Vintage 2010: Umpqua Valley Reference Vineyard Report

Summary:
Southern Oregon and much of the western US experienced a year of records and wide swings in weather. A record hard freeze in early December 2009 was followed by a the warmest January and February on record, the coolest spring since 1991, an average summer with few extremes, then one of the warmest late September-early Octobers on record. The result was a 2010 vintage that was significantly cooler than any other vintage in the last decade, but still significantly warmer than much of the last 80 years in the region. The cool season was influenced by much cooler than normal near coast waters in the North Pacific Ocean coupled with La Niña conditions in the tropical Pacific. The vintage saw roughly 60% more precipitation than average during the growing season, coming largely during the cool spring and in late October, but with little bloom and ripening impacts. In terms of temperature extremes during 2010, moderate frost events occurred in April and into May for some locations while heat spikes over 100°F were less numerous than normal. Growing degree-day totals averaged 2039 for the reference vineyards, which was 12% lower than the seven year project average. Phenological timing of the observed varieties was near normal to slightly late for bud break but significantly delayed for bloom, véraison, and harvest dates (10-15 days). Fruit composition in mid-September reflected the cooler vintage, being significantly lower than average for °Brix, substantially higher in acidity, near average to lower for pH, and near average berry weights compared to past years. Harvest composition levels also showed lower than average °Brix, higher than average acidity, near average pH, and yields that were down 16% on average.

Project Overview:
The goals of the project were to set up a suite of reference vineyards that monitor temperature, phenology, and composition of important varieties grown in the Umpqua Valley AVA. The purpose of the research is to provide an in depth look at spatial variations in important weather, plant, and yield parameters in the region.

During 2003-04 nine reference vineyards were established across a north-south transect throughout the Umpqua Valley AVA at elevations ranging from 335 ft to 1154 ft (642 ft average). The spatial and elevation makeup of the reference vineyards is intended to capture a range of site variability typically found in the Umpqua Valley.

The initial varieties chosen for the trial plantings (in 2003-04) were Tempranillo clone 01, Tempranillo clone 02, Syrah clone 01, Grenache clone 04, Malbec clone 04, and Viognier clone 01. During 2004-05, Pinot Noir (Pommard clone), Pinot Gris (clone 2), and Riesling (Wente clone) where added to the trial. These trial plantings are in various stages of development with four locations contributing observations from the fourth leaf of the plantings. However, due to the time needed for growth, the project participants decided to monitor phenology and composition of five existing varieties: Pinot Noir, Pinot Gris, Syrah, Tempranillo, and Merlot. While not all of the reference vineyards have every interim variety, those chosen provide a reasonable suite of variety/site combinations that can be monitored.

To measure temperature at each site, HOBO® H8 Pro-Temperature Loggers were installed at each of the reference vineyards. The sensors record at 15 minute intervals and the data is collected from each site just after the growing season is over (after Oct 31). The temperature data is then aggregated to hourly and daily average, maximum, and minimum values and finally summarized by site for the dormant (Nov 1 – Mar 31) and growing season (Apr 1 – Oct 31).

Phenological observations for bud break, flowering, véraison, and harvest for the interim varieties are submitted by each reference vineyard. The phenological data is then examined for average dates and intervals between dates for the entire region and by variety.

For composition information, varietal samples are taken on September 13th each year from the interim varieties observed (this year was the third year the trial varieties were also sampled in the same manner). The date was chosen as it represents a "snapshot" of fruit maturity that is not dependent on the subjective determination of ripeness for a given wine style. This date also represents an estimated mid-point of the véraison to harvest period leaving roughly 2-4 weeks before picking. One hundred berry samples are collected and then analyzed for °Brix, titratable acidity, pH, and berry weights using standard industry methods. From the sampling, a report is sent out during the last week of September to all members of the Umpqua Valley Winegrowers Association. In addition, the reference vineyards submit harvest composition (°Brix, titratable acidity, and pH) and yield at the end of the season. In most cases the data came from the wineries where the fruit was processed, while in other cases the values came from field observations. Therefore, the harvest composition data is not as consistent in terms of measuring techniques or devices. The composition data are then summarized by region and variety.

Results:

Regional Climate

Overall the winter of 2009-10 (November 1 through March 31) was characterized by slightly warmer than normal conditions throughout the region (+0.7°F for Roseburg). November started out relatively normal and was followed by the coldest period of the winter during December 6-11 with temperatures nearly 20 degrees below normal (Figure 1). The reference vineyard sites dropped to as low as 8.8 to 12.9°F on December 9th (Table 1). This is the second winter in a row where the coldest temperatures of the winter occurred in early to mid December. An extremely warm period followed resulting in the warmest January and February on record in many locations in Oregon and the western US. Temperatures declined into March, starting a cooler than normal spring (Figure 1).

After a warmer than normal dormant period, the growing season started out cooler than normal throughout Oregon and over the entire western US. April through June experienced some of the coolest spring conditions since the mid 1970s, punctuated by four, week or longer periods, that were 10 to 15 degrees below normal (Figure 1). As a result bud break occurred on average in mid to late April and bloom was centered on the first few days in July 1 (Figure 1). Temperatures returned to near normal to slightly above normal in early July and continued through late August. This period saw fewer than normal and lower temperature heat spikes compared to previous years. Véraison occurred in the last few days of August through early September (see more in the phenology section that follows) and was followed by a fairly cool first three weeks in September (Figure 1). During the last week in September temperatures climbed producing 'Indian Summer' conditions through the third week in October, then a decline to seasonally cool and wet conditions. Overall the growing season daily temperature departures observed at the Roseburg weather station were -1.1°F cooler than the 1971-2000 climate normals. Of the four main wine growing regions in Oregon (Willamette, Rogue, and Umpqua valleys and eastern Oregon), the Umpqua Valley was intermediate for average temperatures for the 2010 vintage, with the other locations ranging from -0.1 to -1.8°F below normal.

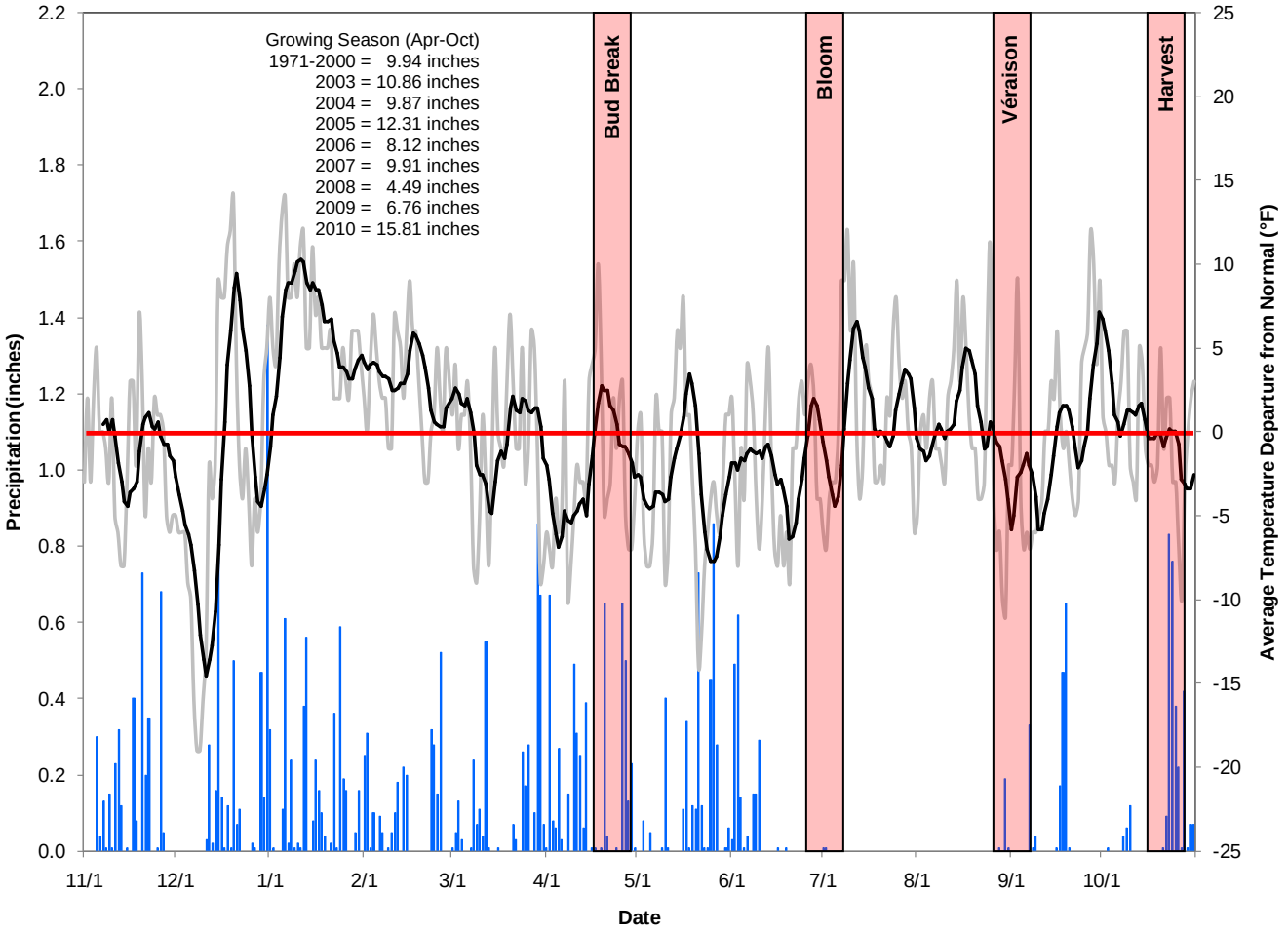

Figure 1 – Daily average temperature departures from normal and precipitation for November 1, 2009 to October 31, 2010 from the Roseburg weather station. The gray line is the day to day temperature departures from normal, the black line is the weekly average departures, and the blue bars are daily precipitation. The long-term average is derived from the 1971-2000 climate normals. The vertical red bars represent the variation in region-wide average phenology (see text for more details).

Rainfall from November through March was 18.8 inches, but 20% below normal which continued the generally dry conditions from earlier in 2009. The growing season (Apr-Oct) rainfall of 15.8 inches was over double the rainfall that occurred during the 2009 vintage and 60% above the 1971-2000 climate normals as measured at the main Roseburg weather station (Figure 1). The bulk of the rainfall during the growing season came in April through mid-June and late October. During the growing season eleven individual rain events greater than 0.5" were recorded in Roseburg with the majority coming in April, May and June. However, the average bloom and véraison periods were relatively free of rainfall (Figure 1). Notable rain events include 2.5 inches of rain over a seven day period in the third week in May, 1.25 inches over a three day period in the middle of September, and an event in late October that essentially signaled the end of the season when nearly 3.0 inches of rain was recorded in Roseburg and was followed by a cool down to more normal to slightly below temperatures (Figure 1).

From a degree-day standpoint the spring heat accumulation started off very slow barely tracking the 1971-2000 climate normal average (Figure 2). Starting in the third week of May the 2010 growing degree-days (GDD) starting tracking below average and continued through till the start of August, then

the remainder of the summer tracked the 1971-2000 climate normals. Degree-day accumulation for 2010 ended up at 2580 for the Roseburg weather station, which is 14% less than 2009, 9% less than the 1998-2010 average, but 1% more than the 1971-2000 climate normals for Roseburg (Figure 2). Statewide Roseburg ended up with lower heat accumulation compared to Medford (2946) and Milton-Freewater (2898) and more than McMinnville (1853). However, these GDD values were 9 to 16% below the 2003-2010 averages at each location.

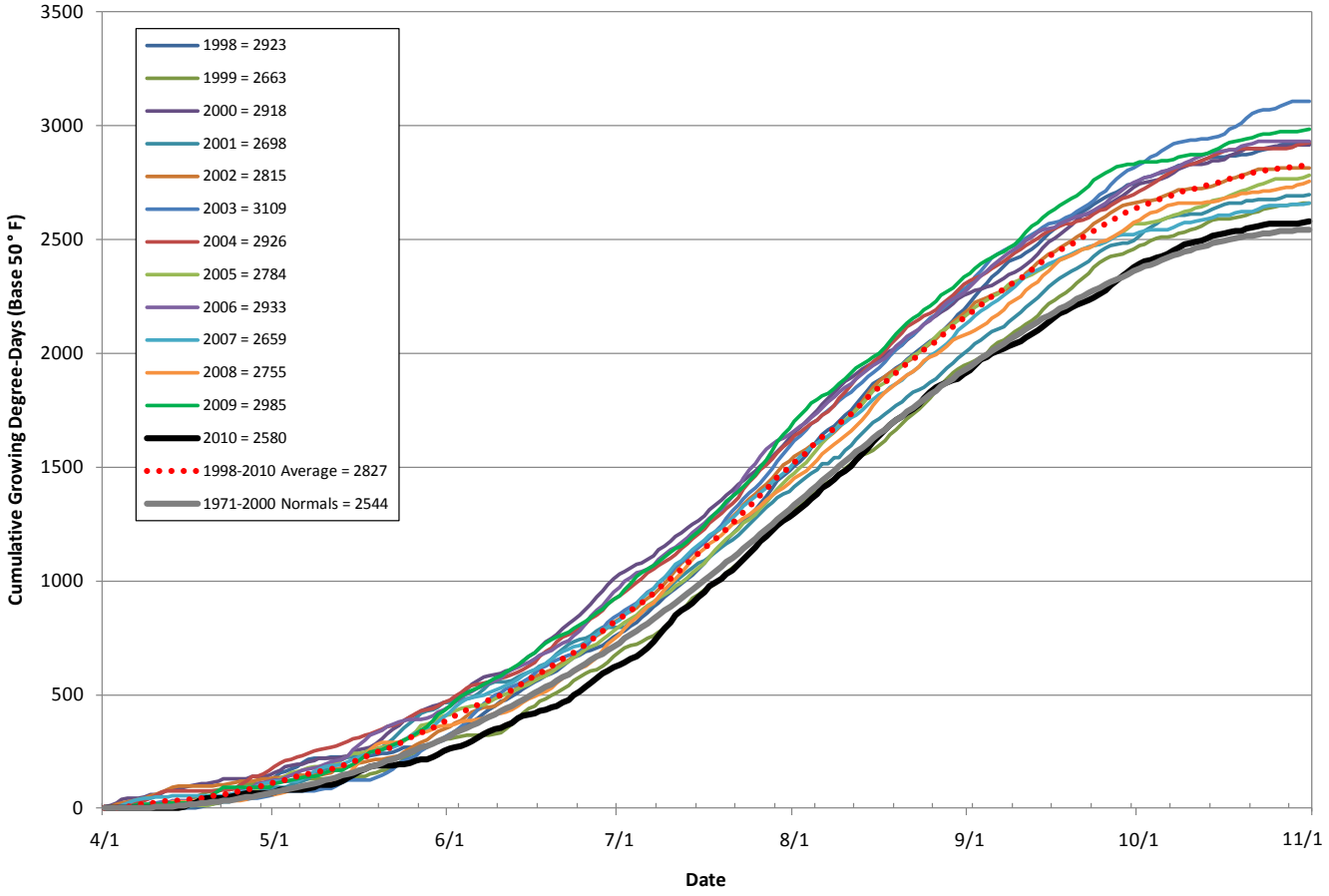

Figure 2 – Growing degree-day accumulation during April-October 2010 from the Roseburg weather station. The long-term averages shown are for the 1971-2000 climate normals (2544) and the 1989-2010 time period average (2827). Data calculated from daily Tmax and Tmin observations for April 1st through October 31st using a base of 50°F with no upper cut-off.

Reference Vineyard Climate Observations:

Dormant Period

The winter conditions of 2008-09 (Nov 1 through Mar 31) observed at the nine references were similar to those observed at Roseburg (see above) with variations coming from site characteristics and relative locations. Overall, the winter was warmer than normal for both maximum and minimum temperatures (Table 1). As has been consistent during the study period, the nine sites observed in the Umpqua also varied nearly three times more in terms of maximum temperatures than minimum temperatures during the winter. The absolute low temperatures for the reference vineyards during the winter ranged from 8.8°F to 12.9°F during the second week of December with the lowest observation occurring on December 9th. The number of days below 32°F, averaged across all reference vineyards was 26 with a range of 17 to 31 due largely to differences in elevation.

Table 1 – Reference vineyard dormant period (November 1-March 31) climate characteristics for 2009-10.

Variable	*Mean*	*Standard Deviation*	*Maximum*	*Minimum*
Average Temperature (°F)	43.6	0.5	44.1	42.7
Average Maximum Temperature (°F)	52.7	1.4	54.6	50.9
Average Minimum Temperature (°F)	37.1	0.5	37.9	36.5
Absolute Minimum Temperature (°F)	10.3	1.2	12.9	8.8
# of Days < 32°F	26	4.6	31	17

Growing Season

The 2010 growing season average growing degree-day accumulation from the nine sites was 2039 with a standard deviation of 264 GDD (Table 2). Maximum accumulation was 2290 degree-days while the minimum was 1485 degree-days. Average growing season temperatures ranged from 55.9 to 60.1°F, while average maximum temperatures ranged from 70.5 to 76.1°F and average minimum temperatures from 45.5 to 47.8°F. The variation in site maximum temperatures was nearly three times greater than that for minimum temperatures (standard deviation of 0.5°F vs. 1.7°F), which is similar to past years. Growing season temperature extremes summarized from the reference vineyards saw a below normal number of summertime heat spikes (lower maximum temperatures) occurring during four main periods (mid to late July, mid to late August, early September, and late September-early October). The absolute maximum temperature observed of 109.6°F occurred on August 25th during a 3 day heat spell where every site was above 100°F for multiple days. The number of days over 95°F averaged 13, but ranged from 5 to 22 (note that in a normal year, the Roseburg weather station observes 27).

Table 2 – Reference vineyard growing season temperature characteristics (April 1st through October 31st 2010).

Variable	*Mean-Median*	*Standard Deviation*	*Maximum*	*Minimum*
Growing Degree Days (base 50°F with no upper cut-off)	2039	264	2290	1485
Average Temperature (°F)	58.8	1.4	60.1	55.9
Average Maximum Temperature (°F)	74.2	1.7	76.1	70.5
# of Days > 95°F	13	5	22	5
Average Minimum Temperature (°F)	46.8	0.6	47.8	45.8
# of Days < 32°F	2	1.5	5	0
Last Spring Frost	Apr-24	14 days	May-6	Apr-9
First Fall Frost	Oct-19	---	> Nov-1	Oct-19

Frost dates are given as the median date.

In terms of minimum temperatures and frost frequency, the 2010 growing season in the Umpqua Valley saw relatively warm absolute minimum temperatures compared to the Rogue Valley. Temperatures dipped into the upper 20s in the second week of April at a few sites, with the absolute lowest temperature during the growing season at 27.6°F on April 9th. While late October cooled down rapidly, there were only two sites that saw temperatures drop below 32°F before the end of the month. Overall the average number of days during the growing season below 32°F was 2, with a range from 0 to 5, but note that these events were mild ranging from 28-32°F (Table 2). During the periods of the coolest nighttime temperatures in April and October, the range between the reference vineyards was just less than 2.0°F. The median last spring frost date was April 24th for the reference vineyards with the earliest occurring on April 9th (four locations) and the latest on May 6th at five locations (Table 2). While six of

the sites did not experience a first fall frost prior to November 1st, the other three sites all had a minor frost on October 19th.

Comparison to Previous Years

Comparing the six dormant seasons during the study period shows that 2009-10 had warmer than average temperatures (+1.0°F) and significantly fewer number of days lower than 32°F (Table 3). However, the region did see its lowest absolute minimum temperatures during the study period. For the growing season, 2010 was 345 GDD lower than 2009, and 12% below the seven year average of 2315 growing degree-days observed over all locations (Table 3). For 2010 the degree-day accumulation occurred mostly over a roughly four month period (late June through early September, then late September through the third week in October). The range in degree-day values between reference vineyards was 805 units, which has ranged from 700-900 over the period of study. Along with the generally cool season, the reference vineyards also experienced below average absolute maximum temperatures and a slightly lower number of days above 95°F compared to the prior vintages. The 2010 vintage also saw near average frost risk with a near average absolute minimum, but slightly fewer days below 32°F than average. The absolute last spring frosts in 2010 were later than the seven year average, while the first fall frost absolute date was a few days earlier (Table 3).

Table 3 – 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	***2003-04***	***2004-05***	***2005-06***	***2006-07***	***2007-08***	***2008-09***	***2009-10***	***Average***
Average Temperature (°F)	NA	43.7	42.3	42.7	40.9	42.2	43.6	42.6
Minimum Temperature (°F)	NA	23.3	16.0	15.9	16.4	14.1	8.8	15.8
# of Days < 32°F	NA	34	32	52	52	40	26	39
Growing Season	***2004***	***2005***	***2006***	***2007***	***2008***	***2009***	***2010***	***Average***
Growing Degree-Days	2636	2302	2458	2144	2243	2384	2039	2315
Maximum Temperature (°F)	107.7	106.7	110.2	103.7	107.2	113.7	109.6	108.4
# of Days > 95°F	17	10	24	11	19	23	13	17
Minimum Temperature (°F)	33.9	30.1	23.3	28.5	24.2	28.1	27.6	28.0
# of Days < 32°F	0	2	4	2	7	5	2	3
Last Spring Frost	Apr-1*	Apr-14	Mar-27	Apr-20	May-9	Apr-24	May-6	Apr-18
First Fall Frost	Nov-5	Nov-4	Oct-26	Oct-27	Oct-11	Oct-12	Oct-19	Oct-22

The maximum and minimum temperatures are the absolute values recorded for the entire region for that year. Frost dates are the absolute latest and earliest 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

This section would normally contain a detailed overview of the phenology from the nine trial varieties and Merlot, however not enough of the reference vineyards had submitted their phenological observations. Therefore, this discussion will be limited to data from six of the sites and will only be summarized over all sites and varieties. Given this scenario a total of 33 observations were submitted, approximately 65% of what was submitted in previous years. If the remainder of the phenological data is submitted, an addendum will be added and distributed.

Summarizing the phenological observations for the entire region and across all varieties shows an average bud break of April 16th with a 7-day standard deviation (Table 4). Bud break was observed as

early as April 1st and as late as May 6th. Flowering occurred on July 2nd on average with nearly 30 days between the earliest and latest sites across the region and over all varieties. Véraison and the start of the ripening phase occurred, on average, over a 22-day period during the last week of August and first week of September (averaging August 30th). The earliest véraison was observed on August 15th while the latest was observed on September 24th. Harvest dates ranged over 20 days across varieties and sites with an average date of October 19th and the majority of sites bringing fruit in from the second to fourth week in October (Table 4).

Average intervals between phenological events (an important measure of vine and berry development timing) shows that bud break to flowering was 75 days on average; that flowering to véraison was 58 days on average; and that véraison to harvest was 46 days on average (Table 4). These intervals had a 6 to 10 day standard deviations across sites and varieties, but a very wide range between the shortest and longest intervals due to the cool season. For 2010, the length of the bud break to harvest period averaged 185 days with a 32 day range between the earliest and latest.

Table 4 –Phenological date and interval characteristics for the 2010 vintage averaged over sites and varieties.

Event/Interval	*Median*	*Standard Deviation*	*Latest or Longest*	*Earliest or Shortest*
Bud Break	April 16	7 days	May 6	April 1
Flowering	July 2	6 days	July 15	June 19
Véraison	August 30	11 days	September 24	August 15
Harvest	October 19	6 days	October 28	October 7
Bud Break to Flowering	75 days	6 days	86 days	67 days
Flowering to Véraison	58 days	10 days	90 days	51 days
Véraison to Harvest	46 days	10 days	65 days	24 days
Bud Break to Harvest	185 days	8 days	200 days	168 days

Comparison to Previous Years

For the 2010 vintage the main phenological events were slightly later than normal to significantly delayed when compared to the previous seven vintages (Table 5). Observations during the project time period has shown bud break to average April 13th with a seven day variation across the vintages, sites, and varieties. The 2010 growing season experienced a bud break that was slightly later than average, but a few days earlier than the last two vintages. Bloom has averaged June 16th over the time period with +/- six day variation (Table 5). The 2010 vintage experienced its median bloom sixteen days later than average and is the latest observed during the seven years of the project. Véraison has typically been relatively consistent from vintage to vintage, but in 2010 véraison was 13 days later than average (August 30th) with a higher than normal site and variety variation. Harvest dates in 2010 were also the latest during the seven years, occurring nine days later than average with moderate site and variety differences (Table 5).

The average time between bud break and bloom was 11 days longer in 2010 than the period average, reflecting the cool spring conditions (Table 5). Even with a later than average bloom, the bloom to véraison period averaged 58 days in 2010, showing overall consistency in average lengths but slightly greater site/variety differences than past vintages. The average length of time between véraison and harvest was 46 days in 2010, six days shorter than average with similar site and variety variation

between vintages. The average bud break to harvest interval of 185 days in 2010 was nearly a week longer than average and comparable to that experienced in 2004 (Table 5).

Table 5 – Reference vineyard average phenology comparisons for each year of the project. Note that the 2010

Region	*2004*	*2005*	*2006*	*2007*	*2008*	*2009*	*2010**	*Average*
Bud Break								
Median	4/1	4/2	4/22	4/9	4/22	4/21	4/16	4/13
Standard Deviation	7 days	11 days	4 days	7 days	8 days	5 days	7 days	7 days
Flowering								
Median	6/5	6/13	6/14	6/9	6/23	6/16	7/2	6/16
Standard Deviation	5 days	7 days	5 days	7 days	6 days	6 days	6 days	6 days
Véraison								
Median	8/13	8/14	8/14	8/12	8/19	8/19	8/30	8/17
Standard Deviation	7 days	10 days	9 days	9 days	9 days	7 days	11 days	9 days
Harvest								
Median	10/5	10/10	10/8	10/7	10/15	10/8	10/19	10/10
Standard Deviation	9 days	12 days	9 days	10 days	9 days	8 days	6 days	9 days
Bud Break to Flowering								
Median	65 days	76 days	54 days	61 days	64 days	56 days	75 days	64 days
Standard Deviation	7 days	14 days	6 days	8 days	6 days	7 days	6 days	8 days
Flowering to Véraison								
Median	68 days	61 days	62 days	63 days	59 days	63 days	58 days	62 days
Standard Deviation	6 days	8 days	8 days	8 days	6 days	6 days	10 days	7 days
Véraison to Harvest								
Median	55 days	51 days	51 days	56 days	55 days	51 days	46 days	52 days
Standard Deviation	11 days	15 days	10 days	11 days	10 days	9 days	10 days	11 days
Bud Break to Harvest								
Median	185 days	194 days	168 days	175 days	174 days	171 days	185 days	179 days
Standard Deviation	13 days	13 days	8 days	13 days	11 days	9 days	8 days	11 days

Composition

Fruit sampling on September 13, 2010 resulted in a "snapshot" of ripening parameters commonly observed by growers and winemakers. A total of 62 samples across all interim and trial varieties were collected and analyzed. The 2010 vintage reference vineyard sampling revealed fruit that reflected the very cool growing season. °Brix levels averaged 14.7 across all of the samples with the highest °Brix values observed in Pinot Noir and Pinot Gris (17.2 and 17.3, respectively) and the lowest in Grenache (11.7) and Viognier (12.7) (Table 6). Variation and ranges in °brix levels across the sites were very large for many varieties indicating high spatial variability in ripening across the sites for those varieties. Pinot Noir was also sampled over all sites and for multiple clones (12 total samples) showing a median °brix of 17.0 but varying from a low of 7.1 to a high of 19.3 (not shown). The sampled fruit titratable acidity levels were extremely high and quite variable across the varieties and sites. Titratable acidity averaged 18.3 g/L with the highest values found in Grenache, Viognier, and Malbec, while lowest TA values were observed for Pinot Gris, Pinot Noir, and the Tempranillo clones. While a few samples showed TA values in the 10-12 g/L range, numerous sites exhibited fruit with TA values above 25 g/L. The larger sampling of Pinot Noir (12 total samples) showed a median of 14.8 g/L (not shown). Average sample pH values were 3.02 and exhibited a relatively narrow standard deviation, but exhibited substantial ranges from the highest to the lowest values across the varieties and/or sites (e.g., 0.41 for Pinot Noir and 0.54 for Tempranillo clone 1). Lowest pH values were observed in Riesling and Grenache, while the highest values were seen in Pinot Noir and the Tempranillo clones. The larger sampling of Pinot Noir (12 total samples) showed a median of 3.16 (not shown), similar to the trial samples. Varietal berry weights (per

100 berries) averaged 131.5 grams and showed a wide range across varieties with Viognier having the smallest berries at 93.4 g and Tempranillo clone 2 having the largest at 172.6 g. Furthermore, wide ranges in berry weights were observed across the sites with ranges over 100 g for Syrah and the two Tempranillo clones. The larger sampling of Pinot Noir (12 total samples) showed a median of 119.7 g, which is lower than the trial samples due to a slightly wider range of 86.0 g across the sites and varieties (not shown). Across the varieties, Grenache and Viognier were clearly physiologically the furthest behind the other varieties (Table 6).

Table 6 – Umpqua Valley reference vineyard °Brix, titratable acidity (TA, g/L), pH, and 100 berry weights (g) statistics from the sampling conducted on September 13, 2010. Note that in some cases the values come from small samples and should be considered carefully.

Variety(Clone)	*September 13th Sample*			
	°Brix	*TA*	*pH*	*Weight*[1]
Average	**14.7**	**18.3**	**3.02**	**131.5**
Interim Varieties				
Merlot	15.2	17.5	3.04	126.1
Pinot Noir	17.0	14.9	3.16	119.7
Trial Varieties				
Grenache (4)	11.7	25.0	2.95	163.4
Malbec (4)	15.1	20.9	3.09	145.5
Pinot Gris (3)	17.3	13.3	3.03	121.4
Pinot Noir (P)	17.2	14.3	3.18	132.6
Riesling (W)	14.7	18.7	2.79	101.6
Syrah (1)	14.0	18.6	2.98	141.6
Tempranillo (1)	15.5	15.2	3.13	163.6
Tempranillo (2)	14.8	14.5	3.10	172.6
Viognier (1)	12.7	21.5	3.01	93.4

[1] Weight of 100 berries, [2] Tons per acre (however yields not applicable for trial varieties)
Note that the number of vineyards with viable trial vine fruit is only three and that the samples come from the 5th leaf.

This section would also normally contain a detailed overview of the harvest composition and yields from the nine trial varieties and Merlot; however, as mentioned previously not enough of the reference vineyards had submitted their observations. Therefore, this discussion will be limited to data from six of the sites and will only be summarized over all sites and varieties. Given this scenario a total of 33 observations were submitted, approximately 65% of what was submitted in previous years. If the remainder of the harvest data is submitted, an addendum will be added and distributed.

Grower-submitted harvest composition values for the 2010 vintage showed an average 22.5 °Brix with a range from 20.0 to 24.8 °Brix across sites and varieties (Table 7). Titratable acidity averaged 7.6 g/L with a minimum of 5.9 g/L and a maximum of 12.0 g/L. Harvest pH numbers averaged 3.31 with range from 3.05 to 4.00. Harvest yields averaged 2.0 tons/acre across the sites and varieties, but ranged from a low just below 1.0 ton/acre to 4.1 tons/acre (Table 7).

Table 7 –Harvest composition characteristics for the 2010 vintage averaged over sites and varieties.

Region	°Brix	TA (g/L)	pH	Yield (T/acre)
Median	22.5	7.6	3.31	2.0
Standard Deviation	1.3	1.7	0.22	0.8
Maximum	24.8	12.0	4.00	4.1
Minimum	20.0	5.9	3.05	0.9

Comparison to Previous Years

For the sampling conducted on September 13th, the 2010 vintage exhibited significantly lower than average °Brix and significantly higher than average TA (Table 8). The other two measures were near the seven year average with pH at 3.02 and berry weights at 131.5 grams this year. °Brix has averaged 19.0 over the seven years, with 2010 significantly behind (4.3 °Brix lower). TA values from the sampling have averaged 9.8 g/L with the 2010 vintage nearly double the previous highs observed in 2008. For pH levels, the seven years have averaged of 3.07 over the time period, with 2010 showing closer to average values compared to 2009. Average 2010 berry weights where very close to the study period average of 138.3 g and varying by roughly 10 grams per 100 berries during the seven years (Table 8). Furthermore, both Viognier and Malbec set little to no fruit at some sites. The coolest sites in the reference vineyard network showed fruit that appeared to be up to a month (°Brix levels up to 10 units lower and TA up to three times higher) behind the warmest sites.

Table 8 – Comparison of the overall ripening sample values (interim and trial varieties) for the seven years of the project.

Parameter	*Ripening Sample*							
	2004	*2005*	*2006*	*2007*	*2008*	*2009*	*2010*	*Average*
°Brix	20.2	20.0	20.6	20.6	18.2	18.7	14.7	19.0
TA (g/L)	7.1	7.9	7.1	8.8	10.8	8.7	18.3	9.8
pH	3.05	3.06	3.09	3.08	3.01	3.21	3.02	3.07
Weight (g and t/a)	142.2	136.4	144.0	143.6	135.6	134.5	131.5	138.3

From the limited number of observations (~65%), the harvest numbers also reflect the cool season with each measure significantly different than the previous six vintages (Table 9). Harvest sugar levels were 1.2 °Brix lower than average, while TA values were 0.8 g/L below average, pH values were below average, and yields were down by 16% on average (ranging from 5% to 50% by site and variety).

Table 9 - Comparison of the overall harvest composition values (interim and trial varieties) for the seven years of the project.

Parameter	*Harvest Numbers*							
	2004	*2005*	*2006*	*2007*	*2008*	*2009*	*2010*	*Average*
°Brix	24.1	24.0	24.4	23.5	23.7	23.5	22.5	23.7
TA (g/L)	6.6	6.9	6.5	7.1	6.8	6.4	7.6	6.8
pH	3.50	3.38	3.46	3.33	3.42	3.41	3.31	3.40
Weight (g and t/a)	1.7	2.4	2.8	2.8	2.5	2.4	2.0	2.4

Conclusions

The 2010 vintage will be remembered as one of the coolest vintages in recent memory. The year started off with the warmest January and February on record in Roseburg and over much the western US, and was followed by a cool and wet spring, average summer, and warm late September and first three weeks of October. The 2580 GDD as measured at the Roseburg station is most comparable to the 1999 and 2007 growing seasons. However, from 1931 to 1990 only eight years were as warm as the 2010 vintage

with the mean GDD near 2400 and nine years even below 2200 GDD. The low GGD during 2010 vintage largely came from little heat accumulation during the spring. The spring conditions (April-May-June) during 2010 were the coolest since 1991, but are comparable to many years during 1931-2010. Furthermore, much of the success of the 2010 vintage hinged on a warm end of September and 'Indian' summer in October, which ended up the as the second warmest October since 1931 (only 1979 had higher GDD for the month of October).

The temperature observations from the nine reference vineyards also reflect these general conditions. The dormant period experienced the lowest absolute minimum temperatures recorded since the project began in 2004 with values dropping below 13°F at all sites on December 9, 2009. However, overall the winter was warmer than average over all sites. The spring was cool across the sites with frost pressure into May at many locations. Growing degree-day accumulation averaged 2039 over the nine sites, which was the lowest observed during the 2004-2010 observation period. Heat extremes were also low during 2010 with fewer heat spikes than normally observed.

Phenological observations from the sites showed generally delayed growth, especially with bloom, véraison, and harvest dates. The cool April through June also produced the longest bud break to bloom growth interval during the study period. Basic composition values reflect the cooler vintage with sampling in mid-September revealing fruit that was significantly delayed in ripening compared to the previous six years. Harvest composition values were behind as well with lower than average °Brix and higher acid levels. Yields were also down anywhere from 5 % to 50% (16% on average) from prior years.

The influences of this year's overall cool vintage can been seen in how the regional climate variability mechanisms behaved. All signs in January and February pointed to sustained El Niño conditions, which would have likely continued the relatively dry conditions in the region and result in a warmer than normal spring. However, a dramatic shift in ocean temperatures in late February and early March caused the atmosphere's circulation to whiplash from unseasonably warm to unseasonably cool, producing a cool air trough over the western US much longer into the summer than anyone anticipated. This happened because of the very cold water along the western US coast (up to 4-8°F cooler than normal) coupled with warmer water out over the North Pacific and the developing La Niña in the tropical Pacific. First, the cool waters off the west coast moderate temperatures along the western US (making it cooler overall). Second, the warmer than normal water further out in the Pacific brings higher moisture levels over the cooler waters producing a more prolonged marine layer and higher humidity along the coast and inland. Third, the warmer than normal water further out in the Pacific induces a stronger than normal trough over the western US (during the spring/fall) or a weaker high pressure ridge during the summer.

What does the winter of 2010-11 and the spring of 2011 hold for our region? The current scenario has us in a moderate La Niña through the rest of the winter, which tends to produce wetter and colder winters from extreme Northern California up into Canada and Alaska. For central to southern California the situation is such that we would expect a slightly cooler and drier winter, but the precipitation signal in California is not as strong as it is in the PNW. For next spring it will be important to watch for any changes in the sea surface temperatures off the west coast, how long the current La Niña lasts, how strong it is, and/or the timing of a possible transition to neutral or El Niño conditions. At this point all of the current conditions and projections point to a greater chance of a cool, wet spring with similar frost pressure as 2010. However, more confidence in the long range projections will come as we head into January and updates will be provided then.

Future Work

The seven years of this project have provided seasonal and spatial overviews of climate for the Umpqua Valley AVA. In addition, observations of phenology and composition have helped document the regional and site similarities and differences for the area. The past seven vintages in the region have produced their own weather and climate challenges, but have provided, in most cases, sufficient heat to ripen the range of varieties planted.

Unfortunately the project is ending with this vintage. The intent of the research was to provide some understanding of the region's climate and grape growing characteristics and we hope that we have achieved some success in these regards. The Umpqua Valley Winegrowers Association and I are discussing ways to continue some aspects of the study and will communicate these with you if it is possible. While this project has been a tremendous amount of work, I have been truly fortunate to collaborate with the industry these past seven years. Through this work I have been able to travel the region, enjoy the glory of the fall and harvest, and watch it develop as a wine producing area … I am one lucky scientist!

Early in 2011 an overview presentation will be given at a meeting of the Umpqua Valley Winegrowers Association (an announcements will be sent out). In addition, if you are headed to the Oregon Wine Industry Symposium during February 21-23, 2011 in Eugene, please attend the "Vintage Overview" and "Southern Oregon Research" session as both will highlight the results from this work. Furthermore, a synthesis report with further in-depth analyses of the seven years of the study will be compiled and made available as soon as possible.

Acknowledgements

This research was made possible by funding from the Oregon Wine Board. In addition, acknowledgement goes to all of the participating vineyards, whose collaborative support provides the framework for the research. Thanks also go to Steve Petrovic who provided the lab space and help analyzing the samples in the Chemistry Department at Southern Oregon University; and especially Sara Powell who pushed me for years to do this sort of research in southern Oregon.

Gregory V. Jones, Ph.D.
Department of Environmental Studies
Southern Oregon University
1250 Siskiyou Blvd
Ashland, OR 97520
TEL: 541-552-6758
FAX: 541-552-6439
EMAIL: gjones@sou.edu