Almond ET/Yield Production Function

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Problem and its Significance:

It is imperative that the almond industry have the best available information on the relation of almond tree yield to different levels of irrigation in mature orchards. This relation is known as a Water Production Function (WPF). We have proposed to develop a WPF at three locations in the state (Kern, Merced, and Tehama counties) starting with the 2013 season, but because each orchard represents a unique combination of soil, environmental, and management conditions, it will be best if we can obtain yield and canopy cover information for the 2012 season, prior to any irrigation treatments. These yields will serve as a reference value for all the subsequent yields, and will increase the accuracy of the WPF based on these yields. Spatial variation in soil will also be an important factor to consider when we locate the experimental plots in the field, so in addition to yield and canopy cover data at harvest, we should obtain information about soil and tree water status variability during the 2012 season.

Objectives:

- Obtain a VERIS map of the three proposed orchard locations.
- Develop a tentative experimental layout for each site.
- Install water meters on irrigation laterals covering the layout to describe grower practice and evaluate system uniformity.
- Make periodic measurements of midday stem water potential (SWP) for trees within the layout during the 2012 growing season.
- Obtain midseason canopy cover (light bar) and harvest values for the 2012 season, including row values from the layout and tree values from the SWP trees.

Results:

In this first year we are documenting within- and between-site differences in soils, tree stress and tree productivity, in order to establish treatment blocks designed to cover the available spectrum of conditions at each site. As has been found in other studies, a sufficiency of applied water compared to ET did not necessarily result in SWP values at the baseline, nor did a deficiency of applied water compared to ET result in stressed levels of SWP (Figure 1). There were clear and consistent north-to-south differences in rainfall and evaporative demand (ETc, Table 1). Based on seasonal totals, the Merced site represented the most deficit irrigation (75% ETc, Table 1), but this did not give the lowest average or minimum SWP value (Table 2). Baseline SWP values at each site were very similar (Table 2), indicating that similar levels of vapor pressure deficit (VPD) prevailed when SWP measurements were made.

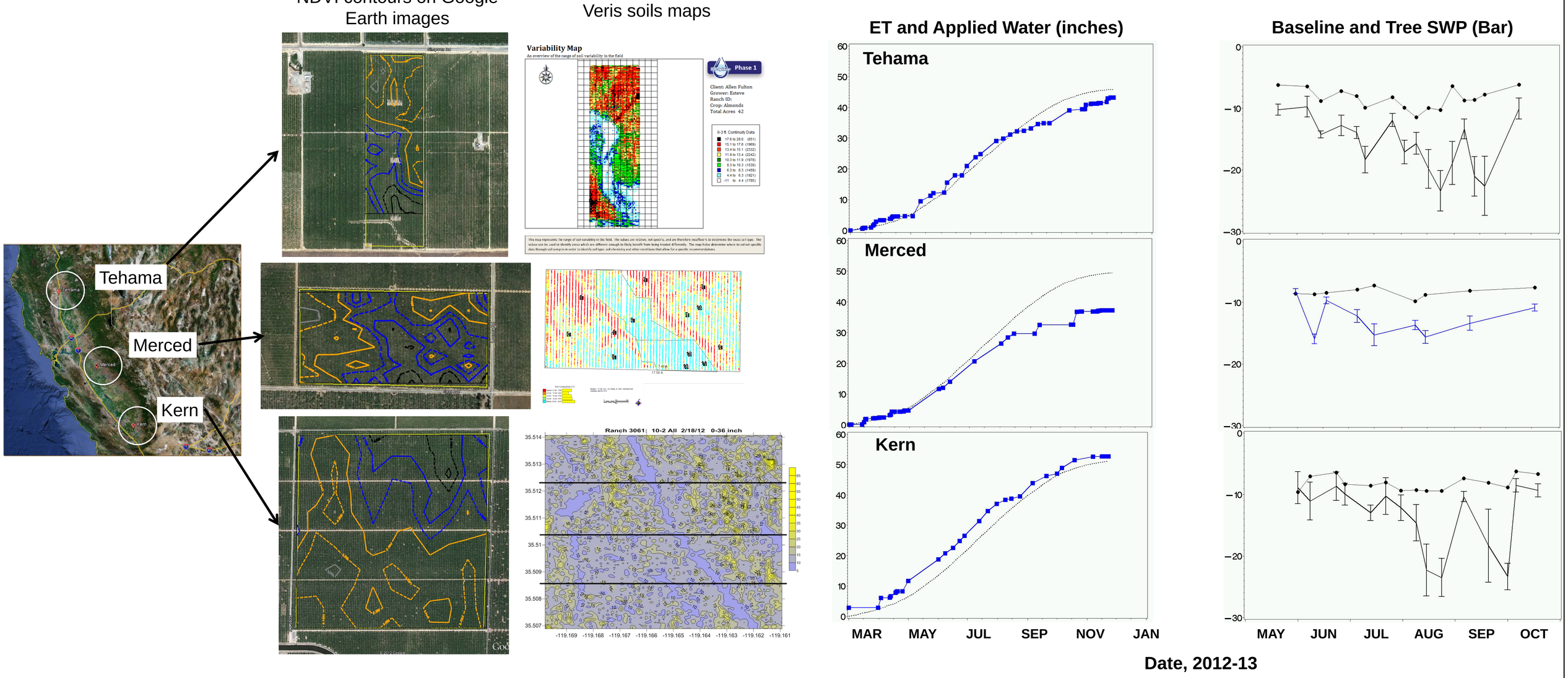

Figure 1. Sites chosen for the study, NDVI (satellite) and Veris (soils) maps, and seasonal patterns observed in ET/applied water and SWP.

Table 1. Comparison of seasonal totals for ET and rain+irrigation for each site.

Site	March 1 – November 23, 2012				
	ETc	Rain	Irrigation	Total	%ETc
North (Tehama)	45.8”	7.7”	35.6”	43.3”	94%
Central (Merced)	49.4”	5.6”	31.6”	37.2”	75%
South (Kern)	51.0”	2.2”	50.5”	52.7”	103%

Table 2. Comparison of average baseline and observed SWP values, and % sunlight interception at each site.

Site	Stem water potential (bar)		% Interception Average (& range)
	Baseline	Tree water stress Average (& range)	
North (Tehama)	-8.4	-15.9 (13-18)	52% (25-75)
Central (Merced)	-8.3	-12.6 (9-15)	61% (53-67)
South (Kern)	-8.1	-13.2 (11-16)	68% (61-78)

Conclusions:

Our sites represent a wide cross-section of almond growing areas and conditions, and hence should provide a good context for the development of an almond water production function (WPF). Our preliminary data has indicated that different amounts of water, compared to ETc, may be required for different locations/soils to achieve the same level of tree water status. Hence, it is possible that an almond WPF may be soil specific, and this will have important implications for water management throughout the state.