Vineyard Evaluation Report

Your Site Description:

Size in Acres: ~57.0 acres

Geographic Location (latitude, longitude):

37.2394, -79.899

Description of Site:

Sample Site Comment

Basemap Source: ESRI World Imagery[1]

Overview of Site Conditions

Soils

For further information see the in depth discussion of these parameters on the following pages.

Parameter	Average	Minimum	Maximum
Saturated Hydraulic Conductivity (KSat) (inches/hour)	1.88	0.98	10.27
Bulk Density (g/cm3)	1.32	1.02	1.38
Soil pH	4.86	3.97	5.0
Soil Organic Matter	0.94	0.27	0.98
Soil Depth (cm)	198.7	13.61	200.0
Available Water Capacity (AWC) (in./in. soil 30" profile)	0.17	0.06	0.18

Climate

These precipitation climate conditions are averages based on 30 years of data analyzed by the PRISM Group at Oregon State University. The other climate factors use PRISM layers as a base for calculations completed at Virginia Tech's Center for Geospatial Information Technology

Parameter	Value
Average Growing Season Temperature (Celsius)	19.31
Average Length of Growing Season (frost-free days)	188
Annual Precipitation (inches)	43.13
Growing Season Precipitation (inches)	26.71
Average Growing Season Degree Days (C)	1996.14
Spring Frost Index	April: 12.4 May: 12.2

Topography

These topographic conditions are determined using the best available public data. Use the in-depth discussion provided on the following pages to further understand how these conditions can effect vineyard production in your area.

Parameter	Average	Minimum	Maximum
Slope (percent slope)	6.92	0.13	21.84
Elevation (feet)	1112	1052	1166

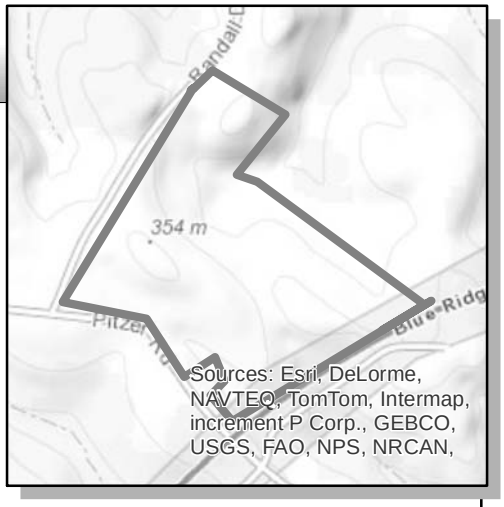
Solar Aspect:
North (14.4%), NE (24.5%), East (14.9%), SE (9.1%), South (16.0%), SW (6.7%), West (5.8%), NW (8.6%)

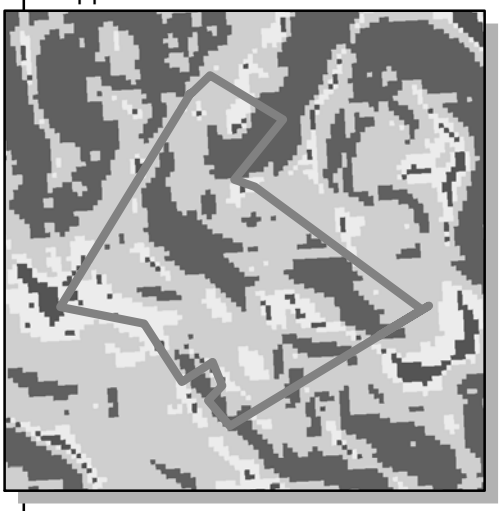
Topographic Features

Elevation in feet

Maximum	1166
Average	1112
Minimum	1052

Elevation has a profound influence on the minimum and maximum temperatures in a vineyard, particularly in hilly and mountainous terrain. Because frosts and freezing temperatures can so dramatically reduce vineyard profitability, elevation is one of the most - perhaps the most - important features of vineyard site suitability. The physics of topographic effects on air temperature are well documented (Geiger, 1966) and its horticultural significance generally well appreciated.





Slope

The change in elevation over a horizontal ground distance, is expressed here as a percent. Gentle to moderate slopes are best-suited for vineyard production as they protect against damaging frosts (Wolf & Boyer, 2009). Cold air has a higher density than surrounding air, causing it to sink with gravity and move downhill. As a result, vineyards planted on slopes at higher elevations benefit from fluid cold air drainage away from vines and the resulting warm air displacement upwards.

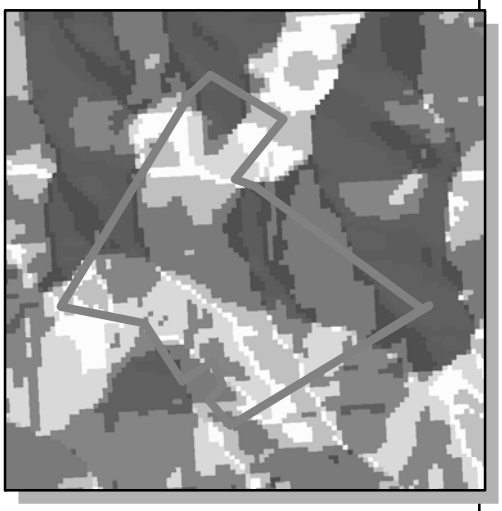
0% - 2%	**Poorly Suited**
2% - 5%	**Fairly Well-Suited**
5% - 15%	**Well-suited**
> 15%	**Poorly Suited**

Minimum	0.13	%
Average	6.92	%
Maximum	21.84	%

Aspect

Aspect describes the direction a slope faces, which relates to the sun angle and amount of sunlight that reaches the ground. According to Dr. Tony Wolf, Virginia's State Viticultural specialist (p.16), aspect is one of the least influential factors related to a vineyard's overall suitability; however, choosing a site with a favorable aspect can enhance grape taste and facilitate efficient disease and pest management.

Northern 315º to 45º	North-facing	14.4%
	Northeastern-facing	24.5%
Eastern 45º to 135º	East-facing	14.9%
	Southeast-facing	9.1%
Southern 135º - 225º	South-facing	16.0%
	Southwest-facing	6.7%
Western 225º - 315º	West-facing	5.8%
	Northwest-facing	8.6%



Land Cover

The Multi-Resolution Land Characteristics Consortium National Landcover Database (NLCD 2006) is a land cover classification that was generated using Landsat imagery.

Open Water	Barren Land	Grassland/Herbaceous
Open Space	Deciduous Forest	Pasture/Hay
Developed-Low Density	Evergreen Forest	Cultivated Crops
Developed-Med. Density	Mixed Forest	Woody Wetlands
Developed-High Density	Shrub/Scrub	Herbaceous Wetlands

Soils

Information

"Soil affects grapevine productivity and wine quality. Confounding influences of vineyard management, climate, varieties and clones, fertilizer and irrigation practices, as well as variation in fruit harvest and winery practices, may easily obscure the more subtle, unique soil contributions to wine quality. Soils cannot be evaluated independently of the other vineyard site considerations, and some compromises in soil quality may be necessary so that the vineyard site selection process does not become too exclusive." - Wolf and Boyer, 2009

Soil Conditions

Organic Matter

Avg: 0.94 Min: 0.27 Max: 0.98

Organic matter is generated by the decomposition of plant and animal waste by the communities of soil arthropods and microbial decomposers that it supports. Organic matter improves soil fertility, structure, aeration and drainage. In large quantities, organic matter releases excess Nitrogen that can lead to vigorous vine growth.

Suitability Info: Unsuitable: < 1% or > 3% Suitable: 1% - 3%

Soil Depth (cm)

Avg: 198.7 Min: 13.61 Max: 200.0

Deep soil depth acts as a protective buffer against drought as it allows for greater volume of potential soil moisture and ample space for cultivation of large, healthy, perennial root structures.

Suitability Info: Unsuitable: < 75 cm (30 in.) Suitable: > 75 cm (30 in.)

Available Water Capacity (AWC - in./in.)

Avg: 0.17 Min: 0.06 Max: 0.18

This describes the quantity of water available for uptake by plants after gravitational forces have removed excess water from a saturated soil. The ability of a soil to hold water is a function of soil texture and organic matter content.

Suitability Info: Poorly Suited: > .14in./in. Fairly Suited: .10 - .14in./in.
Well Suited: < .1 in./in.

Saturated Hydraulic Conductivity (Ksat - in./hr)

Avg: 1.88 Min: 0.98 Max: 10.27

Ksat is a measure of the rate at which water moves through a column of saturated soil also described as permeability. Soils with Ksat values above 0.6 inches per hour tend to be better-suited for viticultural production.

Suitability Info: Poorly Suited: < 0.6 in./hr Fairly Suited: 0.6 - 2.0 in./hr
Well Suited: >2.0 in./hr

Bulk Density (g/cm3)

Avg: 1.32 Min: 1.02 Max: 1.38

Bulk density describes the relationship between soil solids and pore space where air and water can be stored in a given volume of soil. Bulk density is a key factor in productive viticulture because bulk densities higher than 1.6 g/cm3 indicate compacted soil, restricted water movement, poor root development and loss of soil aeration.

Suitability Info: Unsuitable: > 1.6 g/cm3 Suitable: < 1.6 g/cm3

Soil pH

Avg: 4.86 Min: 3.97 Max: 5.0

Soil pH is easily amended, but the cost of amendment whether through lime or gypsum applications may be cost prohibitive for some growers if pH is above 7.5 or below 4.0. Appropriate soil pH levels are critical to vine health. Low pH values are especially detrimental to grapevines as Aluminum and Copper are made plant available which can lead to stunted growth and toxicity.

Suitability Info: Unsuitable: ph < 4.0 or > 7.5 Suitable: ph = 4.0 - 7.5

Soil Series Details

- Hayesville fine sandy loam, 15 to 25 percent slopes
- Hayesville fine sandy loam, 2 to 7 percent slopes
- Hayesville fine sandy loam, 7 to 15 percent slopes
- Peaks gravelly loam, 35 to 60 percent slopes, very stony
- Thurmont sandy loam, 7 to 15 percent slopes

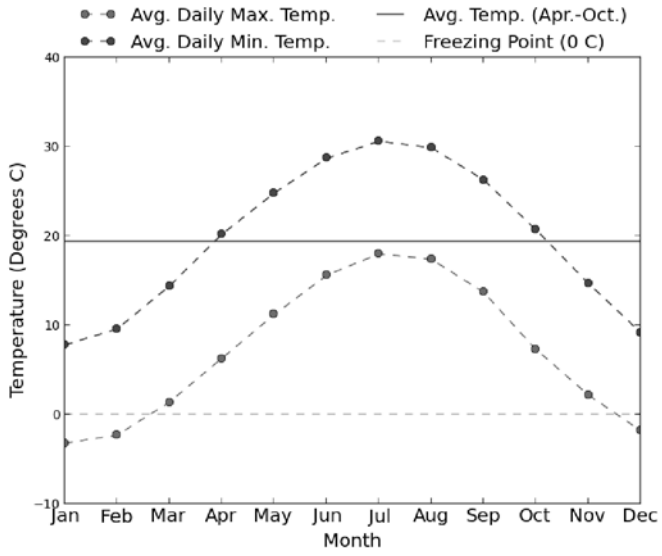
For more soils information: http://www.nrcs.usda.gov/wps/portal/nrcs/site/soils/home/

Climate and Weather

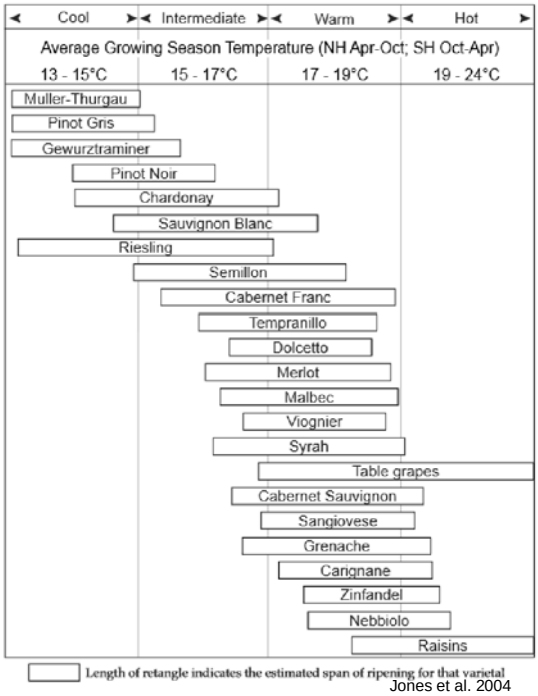
Information

Grapes can be exposed to environmental stresses that can reduce crop quality and yields and injure or kill grapevines. Damaging winter temperatures, spring and fall frosts, extremes of rainfall, and higher than optimal summer temperatures occur with regularity in some regions. Climate refers to the average course of the weather at a given location over a period of years and is measured by temperature, precipitation, wind speed and other meteorological conditions. "Weather" is the state of the atmosphere at a given moment with respect to those same meteorological conditions.
- Wolf and Boyer, 2009

Seasonal Temperature Analysis



Grapevine Climate/Maturity Groupings



Jones et al. 2004

Climate and Weather Conditions

Basic Climate Factors

- Average Growing Season Temperature
  (Mean Temperature April - October)
  °C: 19.31 °F: 51.31
- Average Growing Season Degree Days (C)
  (Avg. Daily Mean Temp. - Base Temp 10°C)
  °C: 1996.14 °F: 3593.06
- Length of Growing Season - frost-free days 188
- Annual Precipitation in inches 43.13
- Growing Season Precipitation in inches 26.71
- Spring Frost Index in °F April: 12.4 May: 12.2
  (Avg. Daily Mean Temp. - Avg. Daily Min Temp)

Extreme Low Temperature Risk Factor

(Number of winters < threshold in a decade)

Threshold:	5°F	0°F	-5°F	-10°F	-15°F
Winters:	1.0	0.0	0.0	0.0	0.0

Other Information:

The length of the growing season will determine whether grapes will ripen or not. A minimum of 180 frost-free days is recommended.

Grapevines can be injured or killed by winter cold. See chart above for statistics on average number of winters with extreme cold temperatures.

Important Information and Data Sources

Important Information

This vineyard evalulation report was created automatically by interpreting publicly-available data as it applies to vineyard suitability. The GIS data layers used in this report are generalized and may not capture all details of a specific site. Furthermore, site management practices can significantly alter natural conditions.

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Daly, C. and Gibson, W., PRISM Group at Oregon State University, 2009, United States Median/Extreme dates of First/Last Freeze in Autumn/Spring: Corvallis, Oregon, USA, PRISM Group at Oregon State University.

National Climactic data Center, NESDIS, NOAA, U.S. Department of Commerce. U.S. Daily Surface Data (DSI-3200, DSI-3202, DSI-3206, DSI-3210): Asheville, NC, National Climatic Data Center. Available online at http://www7.ncdc.noaa.gov/CDO/dataproduct. Accessed 08/2011.

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Gesch, D.B., 2007, The National Elevation Dataset, in Maune, D., ed., Digital Elevation Model Technologies and Applications: The DEM Users Manual, 2nd Edition: Bethesda, Maryland, American Society for Photogrammetry and Remote Sensing, p. 99-118.

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Soils Data:

Soil Survey Staff, Natural Resources Conservation Service, United States Department of Agriculture. Soil Survey Geographic (SSURGO) Database for all available counties in Connecticut, Delaware, Georgia, Kentucky, Maine, Maryland, Massachusetts, New Hampshire, New Jersey, New York, North Carolina, Ohio, Pennsylvania, Rhode Island, South Carolina, Tennessee, Vermont, Virginia, Washington DC, and West Virginia. Available online at http://soildatamart.nrcs.usda.gov. Accessed 07/2011.

Vineyard Evaluation Report

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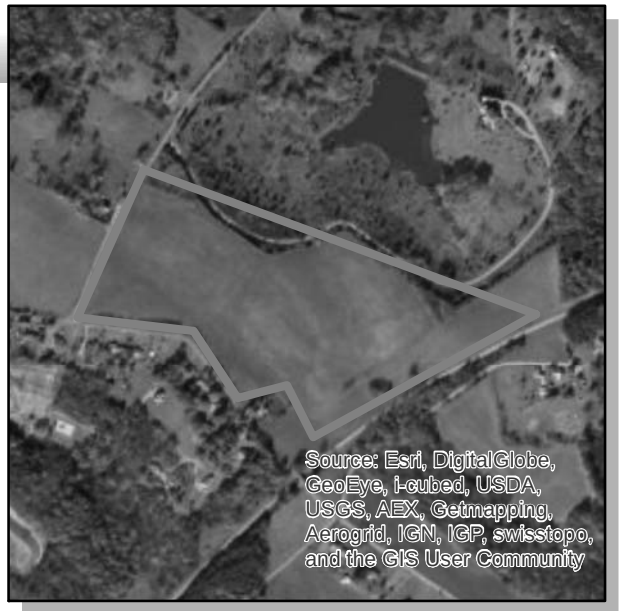
37.2387, -79.8993

Description of Site:

Sample Site Comment



Basemap Source: ESRI World Imagery[1]

Overview of Site Conditions

Soils

For further information see the in depth discussion of these parameters on the following pages.

Parameter	Average	Minimum	Maximum
Saturated Hydraulic Conductivity (KSat) (inches/hour)	1.78	1.78	2.54
Bulk Density (g/cm3)	1.32	1.32	1.32
Soil pH	4.86	4.85	4.86
Soil Organic Matter	0.98	0.77	0.98
Soil Depth (cm)	200.0	13.61	200.0
Available Water Capacity (AWC) (in./in. soil 30" profile)	0.18	0.16	0.18

Climate

These precipitation climate conditions are averages based on 30 years of data analyzed by the PRISM Group at Oregon State University. The other climate factors use PRISM layers as a base for calculations completed at Virginia Tech's Center for Geospatial Information Technology

Parameter	Value
Average Growing Season Temperature (Celsius)	19.31
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Spring Frost Index	April: 12.4 May: 12.2

Topography

These topographic conditions are determined using the best available public data. Use the in-depth discussion provided on the following pages to further understand how these conditions can effect vineyard production in your area.

Parameter	Average	Minimum	Maximum
Slope (percent slope)	6.29	0.13	21.15
Elevation (feet)	1126	1076	1166

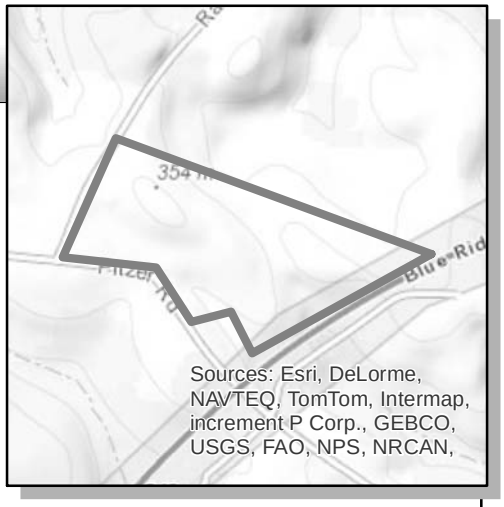
Solar Aspect:
North (13.8%), NE (23.5%), East (12.2%), SE (8.2%), South (21.2%), SW (9.3%), West (4.7%), NW (7.1%)

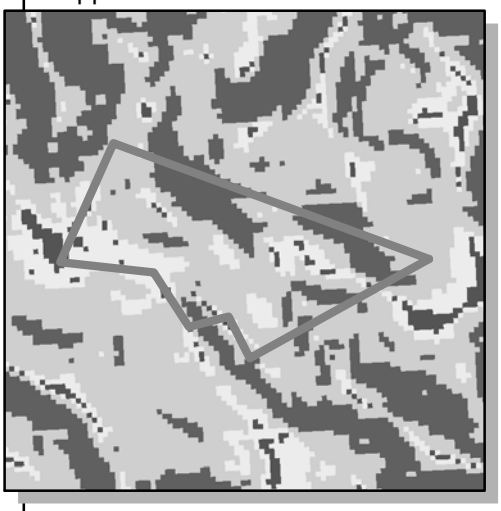
Topographic Features

Elevation in feet

Maximum	1166
Average	1126
Minimum	1076

Elevation has a profound influence on the minimum and maximum temperatures in a vineyard, particularly in hilly and mountainous terrain. Because frosts and freezing temperatures can so dramatically reduce vineyard profitability, elevation is one of the most - perhaps the most - important features of vineyard site suitability. The physics of topographic effects on air temperature are well documented (Geiger, 1966) and its horticultural significance generally well appreciated.





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0% - 2%	**Poorly Suited**
2% - 5%	**Fairly Well-Suited**
5% - 15%	**Well-suited**
> 15%	**Poorly Suited**

Minimum	0.13	%
Average	6.29	%
Maximum	21.15	%

Aspect

Aspect describes the direction a slope faces, which relates to the sun angle and amount of sunlight that reaches the ground. According to Dr. Tony Wolf, Virginia's State Viticultural specialist (p.16), aspect is one of the least influential factors related to a vineyard's overall suitability; however, choosing a site with a favorable aspect can enhance grape taste and facilitate efficient disease and pest management.

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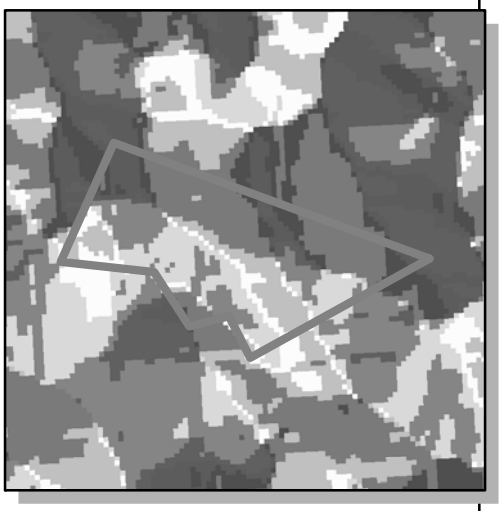

Land Cover

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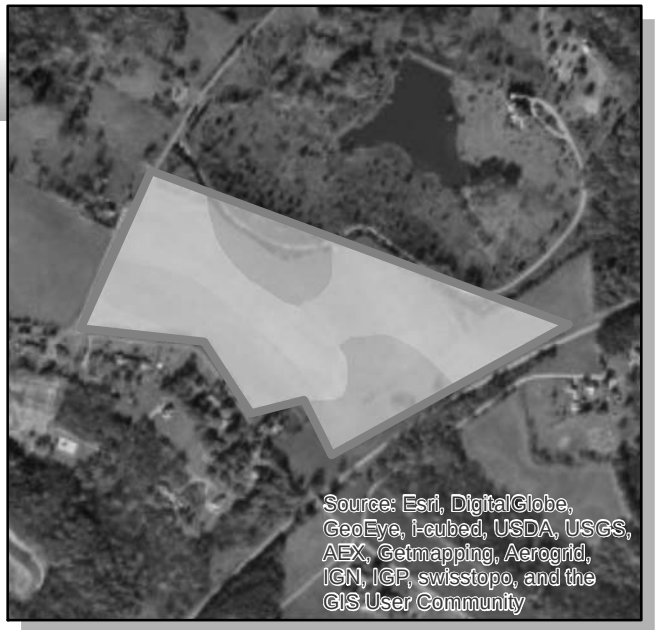
Soils



Information

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Soil Conditions

Organic Matter

Avg: 0.98 Min: 0.77 Max: 0.98

Organic matter is generated by the decomposition of plant and animal waste by the communities of soil arthropods and microbial decomposers that it supports. Organic matter improves soil fertility, structure, aeration and drainage. In large quantities, organic matter releases excess Nitrogen that can lead to vigorous vine growth.

Suitability Info: Unsuitable: < 1% or > 3% Suitable: 1% - 3%

Soil Depth (cm)

Avg: 200.0 Min: 13.61 Max: 200.0

Deep soil depth acts as a protective buffer against drought as it allows for greater volume of potential soil moisture and ample space for cultivation of large, healthy, perennial root structures.

Suitability Info: Unsuitable: < 75 cm (30 in.) Suitable: > 75 cm (30 in.)

Available Water Capacity (AWC - in./in.)

Avg: 0.18 Min: 0.16 Max: 0.18

This describes the quantity of water available for uptake by plants after gravitational forces have removed excess water from a saturated soil. The ability of a soil to hold water is a function of soil texture and organic matter content.

Suitability Info: Poorly Suited: > .14in./in. Fairly Suited: .10 - .14in./in.
Well Suited: < .1 in./in.

Saturated Hydraulic Conductivity (Ksat - in./hr)

Avg: 1.78 Min: 1.78 Max: 2.54

Ksat is a measure of the rate at which water moves through a column of saturated soil also described as permeability. Soils with Ksat values above 0.6 inches per hour tend to be better-suited for viticultural production.

Suitability Info: Poorly Suited: < 0.6 in./hr Fairly Suited: 0.6 - 2.0 in./hr
Well Suited: >2.0 in./hr

Bulk Density (g/cm3)

Avg: 1.32 Min: 1.32 Max: 1.32

Bulk density describes the relationship between soil solids and pore space where air and water can be stored in a given volume of soil. Bulk density is a key factor in productive viticulture because bulk densities higher than 1.6 g/cm3 indicate compacted soil, restricted water movement, poor root development and loss of soil aeration.

Suitability Info: Unsuitable: > 1.6 g/cm3 Suitable: < 1.6 g/cm3

Soil pH

Avg: 4.86 Min: 4.85 Max: 4.86

Soil pH is easily amended, but the cost of amendment whether through lime or gypsum applications may be cost prohibitive for some growers if pH is above 7.5 or below 4.0. Appropriate soil pH levels are critical to vine health. Low pH values are especially detrimental to grapevines as Aluminum and Copper are made plant available which can lead to stunted growth and toxicity.

Suitability Info: Unsuitable: ph < 4.0 or > 7.5 Suitable: ph = 4.0 - 7.5

Soil Series Details

- Hayesville fine sandy loam, 15 to 25 percent slopes
- Hayesville fine sandy loam, 2 to 7 percent slopes
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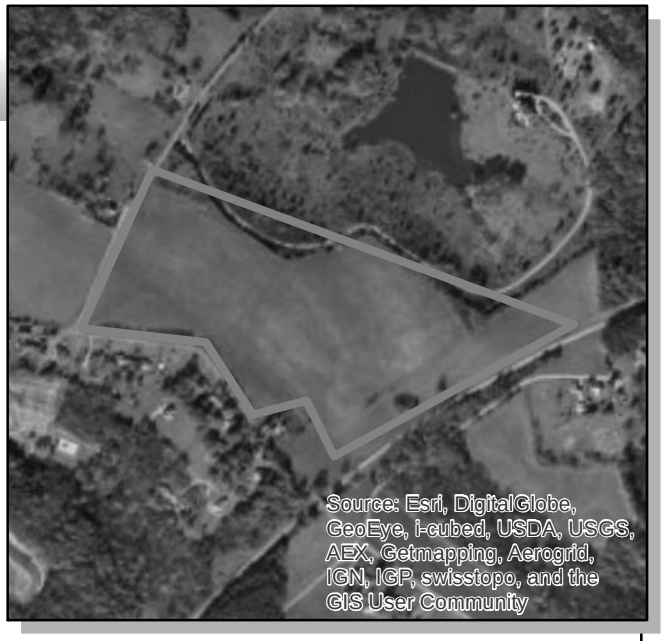
For more soils information: http://www.nrcs.usda.gov/wps/portal/nrcs/site/soils/home/

Climate and Weather



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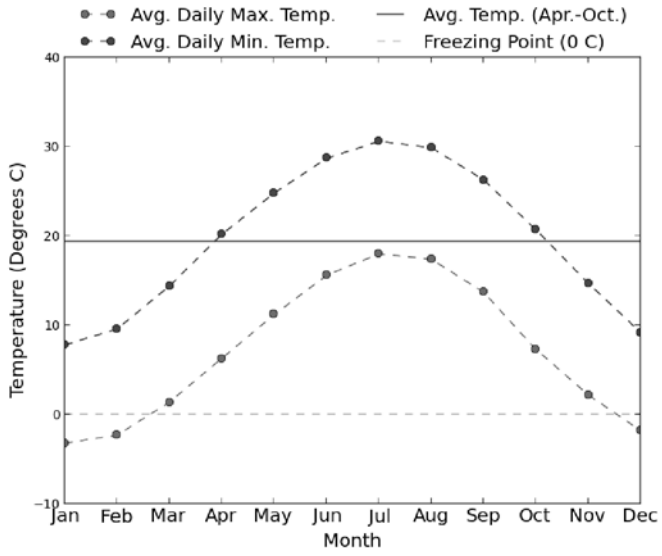

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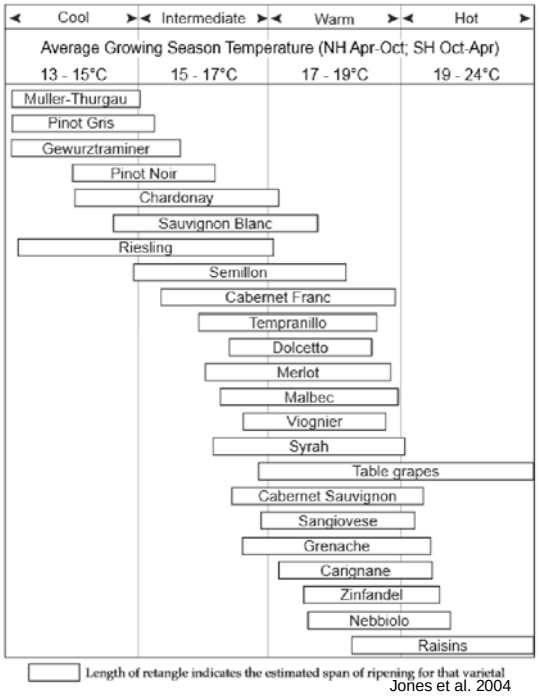

Jones et al. 2004

Climate and Weather Conditions

Basic Climate Factors

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- Average Growing Season Degree Days (C)
  (Avg. Daily Mean Temp. - Base Temp 10°C)
  °C: 1996.02 °F: 3592.83
- Length of Growing Season - frost-free days 188
- Annual Precipitation in inches 43.14
- Growing Season Precipitation in inches 26.72
- Spring Frost Index in °F April: 12.4 May: 12.2
  (Avg. Daily Mean Temp. - Avg. Daily Min Temp)

Extreme Low Temperature Risk Factor

(Number of winters < threshold in a decade)

Threshold:	5°F	0°F	-5°F	-10°F	-15°F
Winters:	1.0	0.0	0.0	0.0	0.0

Other Information:

The length of the growing season will determine whether grapes will ripen or not. A minimum of 180 frost-free days is recommended.

Grapevines can be injured or killed by winter cold. See chart above for statistics on average number of winters with extreme cold temperatures.

Important Information and Data Sources

Important Information

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Gesch, D., Oimoen, M., Greenlee, S., Nelson, C., Steuck, M., and Tyler, D., 2002, The National Elevation Dataset: Photogrammetric Engineering and Remote Sensing, v. 68, no. 1, p. 5-11.

Soils Data:
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