PETITION TO ESTABLISH A NEW AMERICAN VITICULTURAL AREA TO BE NAMED WINTERS HIGHLANDS

This petition is a formal request for establishing an American Viticulture Area (AVA) named as Winters Highlands located in Solano and Yolo Counties, CA. This proposed AVA covers 11.4 square miles (or 7296 acres), with 134 acres established vineyards and additional 60 acres that are planned to be planted. Currently, grapes produced in the established vineyards are used for commercial wine production in three bonded wineries, and two other growers are applying for bonded winery license.

This petition is submitted on the behalf of Berryessa Gap Vineyards, containing the information required to establish an AVA, as per title 27 Code of the Federal Regulation (CFR) part 9 and the AVA manual for petitioners provided by Alcohol and Tobacco Tax and Trade Bureau (TTB).

The key features of the proposed AVA include:

- Located in the area where the two geographic provinces, the Coastal Range and the Sacramento Valley adjoin.
- The proposed AVA is defined by the transition landscape from steep to gentle sloping landscape west to east at the eastern edge of the Coast Range as it intersects within five miles of Putah Creek and its alluvial soils that spill from the drainage of the Berryessa Valley, now occupied by the Lake Berryessa. The climate and soil profile are relatively uniform and unique to this area.
- Protected by the Coastal Range, Winters Highlands experiences a moderate nocturnal marine influence, and its climate is characterized as the continent type with hot and dry in summer and cool and wet in winter.
- Soils in Winters Highlands are dominated by thermic clay or loamy alfisols and inceptisols with good or moderately good drainage.
- The leading red varieties in Winters Highlands include Petite Sirah, Tempranillo, Zinfandel and Malbec. White varieties, such as Chardonnay, Albarino, Verdejo and Sauvignon Blanc, perform well in Winters Highlands. In 2009 Berryessa Gap Vineyards successfully petitioned the TTB to add Verdejo to the recognized grape variety list for use on wine labels.

Overview

Winters Highlands is located at the edge of the northern Coastal Range and the Sacramento Valley adjoin. The Putah Creek dissects the Winters Highlands AVA and flows through the City of Winters, providing the irrigation waters for pioneer farms and orchards established in this area. Lake Berryessa, a man-made reservoir, fed by Putah Creek, is 10 miles west of the City of Winters and five miles from the western boundary of the Winters Highlands AVA. This proposed AVA includes the eastern most foothills of the northern Coastal Range, with the elevation between 100 feet and 400 feet above sea level.

Geographic Features

The geographic features of Winters Highlands play key roles on the unique climatic characteristics (Table 1). Protected by the Coast Ranges, Winters Highlands experiences a minor influence from maritime air from the Pacific Ocean and is a continental type of climate year-round. Thus, as compared to winegrape production regions west of Winters Highlands, Winters Highlands experiences warmer weather during the growing season of the grapevines. Yet, the Putah Creek "gap" formed by the drainage of the upper reaches of Putah Creek and the man-made Lake Berryessa, brings cool air flow from the Pacific Ocean and Lake Berryessa through Berryessa Gap, resulting in lower night temperatures in Winters Highlands as compared to production regions on the north of Winters, especially late in the growing season.

The soils in Winters Highlands differ from the surrounding regions for winegrape productions (Table 1). Derived from the alluvium of mixed sources or the sedimentary rocks, soils in Winters Highlands are dominated by well-drained or moderately well-drained clay and gravely loamy, with gentle, moderate or steep sloping. In the Winters Highlands to the west of the City of Winters, the higher annual precipitation leads to a greater level of cation leaching and soil run-off, and thus the soils in those regions tend to be more acidic that that of Winters. Regions on the east of Winters are on the valley floor, and soils there are formed solely in the alluvium. The soils in the regions on the north and south have a similar profile as that of Winters, but lack the distinction of the higher level of alluvium afforded by the Putah Creek basin. However, soils with poorly drained or somewhat poorly drained soil are more prevalent in regions north of Winters, and the sedimentary rock derived soils are more common in the region south of Winters. This marks one of the distinctions this proposed viticulture area possesses.

Name Evidence

The name of Winters and Winters Highlands is well known to residents and visitors and it has been used by schools, non-profit organization, publication, business, and map titles. Winters is defined by Wikipedia as "a city in rural Yolo County, California, located along Interstate 505 and Putah Creek"[1]. The name of the city honors Theodore Winters, who provided half of the land in town[2]. The bridge on the southwest of the city that connects Yolo and Solano Counties is named Winters Bridge. The Winters zip code, 95694, is used in both Yolo and Solano Counties. The local event center is named Winters Community Center and the public library is named Winters Community Library[3]. A local non-profit organization is named Winters Friends of Library, aiming at promoting library involvement and frosting love of reading in the community[4]. A daily newspaper serving the local community is named Winters Express[5]. Local schools serving the area are named Winters Joint Unified School District and Winters Parent Nursery School. Winters is also widely used by local business, including Winters Post Office, Winters Laundromat, Winters Theater Company, Winters Concrete, Winters Eyecare, Winters Healthcare, Winters Printing Company, and Winters Self Storage[6]. The Winters Highlands housing development lies on the western boundary of the City limits and the Highlands Canal which flows from the Winters Canal south to Dry Creek is part of the eastern border of the proposed AVA. A map is attached in the exhibit to show the business, organizations, and buildings with the title of Winters in the area.

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[1] https://en.wikipedia.org/wiki/Winters,_California

[2] Durham, David L. (1998). California's Geographic Names: A Gazetteer of Historic and Modern Names of the State. Clovis, Calif.: Word Dancer Press. p. 578.

[3] http://www.yolocounty.org/general-government/general-government-departments/library/branch-list/winters-community-library

[4] http://wfol.org/

[5] http://www.wintersexpress.com/

[6] http://winterschamber.com/directory/char/W/

	Winters	West	East & Southeast	South & Southwest	North
Geography and topography	Valley floor and foothills with gentle to steep slopes	Valley floor and foothills with gentle to steep slopes	Valley floor	Valley floor and foothills with gentle to steep slopes	Valley floor and foothills with gentle to steep slopes
Microclimate	Protected from most of the marine influenced by the Coastal Range. Characterized by hot dry summer and cool wet winter.	Largely influenced by the Pacific Ocean breeze. Characterized by cooler summer, lower heat accumulation during the growing season, and higher annual precipitation.	Influenced by the Sacramento Delta. Characterized by cooler summer, smaller difference in diurnal temperatures, and more frequent fog events.	Influenced by the San Pablo Bay and Suisun Bay. Characterized by cooler summer and higher annual precipitation.	Characterized by the continent climate. The heat accumulation and precipitation are similar to that of Winters, while the nights tend to be warmer in the late season.
Soil	Derived from alluvium of mixed source or sedimentary rocks. Dominated by thermic clay or clay loamy alfisols that are well-drained or moderately well-drained.	Derived from alluvium of mixed source or sedimentary rocks. Dominated by clay or loamy vertisols, mollisols, ultisols and alfisols. The pH of soils tends being lower than that of Winters.	Deep soils derived from the alluvium of mixed sources.	thermic or mesic loamy, silty ultisols, mollisols, and alfisols.	Deep soils derived from the alluvium or relative shallow soils derived from sedimentary rocks. Some soils are poorly drained or somewhat poor drained.
Leading Varieties	Petite Syrah, Tempranillo, Malbec, and Chardonnay	Cabernet Sauvignon, Merlot, Chardonnay, Sauvignon Blanc	Zinfandel, Cabernet Sauvignon, Merlot Chardonnay	Pinot noir, Chardonnay	Not clear
Established AVA		Napa Valley AVA	Lodi AVA, Clarksburg AVA	Suisun Valley AVA, Los Carneros AVA	Dunnigan Hills AVA, Capay Valley AVA

Table 1. Comparison of characteristics between Winters and surrounding regions for winegrape production

Historical Evidence

The City of Winters, in western Yolo county, has a long history of agricultural production, and grapes are one of crops produced here starting in the 1840s. Impressed by the fertile soil and constant water supply from the Putah Creek, John Wolfskill established vineyards and orchards to produce fresh fruits in 1842. The fruits, including grapes, served local miners during gold rush around 1848.[7,8].

The historic distinction of this microclimate in western Yolo County allowed production of many varieties of products to be ripe earlier than other places in northern California. By the early 1860's train lines of the California Pacific Railroad were delivering agriculture and other natural products produced in eastern Yolo County from the Davisville station to ships in Solono County at ports in Suisun. The ability to transport these products from western Yolo County, however, was cut off by Putah Creek until the establishment of the train trestle over Putah Creek. Once the bridge was completed in 1875, a community that would come to be called Winters for Thedore Winters, and early rancher and livestock breeder, was soon populated by early farming families that would use the newly connected train line to send their crops to market. [7.5 Larkey, Winters, A Heratage of Horticulture, A Harmony of Purpose]

The late 1800's brought a booming economy of perishable horticultural crops, mainly peaches and apricots, and then later in the 1900's walnuts and almonds. The stone fruit that became ripe early due to this unique microclimate gave Winters a reputation that in this narrow section of western Yolo County production the first fruit of the year, and therefore commanded top prices. Accordingly secondary businesses that supported the farm industry took hold in the small town of Winters. [7.5 Larkey, Winters, A Heratage of Horticulture, A Harmony of Purpose]

Nursery businesses and commercial vineyards were established in Winters from the 1960s. In 1969, Dan Martinez Sr., partnered with San Francisco winemaker Ernest Peninou, started a nursery business to sell certificated rootstocks to commercial vineyards in Napa and Sonoma Counties. In 2000, Dan Martinez, Jr. and Santiago Moreno built a 50-acre vineyard for their winery, Berryessa Gap Vineyards[9]. In the same year, Rominger Brothers Farm started their 20-acre vineyard in their family ranch. And in 2007, Turkovich Family Wines established the Button Turkovich vineyard[10].

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[7] http://ucanr.edu/sites/wolfskill2/The_land_and_Orchards/
7.5 Larkey, Winters, A Heratage of Horticulture, A Harmony of Purpose

[8] http://www.wintersexpress.com/wolfskill.html

[9] http://www.berryessagap.com/Roots/Read-Our-History

[10] http://turkovichwines.com/vineyards/

Crop-based research was initiated in Wolfskill Orchards in Winters from 1930s', and grapes are one of the major crop has been studied. Wolfskill Orchards was established on 1934 after John Wolfskill's daughter, Frances, donated 107 acres of land to the University of California, Davis. In 1980, United States Department of Agriculture (USDA) Agricultural Research Service (ARS) established the National Clonal Germplasm Repository at Wolfskill Orchards. Due to the low air humidity and low disease pressure, 3,600 different excisions of grapes are currently planted there[11].

Geographic Evidence

The geographic characteristics of Winters Higlands are distinct from several AVAs established in the surrounding regions. The locations of Winters Highlands and surrounding AVAs are illustrated in Figure 1 and the elevations are indicated in Table 2. The Napa Valley AVA and Los Carneros AVA are respectively on the east and southeast of Winters Highlands, on the west aspect of the Coastal Range. The Suisun Valley AVA is on the south of Winters Highlands and close to the Suisun Bay. As compared to the Napa Valley AVA, Los Carneros AVA, and Suisun Valley AVA, Winters Highlands experiences less marine influence due to the protection of the Coastal Range. Moreover, the Lodi AVA is on the east of Winters Highlands, located in the southern Sacramento Valley within the Sacramento Delta. Winters Highlands has higher elevation than the Lodi AVA and its climate is less influenced by the Sacramento Delta. The Capay Valley AVA and Dunnigan Hills AVA are both north of Winters Highlands. Even with a similar elevation, Winters Highlands tends to have cooler nights compared to the Capay Valley AVA and Dunnigan Hills AVA, as the cool, eventing breeze from the Pacific Ocean channeled directly through the Berryessa gap to Winters Highlands and the Putah Creek. These conditions promote a greater number of warmer "growing degree days," (GDD) with a wide difference between the daily high and low, a condition that lends itself to Mediterranean-type grapes.

	Elevation of the city (feet above sea level)	Elevation of the city (m above sea level)
Suisun City (Suisun Valley AVA)	7	2.1
Lodi (Lodi AVA)	49	14.9
Napa (Napa Valley AVA)	20	6.0
Oakville (Napa AVA)	154	46.9
Carneros (Los Carneros AVA)	7	2.1
Capay (Capay Valley AVA)	210	64.0
Dunnigan (Dunnigan Hills AVA)	69	21.0
Winters	135	41.1

Table 2. Elevation of Winters Highlands and surrounding regions for winegrape production

[11] http://ucanr.edu/sites/wolfskill2/John_Wolfskill_-_History/The_Grant/

Figure 1. Winters Highlands and AVAs in the surrounding regions (map captured from Google Earth)

Climate Evidence

Climate is one of the most critical factors influencing the site selection of vineyards, the choice of varieties, the productivity of grapevines, and the composition of wine grapes. Thus, the climate of a given region has a profound impact on the style and characteristics of wines. Among a wide range of climatic components, temperature, precipitation, relative air humidity, and solar radiation are often used to depict regions for winegrape production. Given that solar radiation is highly variable between years in a certain region, it is difficult to compare solar radiation between regions. Therefore, in this petition, temperature-based merits, precipitation, and relative air humidity are compared between Winters and five winegrape production regions around Winters.

Temperature-based parameters

Among all the climatic components, temperature plays a key role on determining season length and has a large impact of vineyard management and fruit quality. In this application, a clear climate/routine temperature profile, including heat summation during the growing season, monthly minimum air temperature, monthly maximum air temperature, and frost-free days are compared between Winters and surrounding regions for winegrape production.

Station #	Station Name	Region	Location
6	Davis	Sacramento Valley	Approximately 12 miles (19 km) east of Winters, CA
77	Oakville	North Coast Valleys	Approximately 24 miles (39 km) west of Winters, CA
109	Carneros	San Francisco Bay	Approximately 27 miles (43 km) southwest of Winters, CA
121	Dixon	Sacramento Valley	Approximately 9 miles (14 miles) southeast of Winters, CA
139	Wolfskill Orchard (Winters)	Sacramento Valley	Winters, CA
226	Woodland	Sacramento Valley	Approximately 16 miles (26 km) northeast of Winters, CA

Table 3. The location of weather stations

Daily average temperature, monthly maximum air temperature, and monthly minimum temperature from 2012 to 2017 are obtained from California Irrigation Management Information System (CIMIS) for stations in and around Winters, CA (Table 3). The methods used for data collection are comparable across the stations. After obtaining weather data from those six stations, all the data are carefully examined, and outliers are excluded from the analysis. Among those stations, Oakville, Caneros, and Woodland are within or close to the designated AVAs. Oakville is located within Napa AVA (also within Oakville AVA), Carneros is within Los Carneros AVA, and Woodland station is close to Capay Valley AVA. Although Davis and Dixon are not located in designated AVAs, vineyards and wineries are established in those two regions for over a decade.

Heat summation during the growing season. Heat summation during the growing season of a given region is often used to compare regions for winegrape production and as criteria for variety selection. Heat summation during the growing season is calculated as the cumulative growing degree-days (GDD) from April 1 to October 31 in this petition. Daily GDD is referred to as the difference between daily average temperature and base temperature (10 °C). If the daily average temperature is below 10 °C, the added value to cumulative GDD is zero. The

cumulative GDD in and around Winters, CA from 2012 to 2017 is shown in Table 4. (Note that the cumulative GDD during the growing season for Oakville in 2015 is not complete, since a large part of the record for daily average temperature in October is not available on CIMIS.)

The regional difference in cumulative GDD and the pattern of GDD accumulation during the growing season appears consistent between years. The cumulative GDD during the growing season is greater in Winters and Woodland than Davis, Oakville, Carneros, and Dixon, across six years (Table 4). In addition, to further delineate the difference in GDD accumulation during the growing season among regions, the daily cumulative of GDD from April 1 to October 31 (Julian Day ((days from the beginning of the calendar year)) 92 to 304) is indicated in Figure 2. From April to October, GDD accumulates more rapidly in Winters than Carneros, Oakville, and Dixon over six years. The accumulation of GDD is similar in Winters and Davis during the early season (Day 92 to 170, April to mid-June). However, as the growing season progresses, GDD grows fasters in Winters than Davis. Moreover, the GDD accumulated is similar in Winters and Woodland from April to October.

Monthly maximum and minimum temperatures. The six-year average monthly minimum and maximum temperature are shown in Figure 3. From March to September, monthly minimum temperature is similar in Winters, Davis and Woodland, whereas it is greater in Winters than Oakville, Carneros, and Dixon. Between October to November, the night cools more rapidly in Winters, in comparison to Davis and Woodland. As for the monthly maximum temperature, the regional difference is shown primarily between May and September. The monthly maximum temperature is greater in Winters and Woodland than other regions.

	Davis	**Oakville**	**Carneros**	**Dixon**	**Winters**	**Woodland**
2012	2000	1455	1157	1801	2224	2236
2013	2193	1633	1323	1869	2377	2301
2014	2330	1728	1461	1959	2434	2462
2015	2286	N/A	1455	1959	2396	2392
2016	2170	1343	1292	1853	2293	2304
2017	2297	1756	1366	1989	2357	2474
Average	**2232**	**1597**	**1342**	**1914**	**2347**	**2361**

Table 4. Cumulative growing degree days during the growing season in and around Winters, CA

Frost-free days. Frost events occur during the spring and fall, which have determinant effect on vine productivity. For example, spring frost can damage the newly-emerged shoots; fall frost can lead to leaf senescence and berry damage. Thus, frost free days therefore becomes the criterion for the length of growing season for winegrape production regions. Given the large variation between years for the occurrence of last spring frost and first fall frost, long-term weather record is essential to provide reliable

data. In this petition, data for frost-free days is obtained from Western Regional Climate Center[12], which provides the probability for number of days between last spring and first fall occurrences of given temperature in Davis, Oakville, Winters, Woodland, Oakville, Sonoma (close to Carneros), and Vacaville (close to Dixon), based on the weather record of more than 60 years. The number of days between last spring and first fall occurrence of 0°C at the probability of 60% is shown in Table 5. In general, Winters, Woodland, and Davis should have longer growing season than Oakville, Sonoma (Carneros), and Vacaville (Dixon).

Table 5. Number of frost-free days in and around Winters, CA

	No. of Frost-free days*
Davis	310
Oakville	150
Sonoma (Caneros)	230
Vacaville (Dixon)	230
Winters	290
Woodland	280

* estimated based on the number of days between last spring and first fall occurrence of 0°C at the probability of 60%

[12] Western regional climate center. https://wrcc.dri.edu/

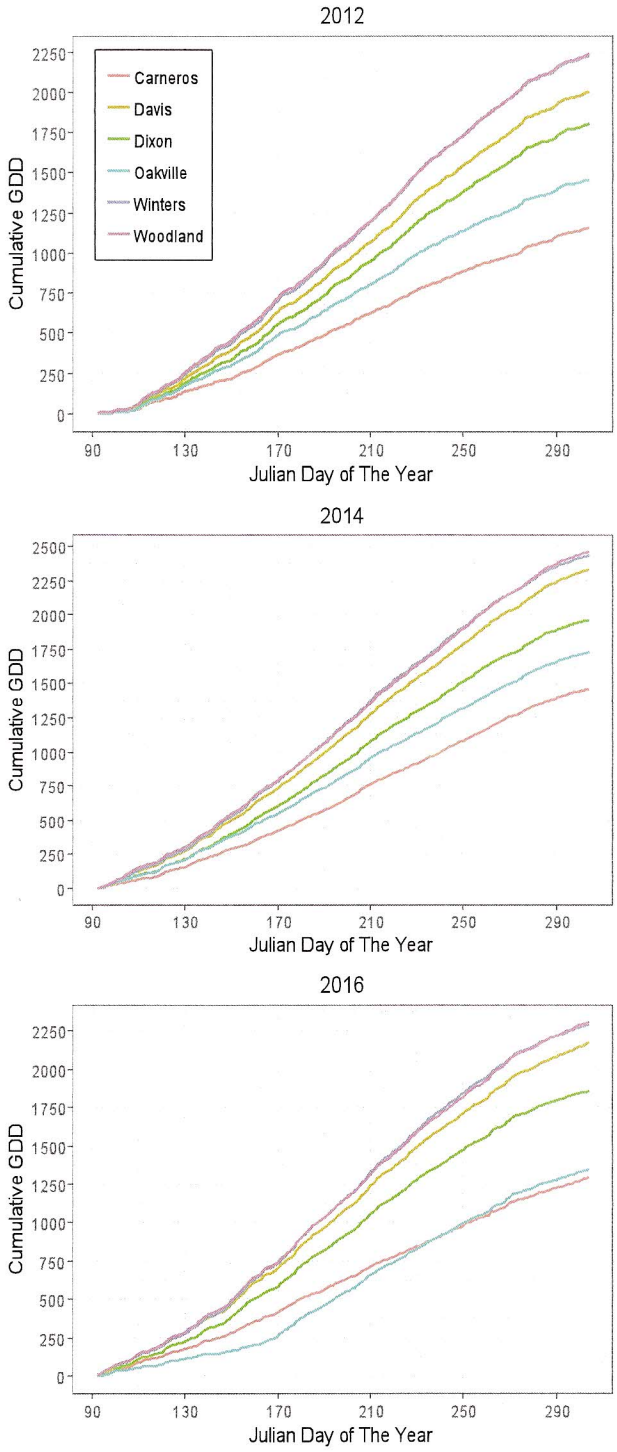

Figure 2. Annual cumulative growing degree days (GDD) from 2012 to 2017 in and around Winters, CA. Annual cumulative GDD is calculated as the running total of GDD from April 1 to October 30 for each year.

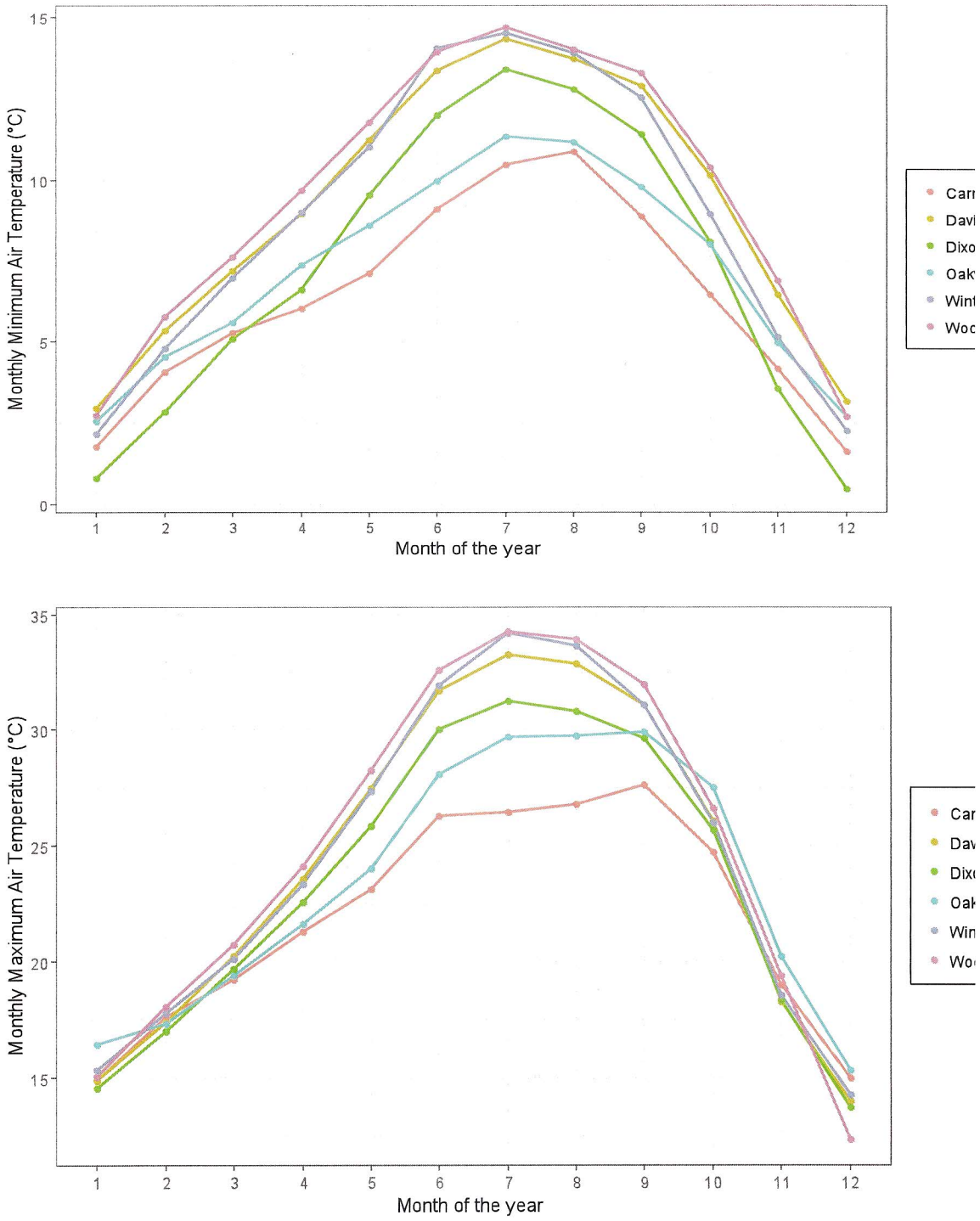

Figure 3. Six-year average monthly maximum and minimum air temperature (from 2012 to 2017) in and around Winters, CA

Precipitation and relative air humidity

Precipitation has a large influence on water reserved in the soil and therefore also influences irrigation decisions during the growing season. Air humidity during the growing season has a profound influence on pest and disease control in the vineyard. Therefore, annual or monthly precipitation and average air humidity are compared between Winters and surrounding regions in this petition. The data of monthly precipitation and average relative air humidity from 2012 to 2017 have been obtained from CIMIS and the selected stations are as stated in Table 1. The six-year average monthly precipitation across six regions is indicated in Figure 4. Due to the Mediterranean climate, all the regions are dry during the summer (May to August) and precipitation takes place mainly in the fall and winter. In the winter (January to March), the monthly precipitation in Winters is similar to Dixon, greater than Carneros, Davis, and Woodland, but lower than Oakville. In the fall (September to December), on the other hand, Winters has the similar average monthly precipitation as Davis and Dixon, but it is dryer than Carneros and Oakville and wetter than Woodland.

The mean of average relative air humidity from 2012 to 2017 is shown in Figure 5. Winters is dryer than Carneros, Dixon, Oakville, and Davis throughout the year. Although the average monthly relative air humidity is similar in Winters and Woodland in the spring, fall, and winter; the summer is dryer in Winters than Woodland.

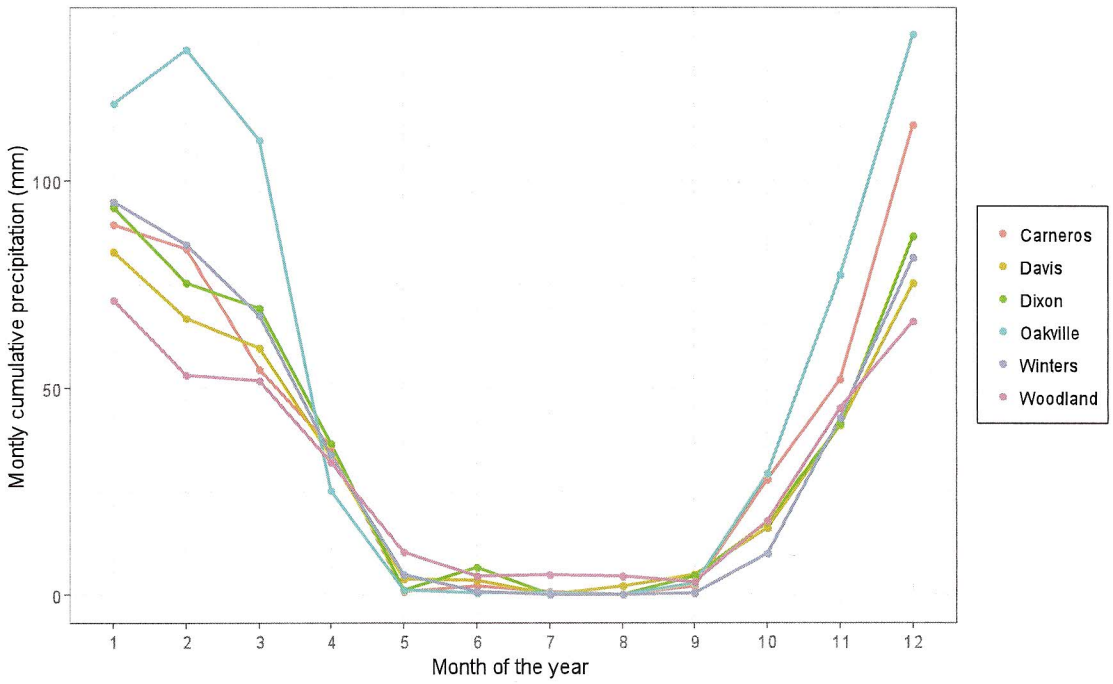

Figure 4. Six-year average monthly precipitation (from 2012 to 2017) in and around Winters, CA.

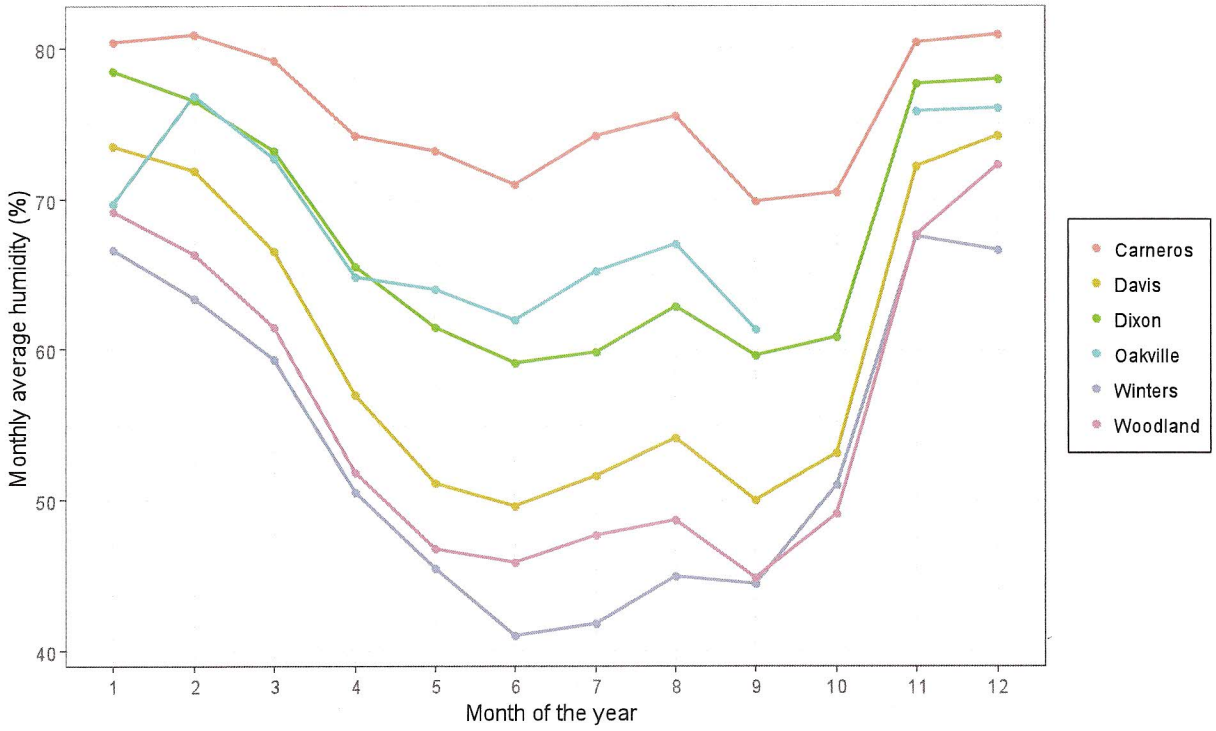

Figure 5. The mean of monthly average relative humidity from 2012 to 2017 in and around Winters, CA

Effect of topography on Climate

Winters Highlands is within the area where the Sacramento Valley adjoins the foothills of Vaca mountains, which is part of the Coast Range. The Sacramento Valley is well inland and somewhat dominated by the continental climate, which is characterized by warmer summer, cooler winters, great diurnal temperature change, and lower air humidity. This continental climate has shown to be a significant impact on Winters Highlands climate. In addition, as Winters Highlands is on the east slope of the Coast Range mountains, this buffer provides some protection to Winters Highlands from the strong air flow of the Pacific Ocean to the east, although the weather of Winters Highlandsmcan still be still influenced by marine air masses, especially in the evenings and in winter and spring months. In this regard, the climate of Winters Highlands is likely reflecting the interaction between maritime air flow and those of continental origins. Moreover, Putah Creek brings cool air flow from Lake Berryessa through Berryessa Gap and can further impact the climate of Winters Highlands. As a result, Winters Highlands has relatively unique climate conditions in comparison to the surrounding winegrape production regions.

Oakville and Carneros are west of Winters, respectively located in Napa AVA and Los Carneros AVA. Although those two regions are less than 40 miles away from Winters, they have distinct climatic conditions. In comparison to Oakville and Carneros, Winters has warmer summer, greater GDD accumulated during the growing season, a longer growing season, lower precipitation, and lower air humidity. This is because Oakville and Carneros are on the west slope of the Coast Range, and thus their climate is more strongly dominated by the Pacific Ocean and characterized by mild winter, cool summer, narrower diurnal temperature range, higher precipitation and higher air humidity. In addition, the weather of Oakville and Carneros is influenced by the air flow from the San Pablo Bay, which leads to the fog and wind in the morning and evening and therefore a larger chance for the occurrence of frost. Winters Highlands generally experiences fog during the early part of the growing season.

Davis and Dixon are, respectively, on the east and southeast of Winters. Although Winters, Davis, and Dixon are in the Sacrameno Valley, the Sacramento Delta has stronger influence on the climate of Davis and Dixon than that of Winters due to the direction of the thermal airflow. Since Dixon is closer to the Sacramento Delta as compared to Davis, the air flow from the Delta exerts a larger impact on the climate of Dixon than that of Davis. Compared to Dixon, Winters has greater cumulative GDD during the growing season, greater maximum and minimum temperature, longer growing season, and lower air humidity. In comparison to Davis, the annual cumulative GDD was about 100 °C lower in Winters from April to October, owing to warmer nighttime temperature in Winters during the summer. In addition, Winters has lower air humidity than Davis throughout the year. Nevertheless, given that Winters, Davis, and Dixon are all far inland, the monthly precipitation in Winters is close to that of Davis and Dixon.

Woodland is on the northeast of Winters, and those two regions are similar in cumulative GDD during the growing season, monthly minimum temperature, monthly maximum temperature, monthly precipitation, and number of frost-free days. However, given that Woodland has a lower elevation than Winters, the air humidity during the summer is lower in Winters than Woodland.

Soil Evidence

Soil is the reservoir of water and nutrients in the earth, which are essential for the growth of grapevines. Even though the water and nutrients in the soil can be altered by irrigation and fertilization, a growing number of viticulturists and growers expect to reduce carbon footprint by decreasing the use of chemical fertilizer and promoting organic management. As for the development of sustainable and organic vineyards, the soil profile is expected to play a more significant role on vine growth, fruit composition, and wine characteristics. This section is focuses on the comparison of soils in Winters and those in the surrounding production regions.

Soil series	Soil texture	Order	Moisture regime	Parent materials	Drainage	Location
Sehorn	Clay loam	Vertisol	Aridic	Sedimentary rocks	Well drained	Terraces
Balcom	Loam	Inceptisol	Xeric	Calcareous shale and sandstone	Well drained	Terraces
Rincon	Clay loam	Alfisols	Xeric	Sedimentary rocks	Well drained	Terraces
Marvin	Silty clay loam	Alfisols	Aquic	Alluvium from mixed rock sources	Moderately well to somewhat poorly drained	Alluvial fans
Corning	Gravelly loam	Alfisols	Xeric	Alluvium from mixed rock sources	Well to moderately well drained	Terraces
Hillgate	Loam	Alfisols	Xeric	Alluvium from mixed rock sources	Well to moderately well drained	Terraces
Yolo	Silt loam	Entisols	Xeric	sedimentary, metamorphic and volcanic rocks	Well drained	Alluvial fans
Brentwood	Clay loam	Inceptisol	Xeric	Sedimentary rocks	Well to moderately well drained	Alluvial fans
Sycamore	Silty clay loam	Inceptisol	Aquic	Alluvium from mixed rock sources	Sycamore soils formed under poorly drained conditions	Alluvial fans
Positas	Gravelly loam	Alfisols	Xeric	Alluvium from mixed rock sources	Moderately well drained	Terraces
Artois	Gravelly loam	Alfisols	Xeric	Alluvium from mixed rock sources	Somewhat poorly drained	Alluvial fans
Diablo	Silty clay	Vertisols	Xeric	Shale, sandstone, and sedimentary rocks	Well drained	Terraces

Table 6. Dominant soil series presented in the proposed Winters Highlands AVA

Soils Map around Winters Highlands AVA

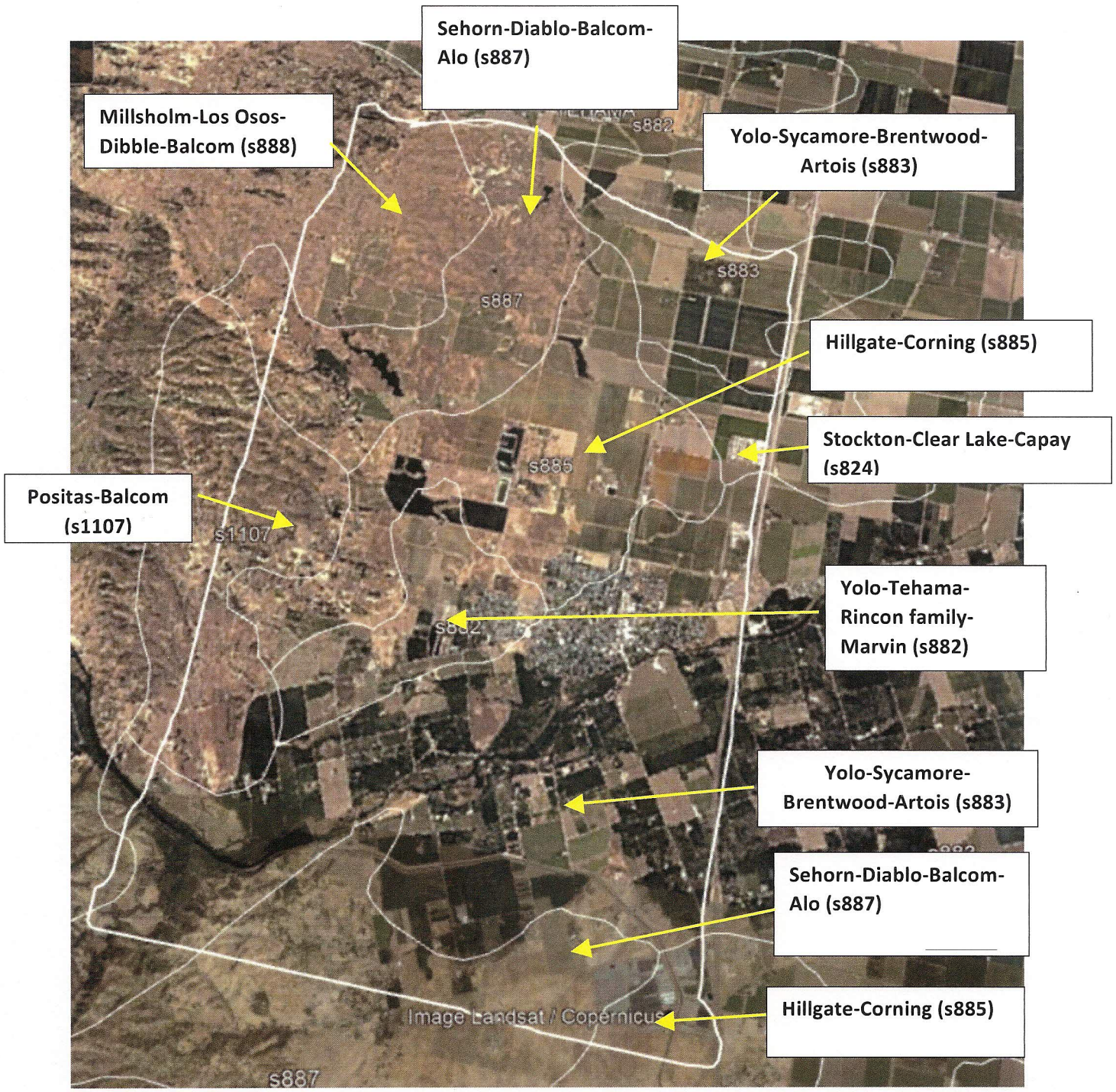

Figure 6. The soil map units presented in the proposed Winters Highlands AVA

The soils in Winters Highlands are dominated by fine clay or loamy alfisols and inceptisol with gentle to steep slope (Table 6 and Figure 6). All the soils in this area are in the thermic regime, with the mean annual soil temperature between 15°C and 22°C[13]. Soils in Winters Highlands are mostly well or moderately well drained, which is critical for root growth and respiration of winegrapes. By virtue of the Mediterranean climate, most of the soils in Winters Highlands are described as xeric, meaning that soils are warm and rather dry in the summer while cool and wet in the winter. Despite the similarity in soil texture, temperature regime, and moisture regime, the parent materials vary between soils in Winters Highlands. Soils, such as Yolo and Sycamore series, are very deep and derived from mixed sources on the alluvial fan. Some other soils, such as Balcom and Diablo, are relatively shallow and formed on the terraces from sedimentary rocks. The parent materials of soils in Winters Highlands reflects its geographic unique characteristics. Winters Highlands is in the area where the two geomorphic provinces, the Central Valley and the Coast Range, adjoined. The Great Valley is an alluvial plain with continuous deposits. The northern Coast Range is dominated by the Franciscan rock, (sedimentary rock mixed with igneous rock) and metamorphic rock from the uplift of between the North Atlantic Plate and the Pacific Plate [14] [15].

The formation of soil is mostly influenced by five factors, including parent material, erosion/soil breakdown, topography, soil microbes, and time. The difference in soils between Winters Highlands and the regions on the west and southwest is mainly attributed to the difference in the erosion over time due to climate. For example, the soils in Napa Valley and southern Sonoma County (e.g. Los Carneros AVA) are mainly the loamy or clay mollisols, vertisols, ultisols and alfisols on the alluvial fans and terraces. The soils on the valley floor are usually very deep and formed from the alluvium of mixed sources. The soils in the foothills are derived more from the sedimentary rocks, with better drainage and shallower profile as compared to the soils in the valley floor. Due to the marine influence, the annual precipitation is greater in the Napa Valley and southern Sonoma County, where the soils are subjected to greater level of cation leaching and thus a general lower soil pH soils in Winters Highlands. Additionally, high rainfall could lead to greater soil erosion, especially in the hills with steep slopes. Overall, despite the similarity in the parent material, the pH difference in soil between Winters Highlands and the regions on the west and

[13] Yolo County Soil Survey, 1972, USDA Soil Conservation Service. https://www.nrcs.usda.gov/Internet/FSE_MANUSCRIPTS/california/yoloCA1972/yoloCA1972.pdf
[14] http://web.sonoma.edu/users/c/cannon/bio314chapter7coastranges.html
[15] California Geomorphic Provinces, Note 36, 2002, California Department of Conservation, California Geological Survey.

southwest can lead to the difference in soil nutrient availability and therefore the difference in fertilization and irrigation management.

The parent material for the soils and topography differ between Winters Highlands and the regions on the east or southeast. The soils in Lodi and Clarksburg are dominated by clay, loamy clay or loam formed from the alluvium of mixed sources, with nearly level or gentle sloping. Those soil are generally deep or moderately deep with varying drainage. As compared to soils in Lodi and Clarksburg, soils in Winters are derived from more complex parent material. Additionally, the soils in Winters Highlands are often situated on a greater slope, especially those in the foothills of the Coastal Range.

The soils in regions on the north (e.g. Capay Valley and Dunnigan Hills) and south (e.g. Suisun Valley) have similar profile as compared to that of Winters Highlands, due to the similarity in climate, parent material, and topography. Soil in the Capay Valley are characterized as deep clay or loamy formed in the alluvium, while the soils in the Dunnigan hills are derived mainly from sedimentary rocks. Nevertheless, soils with poor or somewhat poor drainage, such as the Clear Lake series and Solano series, are more prevalent in this region. The soils in the Suisun Valley AVA are much alike that in Winters Highlands. Yet, there are more hills with higher elevation presented in the Suisun Valley AVA, and so the drainage is different, and the soils in this region are more often formed from the sedimentary rocks than the alluvium.

Map and Boundary Description

The boundary of proposed American Viticultural Area (AVA) is determined based on the unique geographic characteristics of Winters area. The proposed AVA covers 11.4 square miles (or 7296 acres), of the easternmost edge of the Coastal Range and westernmost edge of Sacramento Valley including gentle to moderate slopes at its edge, and is confined to the alluvial deposits of Putah Creek. The elevation of proposed AVA is between 100 and 400 feet, and thus the climatic characteristics are uniform in the proposed area. While the area is drawn along natural topological and geographical lines, where possible, some roads and line of point-to-point edges are also used.

Below are the four named United States Geological Survey topographic maps used to determine the boundaries of the Winters AVA. (USGS) 1:24,000 scale, 7.5 Minute Series

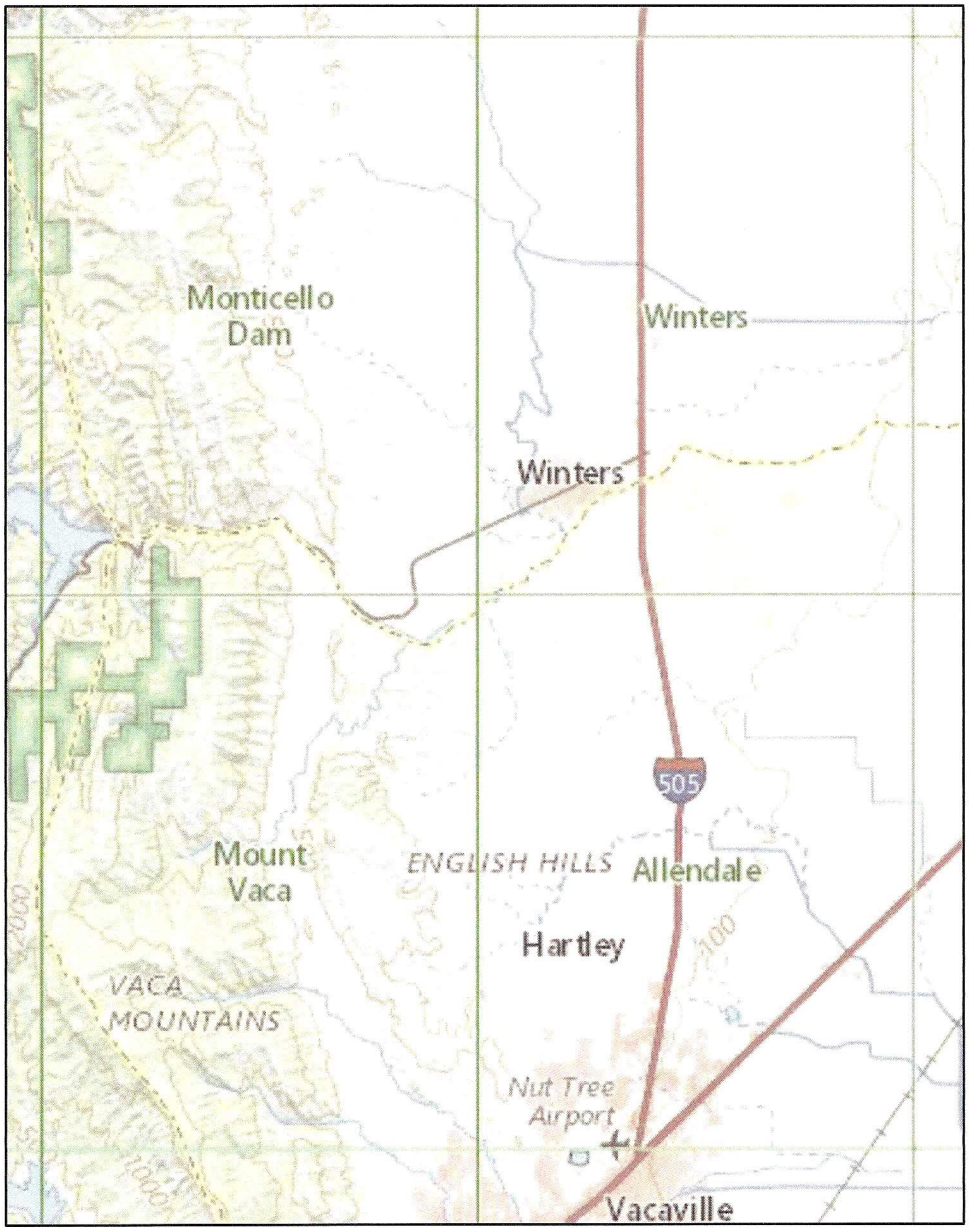

Figure 7 Named USGS maps used in this petition

1) Winters, California, 2015
2) Allendale, California, 2015
3) Mount Vaca, California, 2015

4) Monticello Dam, California, 2015

Proposed Winters Highland AVA on USGS maps

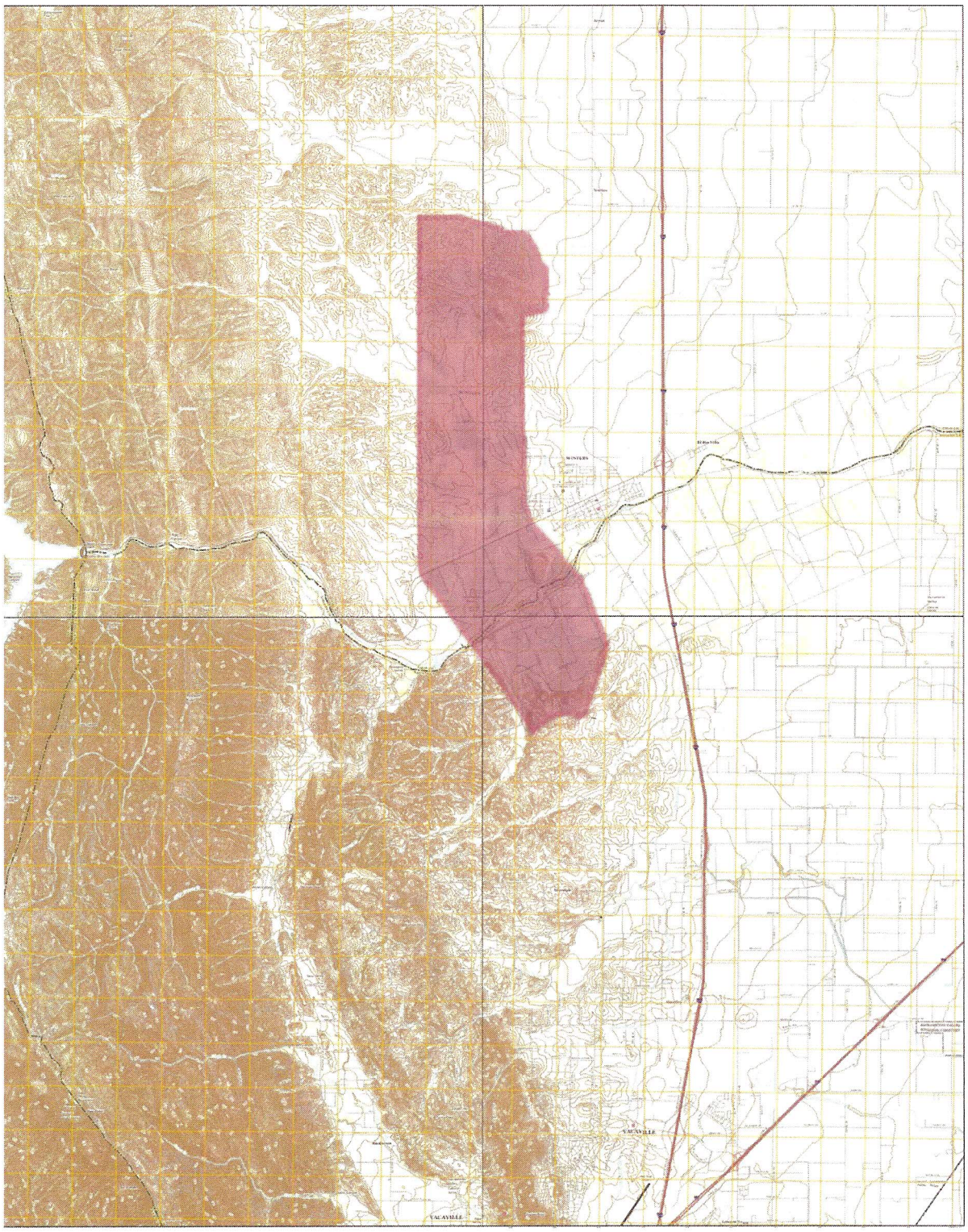

Figure 8 Proposed Winters Highlands AVA on USGS maps

Map of proposed AVA drawn on a satellite image, showing the edge of the Sacramento Valley and points of reference in the discription.

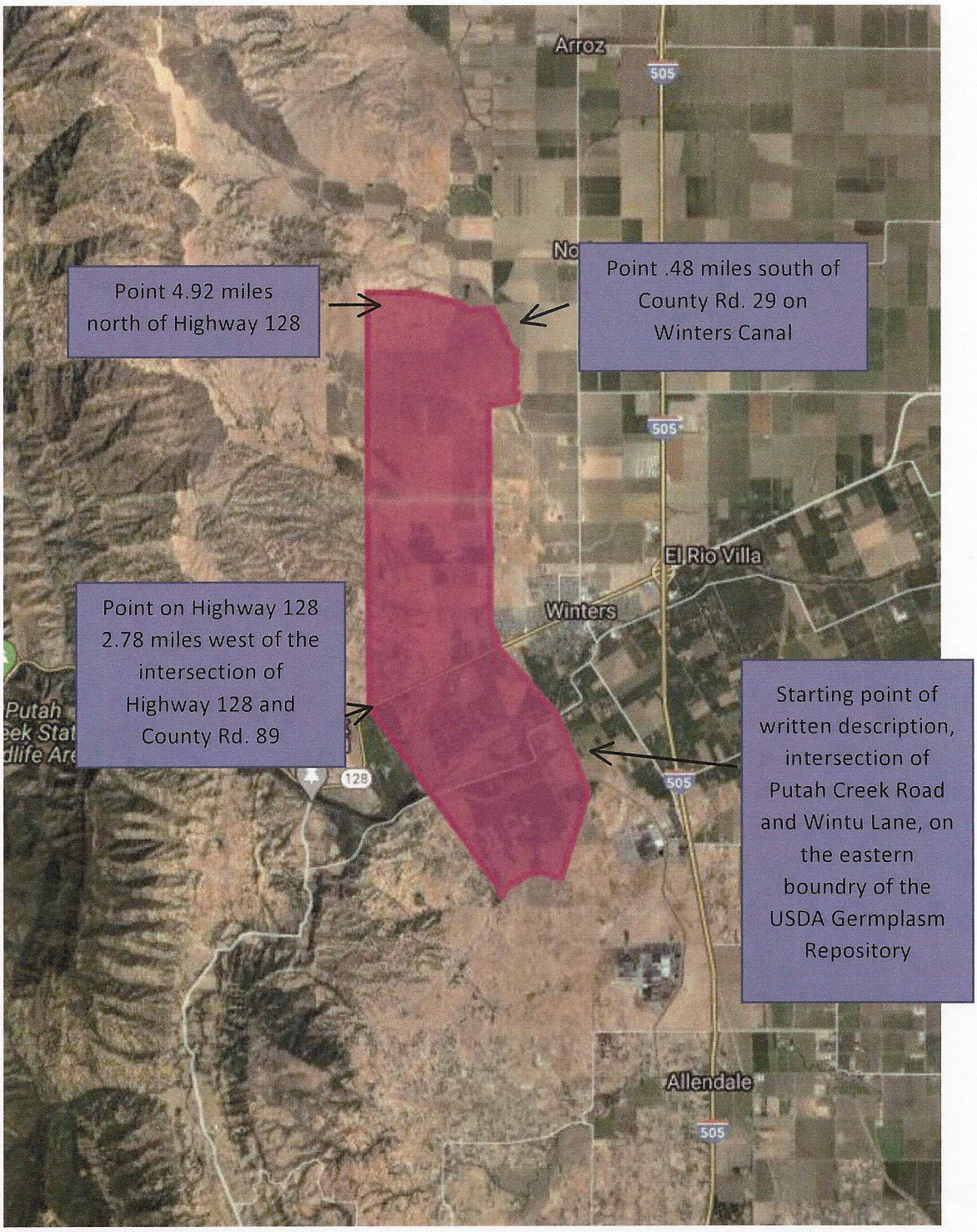

Figure 9 The Ava is defined as the land at the easternmost edge of the Coastal Range and westernmost edge of Sacramento Valley including gentle slopes at its edge, and within the alluvial deposits of Putah Creek, ranging no more than five miles from its banks.

Boundary description

1) The beginning point is on Putah Creek Road at the intersection of Wintu Way; from there, proceed on Wintu way to the termination of Wintu Way, then;
2) From the end of Wintu Way, the boundary follows in a south-southwest direction in a straight line 1.05 miles to the point at the termination of Morse Lane, then;
3) From the termination of Morse Lane proceed west along Morse Lane generally west for approximately one mile to the intersection of Morse Lane and Olive School Land, then;
4) From the point at intersection of Morse Lane and Olive School lane, the boundary follows north, northwest in a straight line 2.52 miles to the point on Highway 128, 2.78 miles west of the intersection of Highway 128 and County Road 89, then;
5) From the point on Highway 128, 2.78 miles west of the intersection of Highway 128 and County Road 89, the boundary proceeds due north exactly 4.29 miles (0.9 miles south of County Road 29) at coordinates 38.57, -122.0, then;
6) From the point at 38.57, -122.017 exactly one mile to a point at 38.57, -121.999, then;
7) From the point at 38.57, -121.999 proceed to a point on the Winters Canal, one mile south of the intersection of County Roads 29 and 88, then;
8) From the point on the Winters Canal, one mile south of the intersection of County Roads 29 and 88, then, proceed south along the Winters Canal along the northern edge of Winters Canal until it reaches the Winters Reservoir 2.298 miles until it reaches the extension of County Road 88;
9) From the point where the Winters Canal and Road 88 join, proceed due south to the termination of where it joins the termination of Valley Oak Drive, then;
10) From the termination of Valley Oak Drive, proceed on Valley Oak Drive to the intersection of Valley Oak and Highway 128, then;
11) From the intersection of Valley Oak and Highway 128 proceed in a straight line roughly south, southwest for 1.04 miles to the beginning of the boundary description at the intersection of Putah Creek Road and Wintun Way.

Appendix—Viticultural Effects of Climate

This proposed AVA area experiences a nightly breeze coming from the Pacific, through the gap in the Vaca Ridge west of Winters, and into the western edge of the Sacramento Valley. The vineyards in this area experience lower nighttime temperatures than those just a few miles north, south, or east of this proposed AVA, especially from May through September. Low nighttime temperatures during the growing season allow vineyards in this AVA to produce grapes with less acid giving winemakers the ability to soften the acidic edge of the whites and lighter red varieties. This gives winemakers an ability to blend wines with subtle flavors. Warm growing season temperatures favor grapes grown historically in the warmer regions of Spain and Southern France, such as Verdelho, Verdejo, Albariño, Grenache, Petite Sirah, and Tempranillo. This area also mimics sub-climate conditions found in pockets of Croatia where Zinfandel grapes grow well. The drier climate favors wine grape growing because it doesn't encourage mildew and mold like in the more humid and cooler regions or those that are subject to fog. The grapes remain viable into a later harvest season and gives winemakers some wider flexibility age and blend wines with subtle flavors that are distinct from surrounding AVA's.