

UC
CE

University of California
Agriculture and Natural Resources

Welcome to Foothill Grape Day 2018

VINE BALANCE

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Setting the Stage: Factors Affecting Foothill Site Capacities

“Capacity”

Vine capacity: *total possible growth and crop (vegetative and fruit) of which the vine is capable.* Winkler, 1962

- **Management**
- **Age of vine**
- **SITE capacity**



The capacity to produce FRUIT
depends on the production of
WOOD



“Vigor”

condition expressed in rapid growth of the vine. Rate of growth (related to time). Winkler, 1962

Affected by:

- Scion variety
- Rootstock
- Age
- Management practices
- Weather
- Pests and disease
- Site capacity



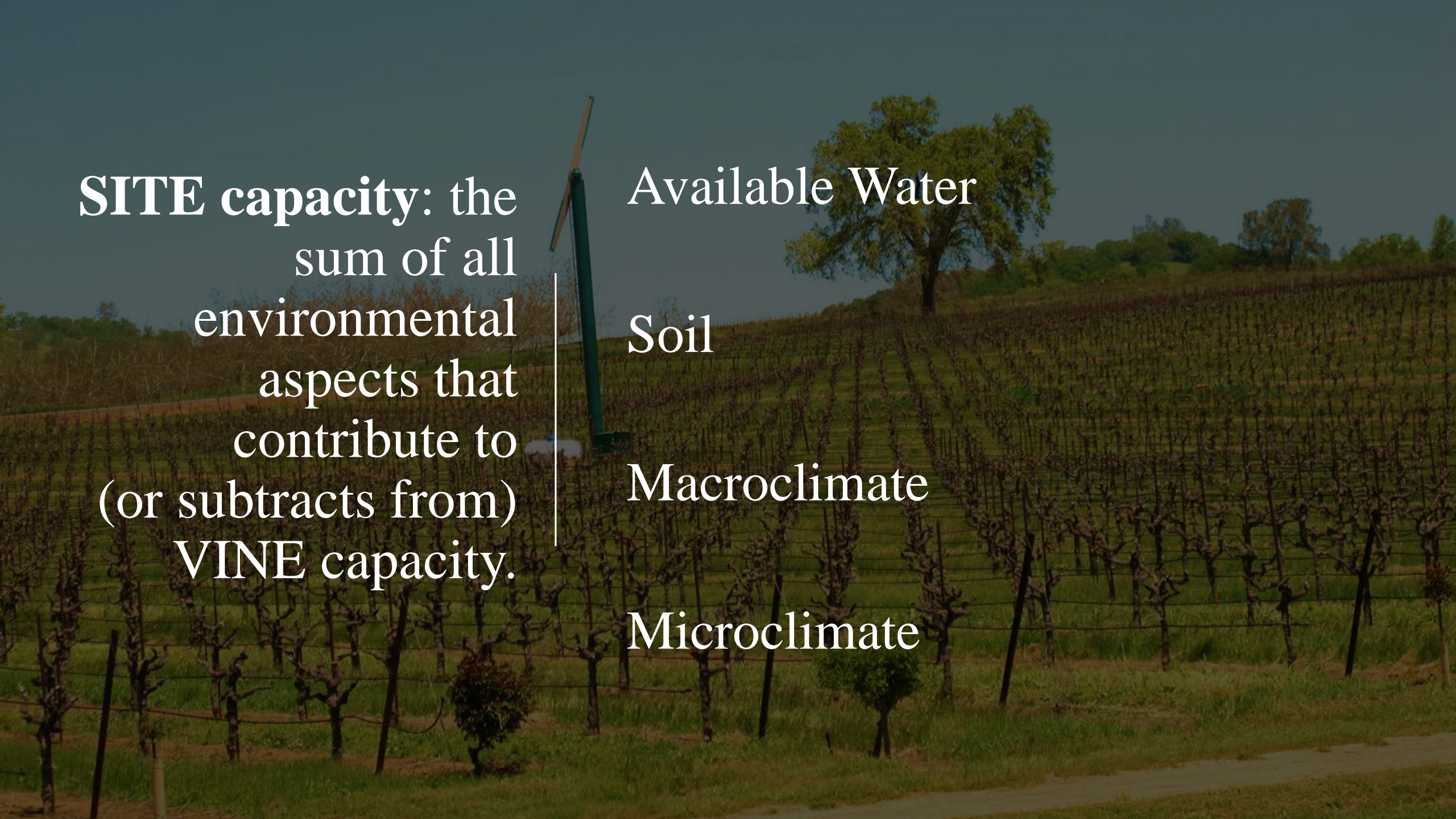
SITE capacity: the sum of all environmental aspects that contribute to (or subtracts from) VINE capacity.

Available Water

Soil

Macroclimate

Microclimate



Site Factor: Climate



Data SIO, NOAA, U.S. Navy, NGA, GEBCO
Image Landsat
Data LDEO, Columbia, NSF, NOAA
Data MBARI

Google earth



Graph: Min, Avg, Max Elevation: 1367, 2017, 3153 ft
Range Totals: Distance: 15.4 mi Elev Gain/Loss: 5280 ft, -3640 ft Max Slope: 29.5%, -33.0% Avg Slope: 9.0%, -8.7%



We now have 7 Powdery Mildew Stations (PMI) up. Thank you to all of the sponsors and hosts:

**Calaveras Wine Alliance-
CA. Specialty Crop Grants
El Dorado Wine Grape Growers
Fish Friendly Farming-
Sierra Nevada Conservancy**

**Ironstone
Lava Cap
Naylor Vineyards
Oso Loco Vineyards
Saurel Vineyards
Screaming Eagle
Renwood
UCIPM**



CIMIS station measures reference E_{t_0} - well watered grass 'reference'





WatchDog
WeatherTracker

[LCD Display]

Power Current Archive [Down Arrow] [Up Arrow] Set

Spectrum
Technologies, Inc.

May 3, 2010 Frost



Oct. 27, 2008 Frost



Site Factor: Macroclimate

Heat summation in viticulture: Growing Degree Days

Sum of average temperatures above 50°F from April 1 to October 31.

If average daily temperature was 65°F, that day would have accumulated 15 growing degree days (GDD).

Important for variety selection and growth: different varieties require different GDD to adequately mature and ripen.

All varieties require plenty of sunshine!



Growing Degree Days in Viticulture: Winkler Regions

Region I
<2500 GDD

Pinot Noir, Pinot Gris,
Gewurtraminer, White Riesling

Region II
2501-3000

Chardonnay

Region III
3001-3500

Merlot, Syrah, Grenache, Sangiovese, Viognier, Sauvignon blanc,
Chenin blanc

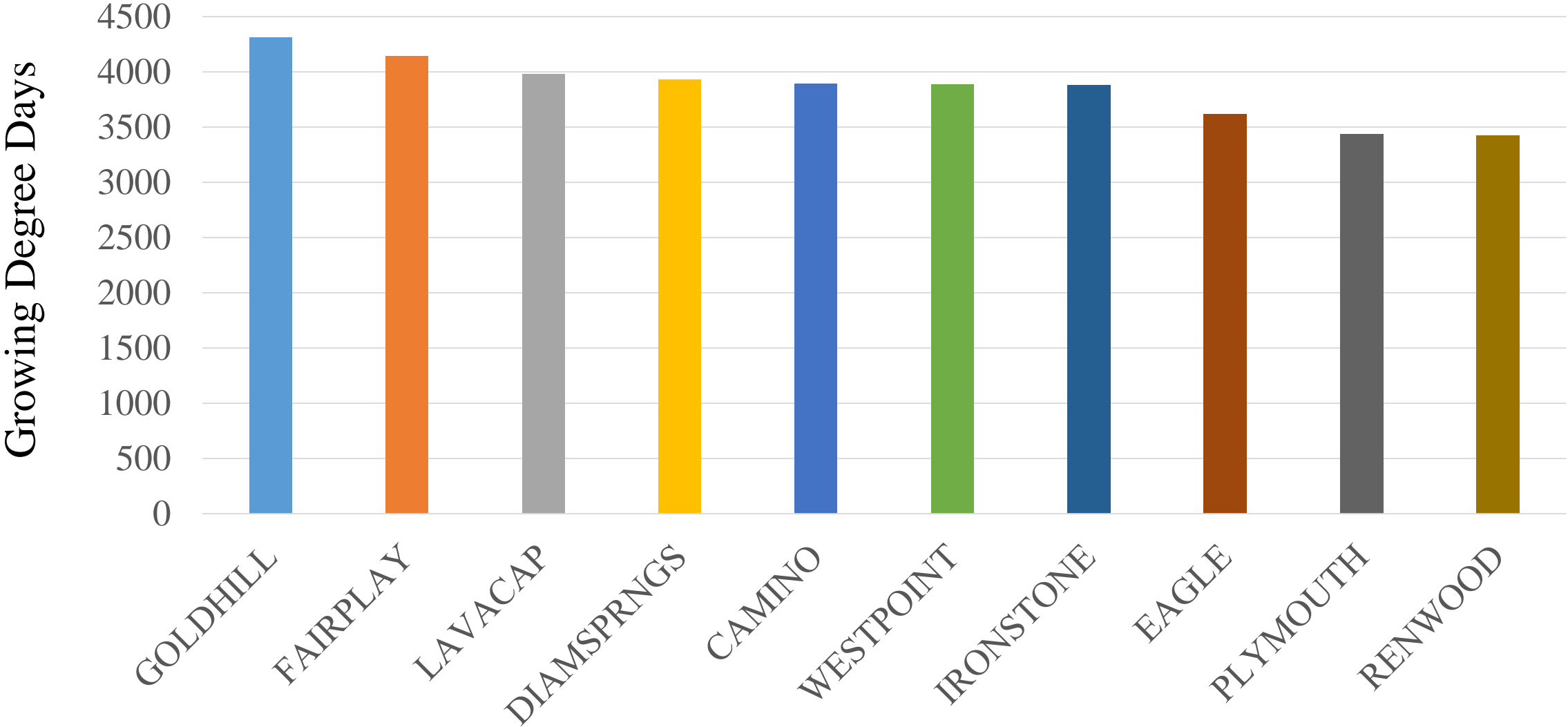
Region IV
3501-4000

Region V
> 4000

Cabernet sauvignon, Cabernet franc, Zinfandel, Barbera, Petite Sirah



Average Growing Degree Days Measured from Foothill Weather Stations 2015-2017



Measured Precipitation from Foothill Weather Stations Oct. 1- March 25, 2018



Site capacity factor: SOIL

- Water holding capacity: Depth, Texture, % Rock
- Structure
- Chemistry and Nutrition

UCCE Soil Specialist
Toby O'Geen



05/14/2013

http://casoilresource.lawr.ucdavis.edu/

The screenshot shows the website interface for the UC Davis California Soil Resource Lab. At the top, there is a navigation bar with links for HOME, SOILWEB APPS, PEOPLE, PROJECTS, SOFTWARE, LINKS, and BLOG. Below this is a section titled "SoilWeb Apps" with a sub-header "SoilWeb Apps". The main content area is divided into four columns, each describing a different application:

- SoilWeb**: "Explore soil survey areas using an interactive Google map. View detailed information about map units and their components. This app runs in your web browser and is compatible with desktop computers, tablets, and smartphones." It includes a screenshot of the app interface showing a map of a field with various soil units and a legend.
- SoilWeb Earth**: "Soil survey data are delivered dynamically in a KML file, allowing you to view mapped areas in a 3-D display. You must have Google Earth or some other means of viewing KML files installed on your desktop computer, tablet, or smartphone." It includes a screenshot of Google Earth showing a 3D view of a soil survey area with a data popup.
- SEE: Soil Series Extent Explorer**: A screenshot showing a map of California with various soil series highlighted in different colors.
- Soil Properties App**: A screenshot showing a map of California with various soil properties highlighted in different colors.

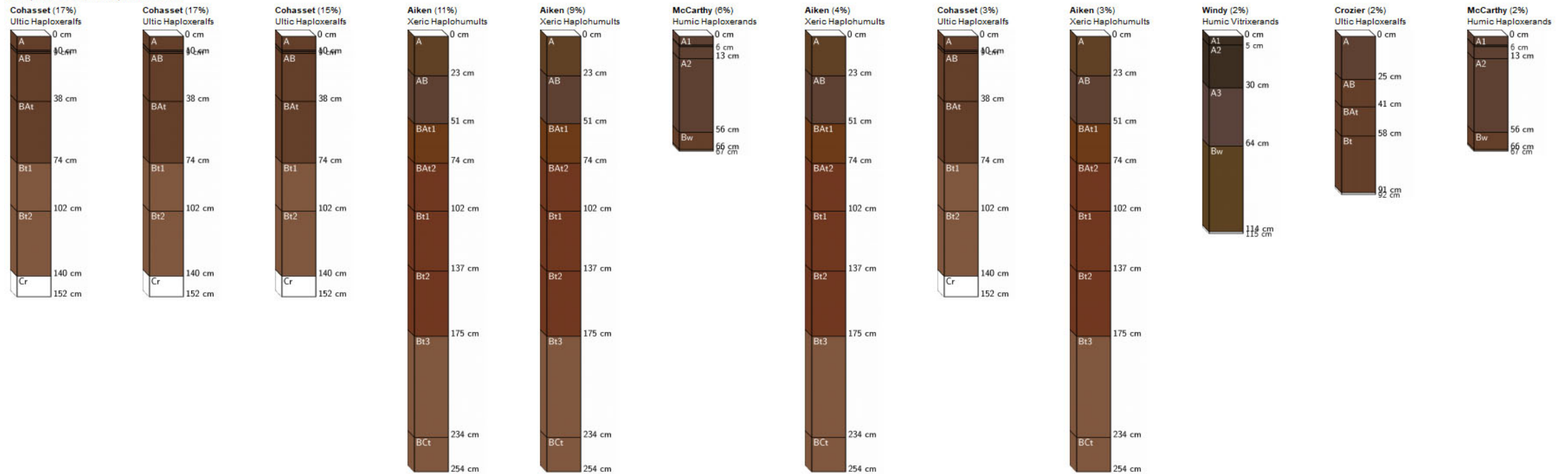


Volcanic Derived Soils: Cohasset, Iron Mountain, Aiken, McCarthy.

Important Properties:
High water holding capacity
Phosphorus deficiency
High Potassium

STATSGO: McCarthy-Cohasset-Aiken (s620)

Components within map unit 660723



Block Diagrams: [Go to NCSS Job Aids](#)

note that these diagrams may be from multiple survey areas

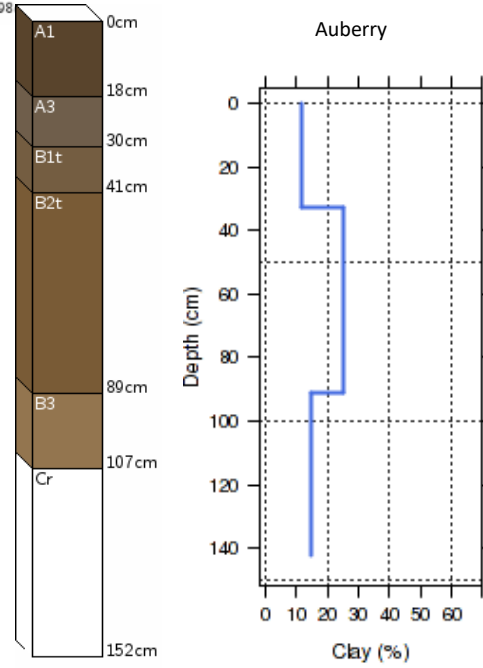
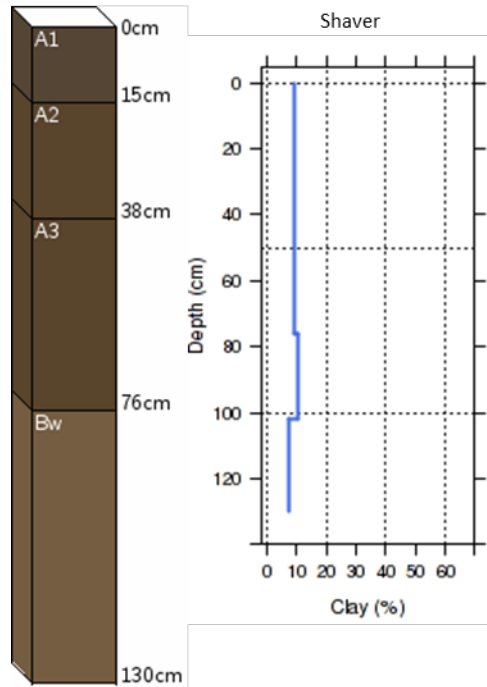
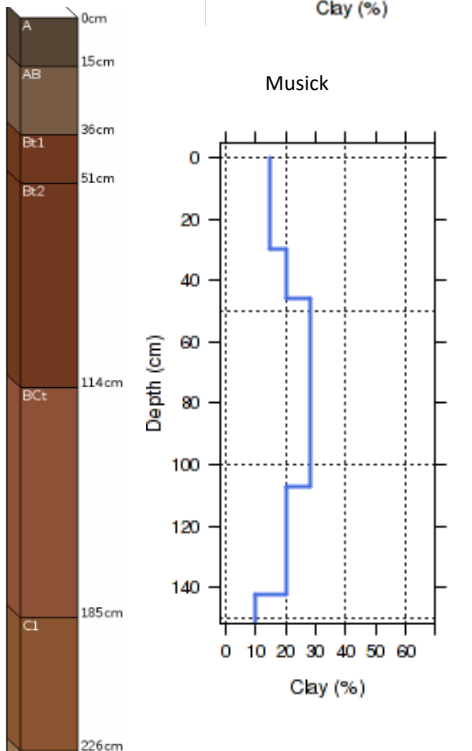
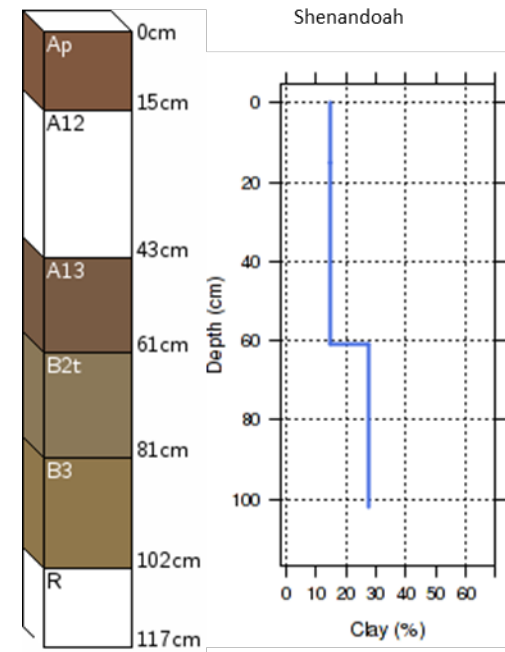
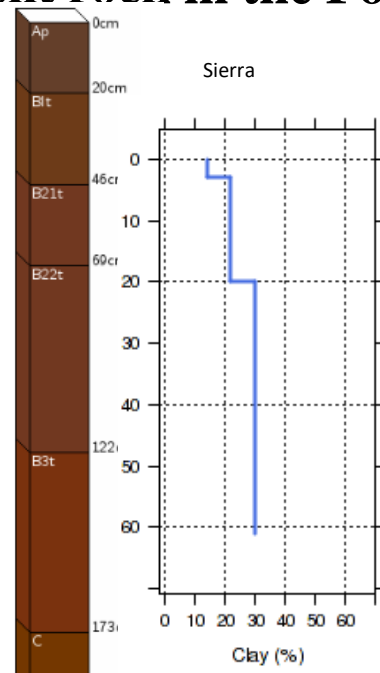
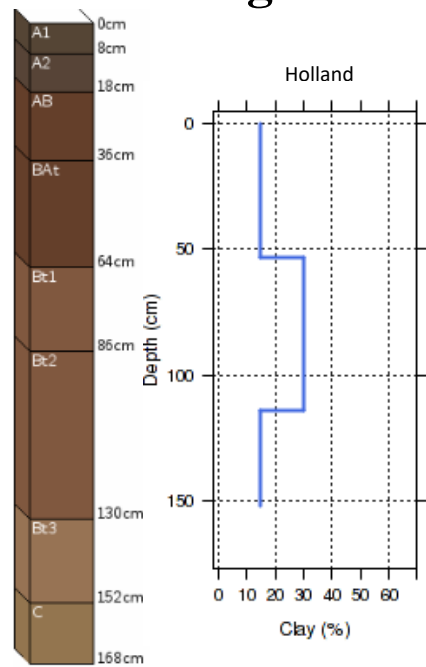
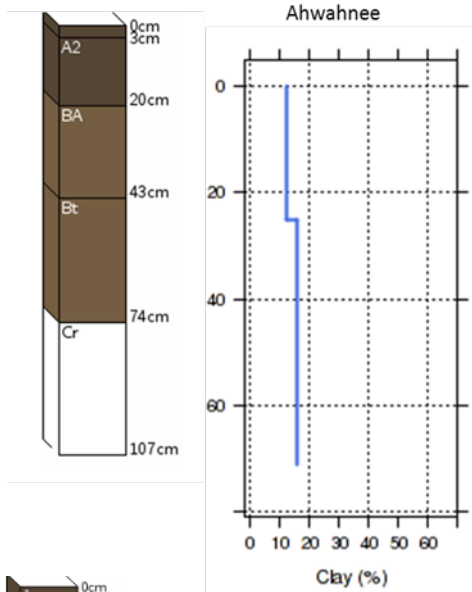
- [WA-2010-11-08-02](#)
- [PA-2010-09-30-06](#)
- [PA-2012-03-13-14](#)
- [WA-2010-11-05-06](#)

Granitic Soils: Shenandoah, Auberry, Musick,
Holland, Sierra, Ahwanhee, Shaver, Snelling.

Important properties:
Low water holding capacity
Potassium deficiency
Soil depth

05/14/2013

Soils formed from granitic parent rock in the Foothills



A hand is holding a rectangular soil sample against a background of green foliage and brown soil. The soil sample shows distinct horizontal layers of different colors, including brown, tan, and a dark blue-grey layer. The text is overlaid on the soil sample.

Metasedimentary Soils: Josephine, Sites,
Auburn, Mariposa, Fiddletown.

Important properties:

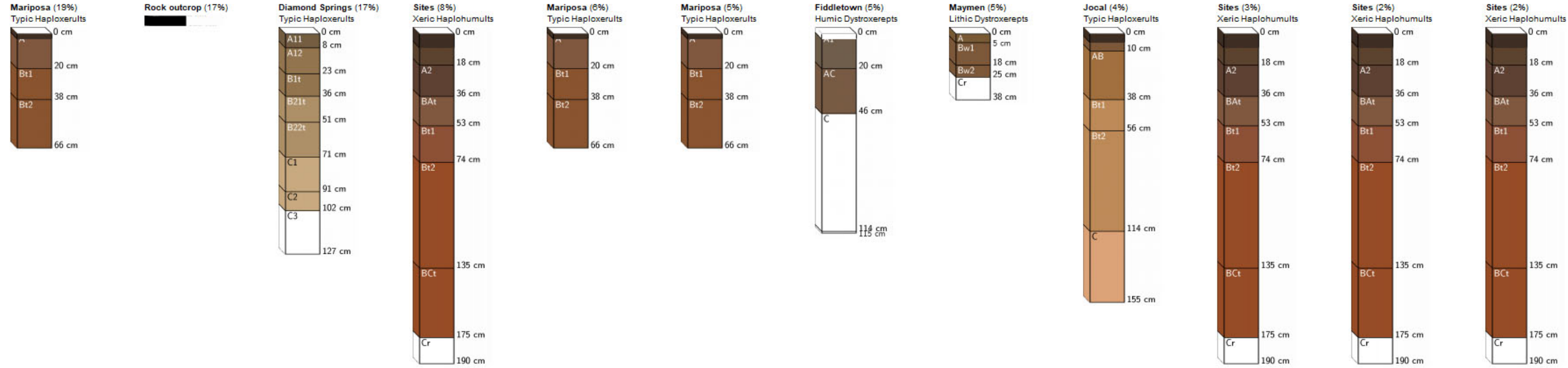
Moderate water holding capacity

Phosphorus deficiency

Soil depth

STATSGO: Sites-Rock outcrop-Mariposa-Diamond Springs (s846)

Components within map unit 660949

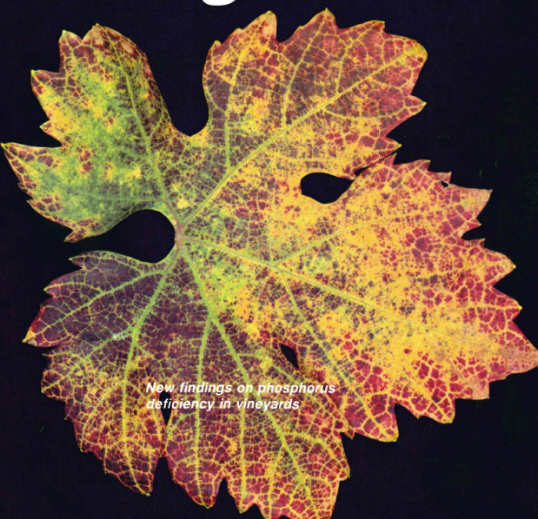


Syrah-Mapped to Aiken/Cohasset
Red blotch GRBV Negative
Leafroll 3 Negative
Petioles at 0.3% P



MAY-JUNE 1983
Volume 37 Numbers 5 and 6

California Agriculture



*New findings on phosphorus
deficiency in vineyards*

University of California Division of Agricultural Sciences Reports of Progress in Research

Syrah-Mapped to Aiken/Cohasset
Red blotch GRBV Positive
Leafroll/3 Negative



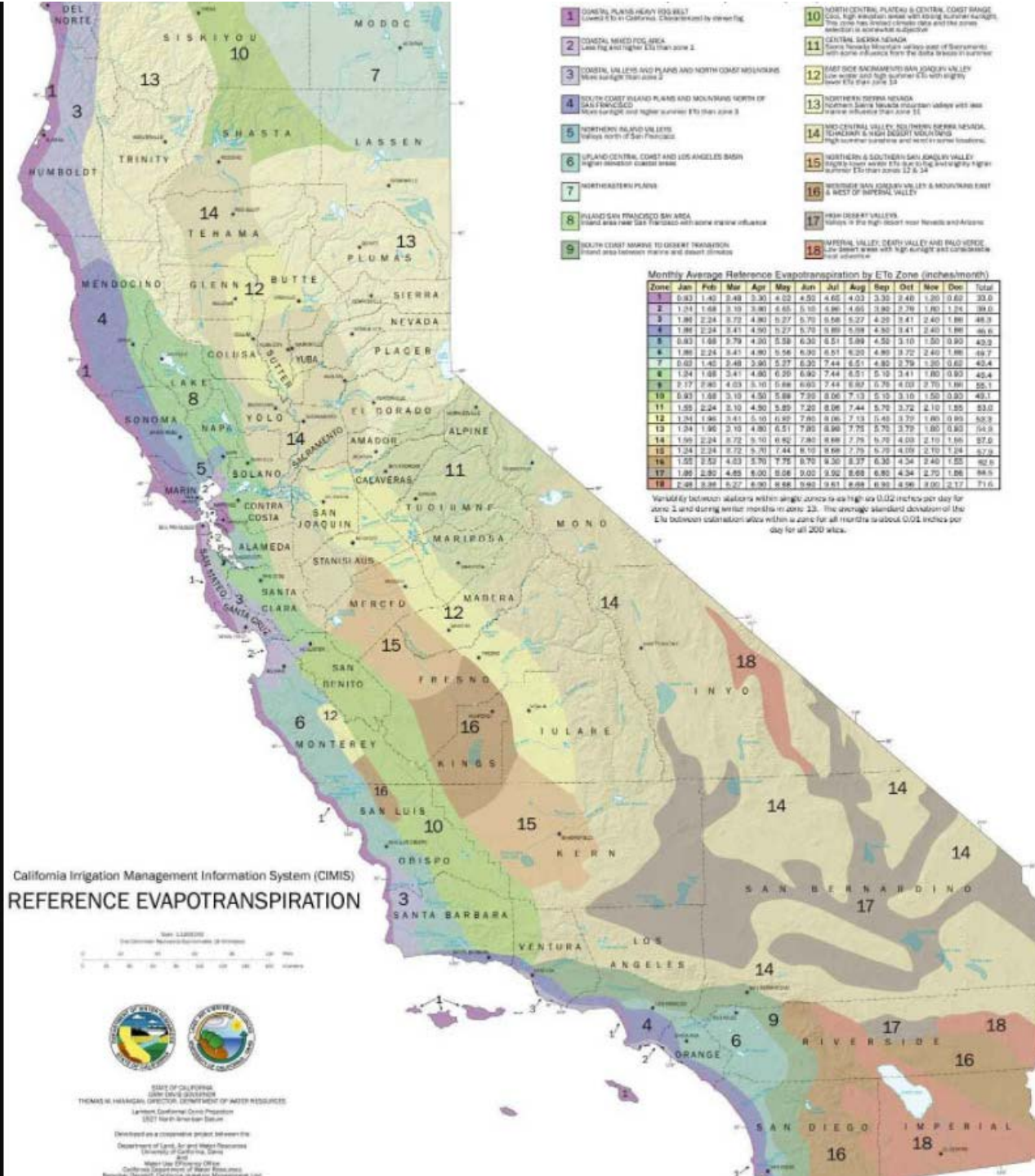
Site Factor: Available Water



Site Factor: Available Water

How much water do the vines use?

- Available water:
 - precipitation
 - irrigation
 - groundwater
- Soil texture, depth,
 - % rock: PAW
- Microclimate:
 - temp
 - RH
 - radiation
 - wind
- Root growth
- Rootstock
- Variety
- Canopy size, trellis
- Vine age and health
- Cover crop



Reference EvapoTranspiration (ET_o) Zones

- 1** COASTAL PLAINS HEAVY FOG BELT
Lowest ETo in California. Characterized by dense fog
- 2** COASTAL MIXED FOG AREA
Less fog and higher ETo than zone 1
- 3** COASTAL VALLEYS AND PLAINS AND NORTH COAST MOUNTAINS
More sunlight than zone 2
- 4** SOUTH COAST INLAND PLAINS AND MOUNTAINS NORTH OF SAN FRANCISCO
More sunlight and higher summer ETo than zone 3
- 5** NORTHERN INLAND VALLEYS
Valleys north of San Francisco
- 6** UPLAND CENTRAL COAST AND LOS ANGELES BASIN
Higher elevation coastal areas
- 7** NORTHEASTERN PLAINS
- 8** INLAND SAN FRANCISCO BAY AREA
Inland area near San Francisco with some marine influence
- 9** SOUTH COAST MARINE TO DESERT TRANSITION
Inland area between marine and desert climates
- 10** NORTH CENTRAL PLATEAU & CENTRAL COAST RANGE
Cool, high elevation areas with strong summer sunlight. This zone has limited climate data and the zones selection is somewhat subjective
- 11** CENTRAL SIERRA NEVADA
Sierra Nevada Mountain valleys east of Sacramento with some influence from the delta breeze in summer
- 12** EAST SIDE SACRAMENTO-SAN JOAQUIN VALLEY
Low winter and high summer ETo with slightly lower ETo than zone 14
- 13** NORTHERN SIERRA NEVADA
Northern Sierra Nevada mountain valleys with less marine influence than zone 11
- 14** MID-CENTRAL VALLEY, SOUTHERN SIERRA NEVADA, TEHACHAPI & HIGH DESERT MOUNTAINS
High summer sunshine and wind in some locations.
- 15** NORTHERN & SOUTHERN SAN JOAQUIN VALLEY
Slightly lower winter ETo due to fog and slightly higher summer ETo than zones 12 & 14
- 16** WESTSIDE SAN JOAQUIN VALLEY & MOUNTAINS EAST & WEST OF IMPERIAL VALLEY
- 17** HIGH DESERT VALLEYS
Valleys in the high desert near Nevada and Arizona
- 18** IMPERIAL VALLEY, DEATH VALLEY AND PALO VERDE
Low desert areas with high sunlight and considerable heat advection

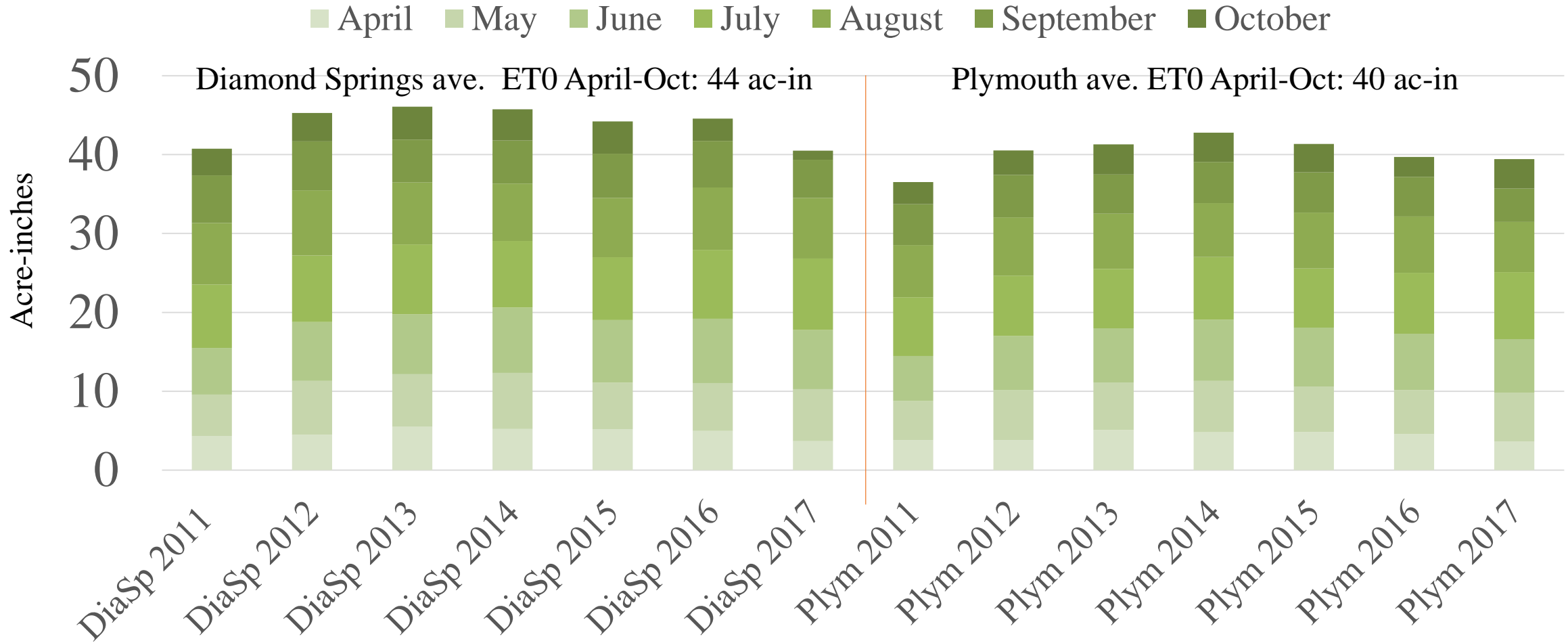
Monthly Average Reference Evapotranspiration by ETo Zone (inches/month)

Zone	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
1	0.93	1.40	2.48	3.30	4.03	4.50	4.65	4.03	3.30	2.48	1.20	0.62	33.0
2	1.24	1.68	3.10	3.90	4.65	5.10	4.96	4.65	3.90	2.79	1.80	1.24	39.0
3	1.86	2.24	3.72	4.80	5.27	5.70	5.58	5.27	4.20	3.41	2.40	1.86	46.3
4	1.86	2.24	3.41	4.50	5.27	5.70	5.89	5.58	4.50	3.41	2.40	1.86	46.6
5	0.93	1.68	2.79	4.20	5.58	6.30	6.51	5.89	4.50	3.10	1.50	0.93	43.9
6	1.86	2.24	3.41	4.80	5.58	6.30	6.51	6.20	4.80	3.72	2.40	1.86	49.7
7	0.62	1.40	2.48	3.90	5.27	6.30	7.44	6.51	4.80	2.79	1.20	0.62	43.4
8	1.24	1.68	3.41	4.80	6.20	6.90	7.44	6.51	5.10	3.41	1.80	0.93	49.4
9	2.17	2.80	4.03	5.10	5.89	6.60	7.44	6.82	5.70	4.03	2.70	1.86	55.1
10	0.93	1.68	3.10	4.50	5.89	7.20	8.06	7.13	5.10	3.10	1.50	0.93	49.1
11	1.55	2.24	3.10	4.50	5.89	7.20	8.06	7.44	5.70	3.72	2.10	1.55	53.0
12	1.24	1.96	3.41	5.10	6.82	7.80	8.06	7.13	5.40	3.72	1.80	0.93	53.3
13	1.24	1.96	3.10	4.80	6.51	7.80	8.99	7.75	5.70	3.72	1.80	0.93	54.3
14	1.55	2.24	3.72	5.10	6.82	7.80	8.68	7.75	5.70	4.03	2.10	1.55	57.0
15	1.24	2.24	3.72	5.70	7.44	8.10	8.68	7.75	5.70	4.03	2.10	1.24	57.9
16	1.55	2.52	4.03	5.70	7.75	8.70	9.30	8.37	6.30	4.34	2.40	1.55	62.5
17	1.86	2.80	4.65	6.00	8.06	9.00	9.92	8.68	6.60	4.34	2.70	1.86	66.5
18	2.48	3.36	5.27	6.90	8.68	9.60	9.61	8.68	6.90	4.96	3.00	2.17	71.6

Variability between stations within single zones is as high as 0.02 inches per day for zone 1 and during winter months in zone 13. The average standard deviation of the ETo between estimation sites within a zone for all months is about 0.01 inches per day for all 200 sites.



Monthly reference evapotranspiration (ET₀) April-October 2011-2017: Diamond Springs and Plymouth CIMIS stations.



Converting ET_0 to crop ET (ET_c) and actual ET (ET_a)

Williams and Ayars, 2005

$$ET_c = ET_0 \times K_c$$

$$ET_c = 40 \text{ ac-in} \times K_c$$

$$ET_{c \text{ (grape, no stress)}} = ET_0 \times (\% \text{ shaded area}) \times 0.017$$

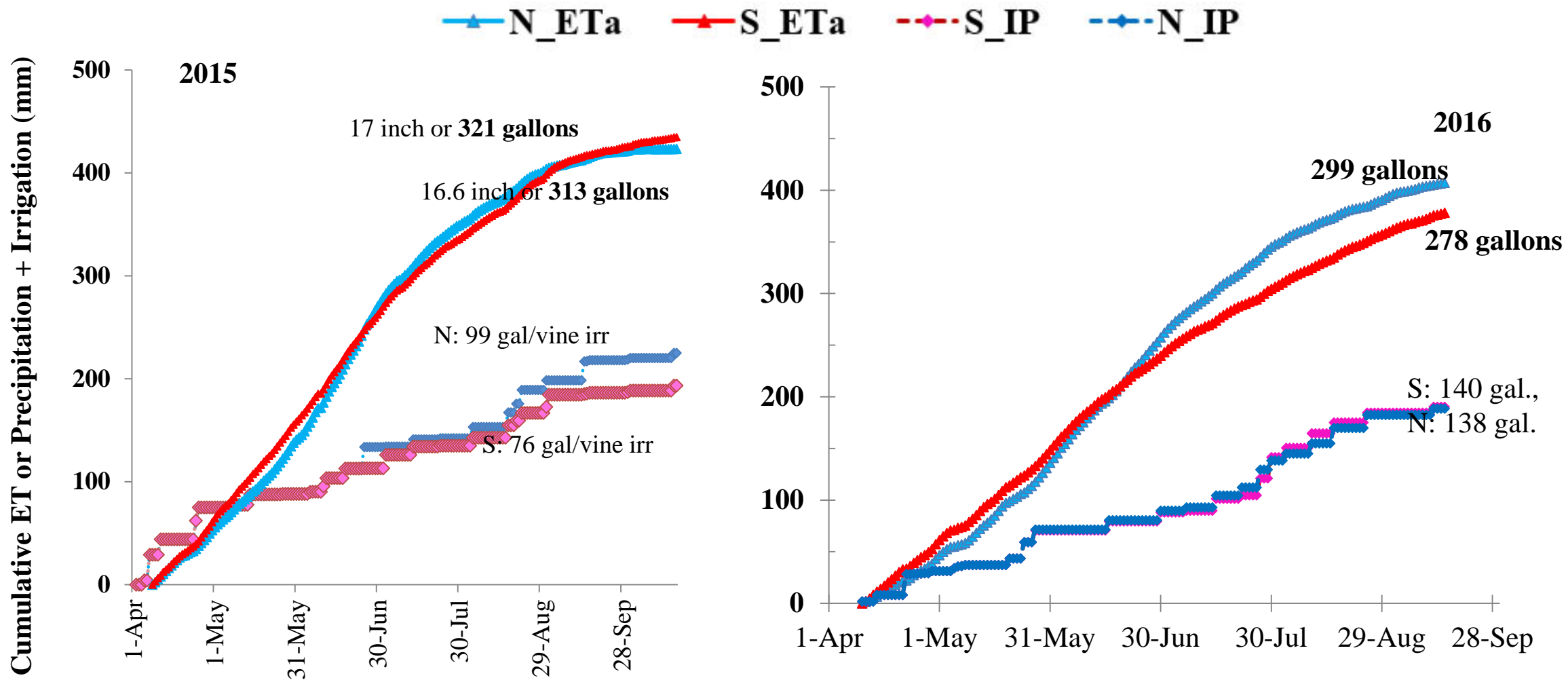
$$ET_{c \text{ (grape, no stress)}} = (40) \times (25) \times 0.017 = 17 \text{ acre-inches}$$

$$ET_{a \text{ (grape actual, RDI)}} = Et_c \times \text{“management factor”}$$

$$ET_{a \text{ (grape actual, RDI)}} = 17 \times 0.5 = 8.5 \text{ ac-inches} \times (27,154 \text{ gallons/ac-in}) = 230,809 \text{ gallons/acre}$$

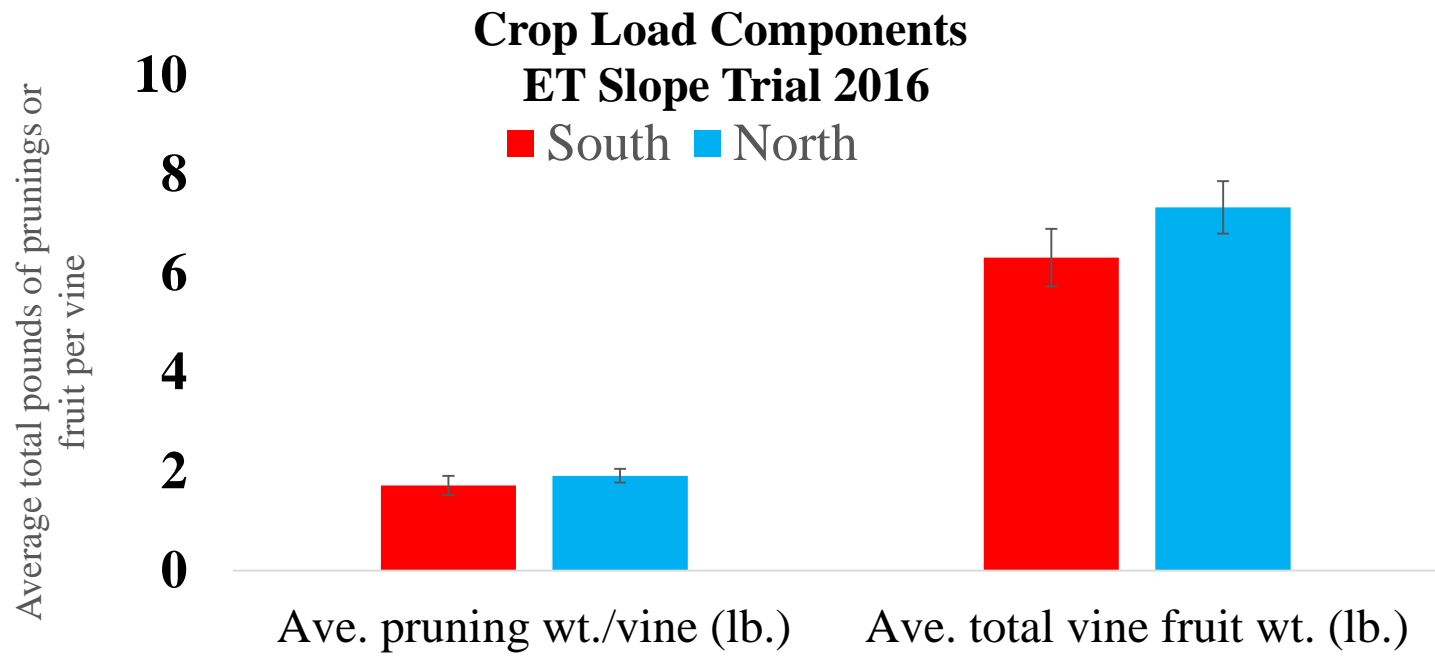
Vines spaced 6 x 10 = 726 vines/acre, 317 gallons of water used per vine

Cumulative evapotranspiration per vine growing on North (N) and South (S) facing slopes, compared to cumulative precipitation and applied irrigation per vine (C-PI), 2015 and 2016.



Vines can consume more water than you might think

Wunderlich, Shackel, Snyder and Zaccaria, unpublished.



Vine spacing is 5 feet X 6 feet (1452 vines/acre)

Yield: 4.6 tons (South) and 5.3 tons (North)

Ravez Index: Vine yield/pruning weight

S: 3.68

N: 3.83



Vine Balance: Crop Load Management



**Canopy and
last year's wood**



**Yield: fruit (RIPE) and
next year's wood**



Foothills very challenging: different “capacity” in different regions, counties, even individual parcels and within parcels.

Makes it difficult to translate a particular vineyard practice that works well in one location onto another parcel.

The better you understand your own site and site capacity, the better you will be to properly manage your vineyard or help others manage it for you, to achieve VINE BALANCE.

A photograph of a vineyard during harvest. In the foreground, a large white tarp is filled with clusters of harvested grapes, showing a mix of yellow and green colors. The tarp is situated in a row of grapevines. The vines in the background have leaves that are turning yellow and orange, indicating autumn. A wooden post is visible among the vines. The overall scene is bright and sunny.

Thank you!
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