# The Fault Line Vineyards of Abacela Winery

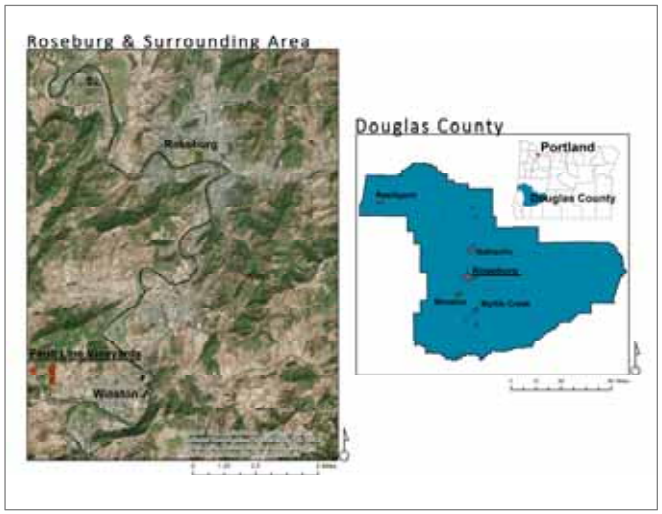
How terrain variation allows a single vineyard in southern Oregon to grow sixteen unique cultivars of *vitis vinifera*

## Objectives

- Investigate the influence of terrain variation on vineyard productivity at Fault Line Vineyard through the lens of solar radiation accumulation.
- Use area solar radiation as a metric to try and explain how sixteen unique cultivars of *vitis vinifera* can be grown at a single site.

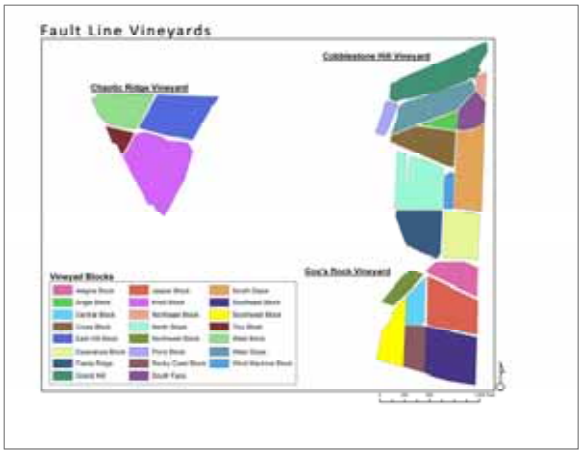
# Vineyard Location

- Fault Line Vineyards is located in Douglas County, Oregon in the Umpqua Valley American Viticultural Area (AVA).



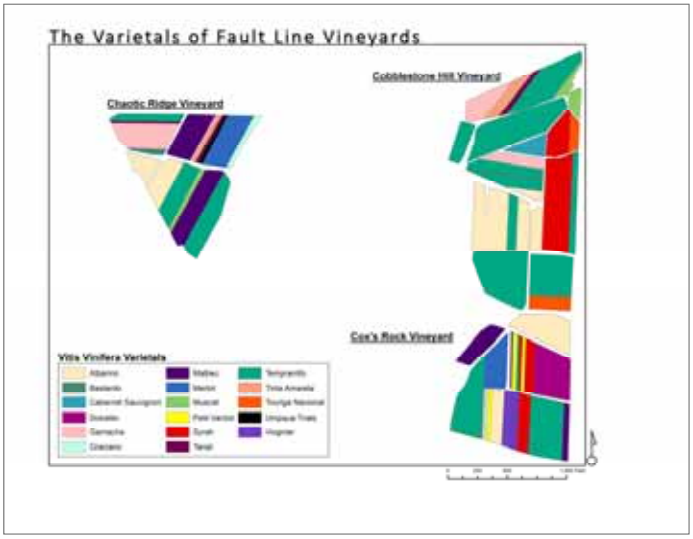

# Vineyard Blocks

- Vineyard is the sole provider of fruit for Abacela Winery.
- First plantings of *vitis vinifera* in 1994.
- Seventy-six acres of grapevines online and in production today.
- Vineyard divided into three sub-vineyards and twenty-three vineyard blocks



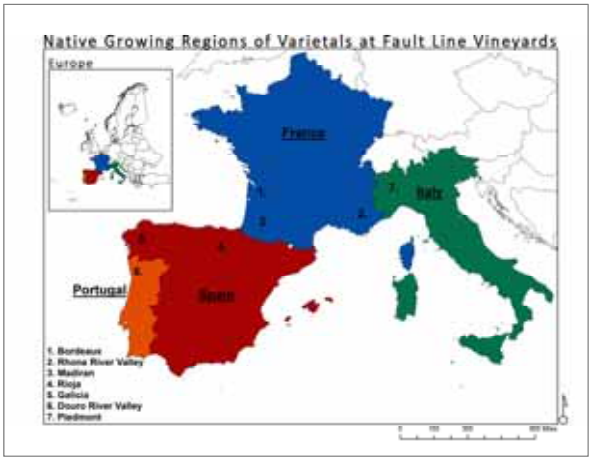
# Varietals Grown

- Sixteen varietals of grapes grown at Fault Line Vineyard.




# Native Growing Regions

- None of the varietals grown at Fault Line Vineyards are native to Oregon.
- All cultivars are native to European growing regions.



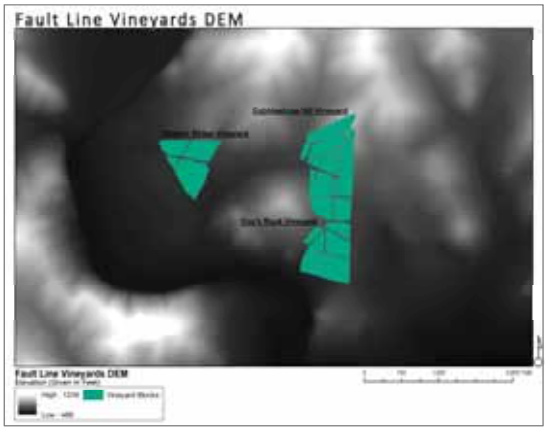

| Varietal | Native Region | Country |
|---|---|---|
| Tempranillo (TP) | Rioja | Spain |
| Syrah (SY) | Rhone River Valley | France |
| Malbec (MAL) | Bordeaux | France |
| Cabernet Sauvignon (CS) | Bordeaux | France |
| Garnacha (GN) | Rioja | Spain |
| Graciano (GR) | Rioja | Spain |
| Tanat (TAN) | Madiran | France |
| Tinta Amarela (TAM) | Douro River Valley | Portugal |
| Bastardo (BA) | Douro River Valley | Portugal |
| Touriga Nacional (TN) | Douro River Valley | Portugal |
| Dolcetto (DOL) | Piedmont | Italy |
| Petit Verdot (PV) | Bordeaux | France |
| Albarino (AL) | Galicia | Spain |
| Viognier (VI) | Rhone River Valley | France |
| Muscat (MU) | Piedmont | Italy |

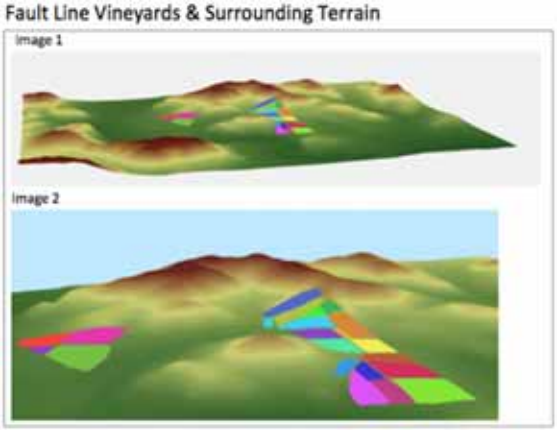
# Data Collection

- Collection of vineyard data done in the field using Trimble Juno 3 Series GNSS (Global Navigation Satellite System) device.
- Data used to represent shape, size, orientation, and varietal composition of each vineyard block.

# DEM Surface

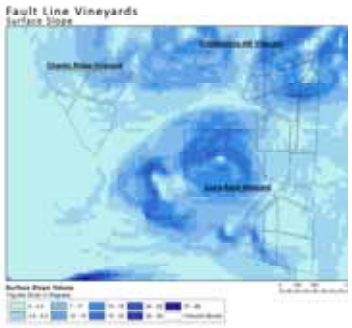
- Constructed a Digital Elevation Model for Fault Line Vineyards in both 2D & 3D.

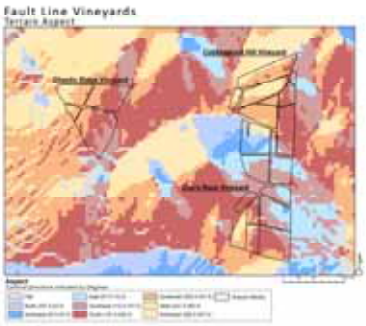


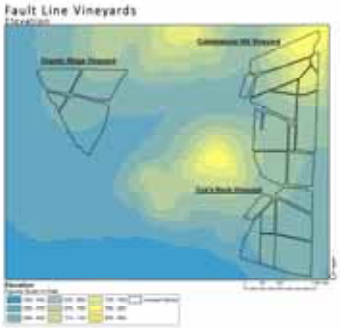



# Surface Models

- Used the Fault Line Vineyard DEM as an input surface, constructed three terrain models representing surface slope, terrain aspect & elevation.

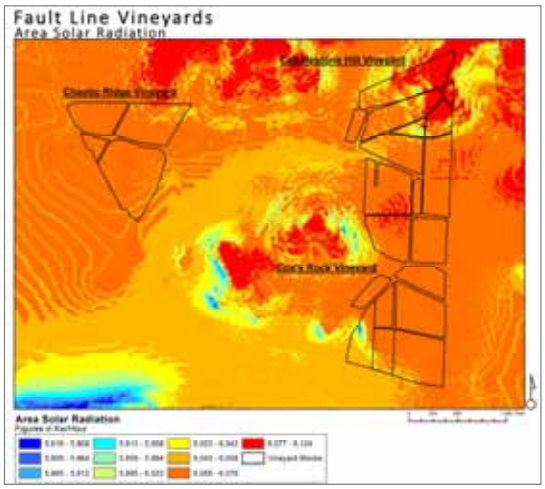



# Area Solar Radiation

- Used the Fault Line Vineyards DEM as an input surface, constructed a terrain model representing area solar radiation accumulation across the vineyard.



# Zonal Statistics

## Part I

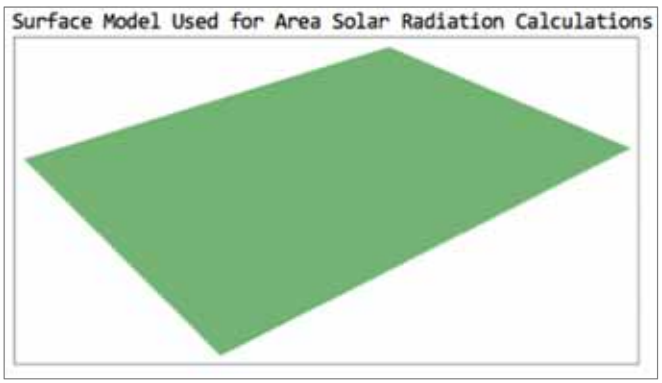
- Computed zonal statistics per vineyard block for all three terrain feature surfaces, as well as the area solar radiation surface.
- Analyzed results in order to identify trends and/or relationships between terrain features and solar radiation accumulation.

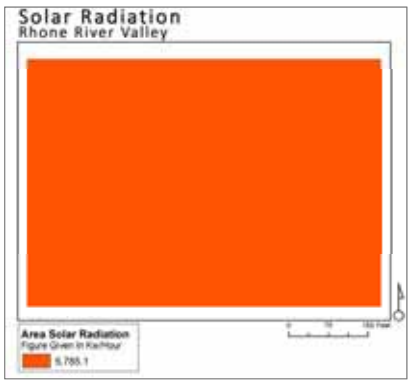
Terrain Analysis Figures per Vineyard Block at Fault Line Vineyards

| Vineyard Block | Avg. Aspect | Avg. Slope (Degrees) | Avg. Elevation (Feet) | Avg. Solar Radiation (Kw/Hour) | Varietals |
|---|---|---|---|---|---|
| Cobblestone Hill Vineyard | n/a | 7.7 | 668.8 | 6,068.4 | |
| Grand Hill | SW | 10.7 | 739.9 | 6,074.1 | TP, MG, TAR, TAM, GN |
| Northeast Block | SE | 10.7 | 772.4 | 6,089.4 | MG |
| West Slope | W | 9.2 | 695.4 | 6,066.1 | TP |
| Pond Block | S / SW | 3.8 | 613.2 | 6,060.3 | TP |
| South Face | S | 11.5 | 746.8 | 6,076.1 | SY, TN |
| South Slope | S | 7.5 | 642.8 | 6,070.6 | SY, TP |
| North Slope | N | 5.2 | 635.3 | 6,068.8 | AL, TP |
| Wind Machine Block | E | 2.2 | 631.8 | 6,072.6 | AL |
| Cross Block | SW | 8.5 | 691.7 | 6,082.7 | GR, TP, BA, AL |
| Angle Block | SW | 17.6 | 701.1 | 6,040.8 | CS |
| Fiesta Ridge | E | 3.8 | 616.6 | 6,070.6 | TP, TN |
| Esperanza Block | E / SE | 4.4 | 641.7 | 6,069.6 | TP |
| Angel's Block | E / SE | 3.5 | 608.8 | 6,069.2 | AL |
| | | | | | |
| Cat's Rock Vineyard | n/a | 5.53 | 601.0 | 6,063.4 | |
| Northwest Block | S | 4.4 | 620.8 | 6,060.0 | MAL |
| Upper Block | E / SE | 2.5 | 606.9 | 6,070.3 | VI, PV, TP, SY, DOL |
| Central Block | S | 2.5 | 612.8 | 6,071.2 | MER |
| Southwest Block | SW | 3.2 | 578.4 | 6,041.0 | TP |
| Rocky Crest | S / SW | 8.6 | 594.1 | 6,062.1 | GR, GR, AL, VI |
| Southeast Block | S | 4.1 | 592.7 | 6,066.3 | VI, SY, TP, MAL |
| | | | | | |
| Chaotic Ridge Vineyard | n/a | 3.8 | 588.1 | 6,044.1 | |
| East Hill | S | 6.6 | 610.3 | 6,063.3 | GR, MER, TAR, AL, GN, MAL |
| West Block | SW / W | 3.8 | 587.6 | 6,041.1 | TP, TAR, GN, BA |
| Tiny Block | SW | 2.2 | 570.9 | 6,045.1 | AL |
| Knoll Block | W / S | 2.7 | 576.3 | 6,042.8 | AL, TP, MG, MAL, TP |

# European Models

- Constructed surface models for each European growing region.
- Calculated ambient area solar radiation accumulation for each region.



# Zonal Statistics

## Part II

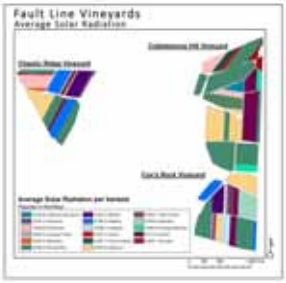
- Calculated zonal statistics for area solar radiation accumulation per *vitis vinifera* varietal at Fault Line Vineyard.
- Compared with area solar radiation score of corresponding native growing region.

Solar Radiation Figures for European Growing Regions

| Region | Location | Latitude (Degrees) | Elevation (Feet) | Avg. Solar Radiation (Kw/Hour) |
|---|---|---|---|---|
| Rhone River Valley | Vienne, France | 45.310002 | 508 | 5,785.12 |
| Bordeaux | Pauillac, France | 45.117864 | 32 | 5,694.76 |
| Madiran | Madiran, France | 43.549516 | 420 | 5,840.03 |
| Rioja | Logrono, Spain | 42.280002 | 1,360 | 6,010.01 |
| Douro River Valley | Porto, Portugal | 41.162142 | 489 | 5,902.17 |
| Galicia | Pontevedra, Spain | 42.433619 | 70 | 5,774.51 |
| Piedmont | Asti, Italy | 44.540972 | 404 | 5,810.05 |

Solar Radiation Values per Varietal at Fault Line Vineyards

| Varietal | Solar Radiation (Kw/Hour) |
|---|---|
| Tempranillo (TP) | 6,065.0 |
| Syrah (SY) | 6,071.4 |
| Malbec (MAL) | 6,065.5 |
| Cabernet Sauvignon (CS) | 6,060.8 |
| Garnacha (GN) | 6,058.9 |
| Graciano (GR) | 6,057.3 |
| Tanat (TAN) | 6,067.4 |
| Tinta Amarela (TAM) | 6,067.7 |
| Bastardo (BA) | 6,063.6 |
| Touriga Nacional (TN) | 6,069.8 |
| Dolcetto (DOC) | 6,069.8 |
| Petit Verdot (PV) | 6,069.1 |
| Albarino (AL) | 6,067.9 |
| Viognier (VI) | 6,064.2 |
| Muscat (MU) | 6,080.1 |




# Conclusions

- Terrain variation plays a prominent role in the accumulation of solar energy throughout Fault Line Vineyards.
- Surface orientation (aspect) plays less significant of a role in dispersal of solar energy across vineyard surface.
- Solar radiation accumulated at Fault Line Vineyards on the 23rd of June, 2014 was greater than the baseline levels received in each European growing regions.

# Acknowledgements

- Not sure what to make of Angle Block.
- Solar radiation is a useful environmental growth factor for an investigation into vineyard productivity. However, it is but a definitive one. Other factors that should be taken into consideration in order to produce a definitive vineyard analysis are:
  - Heat accumulation (Growing Degree Days)
  - Diurnal temperature variation
  - Humidity levels
  - Precipitation accumulation (rain, groundwater, & irrigation)
  - Soil content
  - Winter weather conditions