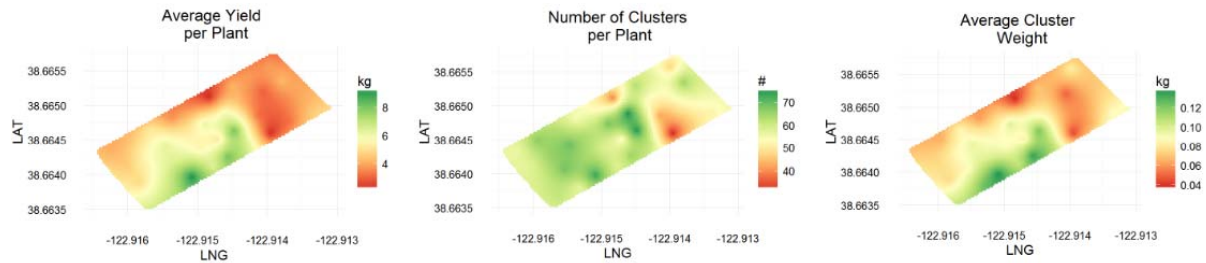
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Photosynthesis

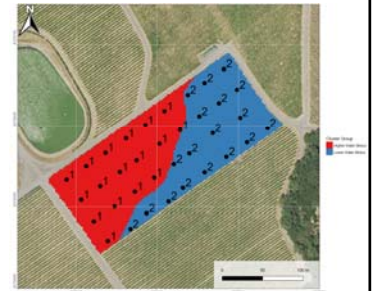


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Components of yield

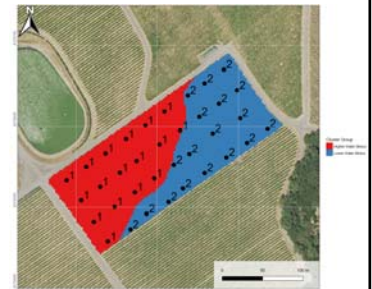
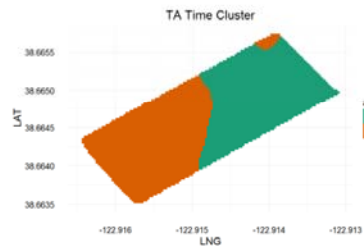
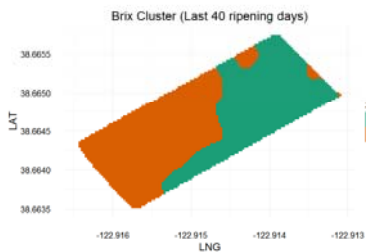
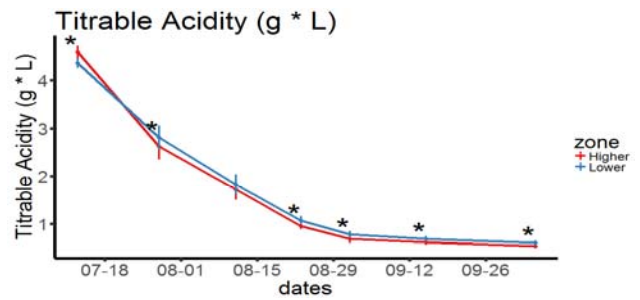
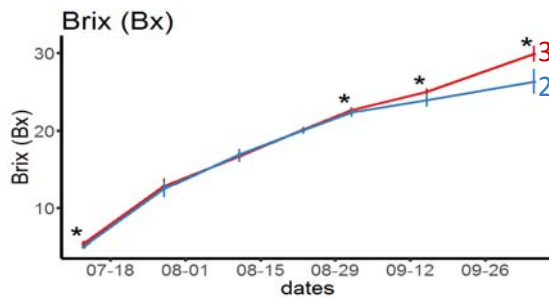


Not a significant correlation between water status and yield!

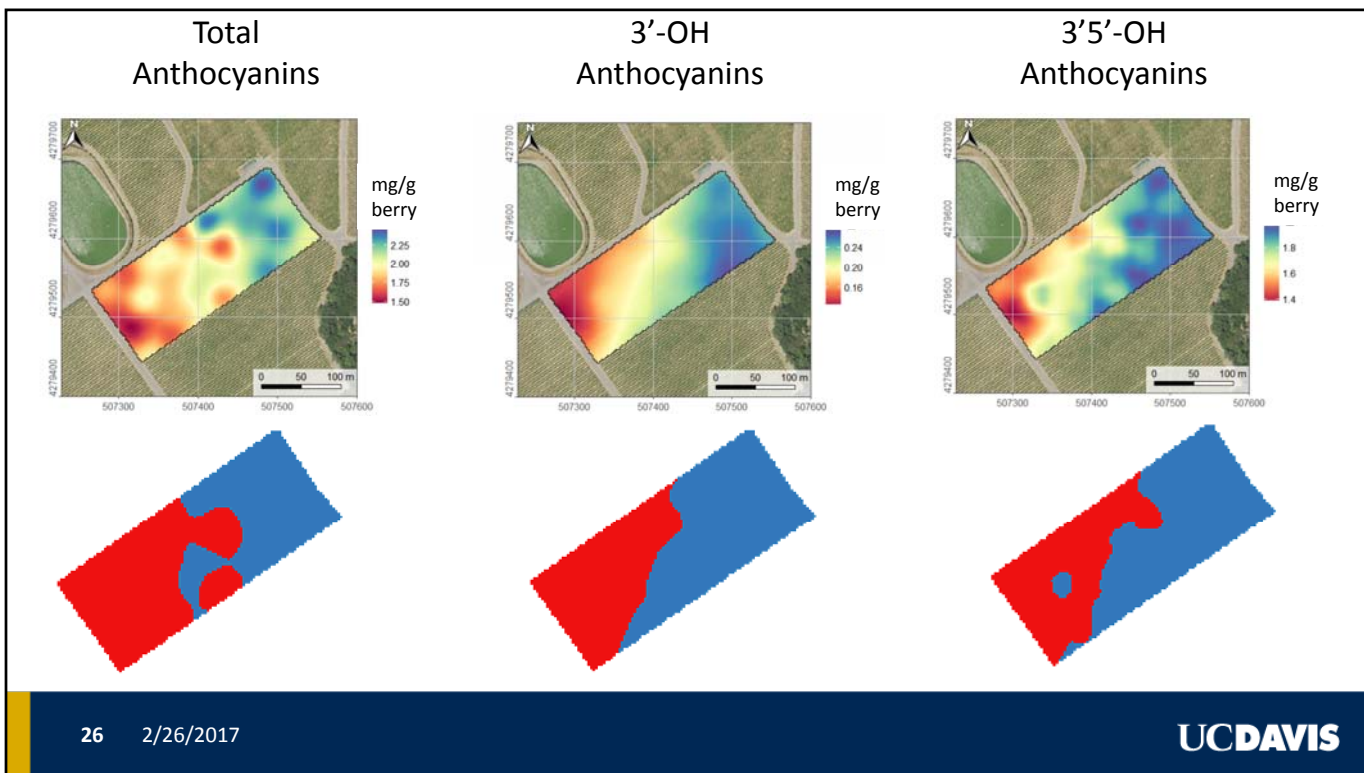
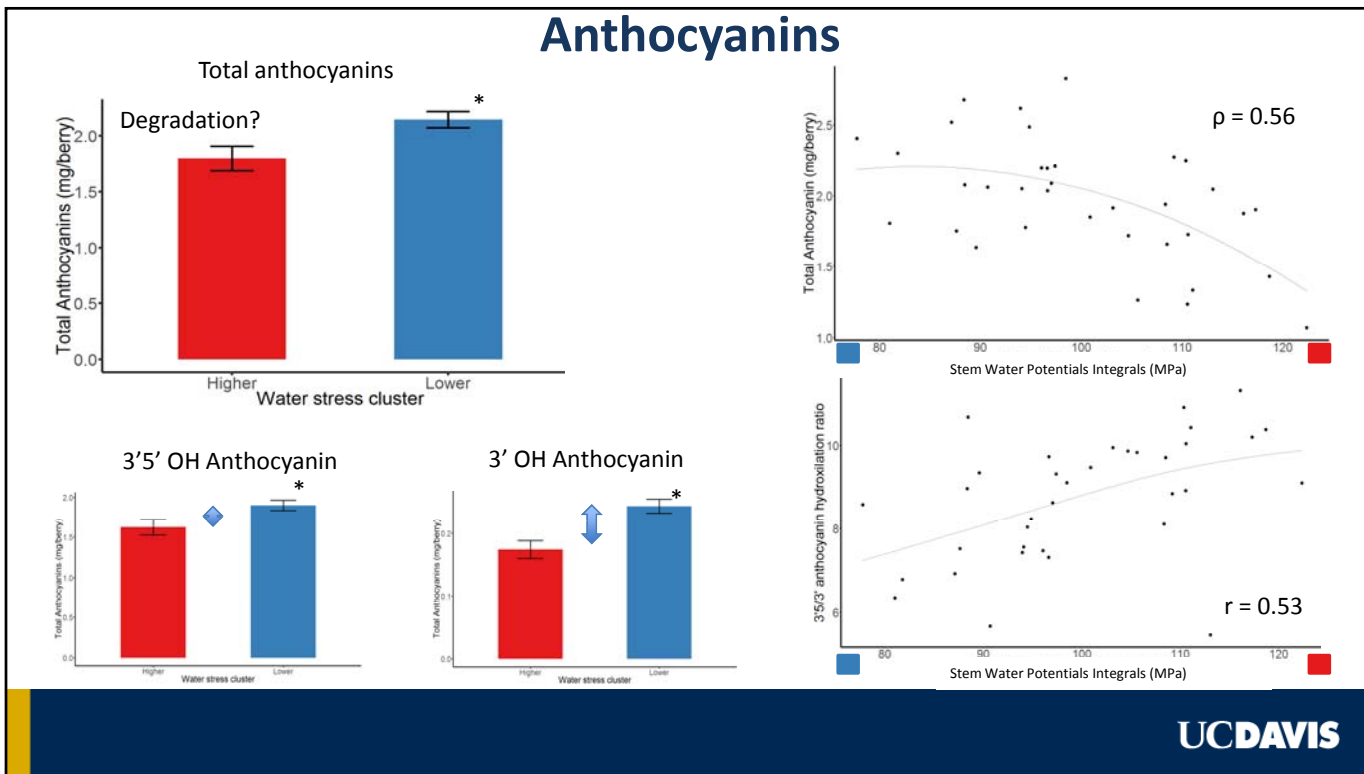


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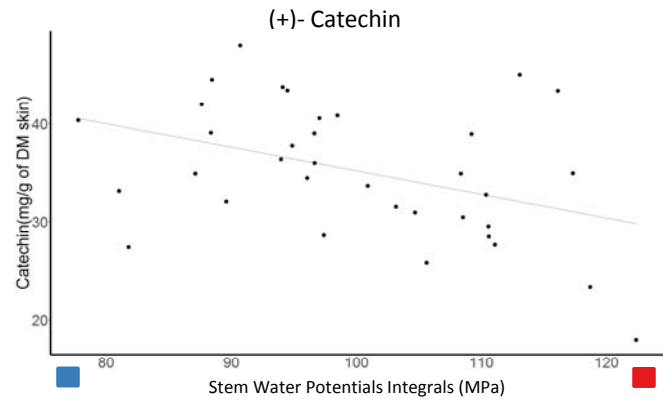
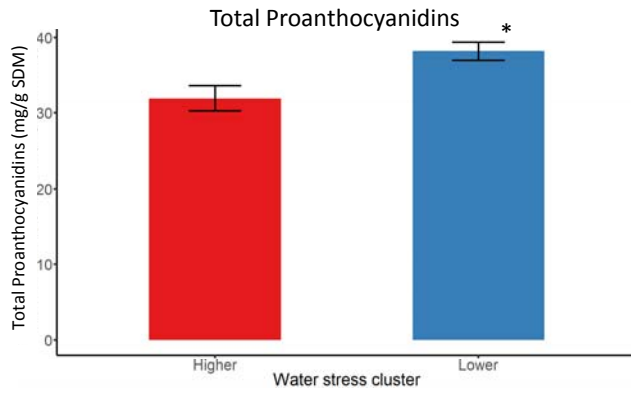
Primary metabolism



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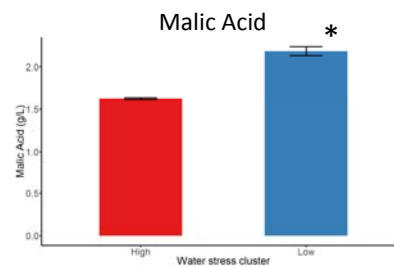
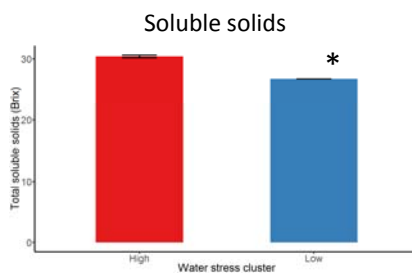


Tannins



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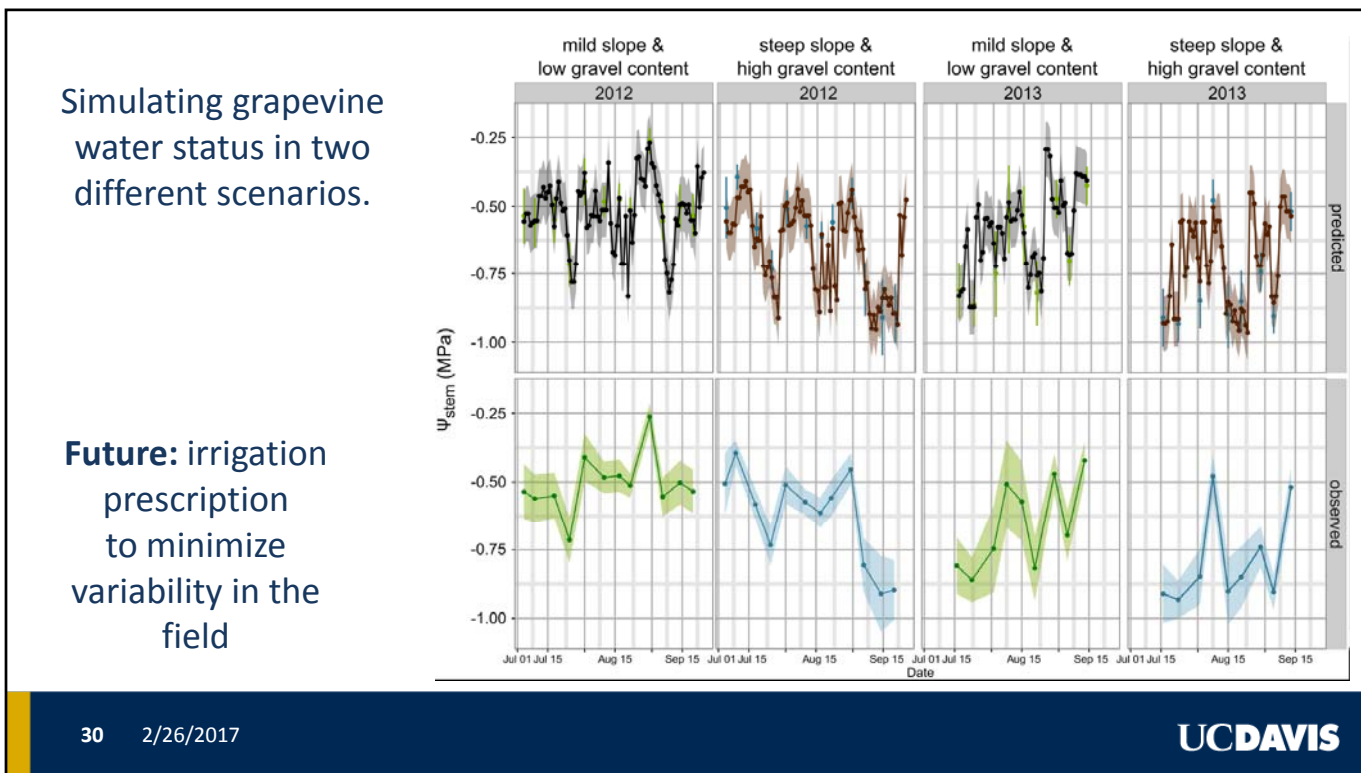
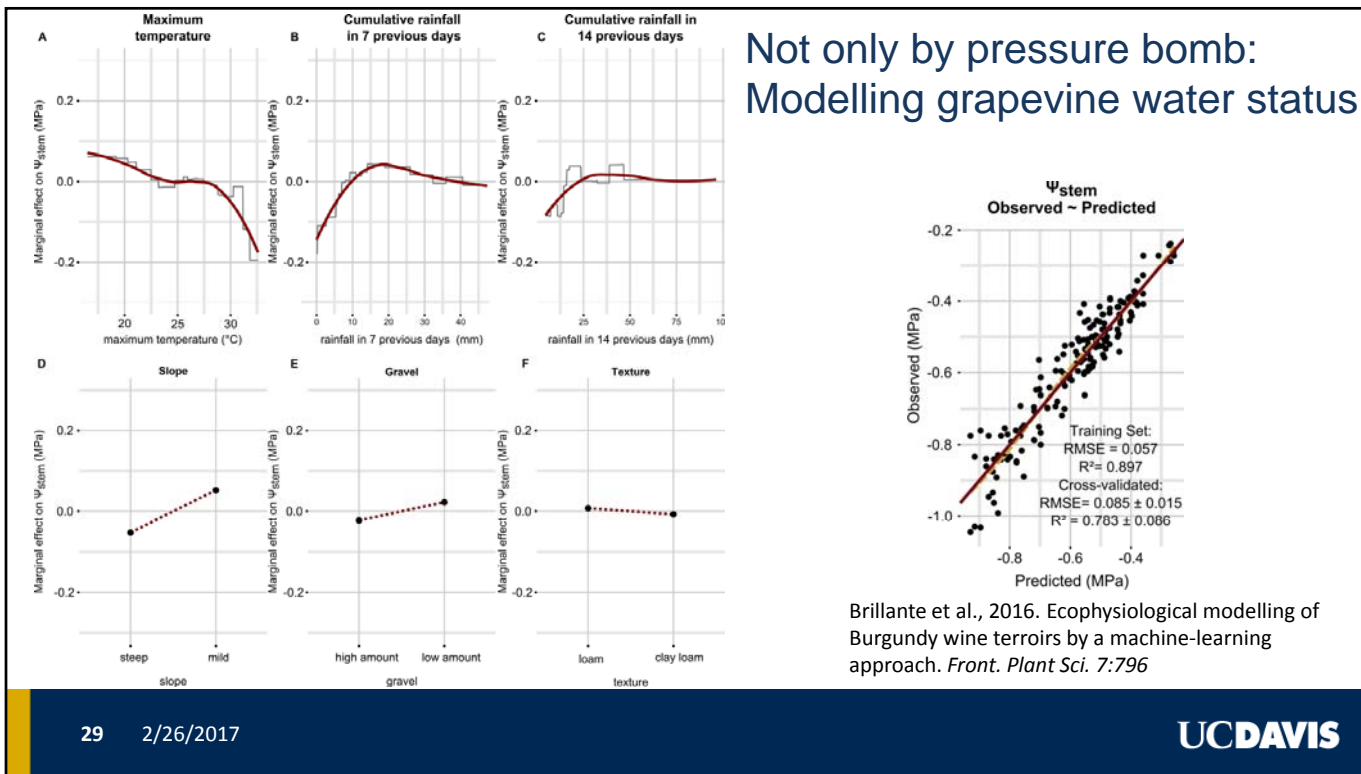
The wine



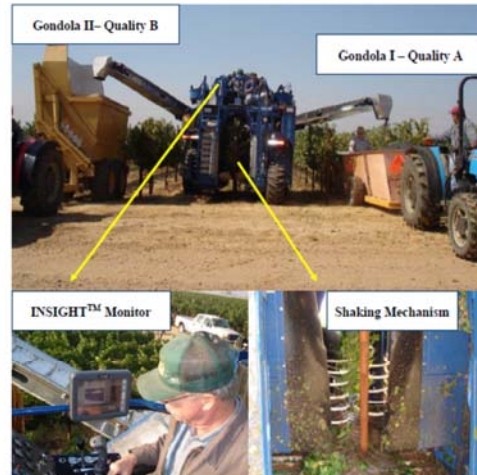
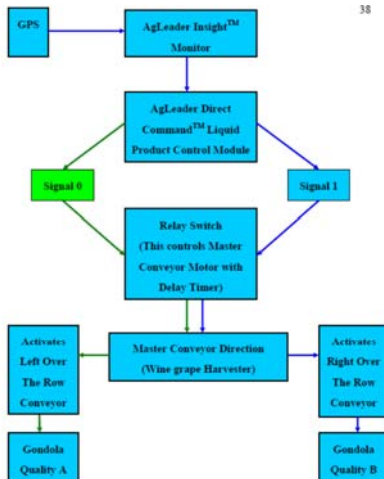
... just finished. STAY TUNED!



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Not only by hands: selective harvest by mechanical means



Kurtural et al. 2012

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Conclusions

- Vineyard variability affects harvest composition and then the wine
- Selective harvest can be a useful strategy when vineyard variability is too large to coalesce
- Water status allows to effectively discriminate between the harvest zones. Less of a need to take repeated measurements and can be easily modelled/sensed.

Perspectives

- Need to evaluate relationships with our proximal sensors/water status modelling. Better investigate relationships with the environment, temporal variations. Wine analysis
- This is only one of the fields, we are testing variable rate management on the others. STAY TUNED!

Acknowledgment



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VITICULTURE & ENOLOGY
Anita Oberholster
Chik Breneman



E&J Gallo Winery
Luis Sanchez & Jim O' Donnell



Cassandra
Plank



Runze 'Cliff'
Yu



Chris
Chen

**We have many interesting posters
about different projects! Take a look!**

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