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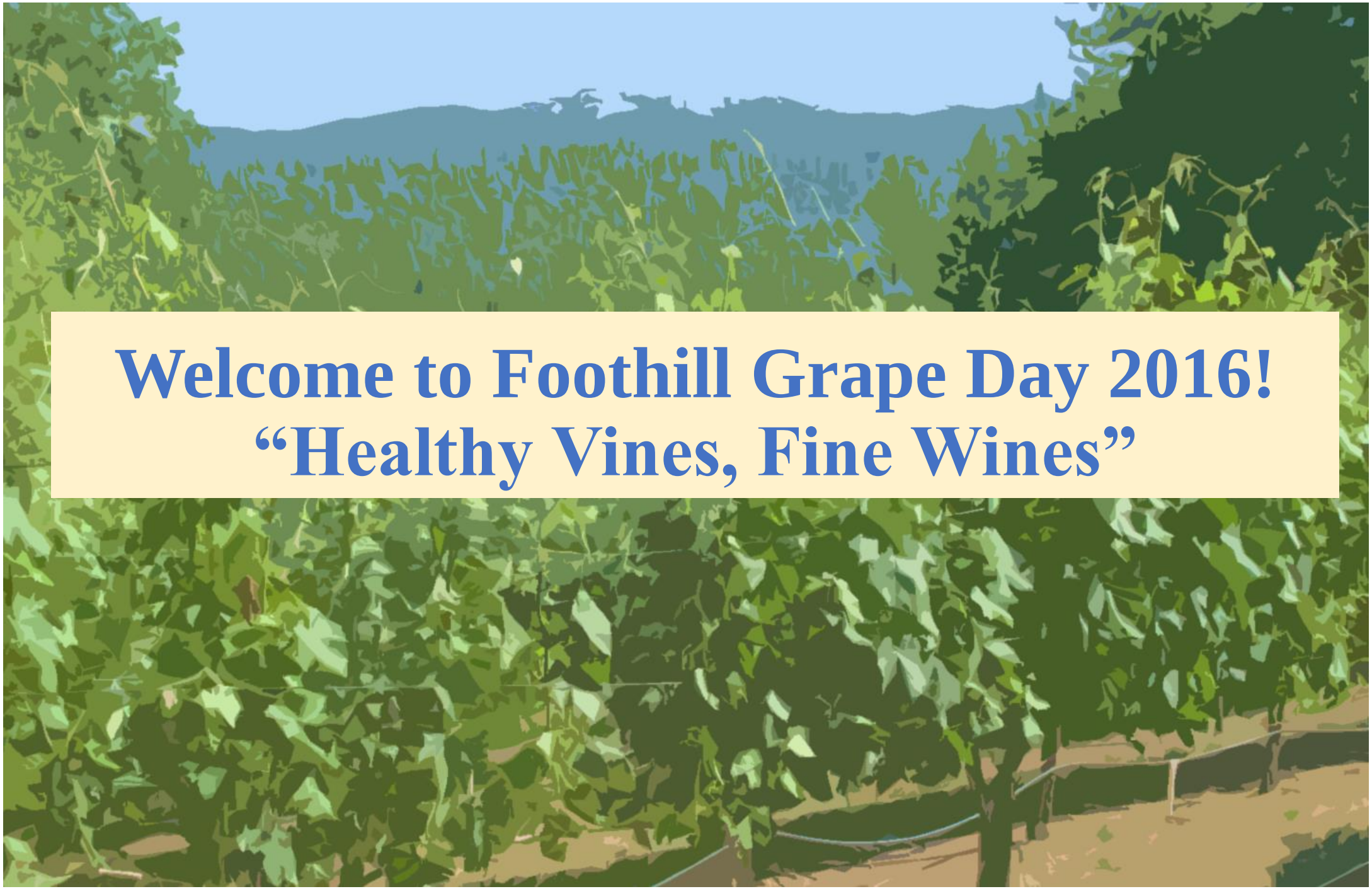
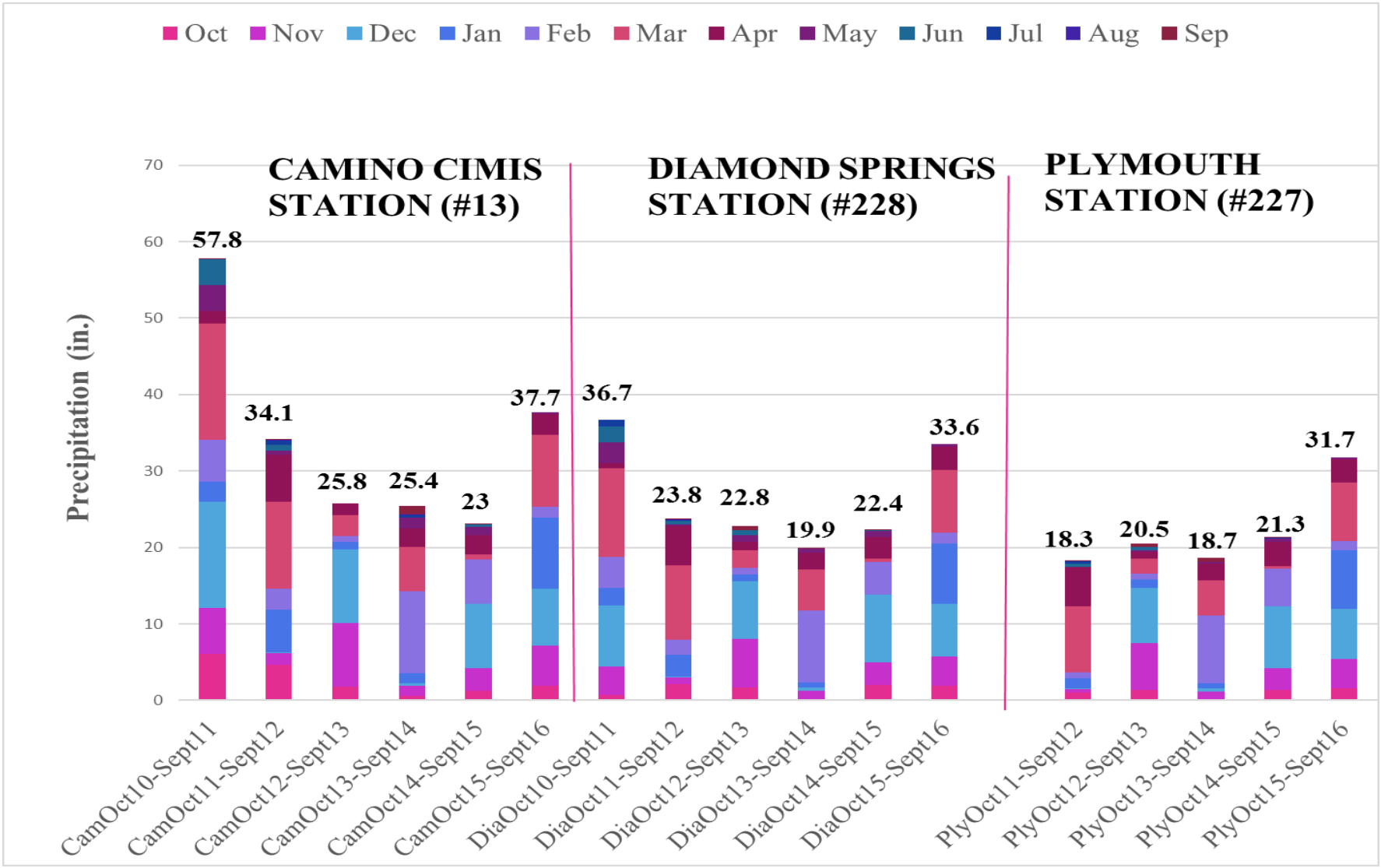


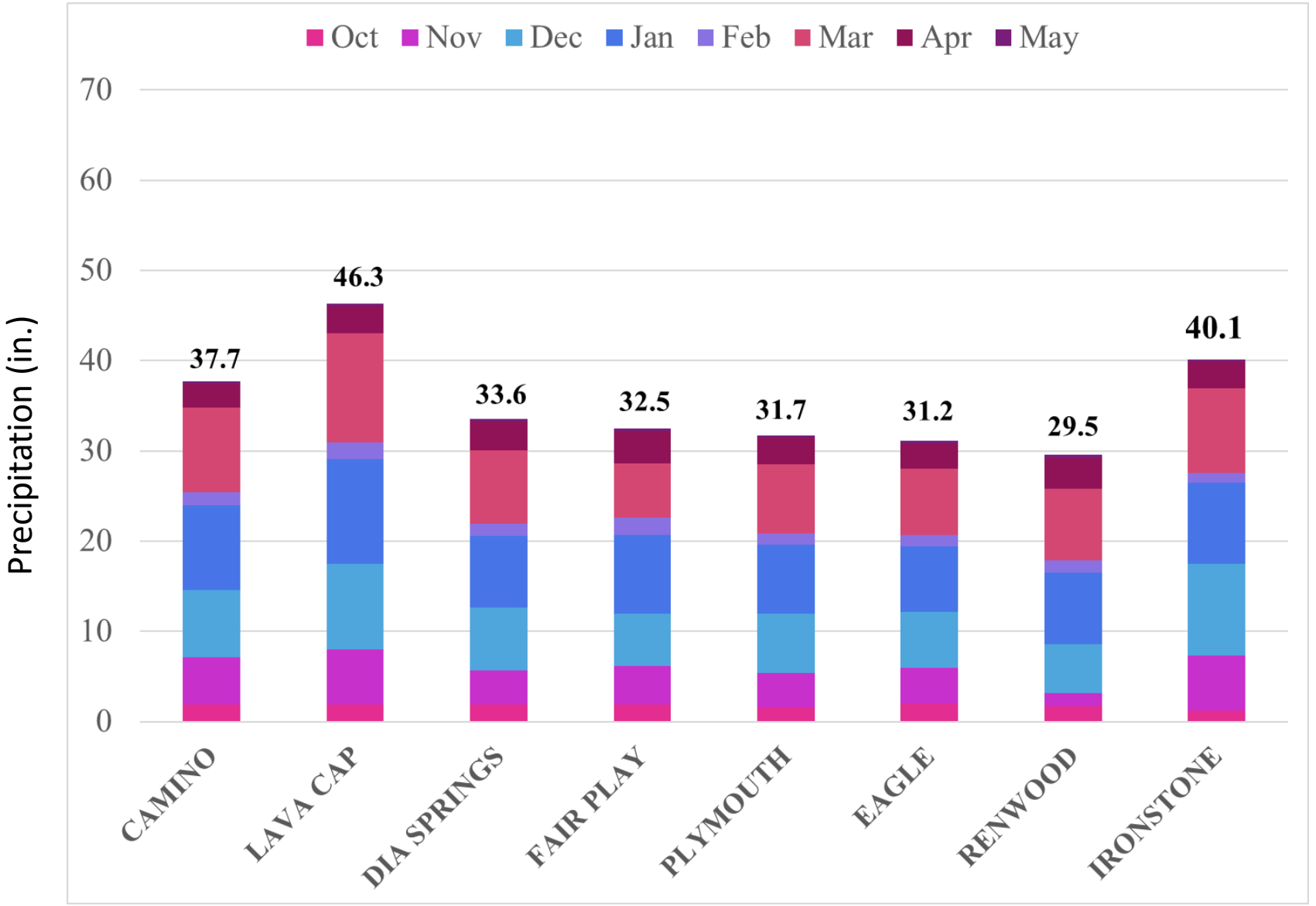
Welcome to Foothill Grape Day 2016!
"Healthy Vines, Fine Wines"

CIMIS station recorded precipitation by month for the hydro year (Oct to Sept).

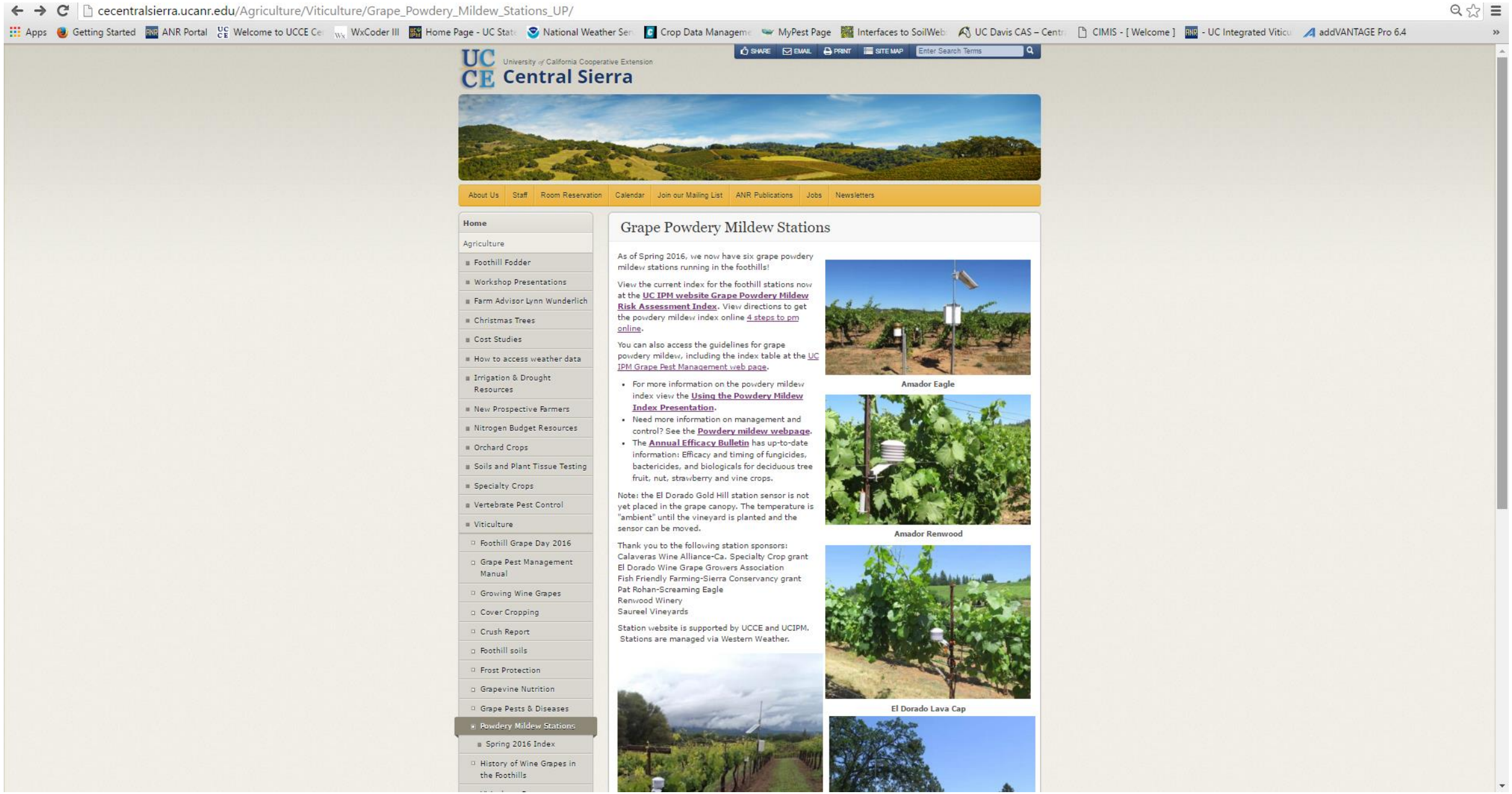
Updated May 9, 2016.



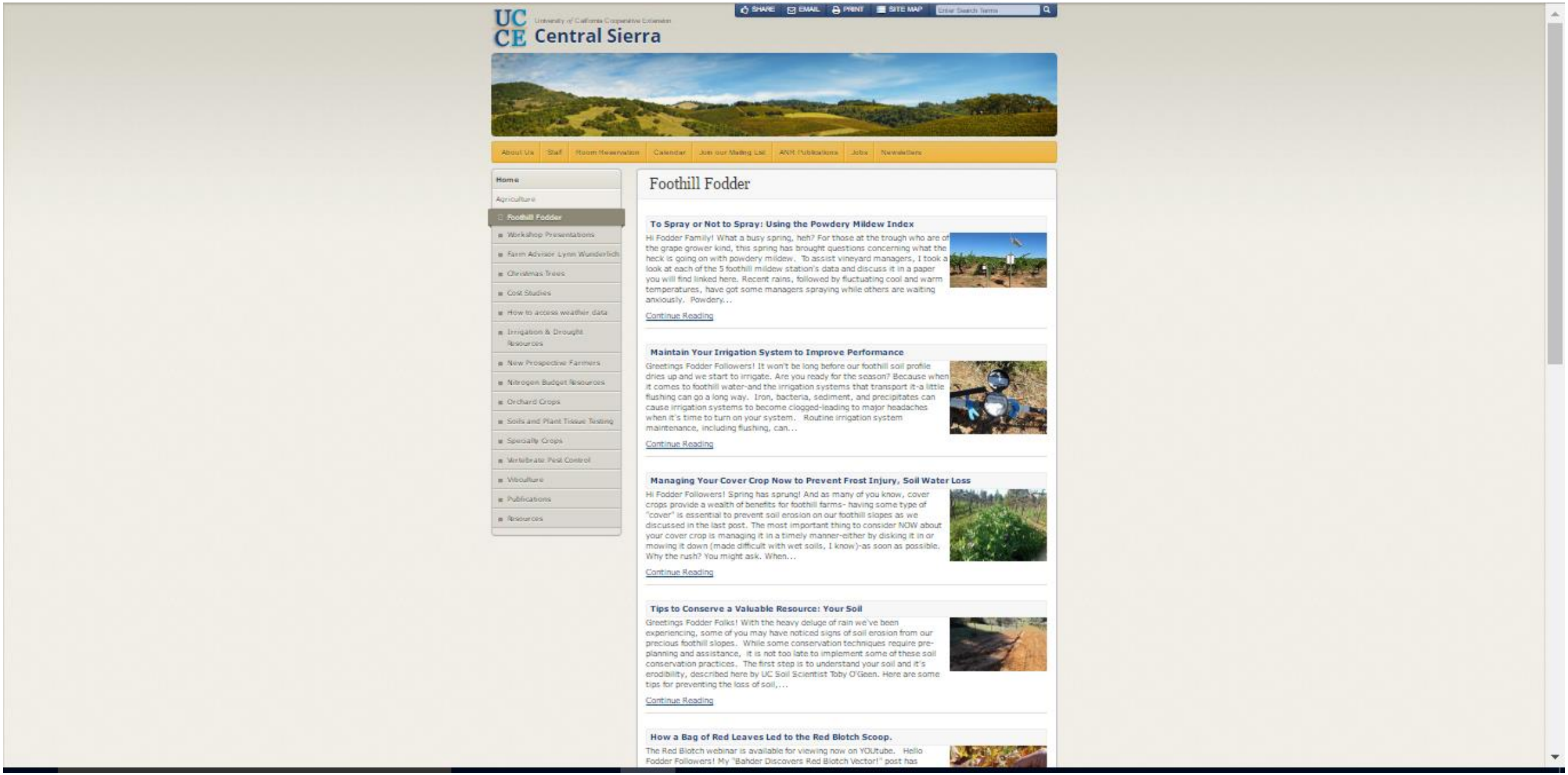
Foothill station recorded precipitation, by month, Oct. 1-May 8, 2016.



http://cecentralsierra.ucanr.edu/Agriculture/Viticulture/Grape_Powdery_Mildew_Stations_UP/



cecentralsierra.ucanr.edu/Agriculture/Foothill_Fodder



SAVE the DATES: Prof. Vittorino Novello visits Aug. 1-4

President of the Master 'Viticulture and Enology Sciences', University of Turin, ITALY;

Member of the European Consortium EMaVE (European Master of Viticulture and Enology)

President of the OIV Working Group "Management and innovation of viticultural techniques"

Author or co-Author of 191 viticulture publications

EVENING ARRIVAL RECEPTION: **Monday, Aug. 1, location TBD**

MORNING VINEYARD TOURS: **Aug. 2: El Dorado County; Aug. 3: Amador County**

EVENING SEMINAR and FAREWELL RECEPTION: **Aug. 4, Terra D'Oro** (all wineries invited to bring Italian wines to taste)

AMADOR WINEGROWERS

Organized and Sponsored by UCCE,
the Amador Winegrowers Association and the
El Dorado Wine Grape Growers Association

El Dorado Grapes
GROWN AT A HIGHER LEVEL

Effect of slope and aspect on vine water use and stress: **How much water do vines REALLY use?**

Lynn Wunderlich, Daniele Zaccaria, Ken Shackel and Rick Snyder

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Vine water use factors

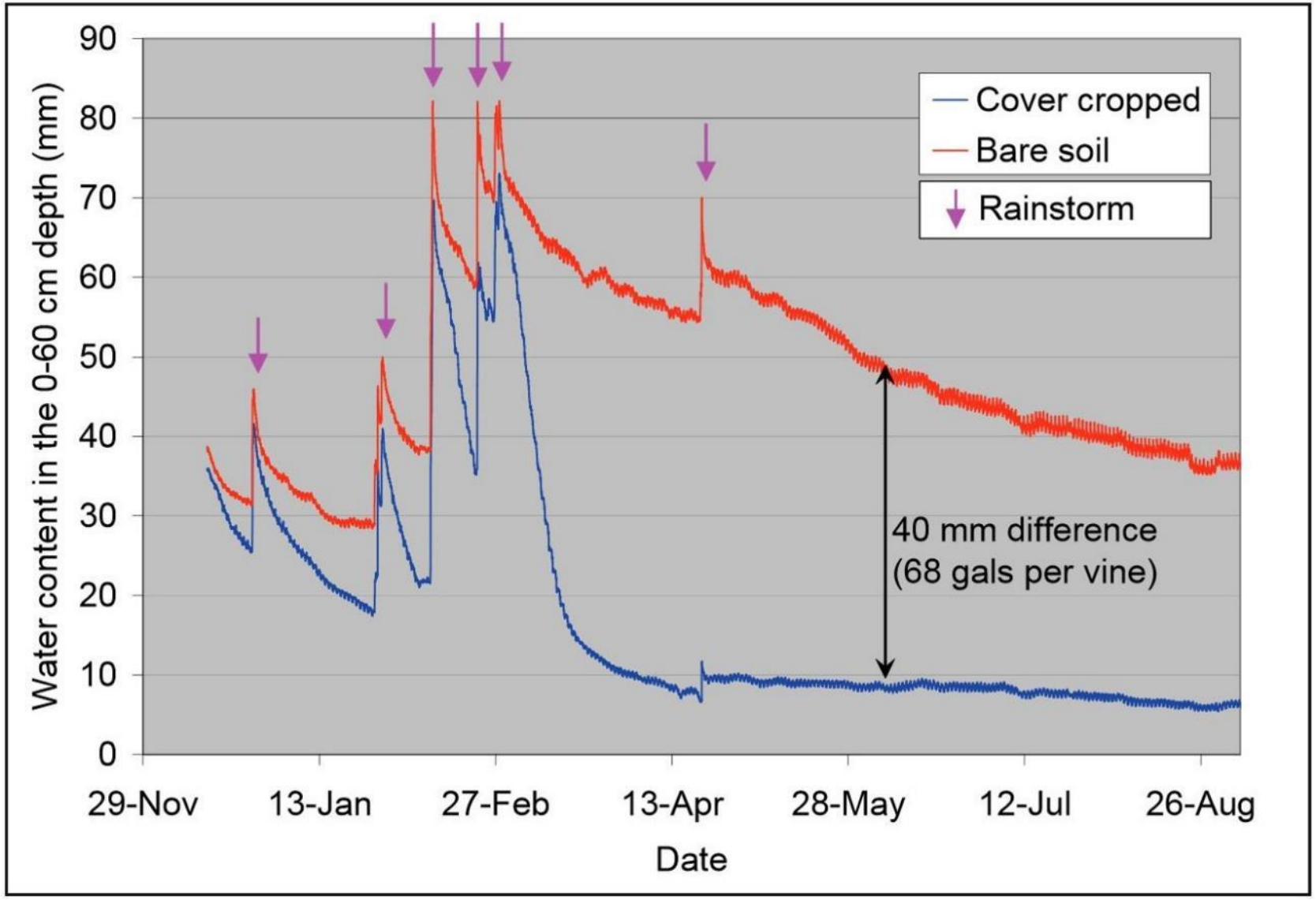
- Available water
  - Precipitation
  - Irrigation
  - Deep soil water storage
- Soil features
  - ✓ texture, depth, rock –Plant Avail. Water
- Microclimate
  - ✓ Temp, RH, Wind
  - ✓ **Net radiation**
- Root growth and Rootstock
- Age
- Variety
- Canopy size (canopy management)
- Cover crop
- Vine health

Degree of slope and aspect?

How much water do cover crops use?

Soil water content (mm) at 0-60 cm. deep: Cover cropped vs. Bare soil.

Courtesy of Mark Battany, UCCE San Luis Obispo/Santa Barbara Counties.



Tools growers have to make irrigation decisions

- **Measure soil**
  - Tensiometers
  - Electrical resistance blocks
  - Neutron probe
  - Di-electric sensors
  - Shovel

- **Measure (or observe) plant**
  - ➢ Tendrils, shoot tip growth
  - Leaf water potential Ψ_{leaf}
  - ➢ **Stem water potential Ψ_{stem}**
  - Stomatal conductance
  - Sap flow-Dendrometers
  - Infrared (IR) canopy measurements

- **Measure climate in order to estimate evapotranspiration (ET)**

-ETc $_{(winegrapes, RDI)}$ calculated from ETo and a Kc, with estimated shade factor and RDI factor

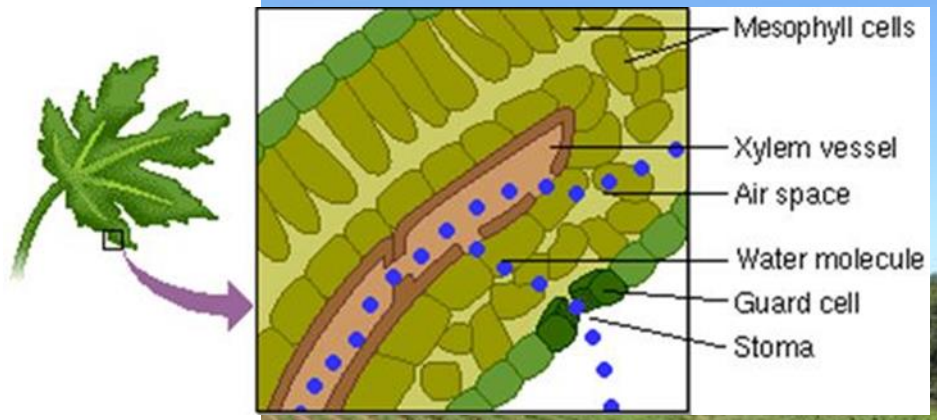
➢ **Measure radiation and calculate ET by energy-balance:**

➢**Eddy covariance**

-Surface renewal

- "modified" surface renewal (TULE TECH)

Evapotranspiration (ET): Evaporation + Transpiration



ET: how much water a parcel of land "uses"

Crop transpiration

Soil evaporation

Weedy groundcover/cover crop transpiration

Our premise: Radiant energy is the *driving force* of ET (when water not limited)

Radiation sinks we can measure:

R_n net radiation

G ground radiation

H sensible heat flux

Energy balance equation for actual ET:

Latent heat= R_n-G-H

$ET_a=(R_n-G-H)/2.45$

2.45 converts from energy flux in MJ $m^{-2}d^{-1}$ to mm d^{-1}

Eddy covariance method uses sonic anemometer to measure H, gold standard, requires fairly large uniform fields, $$$, complex.
Surface renewal method uses a fine wire thermocouple to measure H, and a calibration factor, more affordable.

Shapland et. al. (2012) published research measuring greater ET_a on South facing slopes

Irrig Sci (2012) 30:471–484
DOI 10.1007/s00271-012-0377-6

ORIGINAL PAPER

Estimation of actual evapotranspiration in winegrape vineyards located on hillside terrain using surface renewal analysis

T. M. Shapland · R. L. Snyder · D. R. Smart · L. E. Williams

Received: 29 July 2011 / Accepted: 2 July 2012 / Published online: 1 September 2012

IRRIGATION MANAGEMENT
FOR THE
SIERRA NEVADA FOOTHILLS
OF CALIFORNIA

by

Dick Bethell, Elias Fereres, Richard Buchner and Ronald Mansfield

PREPARED FOR

UNITED STATES BUREAU OF RECLAMATION

JUNE 1981

Elevation	Inches of Water Required Per Season			
	South Slope		North Slope	
	Covercrop	No Cover	Covercrop	No Cover
500 -1000	- - - - - - No Data Collected - - - - - - -			
1000-1500	31	22	26	19
1500-2000	26	18	21	14
2000-2500	22	15	17	12
2500-3000	20	13	15	10
3000-3500	15	10	12	7
3500-4000	- - - - - - No Data Collected - - - - - - -			

Table 6. Estimates of vineyard water use as they relate to the site factors of elevation, slope direction and covercrop practice.

Foothill Studies 2013-present

Objective: to measure ET_a and Ψstem in north (N) and south (S) facing sloped vineyards to evaluate differences in vine water use and vine stress.

Installed ET stations on N and S facing slopes where:

- ✓ clone
- ✓ rootstock
- ✓ spacing
- ✓ planting date
- ✓ trellis system
- ✓ cover crop

was the same.

Irrigations were left to grower-cooperators. Water meters were installed (2015) to track.

Nearest CIMIS station provided precip., ET_o.

Ψstem were taken periodically.

Using a pressure chamber to measure vine stress (Stem Water Potential)

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Are the vines stressed?

2013-2015: Mid-day stem water potential measurements.

2015: Shoot tip ratings and shoot length measurements.

Mid-day **LEAF** water potential	
less than -10 bars	no stress
-10 to -12 bars	mild stress
-12 to -14 bars	moderate stress
-14 to -16 bars	high stress
above -16 bars	severe stress

Mid-day **STEM** water potential	
less than -7 bars	no stress
-7 to -9 bars	mild stress
-9 to -11 bars	moderate stress
-11 to -13 bars	high stress
above –13 bars	severe stress

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2013 Vineyard: Site A

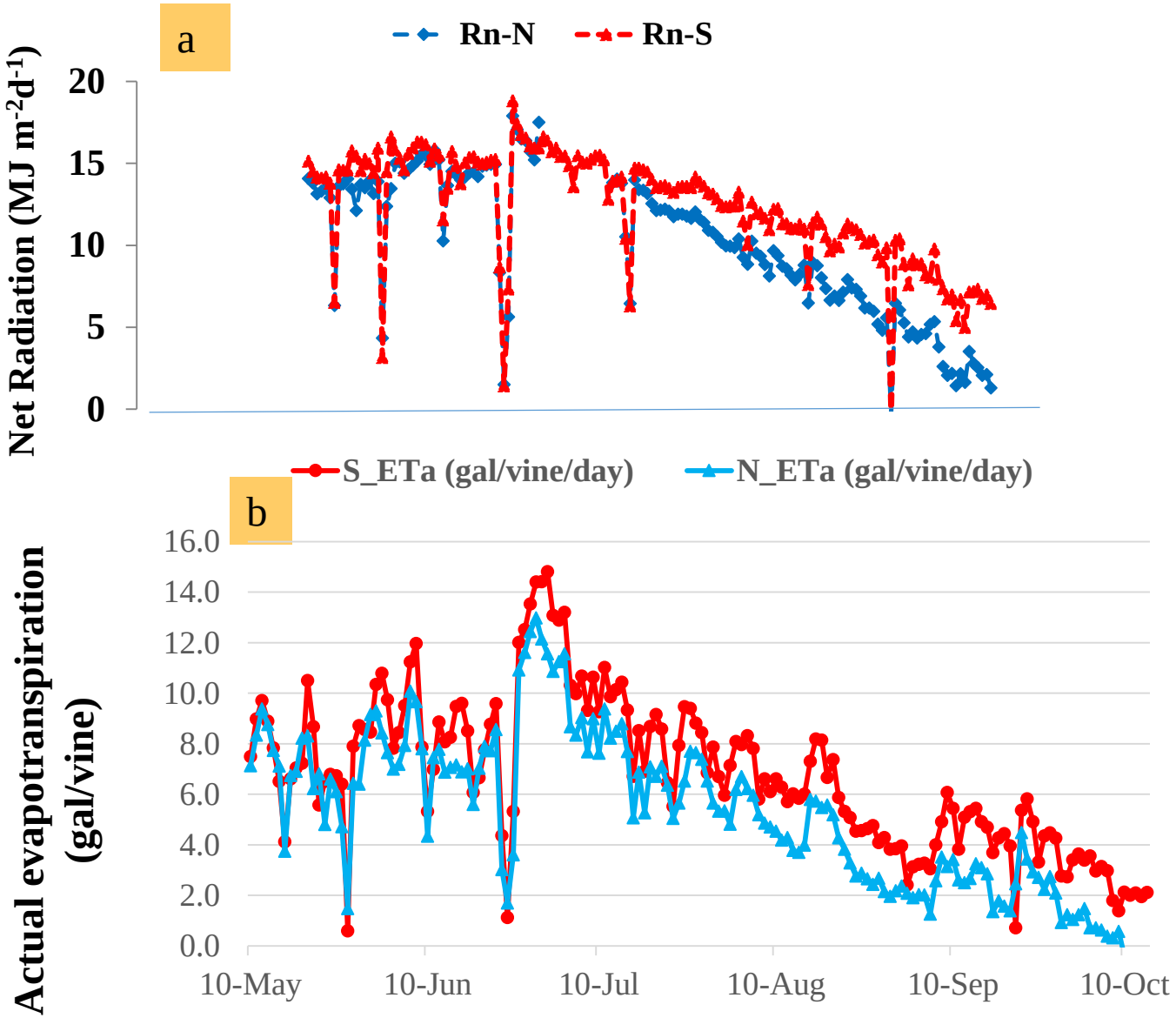
- Merlot on Chenin blanc root, 8 x 12 spacing (454 vines/ac), bilateral cordon
- Planted in 1973; vine health?

- Slope approx. N 8% and S 14.4%
- Auberry soil series-Granitic, typically deep

- CIMIS station Diamond Springs # 228 on site
- 6 irrigations applied: 179 gallons per vine for the season (2.99 ac-in). 6/19-8/15
- Neutron probe on site.
- 1.6 inch precip. May 10 – Oct 13

THANK YOU To Our GROWER-COOPERATORS

Net radiation (a) and actual evapotranspiration (b) on North (N) and South (S) facing slopes: site A (2013).



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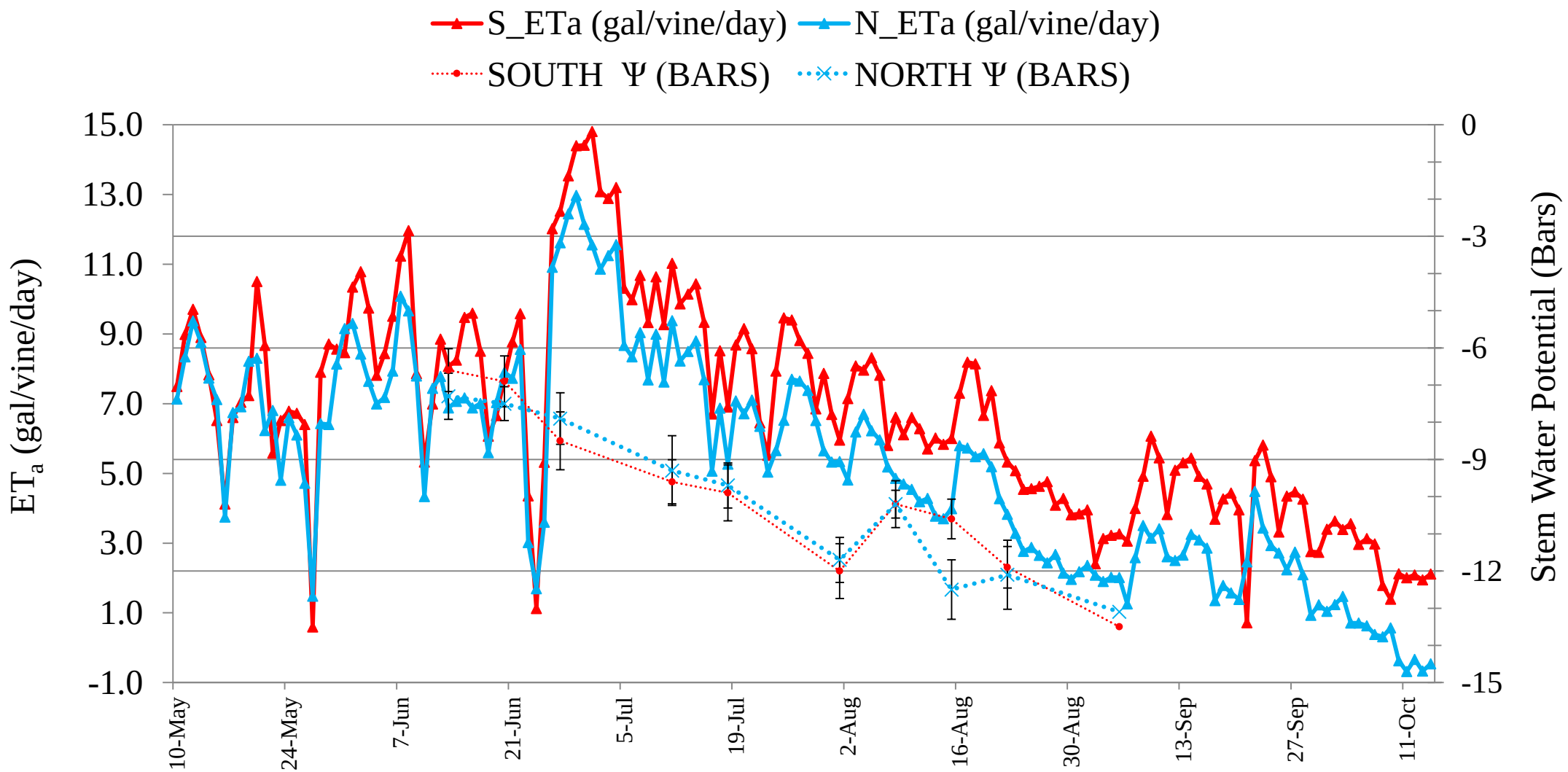
Actual vine water use, ET a (gal/vine/day) and average vine stress (bars). Vineyard A, 2013.



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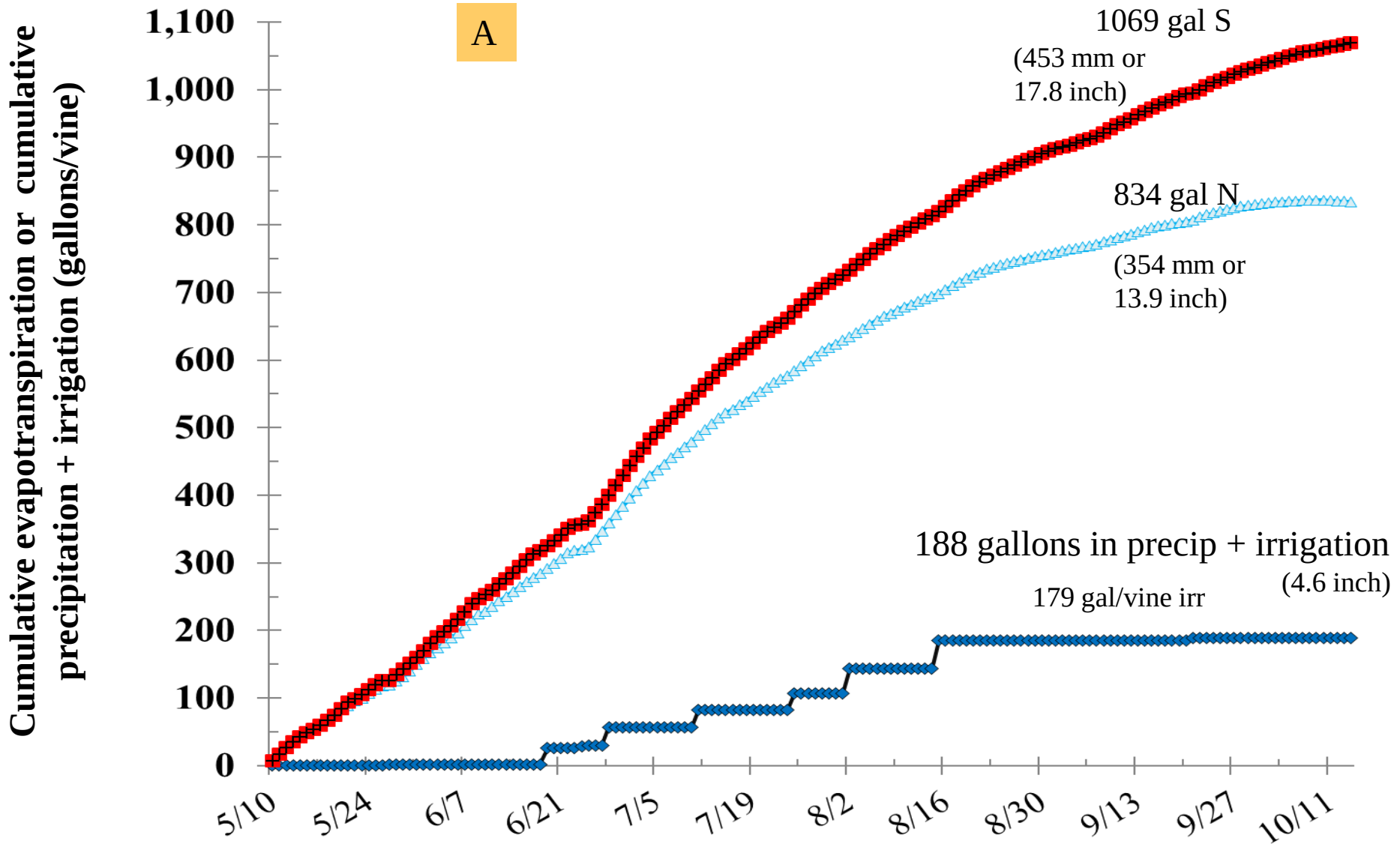
2013 Vineyard A: Cumulative evapotranspiration (C-ET) per vine on North (N) and South (S) facing slopes, compared to cumulative precipitation + applied irrigation (CPI) per vine.



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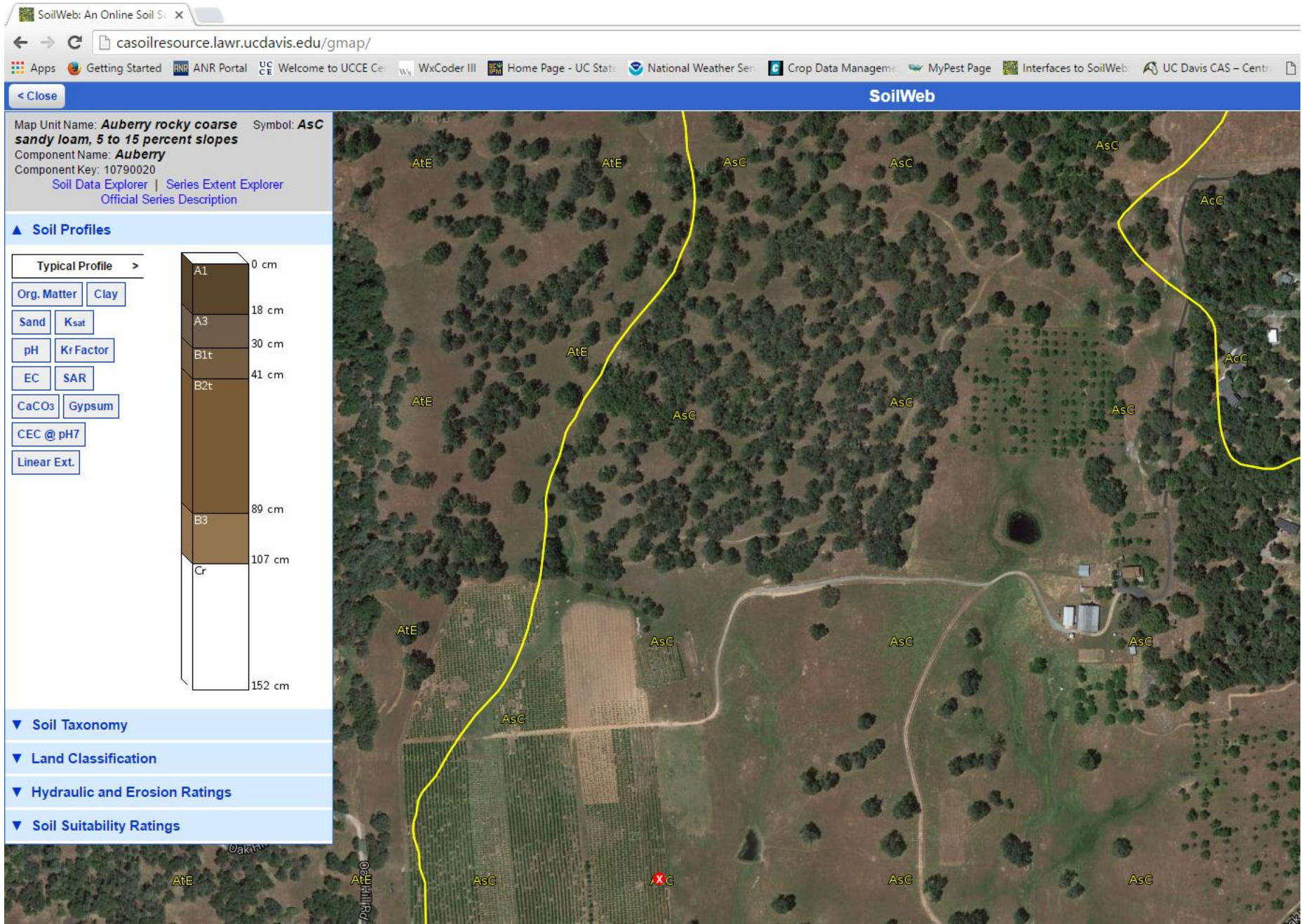
http://casoilresource.lawr.ucdavis.edu/soilweb-apps



2014 and 2015 Vineyard: Site B

- Cabernet sauvignon on 3309, 5 x 6 spacing (1452 vines/ac), VSP trellis
- Planted in 2000
- Slope approx. 18%
- Auburn soil series-Metasedimentary, typically variable in depth
- CIMIS station Auburn #195

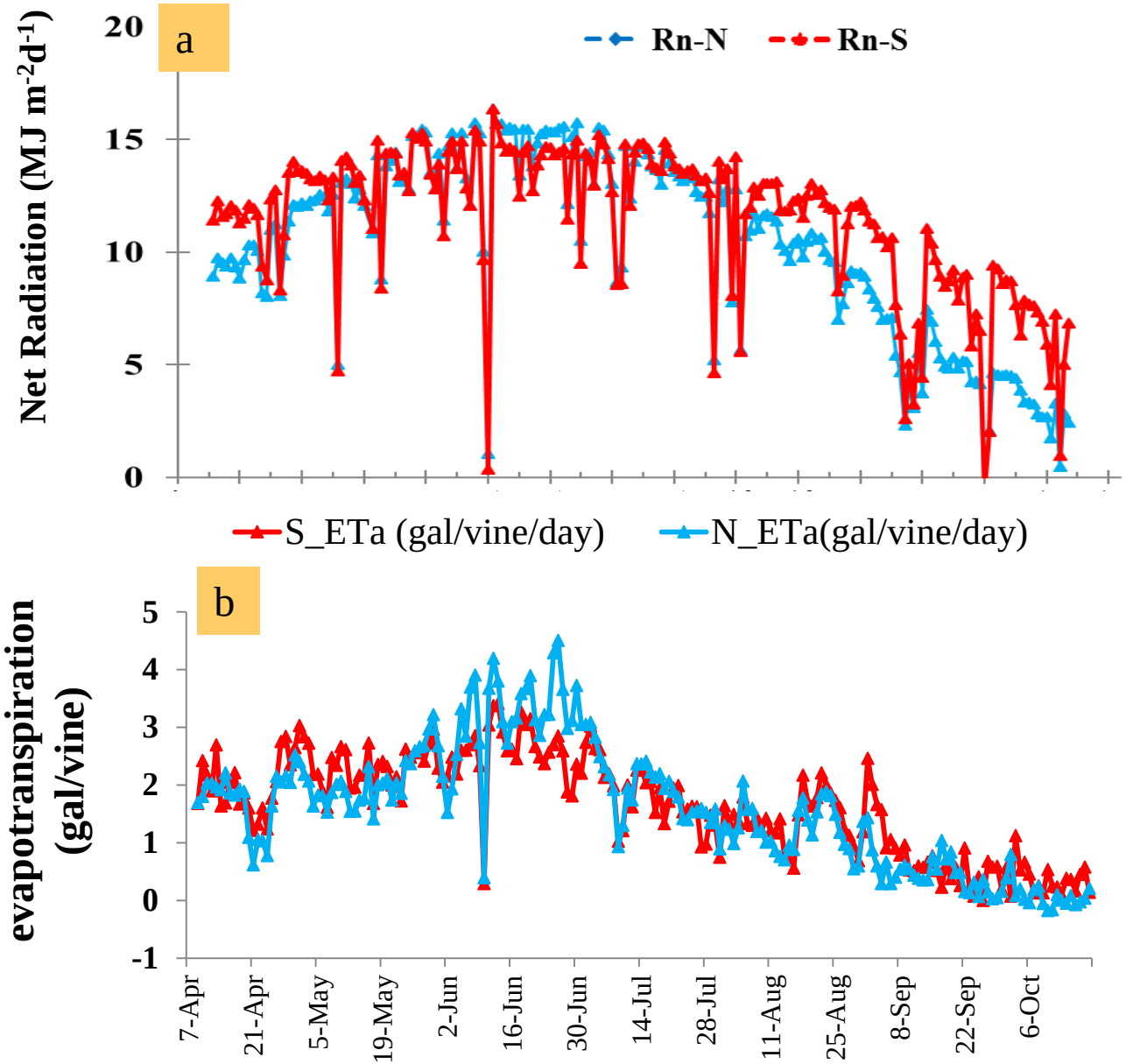
2015: April 8 ET stations installed.
Water meters installed in irrigation lines on each slope.

14 irrigations applied (April 11- Sept. 14):
North: ave. 99 gal/vine
South: ave.76 gallons/vine

3.57 in precip. April 1-Oct. 19.

THANK YOU To Our GROWER-COOPERATORS

Net radiation (a) and actual evapotranspiration (b) on North (N) and South (S) facing slopes: site B (2015).



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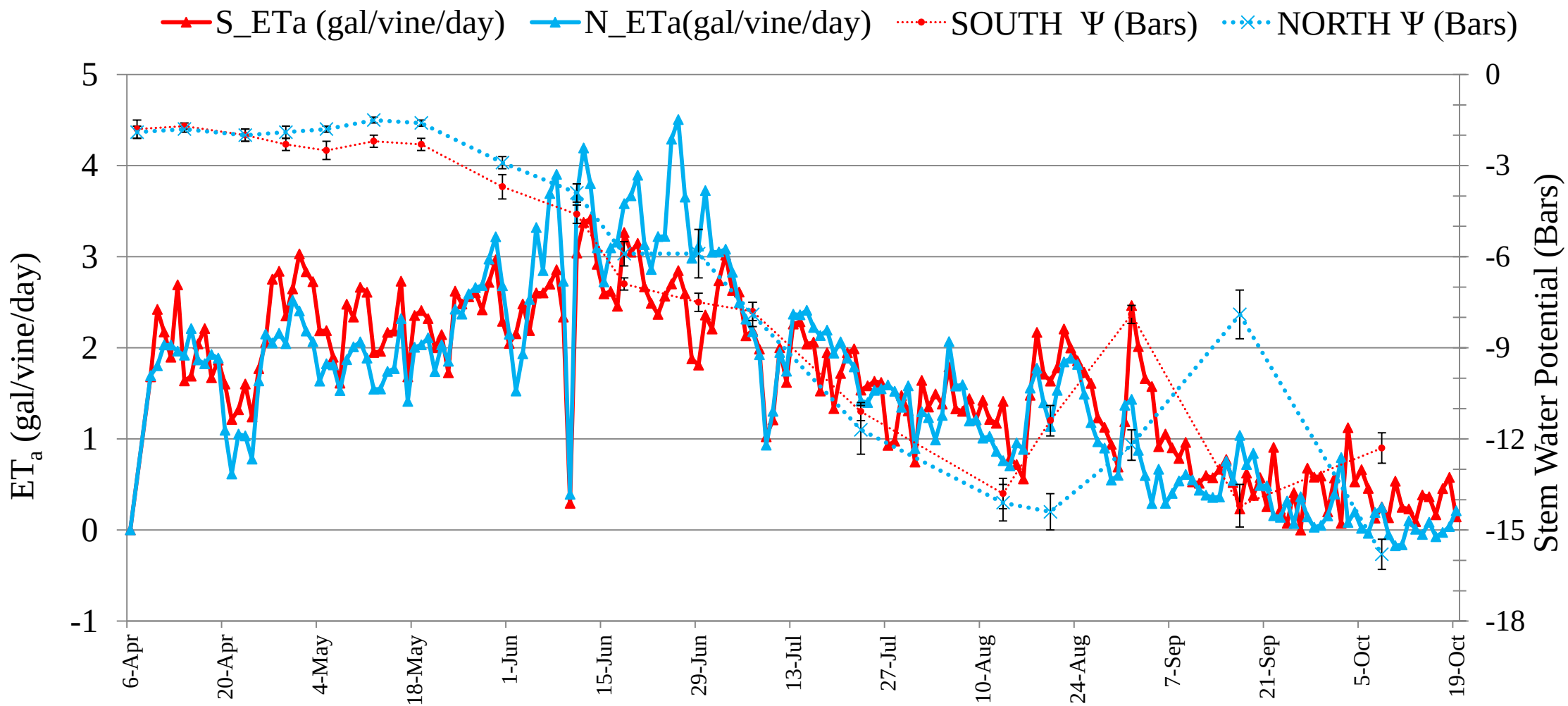
Actual vine water use, ET_a (gal/vine/day) and average vine stress (bars). Vineyard B, 2015.



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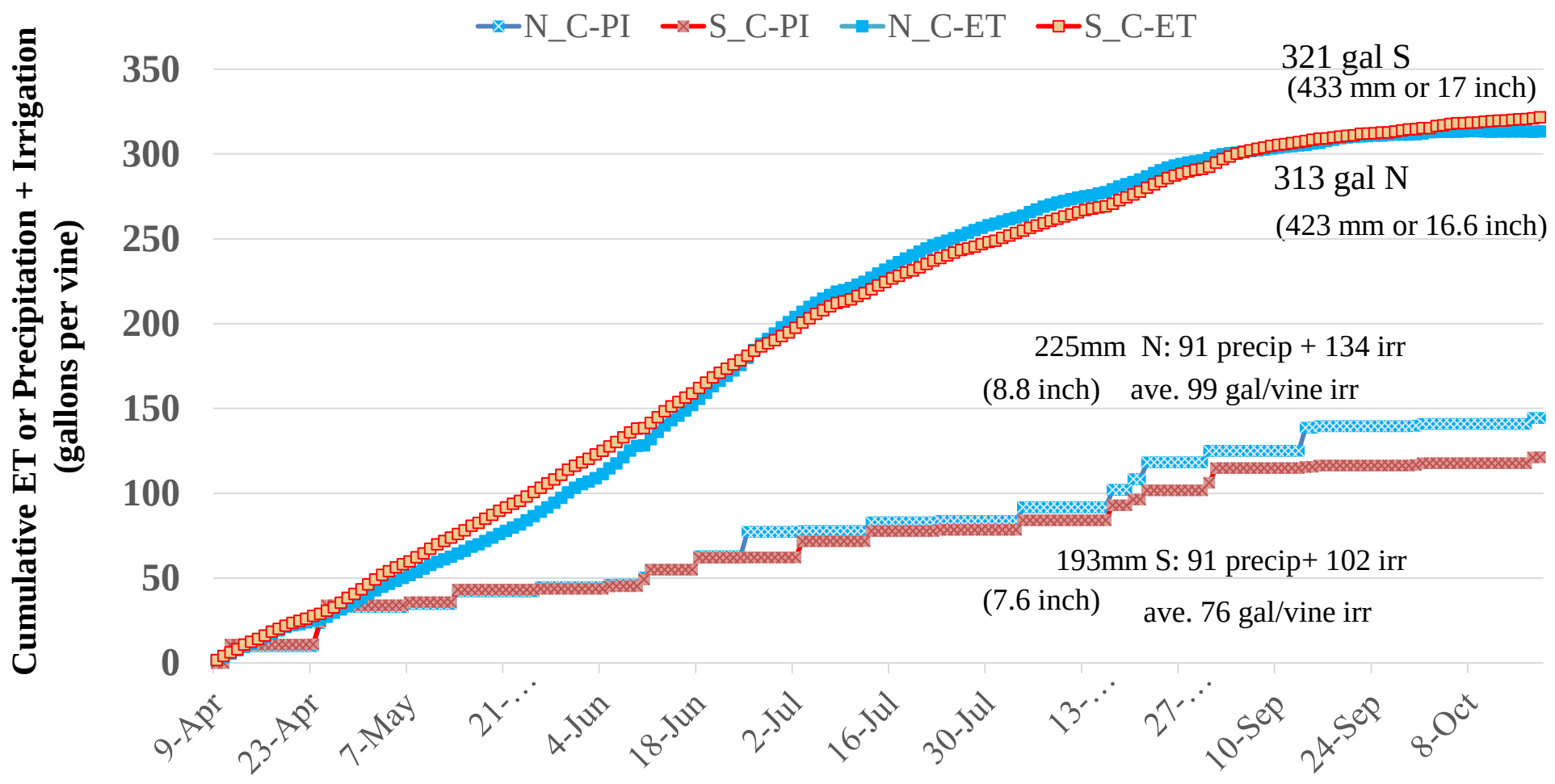
2015 Vineyard B: Cumulative evapotranspiration (C-ET) per vine on North (N) and South (S) facing slopes, compared to cumulative precipitation and applied irrigation (C-PI), April 8-Oct 18.



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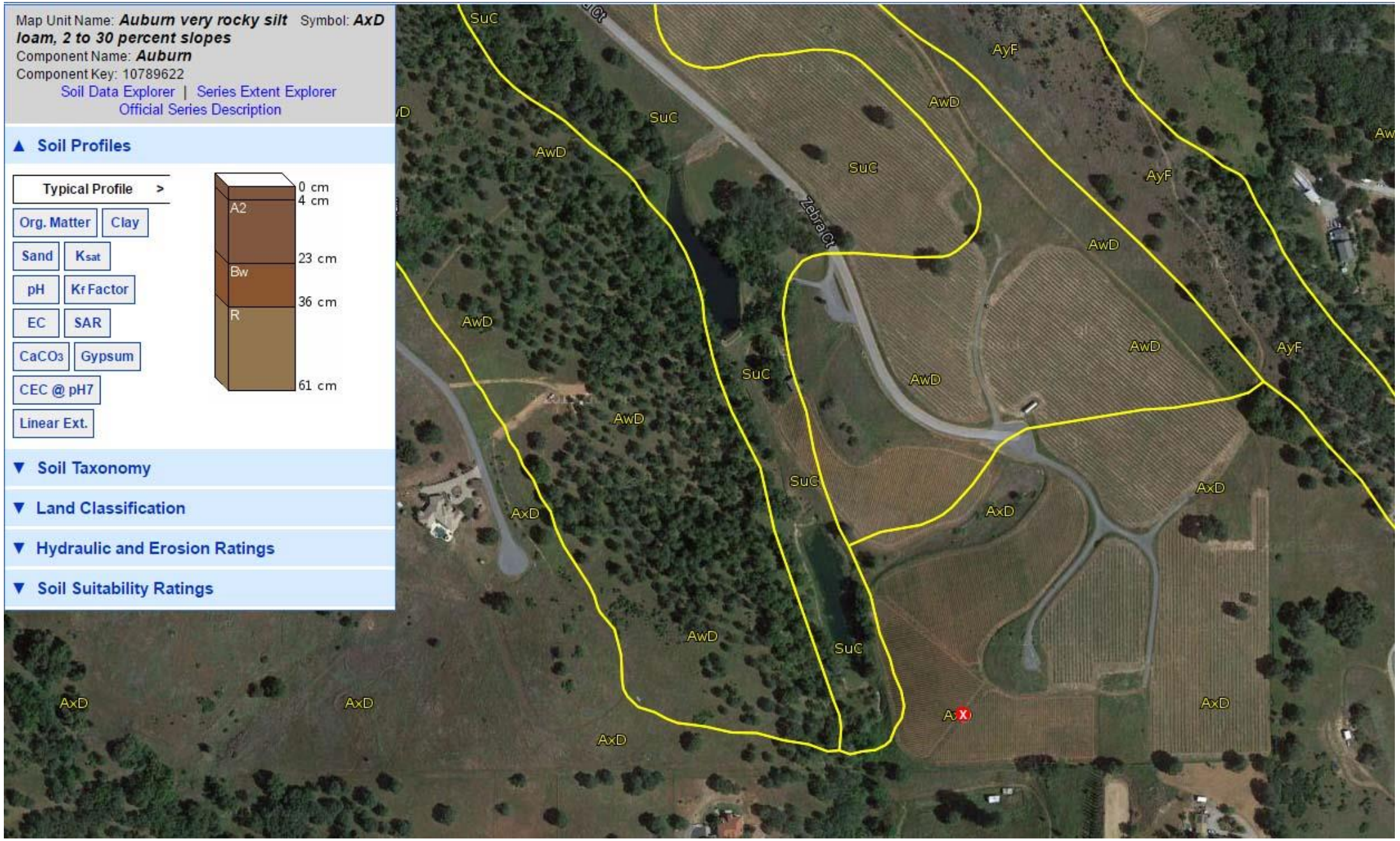

Soil excavation May 14 with Stewart Wilson (O'Geen lab). Soil maps to Auburn series-typical depth 24 in.

South slope: some oxidation features and clay films at 29 in.
(fluctuating water table?). Grape roots at 33 in.
Hit rock at 45 inches (fractures deeper).

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N slope. Less gravel content, finer (clay) texture visibly moister, but shallower. Rock at 34.5 inches.

Effect of slope and aspect on vine water use and stress: what we've learned so far.

In vineyard A:

- Greater daily net rad and ET_a was observed on the **S** slope.
- Stem water potential was similar on N and S slopes.

In vineyard B:

- Greater daily net rad and ET was observed on the **S** facing slope in spring and fall; but
- Greater daily net rad and ET was observed on the **N** facing slope in mid-summer.

- Ψ measurements indicated greater vine stress on the N slope in late summer, even though demand (net rad) was lower and applied irrigation water was greater there than on the S slope, giving us a clue to soil and groundwater differences between slopes.

➢ In both vineyards, vine water use (C-ET)was greater on the S slope.

➢ In both vineyards, vine water use (C-ET) on both slopes was much greater than water we can account for (precip. + irrigation).


tule
04/23/2016


04/23/2016

Thank you.

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