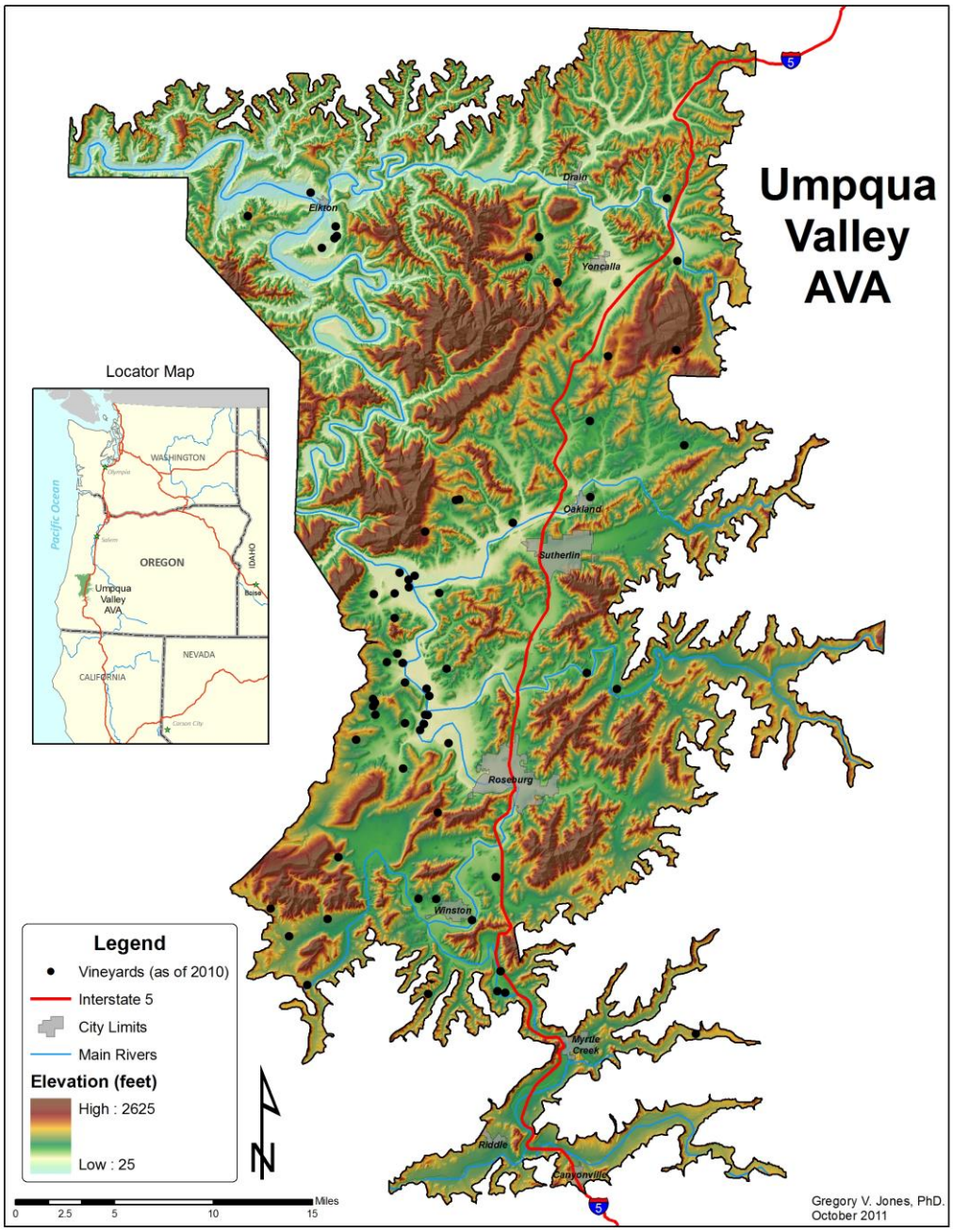
Vintage 2018
Umpqua Valley Reference Vineyard Report



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Summary:
The 2017-2018 winter and growing season were highlighted by a relatively mild and dry winter, a cool spring, a dry summer with low heat stress but numerous regional fires, and a glorious October. The winter over the western US was generally mild ending up with near average temperatures, low winter freeze risk compared to previous years, and was drier than average in most regions including Southern Oregon. A moderately cool spring led to a late start to the growing season with bud break slightly delayed compared to average, however a warm May through August brought plant growth timing to near average to slight ahead of average in the region. The 2018 vintage ended with growing degree-day totals that were above average, very similar to 2017, but below the records set in the 2015 and 2016 vintages. The Umpqua Valley vintage saw a few mild frosts during early April, a warm and mostly dry bloom period, experienced a string of a 100 days or more without precipitation during the middle of the summer, and had a prolonged harvest period from very beneficial weather conditions in October. Overall the growing season saw substantially lower heat stress compared to average. Growers reported generally low impacts from weather risks in 2018. Reports of a very good fruit set were common, although others reported variable set across varieties. The first picking was reported on September 11th and continued through to the last picking reported on October 21st across the different varieties and sites. Growers reported composition levels at harvest that exhibited slightly above average °Brix, near average acid and pH values, and near average yields. Bird pressure was reported to be average to none depending on harvest timing, while other pest issues were mixed with yellow jackets reported as being exceptionally problematic. Disease pressure was reported as being lower than average for most sites over the growing season.

Project Overview:
This work is a continuation of the 2004-2010 reference vineyard project which established a suite of reference vineyards in the Umpqua Valley AVA with a purpose of providing an in depth look at spatial variations in important characteristics of temperature, phenology, composition, and yields in the region. Starting with the 2011 vintage, the project has been scaled back to cover only temperature, phenology, and harvest composition from eight sites (no fruit sampling as in prior years). At each of the eight sites temperature devices record at 15-minute intervals during both the dormant season (Nov 1-Mar 31) and the growing season (Apr 1-Oct 31). The observations are then aggregated to hourly and daily average, maximum, and minimum values and summarized over the entire region. Additional summaries are done for the Roseburg NWS station and the Roseburg Agri-Met station. For phenological observations, the sites submit dates for the four main events of bud break, bloom, véraison, and harvest for a range of varieties planted at each site. The phenological data are then summarized by average dates and intervals between dates for the entire region. Finally, harvest composition values for °Brix, titratable acidity, and pH, along with yields are submitted by the sites and are then summarized for the region.

Climate:
The winter of 2017-18 (November 1 through March 31) was characterized by strong month to month variation in temperatures statewide with November warmer than average, December cooler than average, January substantially warmer than average, and a generally cooler than average February and March. Temperatures during November through March at the Roseburg station ended up 0.3°F above average while those at the reference vineyards were right at the average of the last 14 years (Table 1 and 2). January was the warmest month of the winter with Roseburg temperatures running 3.6°F warmer than normal (Figure 1). In terms of record events, the winter experienced ten record high temperatures, while the winter's coldest periods came during February 12-14 and 22-24 when record lows of 25°F and 23°F, respectively, occurred at Roseburg (Figure 1). During the same time the absolute

winter lows at the reference vineyards dropped to 19.2°F to 23.4°F (Table 1). The remainder of the 2017-18 winter was slightly cooler than average with temperatures in February and March 1.0°F and 1.1°F below average, respectively. During the dormant period from November to March the region experienced an average of 29 days below 32°F, which was slightly lower than both the previous winter and the long-term average (Table 2). While precipitation is not observed at the reference vineyards, values from the main climate stations in the region indicate that November through March were all drier than average, ending up 5-15 inches below the long-term average, with one record event of 1.56" on March 23rd (Figure 1).

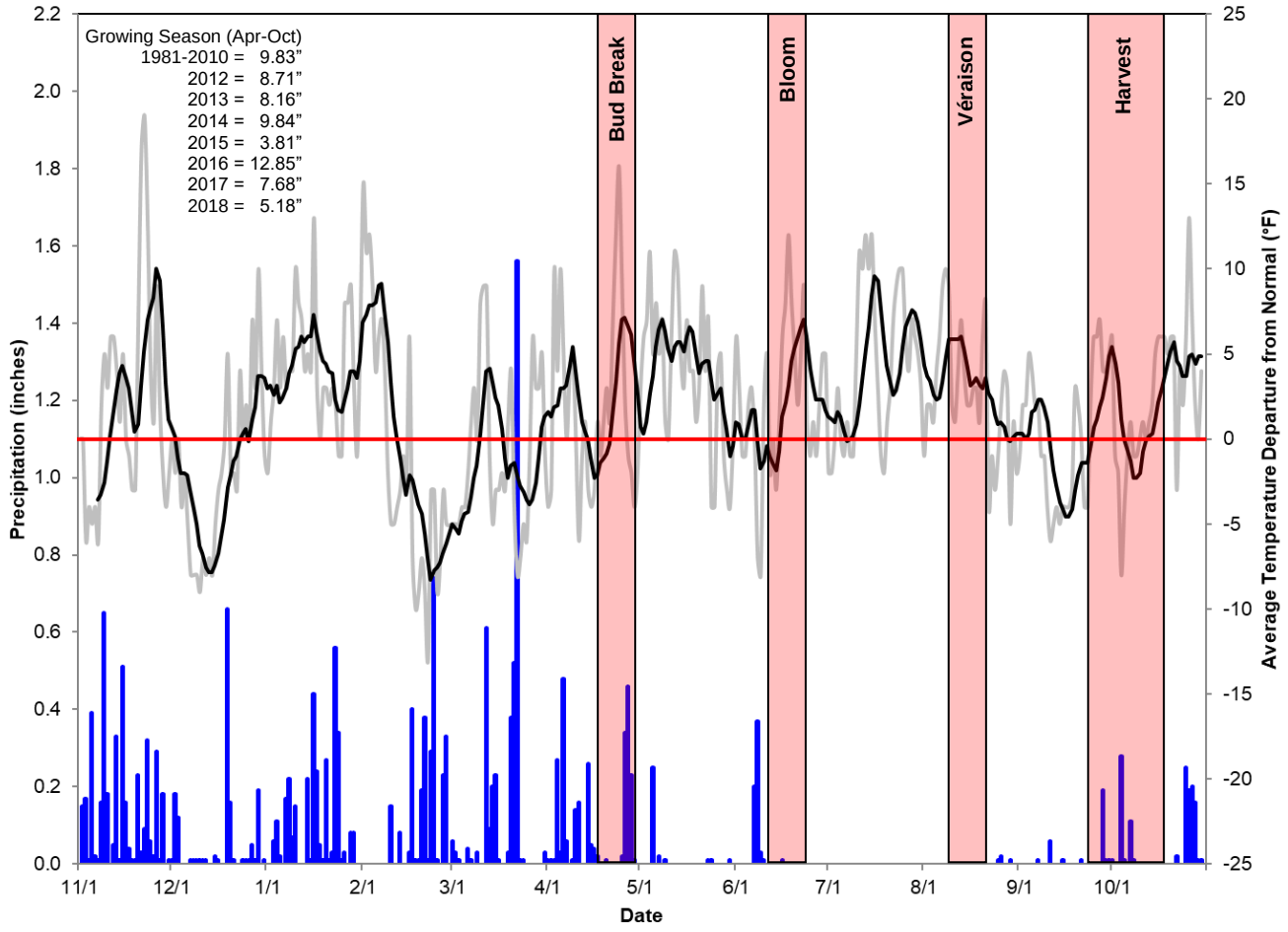

Figure 1 – Daily average temperature departures from normal and precipitation for November 1, 2017 to October 31, 2018 from the Roseburg weather station. The gray line is the day to day temperature departures from normal, the black line is the weekly average departures, and the blue bars are daily precipitation. The long-term average is derived from the 1981-2010 climate normals. The vertical red bars represent the variation in region-wide average phenology (see text for more details).

Following a relatively cool and wet March in the western US, April saw average rainfall but was largely the result of a record event of 0.46" on April 29th, otherwise the month would have ended up drier than average. April saw near average temperatures throughout the region, but cooler than the past few years, resulting in a later than average bud break from the end of the second to third weeks of April, averaging April 20th (see more in the phenology section that follows). Two record high temperature events of 88°F and 90°F in late April started off a period four plus months of mostly warmer than average temperatures with May being +3.6°F for Roseburg. The warm May caught plant growth up to average conditions with a region-wide average bloom date on June 15th (Figure 1) with no major rain

events during the main portion of the bloom period. Across the west many locations saw 70-120 days or more without any precipitation from mid-May through mid-September. The warmer mid-summer conditions produced a region-wide average véraison on August 15th. While the summer was warmer than normal, the overall signature was fewer extremes, especially heat events over 100°F where Roseburg only saw three days in 2018. Figure 1 also shows that there was only one heat spike during the 2018 growing season that reached 15°F above normal and that occurred in late April. The warmest periods in the summer occurred during mid to late June, mid to late July, and early August when daily temperatures were consistently between 90-100°F. The highest temperature of the summer was 103°F and was observed on multiple days in July at the Roseburg station. September 2018 started off relatively warm, then cooled off during the middle of the month (Figure 1) and slowed ripening. Ultimately September ended up slightly below average in terms of temperatures (-0.2°F at Roseburg) and remained lower than average in overall rainfall. Harvest in 2018 started similar to what was seen in 2017, but later than the previous four years (2013-2016) with the first picking reported in mid-September, but the bulk of the harvest came in from the last couple of days in September through mid-October in the region (median harvest date was October 4th). A relatively warm and largely dry early October allowed for a slow transition through to the end of harvest (Figure 1).

Overall the growing season daily temperature departures observed at the Roseburg weather station were cooler than the 2014-2016 vintages but 2.3°F warmer than the 1981-2010 climate normals. All four main wine growing regions in Oregon were warmer than normal, ranging from 1.4 to 2.3°F above average during April-October. The substantially drier conditions during the dormant period (5-15" below average), continued into the growing season which totaled 5.18" at the Roseburg station, 52% (4.6") below average for the location (Figure 1). It should also be noted that nearly an inch of the growing season total occurred in October after most of the harvest was done.

From a growing degree-day (GDD) standpoint spring heat accumulation started off near average but much lower than the very warm springs in the last few years. However, by early May the spring ended up being above the accumulation during the 2015 spring which held until early June. From mid-June on heat accumulation tracked above the average during 1998-2017 but remained below that seen in 2015, the warmest vintage in the region. The relatively cool conditions in mid-September slowed heat accumulation, but it picked back up in the warmer than average October ending the growing season total for Roseburg of 3164 GDD (Figure 2).

Figure 3 shows the same degree-day data but, instead of cumulative as in Figure 2, it gives the daily accumulation relative to the 1981-2010 and 1998-2017 averages. As is common in most springs, 2018 saw wide swings in heat accumulation during April through June, with the warm May the most evident departure in Figure 3. Leading up to flowering there was a period of cool and highly variable conditions that resulted in near average heat accumulation. The rest of the growing season saw mostly average to greater than average daily accumulation, especially in mid-July through mid-August, until the significant drop off in the middle of September (Figure 3). GDD accumulation for 2018 ended up 3164 for the Roseburg weather station compared to 2436 at the Roseburg Agri-Met station and 2750 at the Medford Agri-Met station at SOREC. The 3164 GDD is lower than experienced in 2014 (3547), 2015 (3593), and 2016 (3287) but substantially more than the 1981-2010 normals (2713) and the 1998-2017 average (2940) (Figure 2). The year ended up being most similar to 2003 (3109 GDD), 2013 (3170), and 2017 (3131). Compared to other locations statewide, Roseburg ended up with intermediate heat accumulation compared to state's four main wine producing regions with Medford the highest (3457), Milton-Freewater next (3417) and McMinnville the lowest (2317).

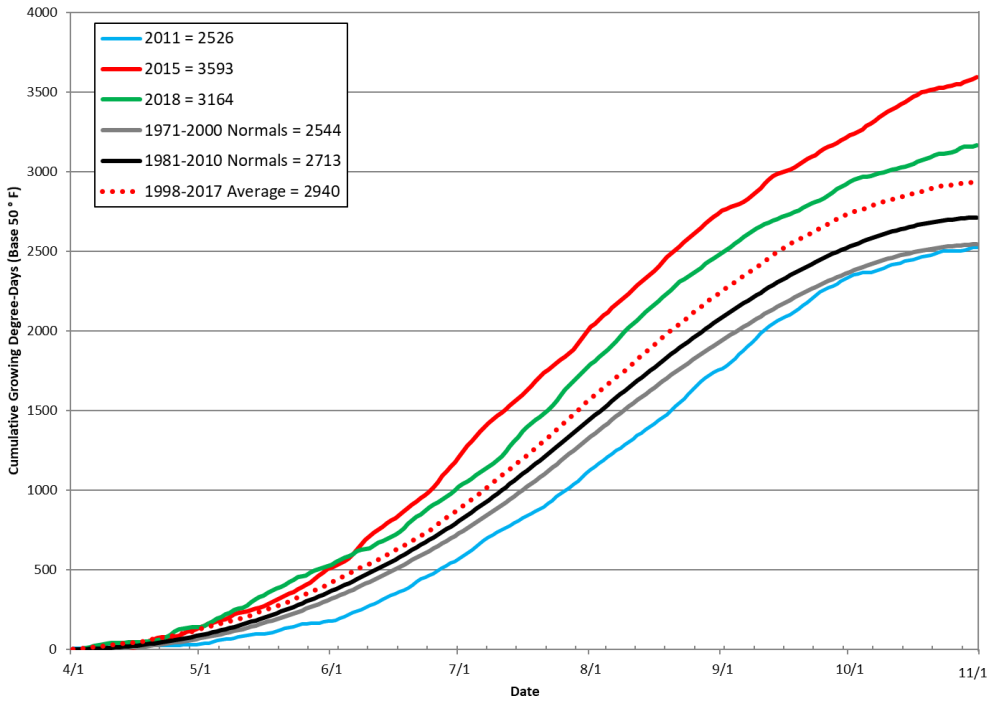

Figure 2 – Growing degree-day accumulation during April-October 2018 from the Roseburg weather station (green line). The long-term averages shown are for the 1971-2000 climate normals (gray line), 1981-2010 climate normals (black line), the 1998-2017 period average (red dotted line), 2015 the warmest year since 1998 (red line), and 2011 the coolest year since 1998 (blue line). Data calculated from daily Tmax and Tmin observations for April 1st through October 31st using a base of 50°F with no upper cut-off.

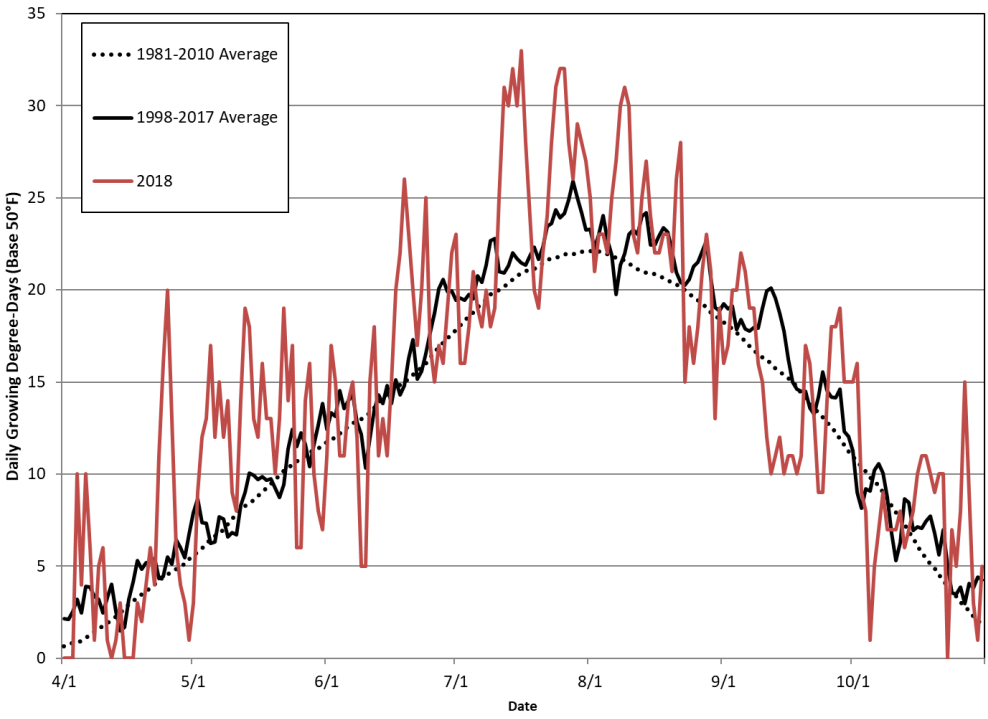

Figure 3 – Same data as in Figure 2 but shown as daily growing degree-day values during April-October 2018 from the Roseburg weather station (base 50°F). The long-term averages are derived from the 1981-2010 climate normals and the average from the 1998-2017 period of record.

For the 2018 vintage, site temperature data from the eight reference vineyards showed that the average GDD accumulation was 2655 with a standard deviation of 272 units (Table 1). Maximum accumulation was 3088 GDD (southern AVA site) while the minimum was 2150 GDD (northern AVA site). In terms of heat extremes there were 25 days on average with temperatures over 95°F across the region, ranging from a low of 11 days to a high of 38 days (Table 1). In addition, there were numerous days over 100°F for the region (5 to 23), with most occurring during mid to late July and the first ten days of August. The hottest days of the year were during July 12-17, July 23-29 and August 7-10 with most sites being over 100°F during these periods. The highest reference vineyard average maximum of 107.5°F and absolute maximum of 112.9°F was observed on July 15th.

The 2018 growing season saw absolute minimum temperatures that were cooler than average at the reference vineyards. The coldest nights during the growing season occurred in the first week of April and the second week in October with temperatures dipping down to 24-32°F throughout the region (Table 2). There were from one to eight days during April through October that dropped below 32°F in 2018 with the majority occurring during October. The median last frost in the spring occurred April 3rd across the region but, like most years, there was a wide range from the earliest being April 3rd to as late as April 19th (Table 1). The median first fall frost was October 18th across the reference vineyard sites varying from as early as October 15th to as late as November 8th, which was the same as the Roseburg weather station. The resulting frost-free period median was 198 days in 2018, ranging 37 days from 182 to 219 days across the sites.

Comparisons with Previous Years

Compared to past dormant periods at the reference vineyards (starting in 2004-05), the 2017-18 winter was right at average for the period (Table 2). This past winter had slightly lower than average number of days below 32°F but had warmer than average absolute minimum temperatures with little freeze risk. During the growing season, the 2018 vintage temperatures across the reference vineyards ended up 0.5-1.1°F cooler than those experienced during the 2014 through 2016 vintages, but slightly warmer than the 2017 vintage. Average maximum temperatures were slightly higher than average while average minimum temperatures were moderately cooler compared to the long-term average. In terms of heat accumulation, the 2018 growing season GDD at the reference vineyards was moderately higher than the 2003-2018 average (2486), 500-600 heat units warmer than 2010 and 2011, 300-400 heat units lower than the 2014 through 2016 vintages, and nearly identical to the 2017 vintage (Table 2).

During the growing season, absolute maximum temperatures were higher than average while the number of days over 95°F during 2018 was four days more than the long-term average. The absolute minimum temperatures observed at the reference vineyards during the growing season were lower than the period average, while the number of days below 32°F was average. The last spring frost date was right at the time period average, but over a month later than observed in 2016. The first fall frost date was nearly two weeks earlier than the time period average and the earliest since the 2010 vintage. The result was a moderately shorter than average frost-free period of 198 days in 2018 (Table 2).

Table 1 – Umpqua Valley reference vineyard dormant season (November 1-March 31, 2017-18) and growing season (April 1-October 31, 2018) climate characteristics. Note that the dormant season minimum temperature value is the average absolute low temperature experienced. Growing degree-days are calculated from April-October 2018 (base of 50°F with no upper cut-off). *Note that **a couple of** the sites did experienced their first fall frost prior to 11/1 and the Roseburg station's first frost was 11/8.

Dormant Season (Nov 1 – Mar 31)	***Average***	***Standard Deviation***	***Maximum***	***Minimum***	***Range***
Average Temperature (°F)	43.4	0.7	44.7	42.3	2.4
Absolute Minimum Temperature (°F)	21.9	1.5	23.4	19.2	4.2
# of Days < 32°F	29	6.7	37	17	20
Growing Season (Apr 1 – Oct 31)	***Average***	***Standard Deviation***	***Maximum***	***Minimum***	***Range***
Growing Degree-Days	2655	272	3088	2150	938
Growing Season Average Temperature (°F)	62.1	1.3	64.2	59.7	4.5
Average Maximum Temperature (°F)	80.3	2.4	83.3	76.2	7.1
# of Days > 95°F	25	8	38	11	27
Average Minimum Temperature (°F)	47.2	1.4	48.7	45.1	3.6
# of Days < 32°F	3	2.0	8	1	7
Median Last Spring Frost (date or days)	Apr 3	6 days	Apr 19	Apr 3	16 days
*Median First Fall Frost (date or days)	Oct 18	12 days	Nov 8	Oct 15	24
Median Frost-Free Period (days)	198	16 days	219	182	37 days

Table 2 – Reference vineyard climate comparisons across the dormant (November 1–March 31) and growing seasons (April 1-October 31) for each year of the project.

Season/Variable	***Year or Period***															
Dormant Season (Nov 1 – Mar 31)	***03-04***	***04-05***	***05-06***	***06-07***	***07-08***	***08-09***	***09-10***	***10-11***	***11-12***	***12-13***	***13-14***	***14-15***	***15-16***	***16-17***	***17-18***	***Average***
Average Temperature (°F)	NA	43.7	42.3	42.7	40.9	42.2	43.6	43.9	41.9	43.4	42.9	47.1	45.3	43.3	43.4	43.3
Abs. Minimum Temperature (°F)	NA	23.3	16.0	15.9	16.4	14.1	8.8	18.5	22.0	20.6	5.6	17.3	17.5	25.3	19.2	17.2
# of Days < 32°F	NA	34	32	52	52	40	26	30	42	35	40	21	15	33	29	34
Growing Season (Apr 1 – Oct 31)	***2004***	***2005***	***2006***	***2007***	***2008***	***2009***	***2010***	***2011***	***2012***	***2013***	***2014***	***2015***	***2016***	***2017***	***2018***	***Average***
Growing Degree-Days	2636	2302	2458	2144	2243	2384	2039	2120	2380	2522	2971	3011	2760	2662	2655	2486
Abs. Maximum Temperature (°F)	107.7	106.7	110.2	103.7	107.2	113.7	109.6	101.9	106.7	105.9	108.3	111.1	113.1	115.2	112.9	108.9
# of Days > 95°F	17	10	24	11	19	23	13	14	20	20	31	31	23	30	25	21
Abs. Minimum Temperature (°F)	33.9	30.1	23.3	28.5	24.2	28.1	27.6	27.3	29.4	29.2	30.8	30.8	33.2	28.6	24.7	28.6
# of Days < 32°F	0	2	4	2	7	5	2	6	2	2	0	1	0	3	3	3
Median Last Spring Frost	Apr-1*	Apr-13	Mar-27	Apr-2	Apr-20	Apr-16	Apr-24	Apr-25	Mar-31	Apr-14	Mar-27	Apr-9	Feb 23	Mar 22	Apr 3	Apr-4
Median First Fall Frost	Nov-5	Nov-4	Oct-26	Oct-27	Oct-11	Oct-12	Oct-19	Oct-26	Nov-9	Oct-29	Nov-30	Nov-24	Dec-7	Oct 31	Oct 18	Nov-1
Median Frost-Free Period	218	205	213	208	174	179	178	184	223	202	247	230	288	213	198	211

The maximum and minimum temperatures are the absolute values recorded for the entire region for that year and season. Frost dates and the frost-free period are the median observed over the entire region for that year. Note that the last spring frost in 2004 is from the Roseburg KQEN station observation, which correlates reasonably well with the reference vineyard sites in other years.

Phenology:

Summarizing the phenological observations for the entire region and across all varieties shows a median bud break of April 20th (Table 3). During the spring of 2018 bud break was observed over a two-week period for all varieties and sites, reported as early as April 9th and as late as April 26th. The median date of flowering was June 15th with over two weeks between the earliest (June 8th) and latest (June 24th) sites across the region and over all varieties. Véraison and the start of the ripening phase during 2018 occurred over a four-week period during early August through early September (median August 15h). The earliest véraison was observed on July 30th while the latest was observed on September 10th. Harvest ranged over a 40-day period from September 11th to October 21st across varieties and sites with a median date of October 4th (Table 3).

Average intervals between phenological events (an important measure of vine and berry development timing) shows that bud break to flowering during 2018 had a median of 56 days; that flowering to véraison was 62 days on average; and that véraison to harvest was 48 days on average (Table 3). These intervals had 3 to 12-day standard deviations across sites and varieties, but a very wide range between the shortest and longest intervals due to site differences. For 2018, the length of the bud break to harvest period averaged 169 days with 42 days between the shortest and longest vineyard sites.

Comparisons with Previous Years

For the Umpqua Valley the main phenological events for the 2018 vintage were in general slightly later than average for earlier events and near average for later events when compared to the previous vintages (Table 4). The median bud break was eight days later than average and nearly three weeks later than observed in 2015 and 2016. Bloom was one day later than the period average, over two weeks earlier than the cool 2011 vintage but two weeks later than the warm 2015 and 2016 vintages. Median véraison dates during 2018 were one day earlier than average, varying by +/- 8 days over sites and varieties, and occurring over 20 days ahead of the cool 2011 vintage but a week or two behind the warm 2015 and 2016 vintages. The 2018 median harvest date was one day earlier than average, over two weeks earlier than the cool 2010 and 2011 vintages, and near the same timing as the 2017 vintage.

For the 2018 vintage, despite the cool late winter and spring which pushed bud break later, the average time between bud break and bloom of 56 days was slightly earlier than the period of record average (Table 4). The bloom to véraison period in 2018 was close to the period average (62 vs 63 days), responding to the rapid warming and drying experienced during this period. The average length of time between véraison and harvest was 48 days in 2018, one day shorter than the period average. The average bud break to harvest interval of 169 days in 2018 was shorter than average by five days, but very similar to the last three vintages. Even though the individual dates of phenological events vary quite a lot from year to year, the long-term data for these intervals between events continues to converge toward very consistent lengths for each growth interval for the region.

Table 3 –Phenological date and interval characteristics for the 2018 vintage averaged over sites and varieties.

Event/Interval	*Median*	*Standard Deviation*	*Latest or Longest*	*Earliest or Shortest*
Bud Break	April 20	5 days	April 26	April 9
Flowering	June 15	4 days	June 24	June 8
Véraison	August 15	9 days	September 10	July 30
Harvest	October 4	12 days	October 21	September 11
Bud Break to Flowering	56 days	3 days	64 days	51 days
Flowering to Véraison	62 days	7 days	78 days	47 days
Véraison to Harvest	48 days	12 days	75 days	29 days
Bud Break to Harvest	169 days	13 days	190 days	148 days

Table 4 – Reference vineyard average phenology comparisons for each year of the project. Note that the 2011-2018 vintage numbers come from fewer sites and varieties than the previous years (see text for details).

Stage or Interval	*2004*	*2005*	*2006*	*2007*	*2008*	*2009*	*2010*	*2011*	*2012*	*2013*	*2014*	*2015*	*2016*	*2017*	*2018*	*Average*
Bud Break																
Median	4/1	4/2	4/22	4/9	4/22	4/21	4/16	5/1	4/22	4/11	4/4	3/27	3/30	4/18	4/20	4/12
Standard Deviation	7 days	11 days	4 days	7 days	8 days	5 days	7 days	7 days	4 days	7 days	7 days	8 days	6 days	7 days	5 days	7 days
Flowering																
Median	6/5	6/13	6/14	6/9	6/23	6/16	7/2	7/3	6/21	6/9	6/10	6/1	6/1	6/17	6/15	6/14
Standard Deviation	5 days	7 days	5 days	7 days	6 days	6 days	6 days	5 days	5 days	4 days	6 days	7 days	5 days	5 days	4 days	6 days
Véraison																
Median	8/13	8/14	8/14	8/12	8/19	8/19	8/30	9/9	8/26	8/12	8/9	7/31	8/6	8/14	8/15	8/16
Standard Deviation	7 days	10 days	9 days	9 days	9 days	7 days	11 days	8 days	7 days	6 days	7 days	9 days	7 days	9 days	9 days	8 days
Harvest																
Median	10/5	10/10	10/8	10/7	10/15	10/8	10/19	10/26	10/3	9/27	9/22	9/23	9/18	10/6	10/4	10/5
Standard Deviation	9 days	12 days	9 days	10 days	9 days	8 days	6 days	6 days	8 days	9 days	11 days	13 days	11 days	9 days	12 days	10 days
Bud Break to Flowering																
Median	65 days	76 days	54 days	61 days	64 days	56 days	75 days	63 days	59 days	57 days	65 days	63 days	64 days	62 days	56 days	63 days
Standard Deviation	7 days	14 days	6 days	8 days	6 days	7 days	6 days	7 days	4 days	5 days	8 days	9 days	6 days	5 days	3 days	7 days
Flowering to Véraison																
Median	68 days	61 days	62 days	63 days	59 days	63 days	58 days	65 days	68 days	65 days	63 days	63 days	64 days	58 days	62 days	63 days
Standard Deviation	6 days	8 days	8 days	8 days	6 days	6 days	10 days	4 days	5 days	6 days	6 days	7 days	7 days	5 days	7 days	7 days
Véraison to Harvest																
Median	55 days	51 days	51 days	56 days	55 days	51 days	46 days	49 days	41 days	44 days	44 days	48 days	45 days	51 days	48 days	49 days
Standard Deviation	11 days	15 days	10 days	11 days	10 days	9 days	10 days	8 days	7 days	8 days	11 days	9 days	12 days	10 days	12 days	10 days
Bud Break to Harvest																
Median	185 days	194 days	168 days	175 days	174 days	171 days	185 days	177 days	164 days	166 days	173 days	172 days	170 days	170 days	169 days	174 days
Standard Deviation	13 days	13 days	8 days	13 days	11 days	9 days	8 days	9 days	7 days	11 days	10 days	14 days	13 days	10 days	13 days	11 days

Composition:

For the 2018 vintage, grower-submitted harvest composition values reflect the near average season showing a median 23.8 °Brix with a wider than average range from 18.5 to 25.7 °Brix across sites and varieties (Table 5). Harvest titratable acidity averaged 6.4 g/L with a minimum of 4.7 g/L to a maximum of 8.4 g/L while pH numbers averaged 3.41 with a range from 3.18 to 3.89 over all sites and varieties. Yields averaged 2.4 tons/acre across the sites and varieties, ranging 4.1 tons/acre from a low of 1.0 to a high of 5.1 tons/acre (Table 5).

Table 5 –Harvest composition characteristics for the 2018 vintage averaged over sites and varieties.

Region	°Brix	TA (g/L)	pH	Yield (T/acre)
Median	23.8	6.4	3.41	2.4
Standard Deviation	1.7	0.9	0.19	0.9
Maximum	27.1	8.4	3.89	5.1
Minimum	20.2	4.7	3.18	1.0
Range	6.9	3.7	0.71	4.1

Comparisons with Previous Vintages

The 2018 vintage harvest composition values from the sites give a general comparison with the 2004 through 2017 vintages (Table 6). Average °Brix values of 23.8 were slightly above the period average but lower than the 2015 and 2016 vintages. Average titratable acidity of 6.4 g/L was slightly lower than the period average (6.5 g/L) and slightly higher than the 2017 vintage. Median pH values in 2018 were slightly lower than the long-term average and had slightly higher than normal site and variety variation. Yields reported from the sites show that the 2018 vintage was right at the period average but slightly below harvest yields from the last four vintages. The range of 4.1 tons/acre across sites and varieties in 2018 was also higher than past vintages (Table 5).

Table 6 - Comparison of the overall harvest composition values (all varieties) for each year of the project. *Note that the 2011-2018 vintage numbers come from fewer sites and varieties than the previous years (see text for details).

Parameter	*Harvest Numbers*															
	2004	*2005*	*2006*	*2007*	*2008*	*2009*	*2010*	*2011*	*2012*	*2013*	*2014*	*2015*	*2016*	*2017*	*2018*	*Average*
°Brix	24.1	24.0	24.4	23.5	23.7	23.5	22.5	21.5	23.6	23.5	23.4	24.1	24.0	23.4	23.8	23.5
TA (g/L)	6.6	6.9	6.5	7.1	6.8	6.4	7.6	7.8	6.3	5.6	5.9	5.9	5.8	6.2	6.4	6.5
pH	3.50	3.38	3.46	3.33	3.42	3.41	3.31	3.40	3.50	3.56	3.50	3.51	3.50	3.40	3.41	3.44
Yield (tons/acre)	1.7	2.4	2.8	2.8	2.5	2.4	2.0	2.9	1.9	2.6	2.7	2.7	2.9	2.7	2.4	2.5

Conclusions:

The main signatures for the 2017-18 winter were relatively mild (near average temperatures with lower than average winter freeze risk) and a relatively dry winter that continued into a dry growing season. The 2018 vintage in the western US ended up as near the average of the last five vintages but with lower than average heat stress, continued drought, and fires raging in or near many wine regions with numerous days of smoke. Production is likely to be near average in California, up in Washington and

Idaho due to continued recovery from previous winter's damage, and slightly higher in Oregon due to a good fruit set, little to no disease pressure and a near perfect harvest period.

In Southern Oregon the vintage started mostly dry and cool with bud break occurring 4-8 days later than average in the Rogue Valley and Umpqua Valley. While not as warm as the 2014 through 2016 vintages, 2018 ended up very close to the temperatures and heat accumulation numbers experienced in the 2017 vintage. One of the most evident weather/climate issues that unfolded in the 2018 vintage was the overall dryness with most of Southern Oregon seeing 70-120 days without any rain, resulting in 40-60% less than average precipitation for the growing season. The second issue was the reduced number of heat extremes and a flip-flop in the expected regional differences. While many locations statewide broke records for the number of days over 90°F, heat spikes over 100°F were down region-wide. The regional flip-flop saw the Rogue Valley see lower maximum temperatures than the Umpqua Valley. This was likely due to the Rogue Valley seeing more frequent days and thicker amounts of mid to high level smoke than the Umpqua Valley. Other weather risks during the 2018 growing season were mixed with some late, but mild frost events into mid to late April, early October frosts in some locations in the Rogue Valley, overall little to no rain during bloom, and very little rain during the main period of harvest. During the ripening period leading up to harvest a cool down in September slowed things down but was followed by a relatively warm and dry early to mid-October that allowed for a slow but steady harvest.

The reference vineyard temperature observations in the Umpqua Valley reflect the general conditions seen across Oregon and the region. The dormant period ended up with near average temperatures and days below 32°F but higher than average absolute minimums. The slightly cool and dry spring was followed a very warm late April and month of May that continued into a warmer than average June through August. This period saw a stretch of 70-120 days without measurable rain. The growing season ended up 1.4-2.3°F across Oregon winegrowing regions with GDD accumulation 5-17% higher than the 1981-2010 climate normal. Averaged over the reference vineyard sites GDD was 2655, which was lower than the 2014, 2015 and 2016 vintages, very similar to 2017 but higher than the long-term average. Heat extremes observed at the reference vineyards during 2018 were below average with 5-23 days above 100°F across the sites and 25 days above 95°F averaged over the region. Phenological observations from the sites showed that bud break was eight days later than average, while the rest of the events were within one day of average. The intervals between growth stages remained generally consistent compared to other years, indicating consistent growth cycles between quite varied vintages. Basic composition values reflect the close to average vintage with °Brix levels slightly above average, acid levels near average, pH values near average, and near average yields.

Comments on the season submitted by growers point to a relatively easy vintage. Most stated that the cool spring slowed early season growth but that the warm May accelerated things to a near average flowering period. The majority of growers noted that the flowering period was nearly ideal, and that fruit set was great, however a few noted some rain and variable set with some varieties at record high levels and others at record low levels. In terms of bird pressure, growers noted similar pressure to the 2017 harvest that picked up with later pick dates in 2018, but most reporting average to very low bird pressure or even no birds at all. Other pest pressure was also stated being variable with some mentioning that deer, turkeys and voles or ground squirrels were the most problematic, likely due to the dry conditions, while the majority said that yellow jackets continued the trend from past years of being especially aggressive and numerous. Comments concerning disease issues tended to indicate a relatively low-pressure year to not seeing any disease at all.

As noted in previous vintage reports, the warmer conditions during the past five vintages (2012-2018) throughout the western US has been linked to a moderate rebound in sea surface temperatures over both the North and Tropical Pacific Ocean. However, the winter of 2017 through much of 2018 was characterized by La Niña conditions (cooler tropical sea surface temperatures) which contributed significantly to the slightly cooler conditions and moderately to the drier conditions seen across the west. We also continue to see more variability in both ocean temperatures and the circulation of the atmosphere. Given this backdrop and the current conditions, what does the 2018-19 winter and the spring of 2019 hold for the western US and Southern Oregon?

Signs of El Niño development continue as we progress further into winter with east-central tropical Pacific SSTs warming to El Niño levels. Both surface and subsurface waters also continue to be markedly warmer than average, however, the atmospheric variables over the region have shown mainly ENSO-neutral patterns. Only lower-level wind anomalies averaged weakly westerly in the eastern Pacific provide a suggestion of El Niño conditions in the atmosphere. The official Climate Prediction Center (CPC) outlook calls for an 80% chance of El Niño prevailing during winter, and a 55-60% chance of continuing into spring 2019. As such the CPC has indicated that an El Niño watch is in effect. Other forecasts from statistical and dynamical models also collectively show ongoing El Niño-level SSTs, most likely weak to moderate in strength, continuing through spring. If these conditions for El Niño development continue to hold, the weather across the PNW and the northern tier of states is forecast to be warmer than average and near average to drier than average, while central to southern California across the southern tier of states is forecast to see near average temperatures and higher than average precipitation.

Forecasting conditions during the late winter and into spring of 2019 will depend on how the dynamic patterns of sea surface temperatures in the Pacific play out and how the Tropical to Arctic circulation of the atmosphere responds. Another area to watch is the North Pacific and the Gulf of Alaska as the ocean continues to warm to record levels with the upper 300 ft of the North Pacific Ocean north of 40°N now warmer (relative to normal) than at any time in the modern data record (1980-present). The current North Pacific sea surface temperatures (SSTs) have had a strong influence over our fall and start of winter conditions, but the spatial pattern is not quite what we saw with the 'Blob' in 2012-2016 as the bulk of the warmth is a little further to the west. Most observation networks believe that the warming North Pacific will likely interact with the warming Tropical Pacific (see above) to enhance the normal weather/climate patterns in the west during El Niño years. The evidence currently would point to a warmer than average spring, like what we experienced in 2014-2016. As ocean and atmospheric conditions unfold over the next 2-3 months, we will have a much better picture of what the spring of 2019 will bring to Oregon and the rest of the western US. Further updates will be provided as more information becomes available.

Future Work

- The observation network will continue for the foreseeable future focusing on site temperatures, phenology, and harvest composition and yields.
- An overview presentation will be given at a late winter/early spring meeting of the Umpqua Valley Winegrowers Association (watch for email and web site announcements for further details).
- The results will also be used to provide a Southern Oregon component to the Oregon Wine Symposium's "Vintage Overview" session during February 12-13, 2019 in Portland at the Oregon Convention Center.

- A synthesis report with further in-depth analyses of the study will be compiled and made available as more data are gathered and processed.

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