Petition for the Establishment of the Mount Pisgah, Polk County, Oregon American Viticultural Area (AVA)

With the following petition and attached documents, the vineyards and wineries of Mount Pisgah, Polk County, Oregon request the Alcohol, Tobacco, and Trade Bureau approve the establishment of the aforementioned AVA as defined in section 4.25a(e)(1), title 27, CFR. The area under consideration is currently within the Willamette Valley AVA. The Willamette Valley AVA (27 CFR 9.90) was established by T.D. ATF-162, which was published in the **Federal Register** on December 1, 1983 (48 FR 54221). The recent expansion of the Willamette Valley AVA does not affect this petition.

Mount Pisgah, Polk County, Oregon Overview

The petitioners request that both "Mount Pisgah, Polk County, Oregon" and "Mt. Pisgah, Polk County, Oregon" be acceptable to represent the area. The Mount Pisgah, Polk County, Oregon area (hereafter "Mt. Pisgah" or "the proposed AVA") surrounds the 835 foot summit of Mount Pisgah in Polk County, Oregon near Dallas, Oregon. The USGS Geographic Names Identification System (GNIS) lists Mt. Pisgah, Polk County, Oregon's ID number as 1163206. The proposed AVA would be the southernmost AVA within the Willamette Valley AVA. It is fifteen miles west of Salem, Oregon.

The proposed AVA contains 5,850 acres. It is currently occupied by 531 acres of commercial grape-growing vineyards, and there are immediate plans to plant 160 more acres. This makes it one of the most highly concentrated viticultural areas in Oregon with 9.1% of its land planted with wine grapes and 2.7% soon to be planted to bring the total to 11.8%. The plantings are distributed throughout the proposed AVA.

The proposed AVA contains ten commercial vineyards and two bonded wineries. Please refer to the map and list of the vineyards and wineries, Exhibits A and B.

Narrative

Name Evidence

The name “Mount Pisgah” in the United States occurs in many states, but only one in Oregon is planted with wine grapes and has an important impact on Willamette Valley viticulture. The name appears on the current and historical USGS maps and is evident on Google Maps, OpenStreetMap, and other internet sites. It is clearly identified on the USGS map of Dallas. The vineyards and wineries of Mount Pisgah are on the Map of Mount Pisgah Vineyards, Exhibit A.

Colonel Cornelius Gilliam crossed the Oregon Trail in 1844 and settled in Dallas, Oregon in 1845. “To the right of them nearby was a small mountain covered with grass and trees which reminded them of Mt. Pisgah, back in Missouri, and Col. Gilliam named the little mountain Mt. Pisgah, which still bears that name.” Mary Dempsey Bronson, a Dallas resident in 1865, recalls her first year there. “My first picnic in Oregon was a May Day Picnic on Mt. Pisgah.” (1)

Polk County Geographic Names, published by the Dallas Chamber of Commerce includes a reference to the mountain in 1927, which is reproduced in Oregon

Geographic Names by Lewis A. McArthur. (2) A Mount Pisgah local of the Oregon Farmer's Union was active during the 1930s, 1940s, and 1950s. Mount Pisgah Fruit Farms as late as 1962 existed on Metzger maps of the region and is in current evidence in real estate listings.

Currently the name is in common use among the residents, most of whom cite existing maps as proof of the area's name. There is a Mt. Pisgah Orchards which both grows fruit and is listed as a religious organization.

Viticulturists have been growing wine grapes on Mount Pisgah since 1981.

Because the name Mount Pisgah has both current and historical evidence on maps and in the community, the name Mount Pisgah, Polk County, Oregon has been chosen as the name for the viticultural area.

Exhibits:
A) Map of Mount Pisgah Vineyards and Wineries
B) List of Mount Pisgah Vineyards and Wineries
C) Printed evidence of Mount Pisgah as a local name.

References:
(1) Oregon Trails site for Polk County, Oregon
(2) Oregon Geographic Names

Boundary Evidence

The Mount Pisgah area is in the Willamette Valley AVA, just south of the 45th parallel, about 15 miles west of Salem. The center of the area lies about 5 miles southeast of Dallas, Oregon. It is entirely within Polk County. The boundaries are defined by the shape of the mountain. The clear divisions of climate, geology, soils, elevation (all above 260'), and topography informed the creation of the boundary. The boundary is easy to follow using roads, elevation contours, and compass points, and has easily identifiable distinguishing features listed below.

Exhibit:
USGS maps Dallas and Airlie North quadrangles, 7.5' series

Written Boundary Description

All map points are shown on the Oregon, Polk County 7.5' (1:24,000) USGS quadrangle maps Dallas and Airlie North included under U.S.G.S Maps.

<u>Beginning on the Dallas map at the point where the 320' elevation contour intersects Mistletoe Road south of the unnamed road known locally as SE Lewis Street,</u>

1) Follow Mistletoe Road generally south 2.1 miles until it reaches the 767' summit of Mistletoe Road.

2) From that point, continue due west approximately 0.5 miles to the 400' elevation contour on the Dallas map.

3) From that point, follow the 400' contour line to Cooper Hollow Road on the Airlie North map near Fisher Reservoir.

4) From that point, follow Cooper Hollow Road generally south to McCaleb Road.

5) Follow McCaleb Road approximately 1.6 miles to the intersection of McCaleb and Mistletoe Road. This point is at 260' elevation.

6) Follow the 260' elevation contour until it intersects again with Mistletoe Road.

7) Follow Mistletoe Road east 0.3 miles to the intersection of Mistletoe Road and Matney Road.

8) Continue north on Matney Road 0.6 miles to a 90 degree turn, where it meets the 260' elevation contour.

9) Follow the 260' contour north and west until it meets Bursell Road.

10) Continue east on Bursell Road 0.2 miles to the intersection with the 260' contour line.

11) Follow the 260' contour line until it meets Whiteaker Road on the Dallas map. (Note that it crosses Ballard Road twice. Whiteaker Road begins at point 12 at a 90 degree turn in Ballard Road.)

12) Follow Whiteaker Road, east and south for 1.0 miles until it meets the 260' elevation contour at a 90 degree turn.

13) Follow the 260' elevation contour north, then west until it intersects Ballard Road.

14) Follow Ballard Road south until it intersects the 300' elevation contour.

15) Follow the 300' elevation contour, generally northwest, until it intersects Cherry Knoll Road.

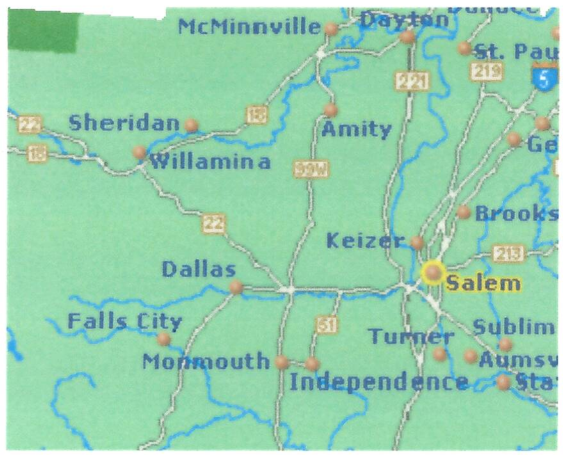
16) Follow Cherry Knoll Road south until it intersects the 320' elevation contour.

17) Follow the 320' elevation contour to complete the boundary at point 1 on Mistletoe Road.

Distinguishing Features

Climate Data: Growing Degree Days

In order to highlight the differences in growing degree days, we will include data from the center of the proposed AVA at the Croft Vineyard, 400 ft of elevation, and 3 miles SE of Dallas; the airport at Salem (KSLE) in the Willamette Valley AVA, 18 miles east of the proposed AVA; and the airport at McMinnville (KMMV), in the Willamette Valley AVA and adjacent to the McMinnville AVA, 23 miles to the NNE.



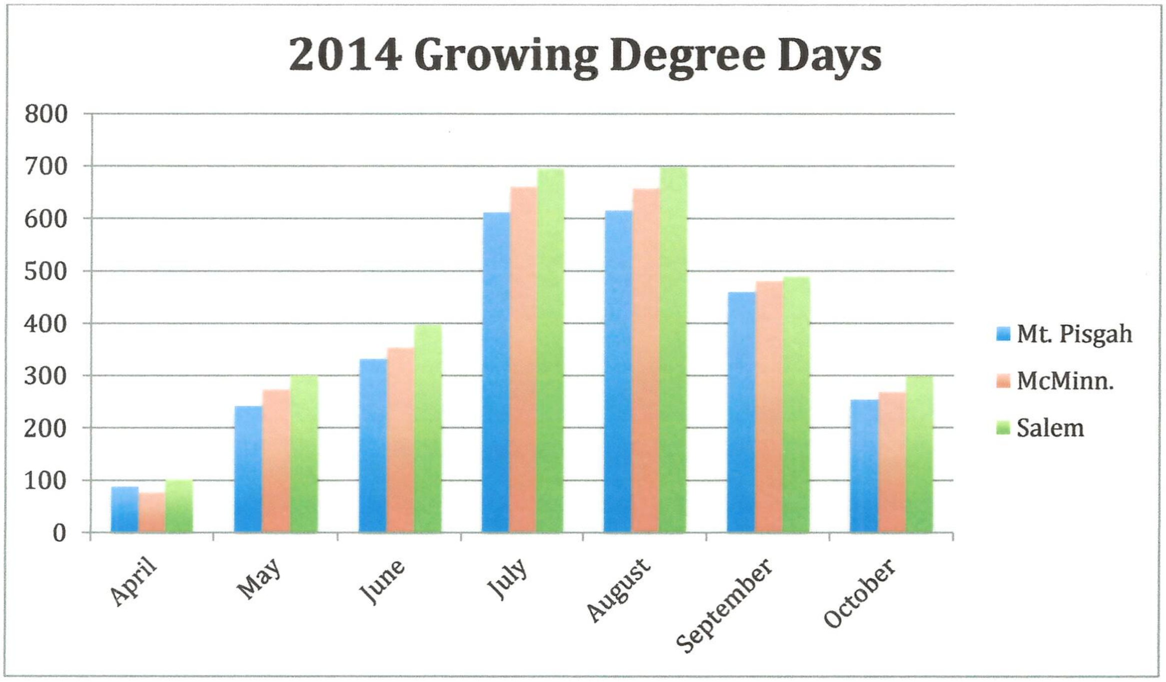
In 2014, the weather stations within Mt. Pisgah totaled 2,568 growing degree-days to 2,774 in McMinnville and 2,981 in Salem. In 2015 the numbers are 2593, 2732 and 2990. In 2016, Mt. Pisgah totaled 2,350, McMinnville 2,480 and Salem 2,739. See the charts included below.

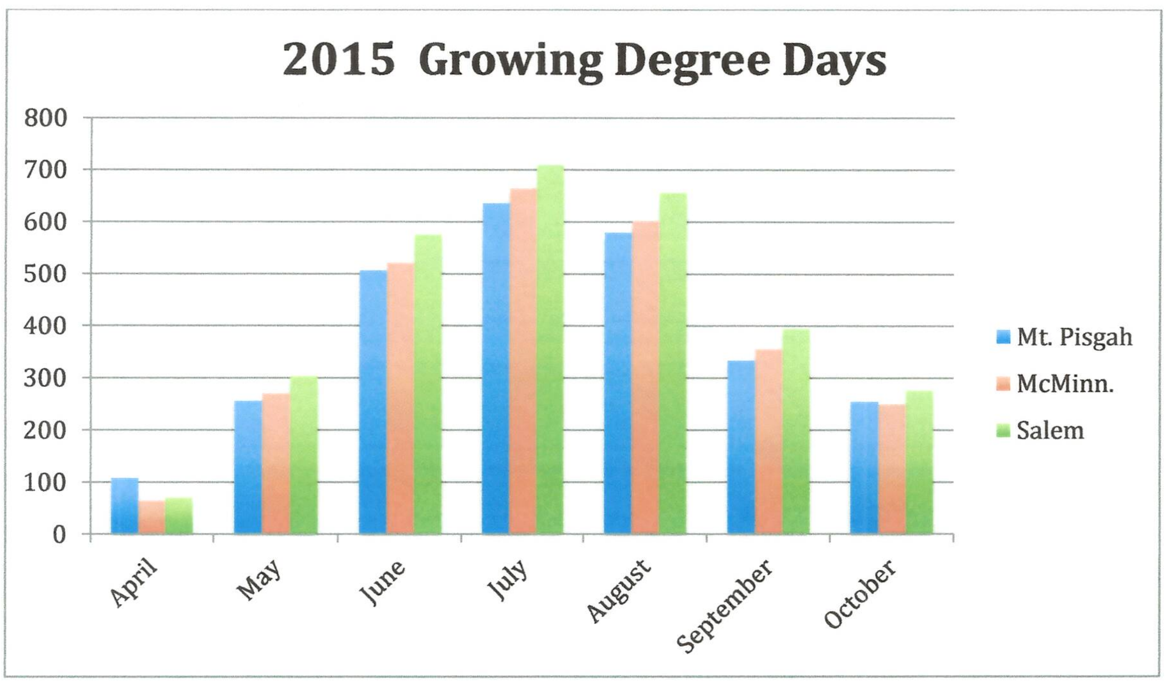
This shows a distinct difference between the Mount Pisgah area and the lower-elevation and more central parts of the Willamette Valley AVA. Mount Pisgah is much cooler reaching an average total of 2,543 degree days in the last 3 years. This puts it at the bottom of region II on the Winkler Scale, (and in region Ib in normal years, which all have been cooler than the last three). Salem is 360 growing degree-days warmer (2,903), closing in on the top of Winkler's region II. McMinnville is warmer than the proposed AVA but only by 119 growing degree-days (2,662), in the middle of Winkler's region II.

The main geographic feature affecting growing degree-days in the mid-Willamette Valley is elevation. McMinnville at 157 feet and Salem at 207 feet are both at the bottom of the Willamette Valley. Salem is nearer to the center of the valley with warmer surrounding areas. McMinnville is closer to the coast range. Both Salem and McMinnville are warmer than Mount Pisgah. The Mount Pisgah area ranges from 260 to 835 feet and thus records cooler temperatures.

This is a consistent yearly difference that has an important affect on viticulture. Winkler noted that certain varietals are optimal in matching climate regions. Winkler identified pinot noir, pinot gris, and chardonnay as typical 1b varietals, which are the main varieties planted in the proposed area. Approximately 90% of Mt. Pisgah is planted with pinot noir, pinot gris, or chardonnay.

There is a smaller difference especially in April because cold air descends from the hills to the lower-elevation areas, which reduces frost pressure and is beneficial for viticulture. In all the other months of the growing year, the Mount Pisgah area is much cooler than viticultural sites on the valley floor.





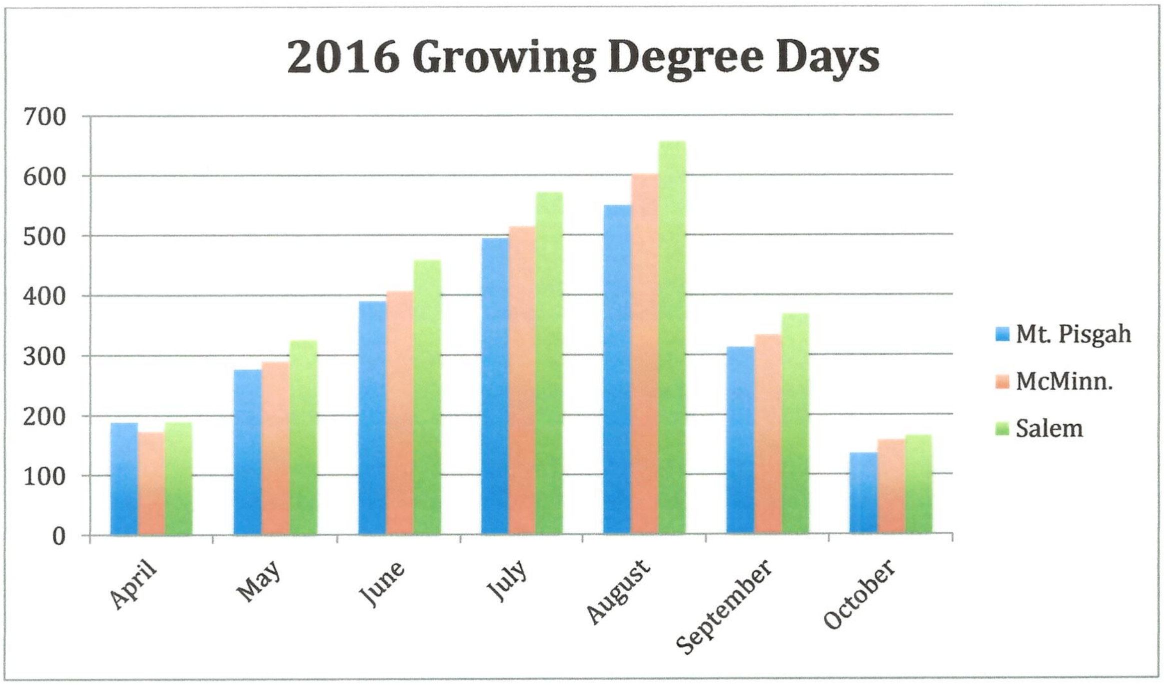


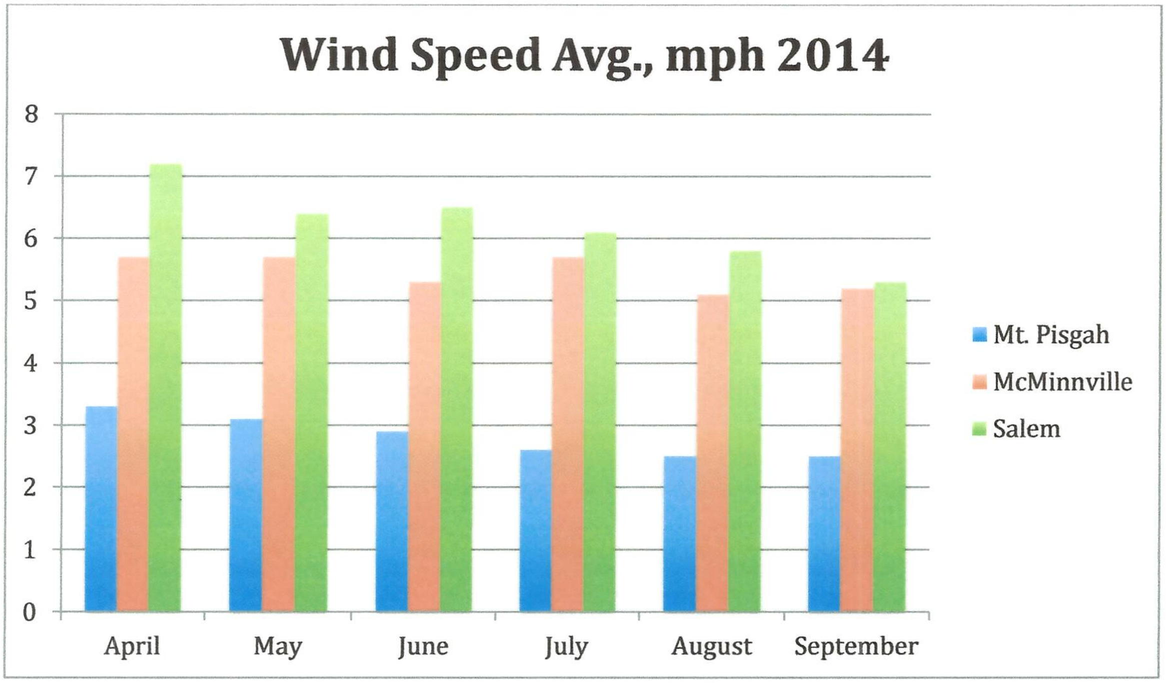
Exhibit:
C. From Weather Station, Mount Pisgah at Croft Vineyard, National Weather Service stations KMMV in McMinnville, Oregon and KSLE in Salem, Oregon.

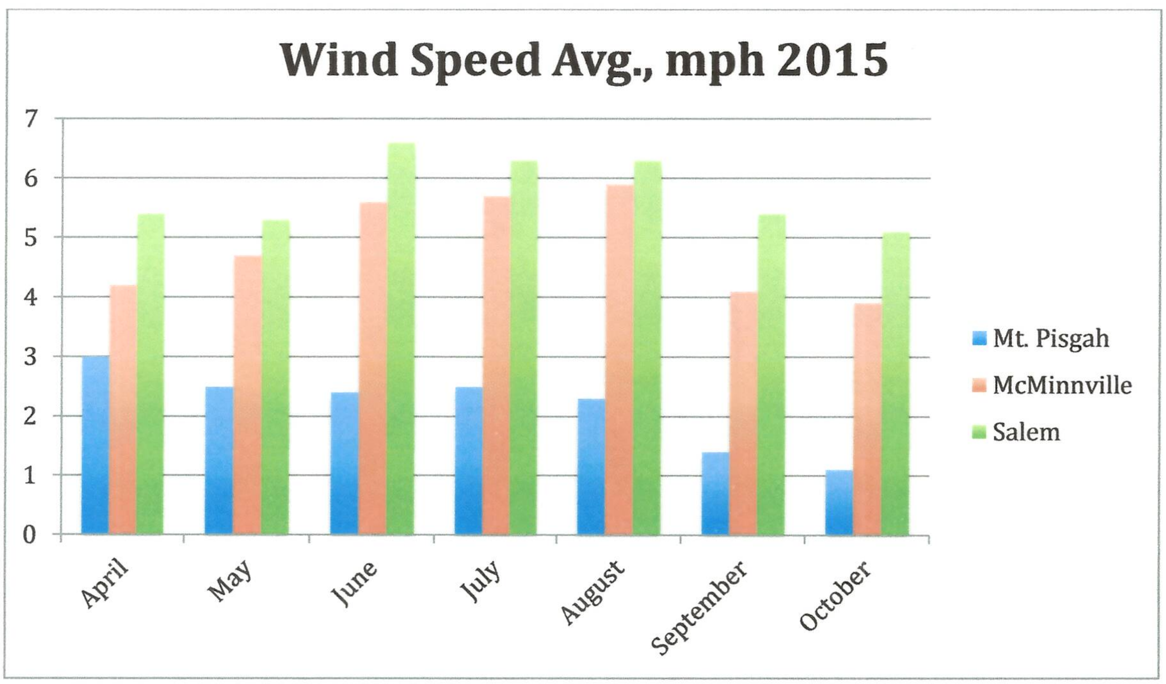
References:
3. Winkler, General Viticulture, Second Revised Edition

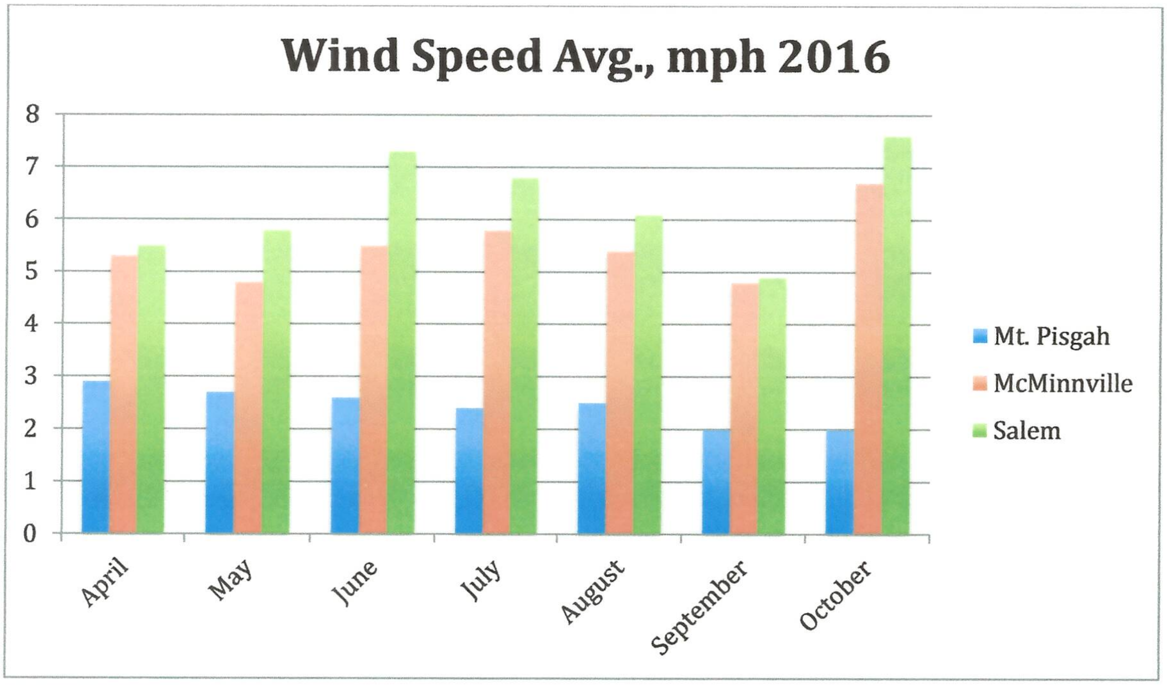
<u>Climate: Wind Data</u>

To the north of Mount Pisgah are the lower-elevation areas of Dallas, Perrydale, and Rickreall, where the Pacific coastal winds enter the Willamette Valley through the Van Duzer Corridor and influence the viticulture of the proposed Van Duzer Corridor AVA and the Eola-Amity Hills AVA. The Pacific coastal winds and Willamette north and south valley floor winds also affect McMinnville and Salem.

<u>Mount Pisgah is protected from the Pacific coastal winds and the valley floor winds, and has a far lower wind speed average.</u>


Wind Speed Avg., mph 2014
8
7
6
5
4
3
2
1
0
April
May
June
July
August
September
Mt. Pisgah
McMinnville
Salem


Wind Speed Avg., mph 2015
7
6
5
4
3
2
1
0
April
May
June
July
August
September
October
Mt. Pisgah
McMinnville
Salem



The above graphs show clearly and consistently that Salem has the highest average wind speed, McMinnville slightly lower, and the proposed AVA a far lower wind speed. Over three years, the average speed in miles per hour in Salem during the growing season is 6.1 mph; in McMinnville, 5.2; and in the Mount Pisgah area, 2.3.

In addition, at 80 meters above ground, The Oregon Annual Average Wind Speed map shows winds between 5.0 meters/second (m/s) and 6.0 m/s in the proposed Van Duzer Corridor AVA and the Eola-Amity HIlls AVA, but only 4.5 m/s in the proposed Mount Pisgah AVA. Though it is a mountain, it is protected from the taller mountains of the Coast Range to the west, whose higher wind speed are evident on the map. (E)

Wind's impact on viticulture is documented. One essential fact is that wind increases diurnal fluctuations. Climatologist Dr. Gregory Jones notes of viticulture in general: "The less variability in the temperature leading up to harvest on a day-to-day basis the [less compromised] the wine quality." (4)

Furthermore, "during the early stages of vegetative growth, high winds can break off the new shoots, delaying and even reducing the amount of flowering. As the berries proceed through *véraison* and into the maturation stage, high winds can be very effective at desiccating the fruit and can result in lower volume...." (5) With the low average wind speed in the proposed AVA, the wines produced will be different than those in the center of the Willamette Valley near McMinnville and Salem, clearly shown in the charts.

Wind affects the composition of the berry, the humidity in the vineyard, its susceptibility to fungal infection, the microflora present on the berry, and, of course, the temperature during ripening and during spring and fall freezes. (6)

Exhibits:
D. From Weather Station, Mount Pisgah area at Croft Vineyard, National Weather Service stations KMMV in McMinnville, Oregon and KSLE in Salem, Oregon.
E. National Renewable Energy Laboratory, Oregon Annual Average Wind Speed at 30m

References:

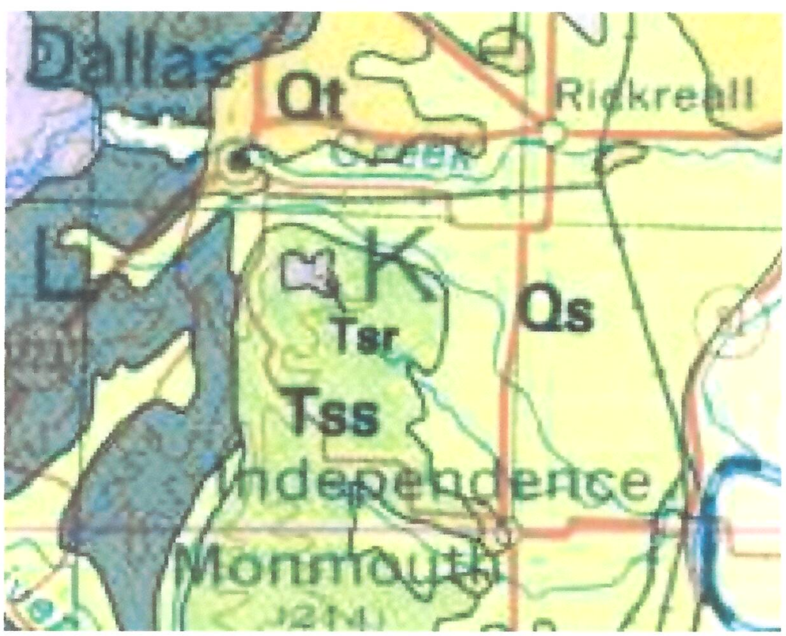
4. Gregory Jones, Climate, Grapes, and Wine.
5. Goldammer, Grape Grower's Handbook, p 57
6. Vineyard Impacts on Flora, UC Davis.

Geology

The Mount Pisgah area is bounded topographically around a unique geological formation occurring only within the proposed AVA. Other AVAs in Oregon have sedimentary soils, but none has the combination of these soils with an ancient parent material.

The parent material of the mountain comes from the Siletz River volcanics of the middle and lower eocene and paleocene (approximately 40 to 60 million years ago). The rocks are zeolitized (containing aluminum) and veined with calcite, and were sea floor mountains. The Siletz River volcanics (Tsr) are exposed near the summit of Mount Pisgah where it directly influences the soils and viticulture.

Throughout the area the parent material is layered underneath the tuffaceous siltstone and sandstone (Tss) of the upper to middle eocene (35 to 45 million years ago). The deep roots of grape plants access minerals from these formations. **The Siletz River volcanics are the oldest rocks within the Willamette Valley, and occur here below marine sediments only 6 miles from the Willamette River, making Mount Pisgah a unique area.**



According to Goldammer's *Grape Grower's Handbook,* "The nature of the parent material can have a profound influence on the characteristics of the soil. The mineralogy of the parent material is mirrored in the soil and can determine the weathering process and control the natural vegetation composition." (7)

The area contains 97.2% of soils with colluvium or residuum as parent material, which are both types of ancient sedimentary soils that form different soil horizons. The only alluvial parent material in the area is old alluvium coming from the Missoula Flood, and that only comprises 2.1% of the area. These parent types of soil affect the other layers. Smart notes: "Grapevines, as a group, appear to have proportionally deeper root distributions compared to many plants in natural ecosystems." Thus, though the geological aspect of an annual plant or a shallow-rooted plant may not be as important in an alluvial plain, in viticulture, mature grape roots are known to reach 20 feet and may penetrate many different soil horizons, accessing different minerals. (9)

The geology of the area is different from all surrounding areas.

Direction from Mount Pisgah	Difference in Geology
North	Alluvial parent material from quaternary period, silt and sand
West	Marine siltstone and basalt sandstone
South	Alluvial creek beds between formations of siltstone and sandstone
East	Alluvial parent material from quaternary period, silt and sand

Exhibit:
F. Parent Material Name, USDA Web Soil Survey

References:
6. USGS map, Geology of Oregon
7. Goldammer, Grape Grower's Handbook, p 324
8. D. Smart et al. "Grapevine Rooting Patterns."

Soils

The weathered soils in the upper layers of the proposed AVA contain fine to coarse grains with calcareous concretions and are carbonaceous and micaceous. They are classified generally as marine sediments, and have a combination of shallow topsoil and clayey/silty subsoils.

The main soil series are marine silty clay loams: Bellpine (18.8%), Jory, (37.1%), Nekia, (8.1%), Rickreall, (7.8%), Willakenzie (7.5%), and others (12.8%). **Silty clay loams together total 92.1% of all the soils in the proposed AVA.**

The areas around the proposed AVA are different for viticulture in every direction as they contain alluvial deposits from the recent quaternary period. Clayey alluvium, silty alluvium, and alluvial loam dominate in distinct lines as shown in the table.

Direction from Mount Pisgah	Difference in Soil
North	Clayey alluvium, creek bottom: drainage class, lower Ksat,
West	Alluvial loam, creek bottom: drainage class, lower Ksat
South	Silty alluvium, creek bottom: lower Ksat
East	Silty alluvium and alluvial loam, creek bottom and river flat land: higher Ksat

Goldammer describes soil characteristics influencing viticulture as follows: "The primary soil property in determining a suitable site is soil texture.... Texture affects the water holding capacity of the soils and internal water drainage." (7)

Soil series and texture are different in the areas surrounding the proposed AVA. Some of the other characteristics that differ include drainage, available water capacity, and saturated hydraulic conductivity.

Drainage class, important to grape growth during the growing season, is clearly delineated near the boundary. Approximately 92% of the soil in the area is classified well drained or moderately well drained. Grapes, which thrive in many soils, are particularly sensitive to high water levels. (G)

On the other hand, grapes need some water during the summer months, and available water capacity in the same area is moderately high. Values of the above soil types range in a narrow band from 0.16 to 0.18 cm of water to 1 cm of soil. This enables dry farming. These values are typically twice as high as loams and four times higher than sandy soils, yet not so high that standing water would prevent aeration. (H)

Hydraulic conductivity is measured as Ksat. This is a linear measurement that describes the ease with which water can move through soil when it is saturated. A balance is excellent for grape growing, allowing for root penetration at a slow but acceptable rate. The Ksat map of the proposed AVA shows a balanced distribution within the area, and both high and low values without. The balanced values within correspond to clays, clayey loams, and silty loams. (I)

The soils and geology of the proposed AVA are derived from a consistent parent material, as shown above, and have characteristics that differentiate the area for its high-percentage production of pinot noir, pinot gris, and chardonnay.

Exhibit:
G. Drainage Class, USDA Web Soil Survey
H. Available Water Capacity, USDA Web Soil Survey
I. Saturated Hydraulic Conductivity, USDA Web Soil Survey

References:
7. Goldammer, Grape Grower's Handbook, p 69

Elevation/Topography

Mount Pisgah is a small mountain among the hills of the Willamette Valley AVA. At 835 feet, the top is within the range of elevation typical for premium wine-grape production, and all the planted acreage lies between 750 and 260 feet in elevation, which allows for adequate heat accumulation and cold air drainage.

The land within the proposed AVA is protected from frost damage in the spring and fall as cool air drains to the surrounding, lower-elevation areas in all directions outside the proposed AVA, especially down Fern Creek, Cooper Creek and multiple forks of Ash Creek. This is evident on the USGS maps. All surrounding areas are lower than the area within the proposed AVA or are at a low point between hills.

Elevation and topography distinguish the proposed AVA on all borders. Furthermore, the physical features of the Mount Pisgah area distinguish it from the surrounding areas. The boundary of Mount Pisgah to the south changes as the topography of the area moves from a south-facing slope to a north-facing slope. The slopes of Fishback Hill, on USGS map Airlie North, and Fern Hill, unnamed on the Airlie North map (whose summit is near Ferns Corner Road) are different topographies and different formations. The slopes of Mount Pisgah distinguish sections of the southern boundary, as the topography moves from south-facing to north-facing at the southernmost boundary of the proposed AVA. "In the Northern Hemisphere, east, south, and west facing slopes are preferred[.]" (7)

Topography, in viticulture as in all agriculture, affects the growing season. "On a south-facing slope and a north-facing slope, plants grow differently. Even if the soils are the same, there is different response to temperatures, different emergence times, and different development rates. The temperature variation across the field itself may be on the order of 5° F." (9)

In growing degree-days over a seven-month season, this could change the total by over 500 at 5° F (for only half the day)—quite significant considering the yearly totals mentioned above. Grapes in cool-climate Oregon are rarely planted on north-facing slopes.

Exhibit:
USGS maps Airlie North and Dallas.
A. Google Earth, Map of Mount Pisgah Vineyards and Wineries

References:
7. Goldammer, Grape Grower's Handbook, p 66
9. Iowa State University Department of Agronomy.

Other, including table of differences by direction and summary

The viticulturists of the Mount Pisgah area petition the Alcohol, Tobacco, and Trade Bureau with very strong evidence for the creation of an American Viticultural Area separate from yet included within the Willamette Valley American Viticultural Area.

Viticultural Characteristic	Direction of Distinguishing Feature	Description of Difference
Growing Degree Days	North (McMinn), East (Salem)	Warmer in lower elevations
Wind	North (McMinn), East (Salem)	More wind in lower elevations, protected by taller western mountains
Geology	North, East, West	No Siletz Rock parent material outside of Mt. Pisgah, other formations surround it
Soils	North, South, East, West	Alluvial soils surround the area, differences in drainage,water holding capacity, Ksat
Elevation	North, East, West	Three directions are below 260' elevation
Topography	North, South, East, West	Topography flattens to north, east, and west; rises to a north face to the south

With clear name evidence and boundary evidence, the petition is able to show why its climate, geology, soils, and topography produce grapes and wine of specific character unique in the state of Oregon and the United States.

The proposed AVA is buffered from extreme temperatures and winds by its location and its physical features, with mainly south and eastern slopes that are above the low-elevation valley floor. Its climate data show it to be cooler than lower areas and with much less wind on average.

The soils in the proposed AVA are from 97% colluvial and residual geological parent material over a paleocene rock formation, leaving 92% marine silty clay loams which drain well and hold water in the summer. **Nowhere else within the Willamette Valley AVA does this specific combination of geology and soils exist.** Its topography including creek beds and hill formations distinguishes it from surrounding lower areas and the hills to the south.

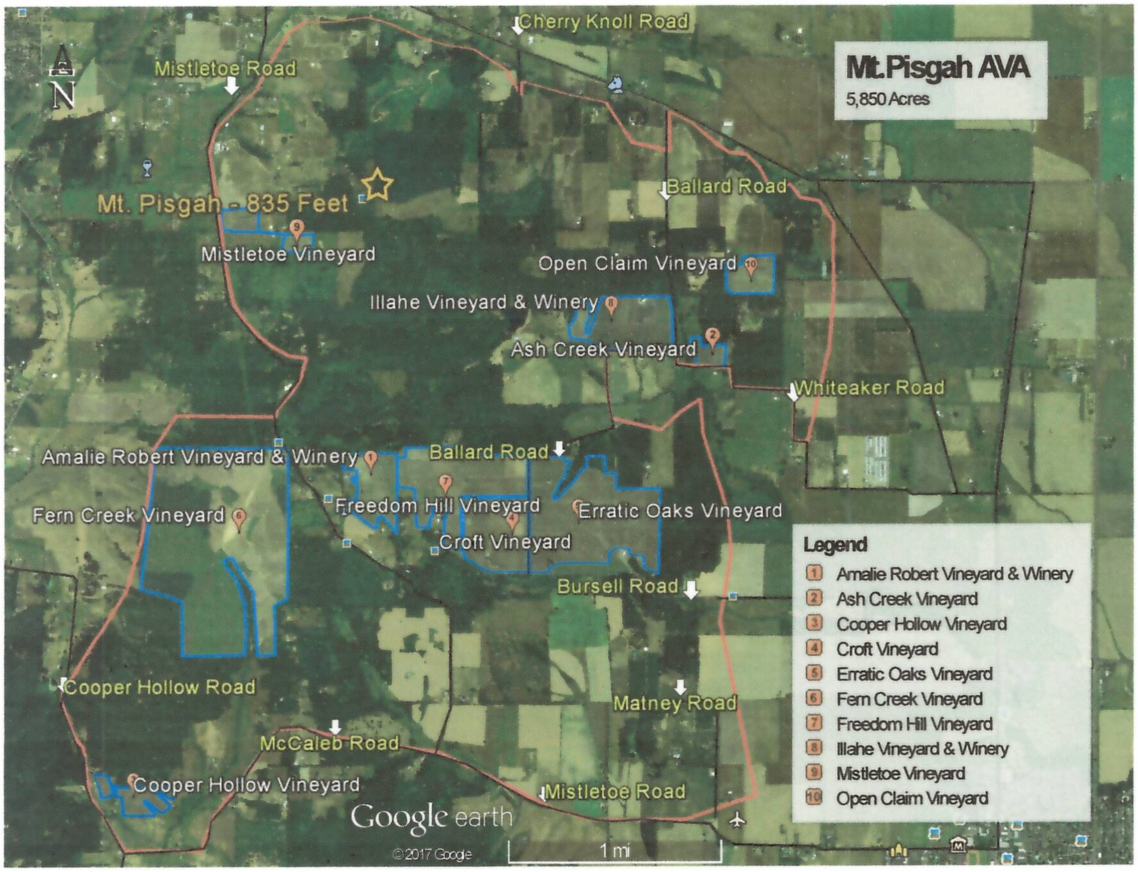
The Mount Pisgah proposed AVA with the Willamette Valley AVA

It has important distinguishing characteristics, yet is located only 6 miles from the Willamette River and should clearly remain within the Willamette Valley AVA. It is surrounded by the Willamette Valley AVA in all directions for miles and is within its elevation boundaries and has climate characteristics within the AVA's range.

The Mount Pisgah petition requests the TTB to recognize the specific and unique factors that will allow the vineyards and wineries to communicate with consumers regarding these same factors.

Exhibits

A. Google Earth, Map of Mount Pisgah Vineyards and Wineries



B. List of vineyards and bonded wineries in the proposed AVA

Vineyard	Acres Planted	Planned Acres
Amalie Robert Vineyard and Winery	36	0
Ash Creek Vineyard	13	4
Cooper Hollow Vineyard	18	0
Croft Vineyard	67	0
Erratic Oaks Vineyard	145	5
Fern Creek Vineyard	55	135
Freedom Hill Vineyard	93	0
Illahe Vineyards and Winery	59	20
Mistletoe Vineyard	24	0
Open Claim	21	0
Total	531	164

C. Growing Degree Days

2014	Mt. Pisgah	McMinn.	Salem
April	88	77	102
May	242	274	301
June	332	354	397
July	612	661	695
August	616	658	697
September	460	481	490
October	254	269	299

2015	Mt. Pisgah	McMinn.	Salem
April	108	65	71
May	256	271	304
June	507	522	576
July	636	665	710
August	580	603	657
September	334	356	395
October	255	250	277

2016	Mt. Pisgah	McMinn.	Salem
April	189	173	190
May	277	290	326
June	390	407	459
July	495	515	572
August	550	603	657
September	313	334	369
October	136	158	166

D. Wind Speed Average

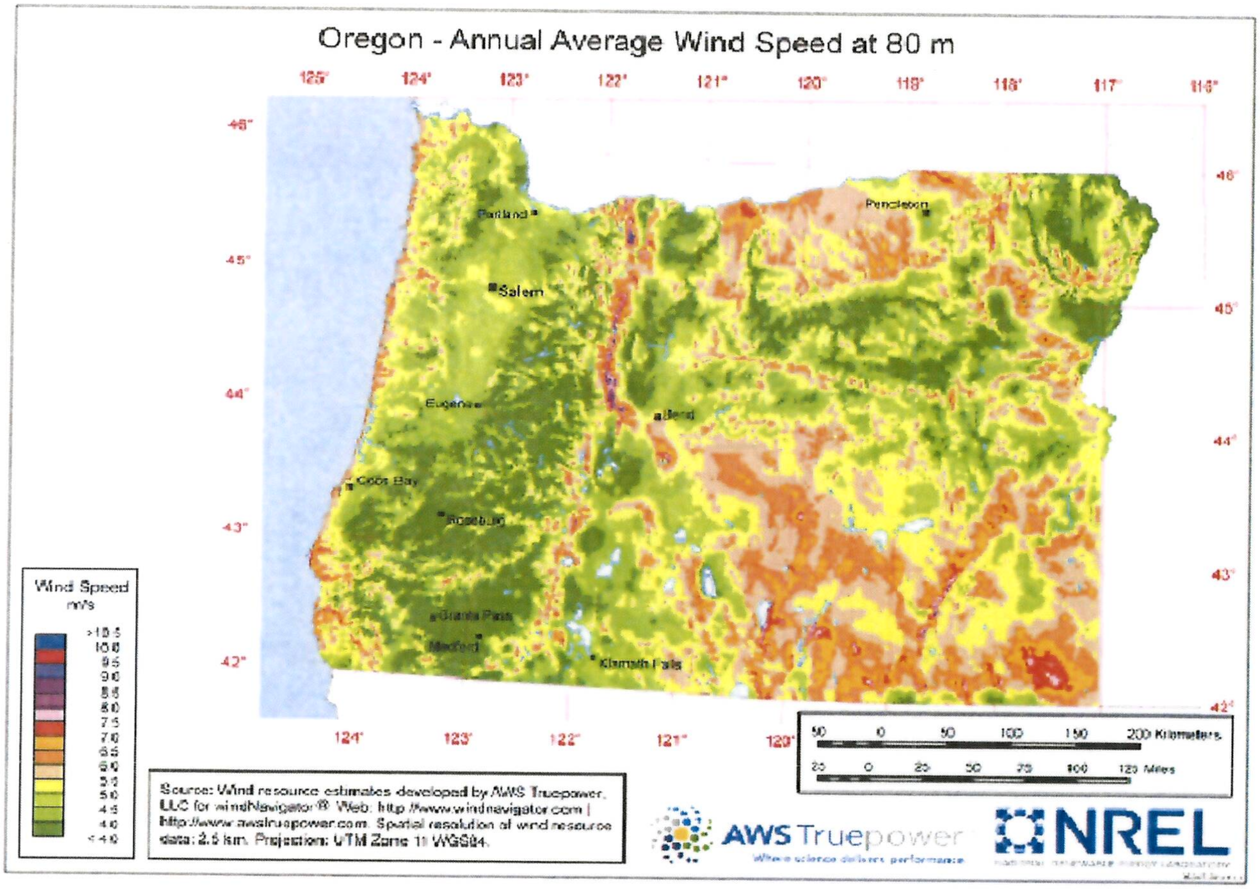
2014	Mt. Pisgah	McMinnville	Salem
April	3.3	5.7	7.2
May	3.1	5.7	6.4
June	2.9	5.3	6.5
July	2.6	5.7	6.1
August	2.5	5.1	5.8
September	2.5	5.2	5.3
October	1.9	4.1	5.8

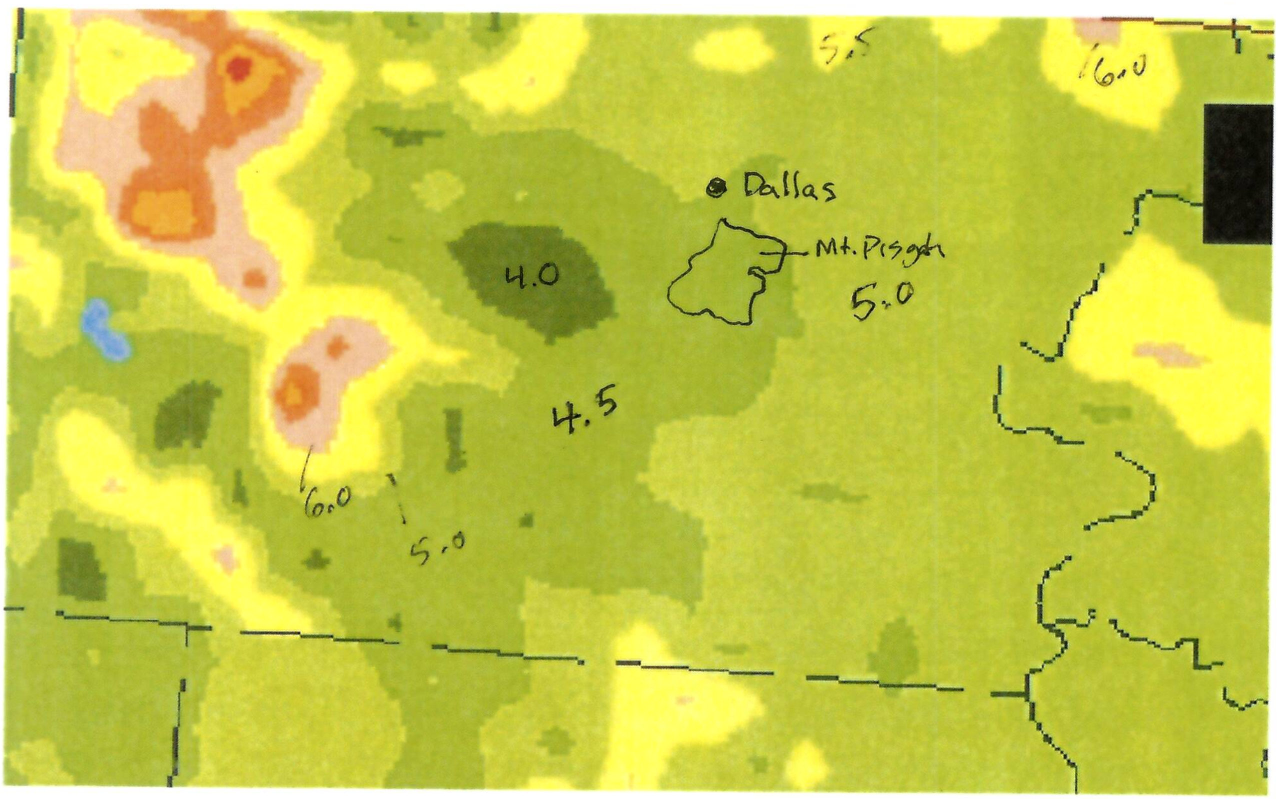
2015	Mt. Pisgah	McMinnville	Salem
April	3	4.2	5.4
May	2.5	4.7	5.3
June	2.4	5.6	6.6
July	2.5	5.7	6.3
August	2.3	5.9	6.3
September	1.4	4.1	5.4
October	1.1	3.9	5.1

2016	Mt. Pisgah	McMinnville	Salem
April	2.9	5.3	5.5
May	2.7	4.8	5.8
June	2.6	5.5	7.3
July	2.4	5.8	6.8
August	2.5	5.4	6.1
September	2	4.8	4.9
October	2	6.7	7.6

Exhibit E

National Renewable Energy Laboratory
https://windexchange.energy.gov/maps-data/104

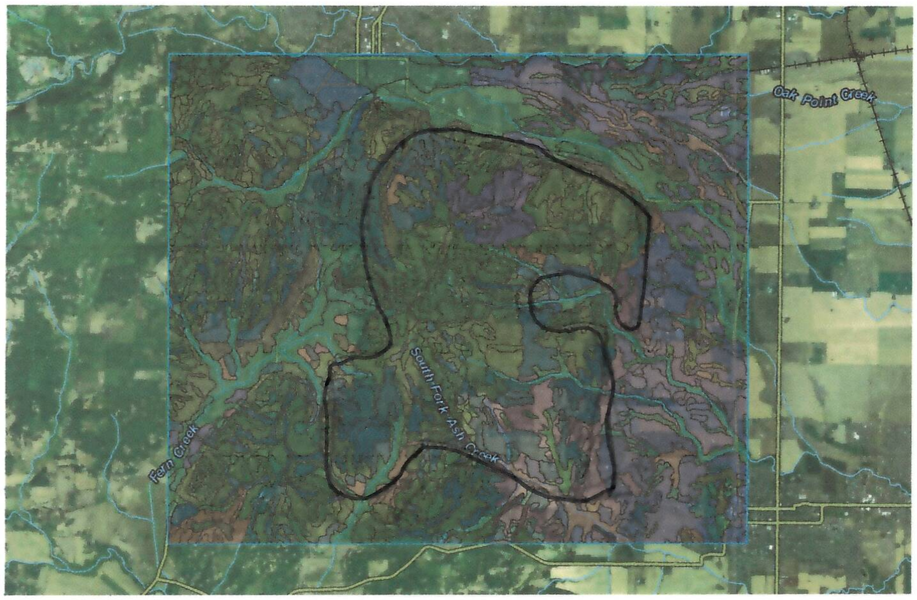




G. USDA, Web Soil Survey
http://websoilsurvey.sc.egov.usda.gov/
Parent Material Name

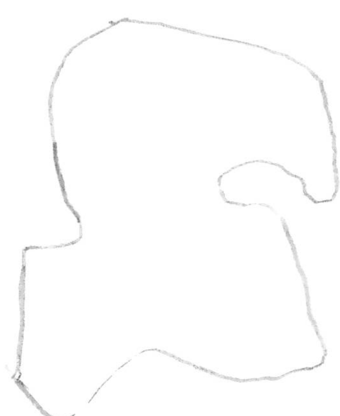
Parent Material Name—Polk County, Oregon

123° 23' 42" W 123° 12' 3" W
44° 55' 39" N 44° 55' 39" N



44° 50' 16" N 44° 50' 16" N
123° 23' 42" W 123° 12' 3" W

Map Scale: 1:70,100 if printed on A landscape (11" x 8.5") sheet.
Meters: 0 1000 2000 4000 6000
Feet: 0 3000 6000 12000 18000
N
Map projection: Web Mercator Corner coordinates: WGS84



MAP LEGEND

Area of Interest (AOI)

- Area of Interest (AOI)

Soils

Soil Rating Polygons

- alluvium and colluvium derived from sedimentary rock
- clayey alluvium
- clayey colluvium derived from sedimentary rock
- cobbly colluvium derived from basic igneous rock
- colluvium derived from basic igneous rock
- colluvium derived from sedimentary rock
- fine textured and moderately fine textured colluvium over residuum weathered from sedimentary rock
- fine textured colluvium derived from basic igneous and sedimentary rock
- fine textured resdiuum and colluvium derived from sedimentary rock
- mixed recent alluvium
- mixed recent alluvium derived from igneous and sedimentary rock
- mixed silty alluvium
- mixed silty and clayey alluvium
- mixed, recent, clayey alluvium
- old alluvium from mixed sources
- old, weathered, clayey alluvium
- recent alluvium
- residuum and colluvium derived from basalt and tuffaceous materials
- residuum and colluvium derived from sedimentary rock
- residuum weathered from sedimentary rock
- residuum weathered from siltstone
- silty alluvium
- silty alluvium of mixed mineralogy
- silty alluvium over older clayey alluvium
- silty and clayey alluvium of mixed mineralogy
- silty and clayey alluvium or lacustrine deposits
- stratified alluvium and colluvium over residuum weathered from sedimentary rock
- stratified recent alluvium
- Not rated or not available

Soil Rating Lines

- alluvium and colluvium derived from sedimentary rock
- clayey alluvium
- clayey colluvium derived from sedimentary rock
- cobbly colluvium derived from basic igneous rock
- colluvium derived from basic igneous rock
- colluvium derived from sedimentary rock
- fine textured and moderately fine textured colluvium over residuum weathered from sedimentary rock
- fine textured colluvium derived from basic igneous and sedimentary rock
- fine textured resdiuum and colluvium derived from sedimentary rock
- mixed recent alluvium
- mixed recent alluvium derived from igneous and sedimentary rock
- mixed silty alluvium
- mixed silty and clayey alluvium
- mixed, recent, clayey alluvium
- old alluvium from mixed sources
- old, weathered, clayey alluvium
- recent alluvium
- residuum and colluvium derived from basalt and tuffaceous materials
- residuum and colluvium derived from sedimentary rock
- residuum weathered from sedimentary rock
- residuum weathered from siltstone
- silty alluvium
- silty alluvium of mixed mineralogy
- silty alluvium over older clayey alluvium
- silty and clayey alluvium of mixed mineralogy
- silty and clayey alluvium or lacustrine deposits
- stratified alluvium and colluvium over residuum weathered from sedimentary rock

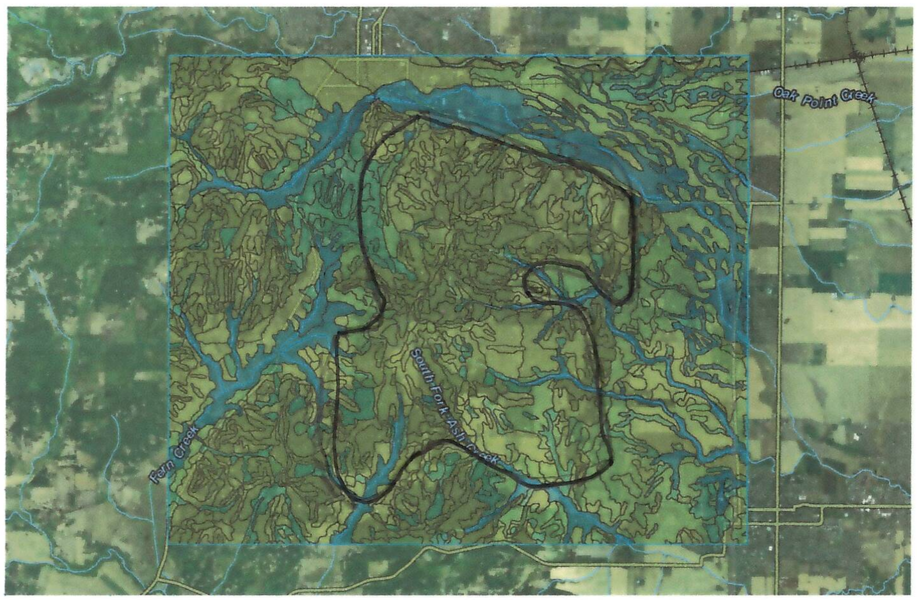
- Main types

H. USDA, Web Soil Survey
http://websoilsurvey.sc.egov.usda.gov/
Drainage Class

Drainage Class—Polk County, Oregon

123° 23' 42" W 123° 12' 3" W

44° 55' 39" N 44° 55' 39" N



44° 50' 16" N 44° 50' 16" N

123° 23' 42" W 123° 12' 3" W

Map Scale: 1:70,100 if printed on A landscape (11" x 8.5") sheet.
N
Meters: 0 1000 2000 4000 6000
Feet: 0 3000 6000 12000 18000
Map projection: Web Mercator Corner coordinates: WGS84

MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils

Soil Rating Polygons
- Excessively drained
- Somewhat excessively drained
- Well drained
- Moderately well drained
- Somewhat poorly drained
- Poorly drained
- Very poorly drained
- Subaqueous
- Not rated or not available

Soil Rating Lines
- Excessively drained
- Somewhat excessively drained
- Well drained
- Moderately well drained
- Somewhat poorly drained
- Poorly drained
- Very poorly drained
- Subaqueous
- Not rated or not available

Soil Rating Points
- Excessively drained
- Somewhat excessively drained
- Well drained
- Moderately well drained
- Somewhat poorly drained
- Poorly drained
- Very poorly drained
- Subaqueous
- Not rated or not available

Water Features
- Streams and Canals

Transportation
- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background
- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:20,000.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Polk County, Oregon
Survey Area Data: Version 14, Sep 19, 2016

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Apr 16, 2015—Feb 12, 2017

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

→ Main types

I. USDA, Web Soil Survey
http://websoilsurvey.sc.egov.usda.gov/
Available Water Capacity

Available Water Capacity—Polk County, Oregon

123° 23' 42" W
123° 12' 3" W
44° 55' 39" N
44° 55' 39" N

44° 50' 16" N
44° 50' 16" N
123° 23' 42" W
123° 12' 3" W

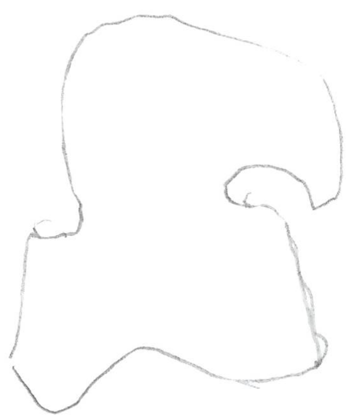
Map Scale: 1:70,100 if printed on A landscape (11" x 8.5") sheet.

N

0 1000 2000 4000 6000 Meters

0 3000 6000 12000 18000 Feet

Map projection: Web Mercator Corner coordinates: WGS84



MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils

Soil Rating Polygons
- <= 0.11
- > 0.11 and <= 0.14
- > 0.14 and <= 0.16
- > 0.16 and <= 0.18
- > 0.18 and <= 0.20
- Not rated or not available

Soil Rating Lines
- <= 0.11
- > 0.11 and <= 0.14
- > 0.14 and <= 0.16
- > 0.16 and <= 0.18
- > 0.18 and <= 0.20
- Not rated or not available

Soil Rating Points
- <= 0.11
- > 0.11 and <= 0.14
- > 0.14 and <= 0.16
- > 0.16 and <= 0.18
- > 0.18 and <= 0.20
- Not rated or not available

Water Features
- Streams and Canals

Transportation
- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background
- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:20,000.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Polk County, Oregon
Survey Area Data: Version 14, Sep 19, 2016

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

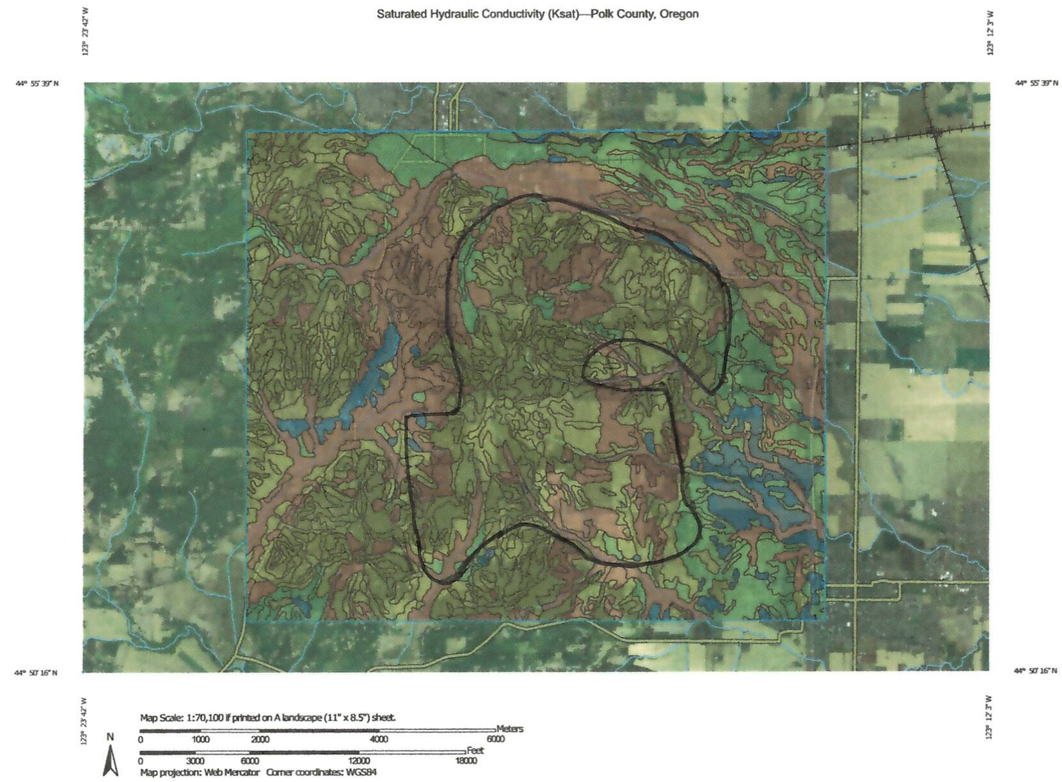
Date(s) aerial images were photographed: Apr 16, 2015—Feb 12, 2017

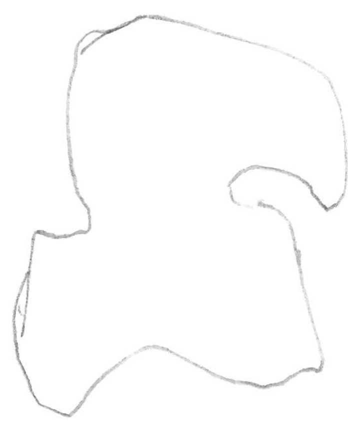
The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

– Many types

J. USDA, Web Soil Survey
http://websoilsurvey.sc.egov.usda.gov/
Saturated Hydraulic Conductivity

Saturated Hydraulic Conductivity (Ksat)—Polk County, Oregon





MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils

Soil Rating Polygons
- <= 3.0167
- > 3.0167 and <= 4.7191
- > 4.7191 and <= 6.7105
- > 6.7105 and <= 9.0000
- > 9.0000 and <= 73.8947
- Not rated or not available

Soil Rating Lines
- <= 3.0167
- > 3.0167 and <= 4.7191
- > 4.7191 and <= 6.7105
- > 6.7105 and <= 9.0000
- > 9.0000 and <= 73.8947
- Not rated or not available

Soil Rating Points
- <= 3.0167
- > 3.0167 and <= 4.7191
- > 4.7191 and <= 6.7105
- > 6.7105 and <= 9.0000
- > 9.0000 and <= 73.8947
- Not rated or not available

Water Features
- Streams and Canals

Transportation
- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background
- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:20,000.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Polk County, Oregon
Survey Area Data: Version 14, Sep 19, 2016

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Apr 16, 2015—Feb 12, 2017

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

—Maintype

Printed Name Evidence

One copy for reference

June 1938

OREGON FARMER UNION

MT. PISGAH
(Polk County)

The Mt. Pisgah local of the Farmers Union No. 145 held the June meeting Friday evening on June 3, with Vice president A. G. Remple in charge.

After the business session, L. H. McBee gave a report on the plans for the Farmers Union picnic to be held at Helmic Park June 19.

A resolution was adopted that this local carry on their membership drive. In the April and May drive we took in 12 new members and reinstated five others.

The following delegate, Henry Alsip attended the state convention held at Sheridan.

One of Mt. Pisgah's first and very active members, Mrs. T. J. Alsip passed away. She will be greatly missed as she was the back bone of the Mt. Pigah local.

Our local welcomes anyone who cares to come to our meetings.—Mrs. Reddekopp, secretary.

RESOLUTIONS

WHEREAS, it has pleased our Heavenly Father to remove Mrs. Mary Alsip from our midst; and

WHEREAS, her passing removes an active co-worker and friends from among us, therefore,

Be it Resolved by the Mt. Pisgah local of the F. E. & C. U. that we hereby express our great loss and our deep sympathy to her many remaining friends and relatives.

Lou Plummer
Harvey Young

Editors Note: Mrs. Alsip was one of our most faithful and cooperative members, and her presence will be sadly missed at all State meetings, Polk county meetings as well as her own local. She was a member of the Polk county Executive Board.

PERRYDALE
(Polk County)

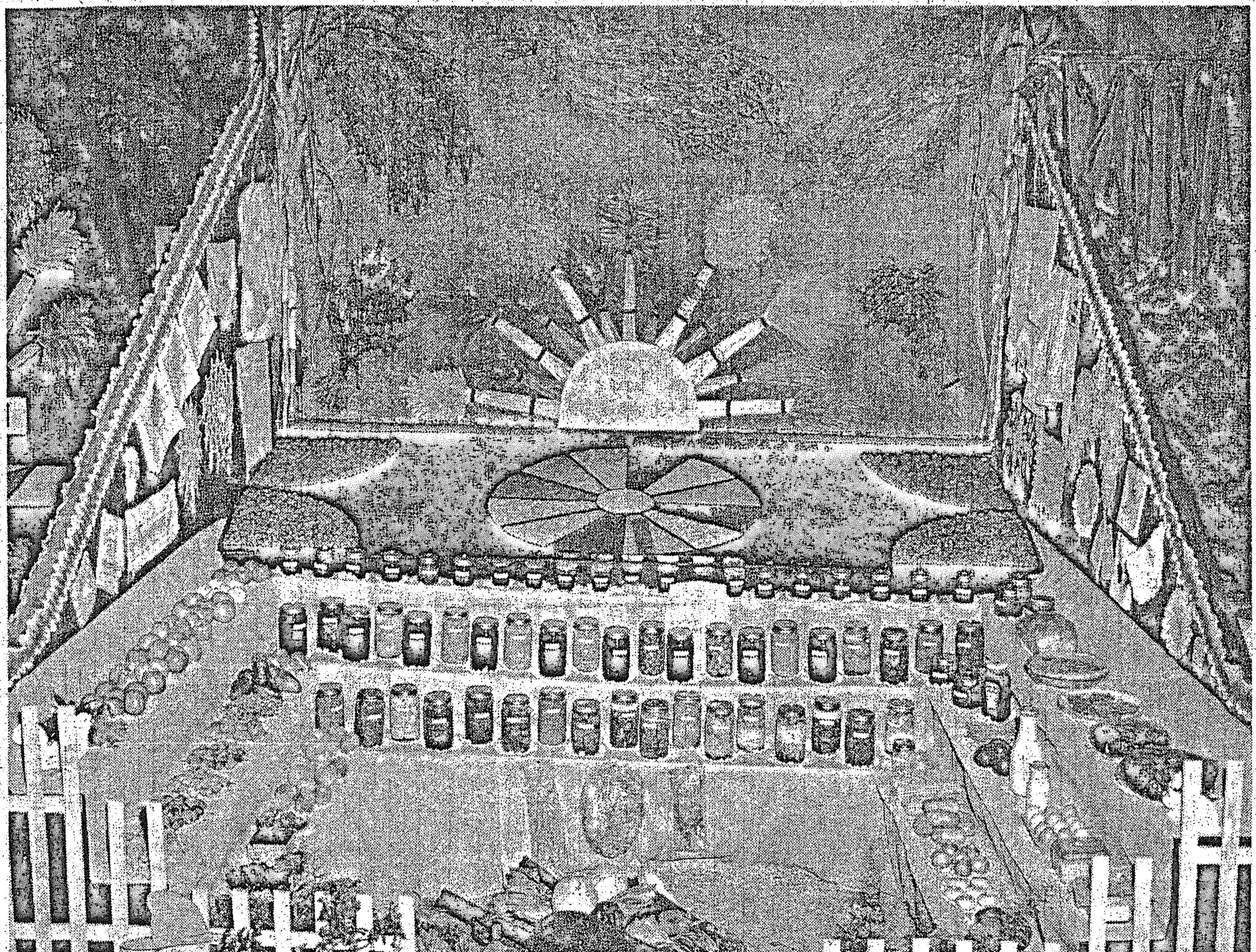
The Perrydale Farmers Union have held their regular monthly meetings all spring. The June meeting was held Thursday, June 9. It was not the regular date but was postponed a week on account of the high school commencement held on the regular 1st Thursday evening of the month.

At the May meeting a splendid review of their recent Hawaaian trip was given by Geo. McCollough of Broadmead.

At the June meeting reports were given from the state convention by L. W. Gilson, delegate.

We congratulate our neighbor, Ballston Union, in the winning of the State Oratorical Contest by Miss Alda Miller.

Ralph Beck of the OSC gave a splendid talk on American standard of living, which was both interesting and educational. Strawberries and cake was served to all present. — Mrs. H. A. Lee.



MT. PISGAH FARMERS UNION won first place on the fair booth in 1950 at Monmouth and several other years at the Polk County fair. Prunes and nuts are featured in the center portion of the display with the circle of grain in the center, and grain in the background. (Picture furnished by Mrs. Vern Alsip, Monmouth).

OREGON FARMER UNION CALENDAR, 1936

LOCAL	SECRETARY — ADDRESS	MEETING DATE
Amity	Wm. Patty, Amity	3rd Fri.
Ballston	J. J. Sechrist, Ballston	4th Fri.
Bellevue-Sheridan	Clair Stringer, McMinnville	2nd Wed.
Bethel	Mrs. Lucy I. Hain, Salem, Rt. 6	1st Mon. 3rd Fri
Blooming	Martha Jepson, Cornelius	2nd-4th Wed.
Bridgeport	Archie Palmer, Monmouth	1st & 3rd Sat.
Brooks	J. W. Fitts, Salem, Rt. 2	4th Tues
Buena Vista	Ray Hansen, Independence	1st-3rd Fri.
Carlton	Gordon Sitton, Carlton	2nd Tues.
Cedar Mill	Mrs. Clara B. Meurer, Hillsboro, Rt. 4	1st Tues.
Central Howell	Earl DeSart, Silverton	2nd Mon.
Cloverdale	A. A. Dumbeck, Turner	4th Wed.
Coast Fork	John Keblebeck, Cottage Grove	2nd Thurs.
Columbia	Floyd Hay, Rt. 3, The Dalles	
Dayton-Webfoot	Andrew Nichols, Dayton	1st Thurs.
Dever	Henry Harnisch, Rt. 2, Albany	2nd-4th Tues.
Downing	Mrs. Addie McAdam, Clatskanie	2nd-4th Tues.
Fairfield	E. B. Smith, Gervais	3rd Fri.
Gaston	J. Donald Watson, Gaston	1st Wed.
Gervais	Robert Harper, Gervais	
Greenwood	R. D. Pence, Rickreall	1st Tues.
Kansas City	Reed Greenwood, Forest Grove	1st & 3rd Wed.
Kingsley	F. H. Hillgen, Dufur	1st Wed. 3rd Fri.
Laurel-Scholls	F. C. Putnam, Hillsboro	2nd Thurs.
Liberty Bell	L. H. McBee, Dallas	2nd Saturday
Luckiamute	Mrs. Chas. Bowman, Monmouth	2nd-4th Fri.
Marion	Mrs. Chas. Sarver, Marion	1st-3rd Fri.
McMinnville	Mrs. Alice Pratt, McMinnville	3rd Thursday
Middleton	Geo. Rupprecht, Rt. 3 Box 238, Sherwood	2nd Tues.
Mt. Angel	Sylvester Schmitt, Mt. Angel	1st Mon.
Mt. Pisgah	Arthur Schroeder, Dallas	1st-3rd Fri.
Nansene	Mrs. Leo Hammel, Boyd	1st & 3rd Wed.
Orchard Heights	Mrs. Grace Bliss, Salem, Rt. 3	1st Wed.
Pedee	R. E. McCaw, Monmouth, Rt. 2	
Perrydale	L. W. Gilson, Perrydale	1st Thrs.
Riverview	Mrs. Effie Sommer, Scio	1st-3rd Sat.
Salmon River	Lynn Goyne, Otis, Oregon	3rd Friday
Santiam-Central	W. E. Meyer, Albany, Rt. 1	2nd & 4th Fri.
Sidney-Talbot	Keith Allen, Jefferson	2nd-4th Fri.
Spring Valley	S. D. Crawford, Salem, Rt. 1	2nd Wed.
St. Paul	Bernard Smith, Woodburn	2nd Thursday
Stafford	Joe Rabick, Sherwood	3rd. Wed.
Valley Junction	Eben Ray, Willamina	1st Wed.
Verboort	Mrs. John Plass, Forest Grove, Rt. 2	2nd Wed.
West Rainier	Francis Attig, Rainier, Oregon.	1st & 3rd Mon.
West Union	Mrs. Eva Meek, Cornelius	1st-3rd Thurs.
Yankton	C. L. Parrish, St. Helens	2nd & 4th Mon.

ITEM #US29741

Page 011, Dallas, Monmouth, Strongs Fruit Tracts

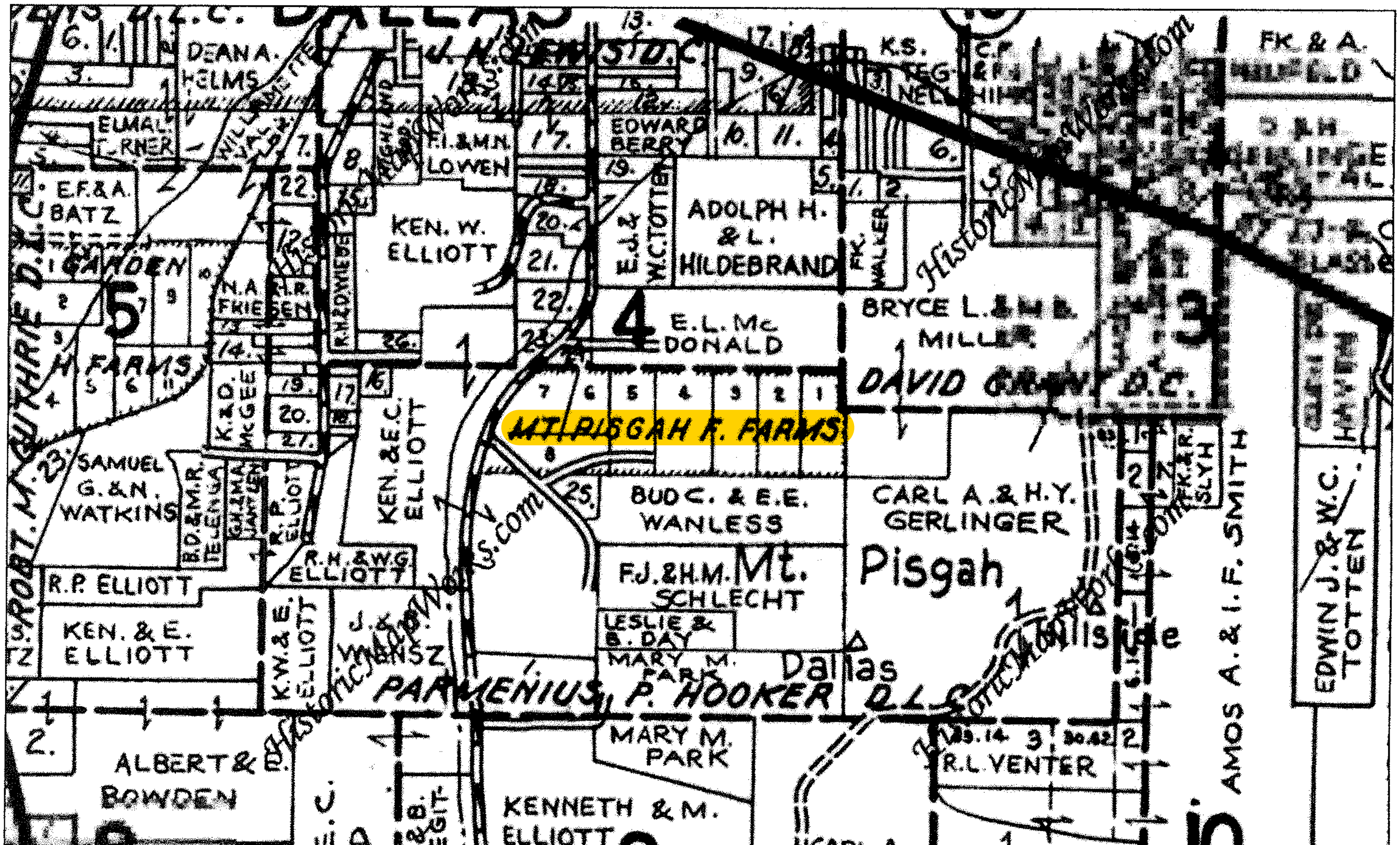
From **Polk County 1962**, Oregon

Published by Metskers Map in 1962

View all the images in Polk County 1962

Buy a Print of this Map »

Download this Map ($4.99+)



View Print Sizes & Pricing »

Overlay This Map

Historic Earth Free Basic

Historic Earth Premium

Map Information

Full Title: Page 011, Dallas, Monmouth, Strongs Fruit Tracts
Full Atlas Title: Polk County 1962
State: Oregon
Location 1: Unattributed

Source Institution:

manta

About Contact Directions More Info Nearby Web Results

Mt Pisgah Orchards Inc

2007 Se Holman Avenue
Dallas, OR 97338

Mt Pisgah Orchards Inc is a privately held company in Dallas, OR and is a Single Location business.

Own This Business?

Categorized under Deciduous Tree Fruits. Our records show it was established in 2009 and incorporated in Oregon. Current estimates show this company has an annual revenue of 80000 and employs a staff of approximately 2.

Contact *Is this your business? Claim This Profile*

Mt Pisgah Orchards Inc

Mt Pisgah Orchards Inc, 10885 Brateng Road, Monmouth, Polk, Oregon, Find Civic Social & Fraternal & Business Associations, Religious & Business & Political & Membership Organizations

Oregon - List of United States Religious & Business Organizations

Pisgah Orchards Inc

Company Name: **Mt Pisgah Orchards Inc**

Status: **Work**

State: **Oregon**

Post: **97361-9506**

County: **Polk**

City: **Monmouth**

Address: **10885 Brateng Road**

Phone: **(503)623-2995**

Contact Principal: **Thomas Brateng**

SIC code: **8661** Industry group: **Membership Organizations**, Business category: **Religious Organizations**, Subcategory: **Religious Organizations**

Description: **Mt Pisgah Orchards Inc** is a business categorized under *religious organizations*, which is part of the larger category *religious organizations*. **Mt Pisgah Orchards Inc** is located at the address 10885 Brateng Road in Monmouth, Oregon 97361-9506. The Principal is Thomas Brateng who can be contacted at (503)623-2995.

Review: Religious Organizations

Was this article helpful? Yes -0 No -0 Click here to Inform about a mistake 1 Rating:

Mt Pisgah Orchards

Analyses:

Summary

Programs

Programs by year

Farm Location(s)

Search

Search for farm substidy recipients

USDA subsidy information for Mt Pisgah Orchards

Mt Pisgah Orchards received payments totaling $22,120 from 1995 through 2014

Year	Conservation Subsidies	Disaster Subsidies	Commodity Subsidies	Total USDA Subsidies 1995-2014
1995	$0	$0	$0	**$0**
1996	$0	$22,120	$0	**$22,120**
1997	$0	$0	$0	**$0**
1998	$0	$0	$0	**$0**
1999	$0	$0	$0	**$0**
2000	$0	$0	$0	**$0**
2001	$0	$0	$0	**$0**

Google Maps Mt Pisgah

Map data ©2018 Google 1000 ft

Mt Pisgah

Oregon 97338

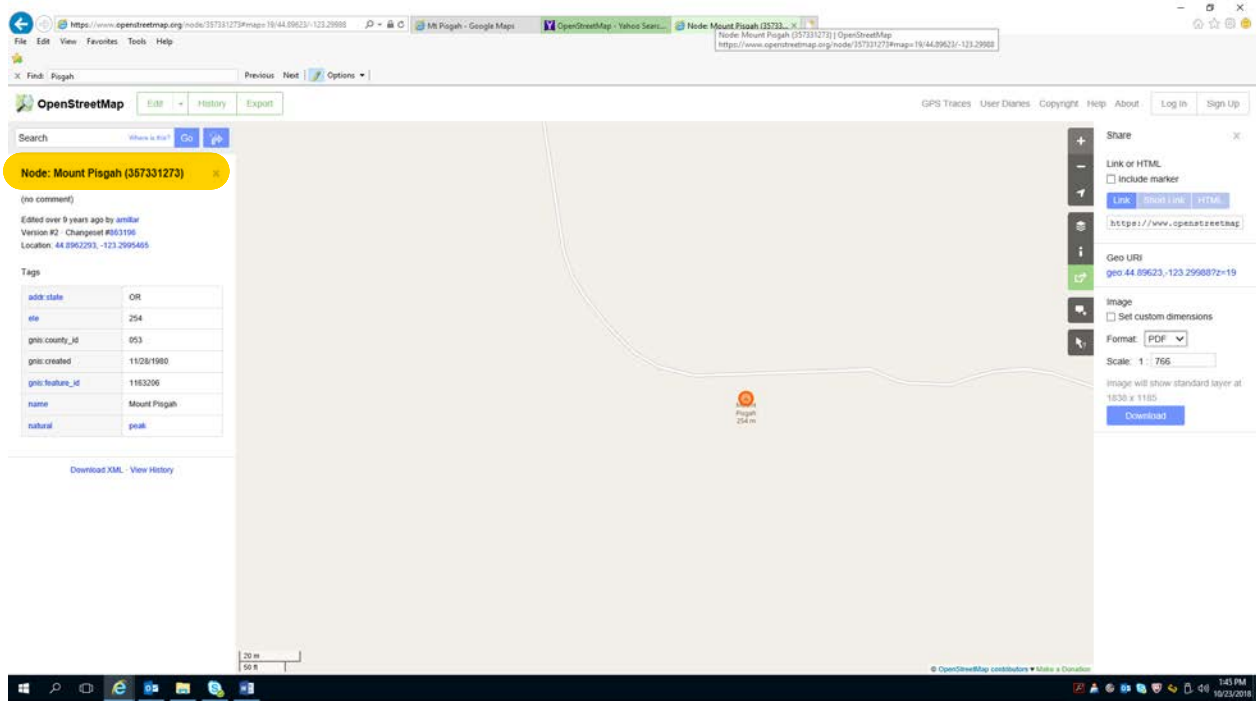
Mountain Peak

Oregon 97338

VPW2+F5 Dallas, Oregon

https://www.openstreetmap.org/node/357331273#map=19/44.89623/-123.29988

Accessed 10/23/2018



References

1. Oregon Trails site for Polk County, Oregon
http://genealogytrails.com/ore/polk/biographies/

2. Lewis A. McArthur, Oregon Geographic Names, Oregon Historical Society, Portland, Oregon, 1974

3. A. J. Winkler; James A. Cook; W. M. Kliewer; Lloyd A. Lider. General Viticulture, Second Revised Edition. University of California Press, 1974

4. Gregory Jones, Climate, Grapes, and Wine.
https://www.guildsomm.com/public_content/features/features/b/gregory_jones/posts/climate-grapes-and-wine

5. Vineyard Impacts on Flora
http://wineserver.ucdavis.edu/industry/enology/fermentation_management/wine/vineyard_impacts_on_flora.html

6. USGS, Geologic Map of Oregon
http://ngmdb.usgs.gov/Prodesc/proddesc_16259.htm

7. Goldammer, Ted. Grape Grower's Handbook: A Guide to Viticulture for Wine Production, second edition. Apex Publishers, July 2015.

8. "Grapevine rooting patterns: A comprehensive analysis and review" By: D. Smart, E. Schwass, A. Lakso, and L. Morano, UC Davis
http://wineserver.ucdavis.edu/pdf/attachment/18root%20review.pdf

9. Iowa State University Department of Agronomy.
http://agron-www.agron.iastate.edu/courses/Agron541/classes/541/lesson03a/3a.4.2.html

was elected County Judge. In politics he was a Democrat. The town of Rickreall was first named Dixie by him.

Theodore C. Thorp owned a flour mill at Falls City before there was any town there. In the year 1865 this mill was moved to Rickreall by I.I. Dempsey for a one-half interest in the same. In 1869 T.C. Thorp deeded his interest to Abel Uglow who purchased Mr. Dempsey's interest in 1870. This mill property was deeded in 1875 to James Morrison and Thomas Young. Morris and Young sold to Kratz, Washburn and Munch in 1872. The property passed into the hands of Geo. White and Andrew McDaniel and the mill was destroyed by fire. It was rebuilt and became the property of Frank Gibson, The Dallas Bank and Chet. Coad, and later of Peter Cook and William Rowell.

During the last few years of the life of Isaac I. Dempsey, he was blind. He died on June 25, 1887, his wife on Oct. 3, 1894, and they are both buried in the Burch cemetery east of Rickreall.

My Trip Across the Plains
By Mary J. Dempsey Bronson
(Written by Mrs. Bronson in 1915)

In the spring of 1862 I left my home in Knox County Illinois to come to the Western State of Oregon. WE had quite a company of our own, my father I.I. Dempsey, having three four-horse teams, a carriage and two other horses, two men for each wagon, besides my father and a man to care for the loose horses; making in all twelve persons with my parents, two sisters and one brother. I often wonder how my mother and sisters ever managed to cook for so many on such a long journey. The man who cared for the two horses was a baker by trade and he was to do all the baking, but he made such a complete failure with his first baking, he was never asked to bake any more. We thought he had an object in doing it so he would not have any more to do.

We crossed the Missouri River at Omaha where we met with many other travelers coming to the west. They formed into a company and elected my father captain of the train. I do not remember how many wagons there were with us, but there was quite a large company. We kept close together for fear of the Indians, stopping before night to let our horses feed on the green grass. Our wagons were all formed in a circle to make a corral at night for the horsed to be placed in, and men stood guard all night. In the morning they were taken out to feed again. One night a young man who was standing guard got sleepy, got into our carriage, and was found fast asleep. I had a cage of canaries in there, and he was laughed at more than he liked, about guarding my birds instead of the horses.

Oh, the long dreary, hot days we had traveling up the Platte River; through the deep sand we would travel for miles and miles without see-have to carry our wood with us to do our cooking. Some people used buffalo chips, but we never did. We brought a small iron cookstove with us; the only one in the train. When we would stop for a few days to rest our horses, our stove would never be idle.

We had some musicians with us; my uncle and cousin both played the violin, and another young man rattled the bones. Some evenings they would smooth down the sand and dance for a while. It was the first dancing I ever saw. One Irish woman in the train came bare-foot all the way. Some of the boys said she could strike fire with her heels. Another one wore bloomers; a very sensible way of dressing for such a trip. They called her "the wild goose". One family had a small child; they brought their cow with them; the only one on the train; she came all the way through; would take the lead in the morning as if she knew where she was going.

We passed through several different tribes of Indians and many Indian villages, but did not have any trouble with them. Many thought the most of the murdering was done by the Mormons. One morning a company of Cheyennes came to us all dressed in their war paint and feathers which created quite a little excitement. Our little baker got frightened and was found giving away all our bread to keep on the good side of them. They were not hostile with us, but were warring with the Pawnees across the river, and came to us to inquire if we had seen their enemies.

We saw deer, bear, buffalo, antelope and wolves and many a lonely grave by the side of the road where some one had left a loved one. I suppose we had had as pleasant a trip as most any other travelers making so long a journey. We had no serious illness and our company was very agreeable. Sometimes when the dogs would get into a fight the men would lost their tempers.

When we got to where there was no danger of Indians, our company began to scatter out to different places. Quite a number stopped at the beautiful valley situated in the Blue Mountains called Grand Ronde. It is said that two thousand located in that valley in 1862, while eight thousand passed on down the Columbia.

We arrived at the Willamette, the land of red apples, the first of October, and thought we had got to paradise, after being without fresh fruit all summer. The first year we lived on David Whiteacre's farm three miles north of Monmouth. The next year we lived on Dr. Boyle's farm three miles east of Dallas, and in 1865 my father moved the Thorp Flouring Mill from Falls City to Rickreall for half of it. Mr. Thorp and he were partners for some time.

It seems strange that we would leave a good home, many friends and relatives to come to Oregon, but we came to be away from civil war. We lived in the north; our sympathies were with the south. Oregon was so far away, they did not hear much about the war; no railroads across the plains; you had to go around by Panama or travel the long dreary road we came over. If we sent a letter back to our friends, it was a long time in getting there and cost us ten cents. Polk County had then but five towns that I remember: Dallas, Independence, Eola, Rickreall and Monmouth. Dallas had but two stores, run by W. C. Brown and John Waymire, who had also a flouring mill. Dry goods and groceries were all sold over the same counter. Mr. Robb had a Drug Store and William Clinghan a saloon. Mr. T.J. Lovelady ran the only hotel, which stood where Stafrin's Drug Store now stands. There were two churches, the Methodist and Baptist. The Baptist is the same as they use it now, only remodeled. The Methodists have built a new one. The old jail is the same as when we came here. The merchants had to bring their goods with teams from Portland or have them come to Independence by boat and then bring them here. Not many buildings are standing today that were here when we came, and not many people living today that lived here then.

My first picnic in Oregon was a May Day Picnic on Mt. Pisgah. Miss Roxy Moore was crowned queen of May. Her crown was a wreath of apple blossoms. My first watch meeting was at the Baptist church. When they thought it was about time for the New Year to come, they inquired if any one had a watch. There was none in the house and they had to send out and borrow one. Very few people possessed a watch in those days. A.C. Gibbs was Governor of Oregon. The population of Oregon in 1860 was only 52, 405. She had been admitted into the union only one year before. In 1869 the railroad was completed from the east to San Francisco. In 1869 they commenced building a railroad on each side of the Willamette. Five years later the east side road was furnished to Roseburg. The roads were both completed 19 years later. The Northern Pacific was built in 1883. Portland, when we came, had about as many inhabitants as Dallas has today.

Back to Polk County Home		Back to Biography Index

Reference 2

Lewis A. McArthur

Oregon Geographic Names

Fourth Edition
Revised and Enlarged by
Lewis L. McArthur

For almost 50 years *Oregon Geographic Names* has served as the key to unlocking the exciting, dramatic and sometimes humorous history of Oregon. Growing out of the dedication and toil of Lewis A. McArthur, an Oregonian whose interest in the history of the state began in childhood, *Oregon Geographic Names* has successfully passed through three editions, each of which became a "best seller." This Oregon tradition is continued into this long awaited 4th edition through the work of Lewis L. McArthur, son of the original author and an equally brilliant student of Pacific Northwest history. Supported by Oregonians everywhere, and with the support of the Geographic Names Board, this new edition of *Oregon Geographic Names* contains more than 5000 additions, a fourth new material, and endpaper maps especially prepared for this publication.

Long considered the essential research tool dealing with the State of Oregon, *Oregon Geographic Names*, 4th edition, promises to find its place in the libraries of historians, geographers, travelers, politicians, writers, researchers of all kinds and those who are just plain fascinated with Oregon.

Continued in back of book

Lewis A. McArthur

Oregon Geographic Names

Fourth Edition
Revised and Enlarged by
Lewis L. McArthur

Oregon Historical Society
Portland, Oregon
1974

factors in charge of Fort William, the chief depot and factory of the North West Company, at the time of the consolidation with the Hudson's Bay Company. His wife was the widow of Alexander McKay, who had been killed in the *Tonquin* disaster at Clayoquot Sound, Vancouver Island, in June 1811. Dr. McLoughlin built Fort Vancouver in 1824-25, and there he created a farm of 3000 acres and established a sawmill and a flour mill. His district of the Hudson's Bay Company (the Columbia) grew to be profitable. There were numerous forts and posts tributary to Fort Vancouver, there being, in 1839, about twenty of these forts besides Fort Vancouver. In the development of the fur business, of agriculture and commerce, and in the government of the country, Dr. McLoughlin displayed rare powers of organization. He met the American traders with kindness, but with severe competition, and the American missionaries and settlers, with benevolence. He left the service of the Hudson's Bay Company in 1846, and became an American citizen at Oregon City May 30, 1849. After his resignation he carried on a milling and merchandise business at Oregon City, where he died September 3, 1857. Dr. McLoughlin's house at Oregon City, built in 1845-46, and occupied by him until his death, was moved, by the McLoughlin Memorial Association, to the bluff overlooking Willamette River, and restored to its first condition. It was dedicated as a permanent memorial September 5, 1909. For narrative, "Dr. John McLoughlin and His Guests," by T. C. Elliott, see *Washington Historical Quarterly*, volume II, pages 63-77; for biography, see F. V. Holman's *Dr. John McLoughlin; John McLoughlin: Patriarch of the Northwest*, by Robert C. Johnson, and Richard G. Montgomery's *The White-Headed Eagle*. For long list of references to published material about Dr. McLoughlin, see Scott's *History of the Oregon Country*, volume I, pages 295-96. McLoughlin's *Fort Vancouver Letters* have been published by the Hudson's Bay Record Society in three volumes. See also *Letters of Dr. John McLoughlin*, edited by Dr. Burt Brown Barker, 1948.

Mount Mitchell, Clackamas County. This mountain, elevation 5110 feet, was named for Roy Mitchell, a veteran of World War I, who was killed while fighting a forest fire August 20, 1919. The mountain was formerly called Oak Grove Mountain, an unsatisfactory name because there were no oak trees on the mountain, and also the name caused confusion with Oak Grove Butte, seven miles to the south. Oak Grove Mountain had been applied because the feature was near Oak Grove Fork Clackamas River.

Mount Moriah, Union County. This mountain is in township 1 south, range 41 east, and has an elevation of about 5500 feet. It is flat on top. In early days it was called Stubblefield Mountain in compliment to Jasper Stubblefield who had a homestead west of the mountain in about 1878. Later some Bible enthusiast named it for the place in Palestine, about which a great deal seems to be unknown.

Mount Pisgah, Polk County. J. L. Ford, many years a resident of Dallas, wrote the compiler in August, 1927, as follows: "I find that Colonel Cornelius Gilliam named the little butte southeast of Dallas 'Mt. Pisgah' for a butte so named near his old home in Missouri, and probably also because of his veneration for biblical names." Pisgah was a mountain of Abarim, Moab, northeast of the Dead Sea. Mount Nebo was one of its summits.

Mount Pleasant, Linn County. Mount Pleasant is a descriptive name for a nice viewpoint mostly in section 30, township 9 south, range 1 east. This hill rises about 200 feet above the surrounding land but it pleased the early settlers to call it a mount. The compiler does not know who was responsible for this but probably members of the Irvine family who took up property there in the early fifties. The locality was once known as the Irvine District and it was called The Hill. There is a cemetery on the top of Mount Pleasant and there are also nearby school grounds probably set aside by Robert Irvine. The church property was set aside by Washington Crabtree and it is reported that Ben Irvine raised the money for the various necessary buildings. A post office called Mount Pleasant was established in August, 1874, with Elijah Richardson first of several postmasters. This office was discontinued October 10, 1887. Mount Pleasant is about seven miles northeast of Scio.

Mount Popocatepetl, Lane County. This mountain, elevation 1020 feet, is a well-known point in the Oregon Coast Range, but not one of the highest. The peak was named about 1888 by R. O. Collier, a government surveyor, because it was so hard to climb. The crew was smoking hot when it reached the top. The original Mount Popocatepetl is the second highest mountain in Mexico and is named with the Aztec word for smoking mountain. This information was furnished by E. A. Collier of Salem.

Mount Reuben, Douglas and Josephine counties. Mount Reuben is a prominent peak about ten miles west of Glendale on the divide between the waters of Cow Creek and those of Rogue River. It was named for Reuben Field of Linn County, who was a member of Captain Jonathan Keeney's company who fought Indians in this part of Oregon in 1855. While the company was trying to cross Rogue River not far from this mountain Field made a jocular prediction that the Indians would make an attack. The prediction was soon fulfilled and Mount Reuben and Reuben Creek nearby have since borne his name.

Mount Scott, Clackamas County. This well-known butte is in the southeast outskirts of Portland and is 1083 feet above sea level. It was named for Harvey Scott, editor of the *Oregonian*, by W. P. Keady, in 1889. In that year, and in 1890, Mr. Scott bought 335 acres of land on the north and west slopes of the hill. From that time until November, 1909, when he sold the land to Mount Scott Park Cemetery Corporation, the editor continually kept men working the soil and clearing away the forest and stumps. In this effort Mr. Scott expended considerable money, but he was determined to "tame that wild land," as he frequently expressed it. For a detailed description of Mr. Scott's life, see Scott's *History of the Oregon Country*. For W. P. Keady's part in the development and naming of Mount Scott, see editorial page of the *Oregon Journal*, September 24, 1928. There it is said that the butte was once called Mount Zion.

Mount Scott, Douglas County. The history of this post office is

Reference 4

https://www.guildsomm.com/public_content/features/articles/b/gregory_jones/posts/climate-grapes-and-wine

Climate, Grapes, and Wine

Terroir and the Importance of Climate to Winegrape Production

Wine is the result of myriad influences that are often embodied in the concept of *terroir*, a term which attempts to capture all of the environmental and cultural influences in growing grapes and making wine. *Terroir* is derived from the Latin "terra" or "territorium" and its first modern definition appears as "a stretch of land limited by its agricultural capacity." Historically, the use of *terroir* as defining aspects of landscapes grew out of the wine production traditions of the Cistercian monks in Burgundy, but the term was also broadly embraced by the French as an agricultural production concept tied to specific regions (i.e., wine, cheese, pâté, and other specialty crops). Burgundians also used the concept to market their wine, promote tourism, affirm regional traditions and obtain a comparative advantage over other regions, leading some to see it as an economic protection mechanism, even back then. Over time the French approach and ideals embodied in *terroir* eventually led to the Appellation d'Origine Contrôlée (AOC) system in 1935—a French certification system that is used to legally delineate geographical regions and regulate agricultural products (*produits du terroir*).

While the natural components of *terroir* encompass weather/climate, geology, soil and their interactions, general perceptions of *terroir* often point to "land" or "soil," a form of "geographic identity," "a sense of place," or as Matt Kramer of the Wine Spectator put it so eloquently: "somewhereness." As one might expect, there have been controversies and debate in wine circles between Europe and the New World, whereby *terroir* is discussed in "traditional" versus "industrial" production terms, as being "naturally endowed" versus "marketed," and as an outcome of "protectionism" versus "experimentation" approaches to growing grapes and making wine. While examination, scrutiny, and debate over *terroir*'s role in wine production is rightfully ongoing, what is clear is that climate is arguably the most critical environmental aspect in viticulture and wine production.

Wind

The role that the wind plays in the growth of the grapevine and the production of fruit is exhibited mainly through its effects on vine health and yield, but wind can also play a role on the heat budget of a vineyard. This is physically apparent through direct contact with the vines and through physiological effects of photosynthesis disruption (stomata closure) and reduced disease infestations. During the early stages of vegetative growth, high winds can break off the new shoots, delaying and even reducing the amount of flowering. As the berries proceed through *véraison* and into the maturation stage, high winds can be very effective at desiccating the fruit and can result in lower volume and quality. However, drying winds that occur at night and early morning can help reduce the occurrence of fungus-borne diseases by limiting the formation of dew on the leaves and berries. Nighttime winds can also be beneficial—they can help limit the occurrence of radiation frosts.

Local winds, generated from a region's topography, are very common in viticultural areas worldwide. The most common local winds are the general land-sea breeze (affecting coastal regions or those near large bodies of water) and the mountain-valley breeze (affecting inland areas with substantial topographical relief), which provides dry-summer viticulture regions with some relief through late afternoon advection from the coast or down the mountains. While the overall occurrence of winds can have both positive and negative effects on the growth and maturation of grapevines, wind can be mitigated by location, topography, and the use of natural and man-made windbreaks. However, windbreaks in a region also might serve as an obstruction for cold air drainage and could enhance frost or freeze conditions.

Precipitation, Humidity, and Water Balance Characteristics

Given its importance to the growth and productive balance in grapevines, fruit quality, yield, and disease pressure, understanding water relationships in any wine region is very important. Factors such as ambient atmospheric moisture or humidity, local rainfall frequency and timing, soil water-holding capacity, and evapotranspiration rates are all important aspects. In addition, each of these aspects of water availability can be evaluated in terms of a water balance or budget.

Atmospheric moisture is very important in regulating the evaporative demands put on the grapevines and the occurrence of fungal diseases. During the growth stages of the grapevine, some of the climatic conditions that can most severely afflict the vines and berries are associated with moisture. Atmospheric moisture is commonly measured as relative humidity, and as such it displays a distinct diurnal and seasonal cycle. Relative humidity is normally highest early in the morning, when temperature is lowest, and at a minimum during the

Reference 5

UC DAVIS
VITICULTURE & ENOLOGY

Vineyard Impacts on Flora

Home > Industry Info > Enology > Fermentation Management Guides > Wine Fermentation > Vineyard Impacts on Flora

Vineyard Impacts on Flora

Fermentation management begins in the vineyard. This is especially true for native flora fermentations but even inoculated fermentations can be influenced by the nature of the organisms present on the grapes. Grapes, leaves, bark, even the trellis system and irrigation systems support microbial flora in vineyards. The type of microbes best adapted to the localized environment of the plant will dominate that surface, but rarely is a single species of organism able to completely dominate an environmental niche. In fact the opposite is most often true - a community of metabolically diverse organisms is found co- localized in the same habitat. This diversity stabilizes the population against changing environmental conditions and may alternately favor blooms of certain species as conditions warrant. Changing the berry surface flora can therefore be difficult if not impossible as organisms become highly adapted to their environment and difficult to completely displace. With respect to subsequent fermentation many of these organisms are inconsequential, but others may have a profound impact on the fermentation and the flora of the fermentation. If native flora fermentations are to be conducted then it is important to “farm” the optimal flora on the surface of the fruit pre-harvest. There are several viticultural factors that impact grape flora.

Varietal Factors

There are grape variety-specific factors that can impact the types and numbers of organisms at harvest. The principal factor affecting microbial loads on the surface of the grape is the amount of nutrient seepage from the fruit to its surface. In addition some varietals may make antimicrobial compounds excreted from the surface that may limit the growth of some classes of organisms, or favor the growth of beneficial organisms over undesired or damaging ones. The organisms themselves can produce inhibitory substances so in supporting a beneficial population the plant may gain secondarily if that population has the ability to inhibit invasive organisms. Several studies have shown that grape flora yeast are able to inhibit *Botrytis* and block invasion of the fruit. The converse is also true - once *Botrytis* becomes established it is able to make compounds that inhibit the beneficial flora. Which population wins the battle depends upon which population is favored by the nutrients available from the fruit on its surface.

In general, nutrient availability favors the bacteria and molds. Bacteria and molds are both able to produce large amounts of biomass faster and with less organic substrates needed than the yeasts. The yeasts are specialized organisms that do well in more nutrient rich environments, like crushed fruit, than with limiting nutrients. If there is seepage of high sugar contents this favors yeast but this usually only occurs if there is some damage to the berry or cluster. Organisms generally are adapted to specific types of energy sources.

The tendencies of berries to seep nutrients varies by the variety. Some berries detach from the rachis more readily than others leading to greater leakage of components. Fruit with thicker walls are less likely to leak internal components. Varieties that create tightly packed bunches with obvious deformity and damage to fruit will also have higher sugar leakage rates on the fruit surface. If the pulp does not contain any inhibitory phenolic compounds but only growth nutrients then those organism more readily adapted to sugar will be favored. If other berry components are also being released, such as phenolic compounds, or polyphenol oxidase, these

components may inhibit sensitive organisms and favor the resistant ones. Although only limited studies have been performed, those that have suggest that as sugar seeps from the fruit there is a change in populations to favoring the lactic acid bacteria (Lactobacillus) and the must non-*Saccharomyces*yeasts (*Hanseniaspora, Metschnikowia, Candida*) over the microbes present during earlier stages of maturation.

Site Factors

Site-specific factors can also impact the flora of the grape surfaces at all stages of ripening. Climatic conditions influence fruit composition, but also three other important secondary effects on grape flora: nature and type of insect vectors present in the vineyard, the localized temperature of the surface of the fruit, and the relative humidity of the surface of the fruit or within the cluster. Soil composition affects the nature and concentrations of soil microbes and, depending upon vineyard practices, these organisms may be transferred to the surface of the fruit, generally as transient species, but they may be there at the point of harvest.

Of the climatic factors the two most important are temperature and humidity. Some microbes are more heat tolerant than others, with the bacteria being the most heat tolerant of the microbial kingdom. Warm berry surfaces tend to favor larger populations of bacteria. Humidity also exerts a strong impact. All organisms have a range of available water under which growth is permissive. Above this range (too much water) cells have difficulty maintaining the integrity of the membranes and preventing osmosis from bringing in so much water the pressure causes the membranes to rupture. The relative strength if the cell wall is important here as well. If the available water is too low the cells will lose water and not have sufficient water to keep cellular components hydrated and to foster molecular movement within the cell. Shriveling of the cell can occur, which may be fatal. Many microbes can form spores or other resistant bodies that can withstand extremes of water availability and temperature and under these conditions become dormant but are not eliminated from the population. As with plants, some microbes are more resistant to water excesses or deficiencies than others. Many of the

molds require a narrow window of humidity to sustain population growth.
Viticulture and Enology
Molds can grow quickly as filaments and cover a wide territory but they are very sensitive to dehydration as a consequence. Localized humidity of the clusters is important as well as this can foster mold growth. Molds produce asexual spores that can be airborne and spread the colony over great distances so even a localized infection can become a problem for the entire vineyard if conditions quickly become favorable, such as a late rain. Microbes are much more resistant to cool temperatures so temperature decreases at night or late in the season often may be inhibitory to growth but not lethal to a well-established population on the surface of the fruit.

Another site factor that can have an impact is wind. If the vineyard is in a very windy area, humidity will likely always remain low, but significant wind may impact berry structure leading to small berries with thickened cell walls. This in turn may impact seepage and the flora present on the surface of the fruit.

Seasonal Factors

The microbial flora of the grape surface can be influenced by the season indirectly via impacts on climate and insect and animal vectors resident in or visiting the vineyard. Very few studies have looked at seasonal impacts on resident flora directly. However, the impacts on insects as discussed below may be dramatic across seasons. If climate tends to vary dramatically over the growing season there will be a strong seasonal influence due to climactic variation.

Floor Management

The microbes of the soil environment can be transferred to the fruit during any normal vineyard operation that disturbs soil and creates dust. Often these microbes are highly adapted to the soil environment and unable to displace the microbes of the fruit surface. However most of the soil microbes are spore formers so they can persist on the grape surfaces and may be transferred to the winery without actually needing to have grown on the surface of the fruit. Soli fungi, filamentous bacteria and bacilli have been isolated from winery surfaces and from musts suggesting that they were viable and present at the time of harvest. Depending upon which specific

Reference 7

Goldammer, Ted. Grape Grower's Handbook., Centreville, Virginia: Apex Publishers, 2013.

wind

Wind

Light breezes maintain air circulation around the berries stopping the buildup of humidity and maintaining an even temperature within the canopy. However, high winds can cause serious damage to grapevines, especially to vines in the spring and early summer, when shoots are tender and more easily broken. Exposure to moderate and high winds also have a desiccating effect due to the high evapo-transpiration rates, which causes physical damage. As the berries proceed through véraison and into the maturation stage, high winds can be very effective at desiccating the fruit and can result in lower volume and quality. Winter winds may also serve to reduce the heat budget for a site and thus increase cold injury. In regions with significant wind issues, the direction of rows should run parallel to the prevailing wind where possible in order to minimize damaging effects of wind. In humid climates, positioning the vine rows at right-angles to the prevailing winds can increase surface drying of the foliage and fruit by enhancing wind turbulence.

Evaporation

Evaporation is based on various climatic factors such as temperature, day length, wind, vapor pressure and solar radiation which affects plant growth. The actual and potential evapotranspiration is based on

Page 57

latitude 50 deg.) is a good example of a reg... Valley vineyards sit on hills that slope in all different directions at ...

A prospective site should be free of depressions on the slope, called frost pockets since they can collect cold air. Frost pockets are often accompanied by fog, so they are rather easy to identify. It's still very possible to plant a vineyard on a hillside with one or more frost pockets, but the vines themselves should not be planted near the pockets, as they will likely suffer from colder temperatures.

Aspect

A vineyard's aspect refers to the direction that the slope faces (e.g., east, southeast, etc.). Aspect affects the angle that the sunlight hits the vineyard and thus its total heat balance. Aspect is more important in higher latitudes where radiation is weaker, due to the angle of the sun, and light interception may be limiting to growth. Among a site's physical characteristics, aspect is probably least important, being far outweighed by elevation, soil properties, and degree of slope. In the Northern Hemisphere east, south and west facing slopes are preferred while in the Southern Hemisphere east, west or north facing aspects are preferred.

Southern-facing Aspects

Vineyards with southern aspects (for the Northern Hemisphere) warm earlier in the spring and the vines may undergo bud break earlier than vineyards with northern aspects. The early bud break is desirable in locations that do not have a danger of spring frost because it translates into earlier bloom and harvest of the fruit. However, in frost-prone areas early bud break can increase the potential for frost damage in the spring. Southern-facing aspects can lead to more extensive vine warming on sunny winter days than on northern aspects. The consequences could be reduced cold resistance and subsequent cold injury. Bark splitting and trunk injury to the southwest sides of vines is occasionally observed and is related to trunk warming on sunny winter days with subsequent, rapid cooling.

moderate fertility, and minimal soil salinity. Soils that are limiting in some of these ch
can be improved by modifications such as installing drainage tiles, deep ripping of soil t
restrictive layers, irrigation, lime application to modify soil pH, and appropriate fertilization

Physical Properties

Viticultural soils have traditionally been chosen by their physical properties. Moisture sto
drainage are considered important for good grape production, especially in areas where irrig
unavailable or not permitted. Shallow, poorly drained soils tend to be susceptible to waterlogg
moisture deficiency with only average fluctuations in rainfall.

Soil Texture

The primary soil property in determining a suitable site is soil texture. The direct effects of soil texture (proportions of sand, silt and clay) on wine quality are poorly defined, but the indirect effects of texture on soil hydrology are more important. Texture affects the water-holding capacity of the soils and internal water drainage. Ideal vineyard sites would have loam, sand loam or sand clay loam textures.

Soil Drainage

With undulating topography, superior vineyards sites will typically be situated on convex land patterns—features that tend to shed surface water, rather than collect it. Concave land forms—swales, ravines, or gullies—are usually areas of poor water drainage but offer passive frost protection (See Figure 4.3). Thus, the vineyard must be located in an area where no ponding or puddling of water will occur for extended periods following a rain. This is especially crucial during the growing season. Open ditches may provide drainage in regions with shallow grades; however, in most situations drainage tiles are

- B Horizon: … *illuviation* where downward moving, especially fine material, is accumulated. The accumulation of fine material leads to the creation of a dense layer in the soil. The B horizon is often observed at a depth of about 1 to 3 feet (0.3 to 0.9 m). The upper portions of this horizon may show some change in soil structure from tillage, but the effect is likely to decline with depth.
- C Horizon: The C horizon is the material from which the mineral part of the soil forms. It is the parent material of soils. The C horizon often is composed of unconsolidated parent material from which the A and B horizons have formed. It lacks the characteristic features of the A and B horizons and may be either relatively unweathered or deeply weathered. The C horizon influences many soil properties, especially color, permeability, base content, particle size, mineralogy, and nutrient content.

Parent Material

Parent material refers to material from which the soil has been derived and, in most cases, is of geological origin. The nature of the parent material can have a profound influence on the characteristics of the soil. The mineralogy of the parent material is mirrored in the soil and can determine the weathering process and control the natural vegetation composition. For example, lime-rich parent materials tend to produce calcareous soils. Acid rich parent materials tend to produce acid soils. Three types of parent material are recognized:

1. Residual or Sedentary: Developed in place (in situ) from the underlying rock. Typically it experienced long and intense weathering. Residual parent materials can be found overlying any rock type – provided that the landscape has been stable for a sufficient period of time for weathering to occur.
2. Transported: Loose sediments or surficial materials (i.e., weathering products of rocks that are not cemented or consolidated) that have been transported and deposited by gravity, water, ice, or wind. These materials …

Reference 8

http://www.ajevonline.org/content/ajev/57/1/89.full.pdf

From Proceedings of the Soil Environment and Vine Mineral Nutrition Symposium

Grapevine Rooting Patterns: A Comprehensive Analysis and a Review

David R. Smart,[1]* Erin Schwass,[1] Alan Lakso,[2] and Lisa Morano[3]

Abstract: Grapevines are grown either on their own roots or on rootstocks that represent a mixture of grapevine species and hybrids. Developmental and physiological factors other than phylloxera resistance, lime tolerance, and ease of propagation were not directly considered during rootstock breeding, including rooting patterns. Here, in a comprehensive literature synthesis, we have compiled information concerning rooting depth distributions of grapevine roots from wall profile studies comprising a broad range of soil environments and rootstock genotypes. We considered the distributions based on the asymptotic equation of $Y = (1 - ß^d)$, where d = soil depth (cm) and Y = the proportion of roots from the surface to depth d. The median value of ß for the root distributions analyzed was 0.9826 and the standard deviation over all observations was 0.0068 (n = 240); most profiles had fitted values of ß generally greater than 0.975. This value places the depth distribution of grapevine roots in the vadose zone among the deepest observed for plants worldwide. The data suggested that soil properties such as the presence of soil profiles impermeable to root penetration, stoniness, and presence of gravel lenses have a greater influence on depth distributions than does genotype, even in deep fertile soils. Genotypic differences were not apparent, although the rootstock O39-16 (ß = 0.9867 ± 0.0009, mean ± se, n = 11), with a reputation for deep-rooting behavior, did exhibit deeper root distributions. The analysis also suggests that root characteristics other than root horizontal and vertical spread may need to be considered in order to explain some key rootstock characteristics like scion vigor or drought tolerance.

Key words: grapevine rootstocks, root distribution, rooting depth, vineyard soil

Roots provide structural support and surface area for water and mineral nutrient absorption. For grapevines and many other lianas, the existence of tendrils (Mullins et al. 1992) curtails the need for roots as structural support organs. Consequently, the evolution of grapevine root form and function has probably been directed by factors other than support, like demands for water and nutrient foraging. For the rootstock species and hybrids within the genus *Vitis*, the size of the root system, in terms of its horizontal and vertical depth distribution, is important to water and nutrient foraging capacity. Variation in vertical and horizontal depth distribution of grapevine root systems may have a genetic component (Guillon 1905, Pongrácz 1983) (Figure 1), while environmental parameters controlling phenotypic expression may play a more definitive role (Perold 1926, Winkler et al. 1974, Van Zyl 1988). Teasing apart the relative contributions of environmental versus genetic controls on root distributions of grapevines and then understanding functional differences among the diverse genotypes that represent grapevine rootstocks will be extremely challenging.

Work conducted primarily in South Africa has suggested that variation in vine form and function aboveground (mainly size) may serve as an indicator of characteristics

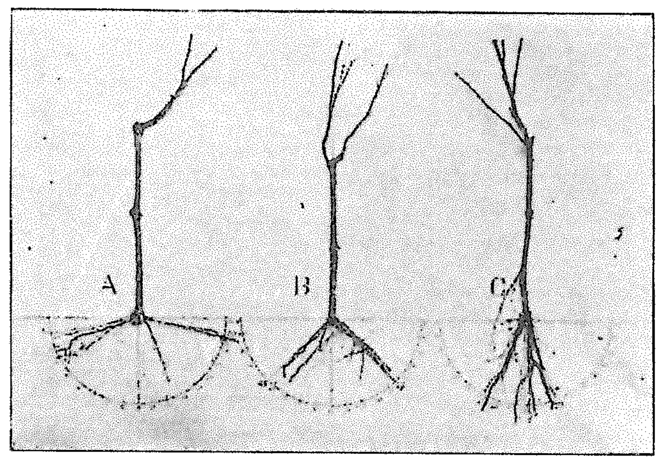


Figure 1 Emergence angles of adventitious roots produced by cane cuttings of, from left to right, Riparia Gloire de Montpelier (*V. riparia* Michaux), *V. riparia* x *V. rupestris* cv. 3309C, and Rupestris du Lot (*V. rupestris* Scheele) (Guillon 1905; reproduced with the permission of Masson Publishers/Dunod, Paris).

[1]Department of Viticulture and Enology, University of California, One Shields Ave., Davis, CA 95616; [2]Department of Horticultural Sciences, New York State Agricultural Experiment Station, Cornell University, Geneva, NY 14456; [3]Department of Natural Sciences, University of Houston, Downtown, Houston, TX 77002.

*Corresponding author [fax: 530-752-0382; email: drsmart@ucdavis.edu]

Acknowledgments: Support from The American Viticulture Foundation and the USDA/CSREES Special Research Grants Program 2001-34360-10328 and 2003-34360-13177 is gratefully acknowledged. The root mapping data in New York was obtained from unpublished maps done in 1962-63 provided for retracing and further analyses to A. Lasko by Dr. Nelson Shaulis of Cornell University, now deceased. We thank Anna Vu and Christine Stockert for technical assistance. David M. Eissenstat, Kerri L. Steenwerth, and M. Andrew Walker made many helpful comments that greatly improved both the scope and clarity of this manuscript.

This article was first published in the Proceedings of the Soil Environment and Vine Mineral Nutrition Symposium. L.P. Christensen and D.R. Smart (Eds.), pp. 153-169 (2005). American Society for Enology and Viticulture, Davis, CA.

have the deepest root distributions. The average value of ß over all species and hybrids of grapevine we analyzed was 0.9826, with a standard deviation of 0.0068 (n = 240). The fits to the model indicated that approximately 63.2 ± 2.6% (mean ± 95% CI, n = 240) of grapevine roots were in the upper 60 cm, and 79.6 ± 2.4% (mean ± 95% CI, n = 240) within the upper 1.0 m. For the coniferous forests (Jackson et al. 1996), the percentage of roots encountered to the same depths was 76.7% and 91.2%, respectively. Thus, grapevines as a group appeared to have proportionally deeper root distributions in the vadose zone compared with many plants in natural ecosystems. It must be kept in mind that grapevine root distributions reported are from selected, disturbed, and managed agricultural systems. Factors such as cultivation or altered competitive relationships may influence the above results compared with undisturbed natural ecosystems. This observation also does not indicate that grapevines have extremely deep roots per se. Many other plants have been reported to have roots up to 50 meters longer than the longest reported for grapevine (Stone and Kalisz 1991, Canadell et al. 1996). The maximum rooting depth of grapevines and how maximum rooting depth relates to vine performance are yet to be determined. Given the depth of grapevine roots in the upper one to two meters of soil, we expect their roots to reach depths comparable to those reported for other woody taxa.

Lateral spread of grapevine roots. Investigations characterizing lateral spread of grapevine roots were rare. Studies that did so generally relied on arrays of soil cores from which root length densities or fresh weights of roots were recorded. In at least three cases, detailed excavations were undertaken (Horvath 1959, Kozma 1967, Saayman and Van Huyssteen 1980, McKenry 1984, Morlat and Jacquet 2003). These researchers generally found fairly high root densities at distances greater than a meter from the vine trunk. Although Saayman and Van Huyssteen (1980) found lateral spread was somewhat restricted in a soil previously ripped along the vine row, they nevertheless found that root densities were still relatively high at 1.5 m from the trunk.

Nagarajah (1987) quantified root length densities into the row for own-rooted *V. vinifera* cv. Thompson Seedless and Thompson Seedless grafted onto *V. champinii* cv. Ramsey rootstock. He used an array of cores sampled at 30, 90, and 120 cm into the vine row from the trunk, and in 10-cm increments to 120 or 220 cm depth, depending on soil texture. He found root length densities to range between 0.4 and 1.7 mm cm^{-3} depending on soil texture, with coarse-textured soils having the lowest root densities and fine-textured soils having the highest densities. Horizontal root length densities suggested that the spread of these two genotypes was fairly extensive with respect to the areas sampled, with density diminishing by an average of only 28.0 ± 5.4% (mean ± se, n = 9) from 30 to 90 cm distance from the trunk. Perry et al. (1983) used a slurry method to quantify root length densities in samples extracted from cores taken in the row for four grape species (Appendix). They found unacceptable variation in core samples as compared with wall profiles and reported the technique to be unreliable. McKenry (1984) examined lateral spread of roots in a Thompson Seedless vineyard using root length and fresh mass. He found that approximately 11.6% and 14.4% of the total root biomass were found 1.2 to 1.5 meters from the trunk when excavated to a depth of 1.2 m with respect to a raised berm (Figure 4). This was actually a fairly large proportion considering roots excavated near the trunk were large framework roots and thus would weigh more. The detailed drawings of Kozma (1967) indicated that some larger framework roots can reach a maximum spread of approximately 10 m, and our own excavations support this contention (D. Smart, unpublished data, 2002).

Soil physical properties and grapevine roots. Soil texture may influence rooting patterns in the sense that fine-textured soils would have higher water-holding capacities, lower resistances to water extraction, and shallower infiltration rates than coarse-textured soils (Brady and Weil 2002). So, it might be predicted that root systems in fine-textured soils would be smaller and shallower and, conversely, those in coarse-textured soils deeper (Sperry et al. 1998, Jackson et al. 2000). Even so, correlations between texture and horizontal or vertical spread in natural ecosystems have not been found (Schenk and Jackson 2002).

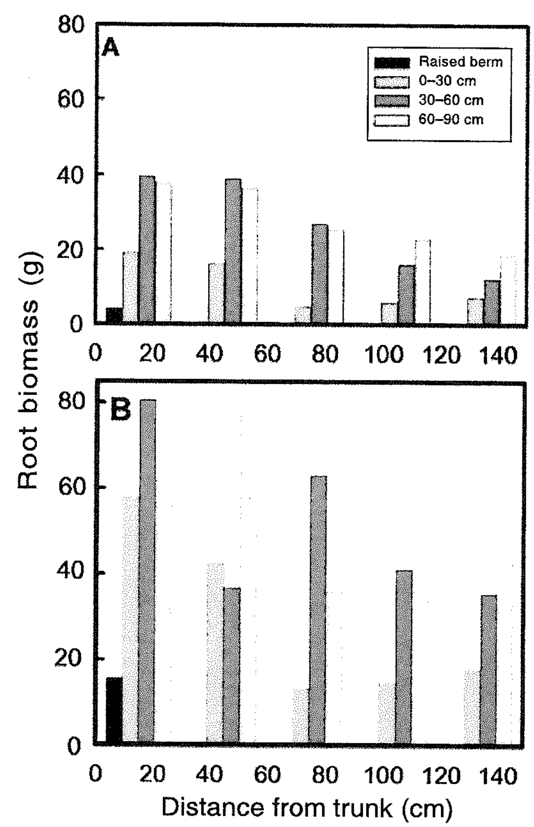


Figure 4 Root fresh biomass (g m^2) for (**A**) *V. vinifera* cv. Thompson Seedless and (**B**) *V. solonis* X *V. rupestris* cv. Ramsey (McKenry 1984).

Cover crop. A close-growing crop grown primarily to improve and protect the soil between periods of regular crop production, or a crop grown between trees and vines in orchards and vineyards.

Cutbanks cave. Unstable walls of cuts made by earth-moving equipment. The soil sloughs easily.

Depth to rock. Bedrock at a depth that adversely affects the specified use.

Drainage class (natural). Refers to the frequency and duration of periods of saturation or partial saturation during soil formation, as opposed to altered drainage, which is commonly the result of artificial drainage or irrigation but may be caused by the sudden deepening of channels or the blocking of drainage outlets. Seven classes of natural soil drainage are recognized:

Excessively drained.—Water is removed from the soil very rapidly. Excessively drained soils are commonly very coarse textured, rocky, or shallow. Some are steep. All are free of the mottling related to wetness.

Somewhat excessively drained.—Water is removed from the soil rapidly. Many somewhat excessively drained soils are sandy and rapidly pervious. Some are shallow. Some are so steep that much of the water they receive is lost as runoff. All are free of the mottling related to wetness.

Well drained.—Water is removed from the soil readily, but not rapidly. It is available to plants throughout most of the growing season, and wetness does not inhibit growth of roots for significant periods during most growing seasons. Well drained soils are commonly medium textured. They are mainly free of mottling.

Moderately well drained.—Water is removed from the soil somewhat slowly during some periods. Moderately well drained soils are wet for only a short time during the growing season, but periodically for long enough that most mesophytic crops are affected. They commonly have a slowly pervious layer within or directly below the solum, or periodically receive high rainfall, or both.

Somewhat poorly drained.—Water is removed slowly enough that the soil is wet for significant periods during the growing season. Wetness markedly restricts the growth of mesophytic crops unless artificial drainage is provided. Somewhat poorly drained soils commonly have a slowly pervious layer, a high water table, additional water from seepage, nearly continuous rainfall, or a combination of these.

Poorly drained.—Water is removed so slowly that the soil is saturated periodically during the growing season or remains wet for long periods. Free water is commonly at or near the surface for long enough during the growing season that most mesophytic crops cannot be grown unless the soil is artificially drained. The soil is not continuously saturated in layers directly below plow depth. Poor drainage results from a high water table, a slowly pervious layer within the profile, seepage, nearly continuous rainfall, or a combination of these.

Very poorly drained.—Water is removed from the soil so slowly that free water remains at or on the surface during most of the growing season. Unless the soil is artificially drained, most mesophytic crops cannot be grown. Very poorly drained soils are commonly level or depressed and are frequently ponded. Yet, where rainfall is high and nearly continuous, they can have moderate or high slope gradients, as for example in "hillpeats" and "climatic moors."

Drainage, surface. Runoff, or surface flow of water, from an area.

Erosion. The wearing away of the land surface by running water, wind, ice, or other geologic agents and by such processes as gravitational creep.

Erosion (geologic). Erosion caused by geologic processes acting over long geologic periods and resulting in the wearing away of mountains and the building up of such landscape features as flood plains and coastal plains. Synonym: natural erosion.

Erosion (accelerated). Erosion much more rapid than geologic erosion, mainly as a result of the activities of man or other animals or of a catastrophe in nature, for example, fire, that exposes a bare surface.

Excess fines. Excess silt and clay. The soil does not provide a source of gravel or sand for construction purposes.

Fast intake. The rapid movement of water into the soil.

Favorable. Favorable soil features for the specified use.

Fertility, soil. The quality that enables a soil to provide plant nutrients, in adequate amounts and in proper balance, for the growth of specified plants when light, moisture, temperature, tilth, and other growth factors are favorable.

Fine textured (heavy textured) soil. Sandy clay, silty clay, and clay.

First bottom. The normal flood plain of a stream, subject to frequent or occasional flooding.

Flooding. The temporary covering of soil with water from overflowing streams, runoff from adjacent slopes, and tides. Frequency, duration, and probable dates of occurrence are estimated. Frequency is expressed as none, rare, occasional, and frequent. *None* means that flooding is not probable; *rare* that it is unlikely but possible under unusual weather conditions; *occasional* that it occurs on an average of once or less in 2 years; and *frequent* that it occurs on an average of more than once in 2 years. Duration is expressed as *very brief* if less than 2 days, *brief* if 2 to 7 days, and *long* if more than 7 days. Probable dates are expressed in months; *November-May*, for example, means that flooding can

Reference 9

undefined

Growing Degree Days

GDD Inaccuracies

How the growing degree calculation is made and one of the limitations (that growing degree days are linear and crop development is not linear) have been pointed out. There are other limitations. One that should be obvious from the rules previously stated is the limitation of what to do with the low or the base temperature. If the threshold temperature, called THR, is 50° F, the actual low temperature is 50° F and the high temperature is 70° F, there were 10 growing degree days during the 24-hour period. During the period, the temperature warmed up to 70° F, and later assume it cooled back down to 50° F. If lines connect the temperature values, the area under the "curve" represents crop growth/development potential (Fig. 3.14). However, temperature seldom varies between the daily low and high value in a manner linear with time. Hence, the "area under the curve" is not totally realistic.

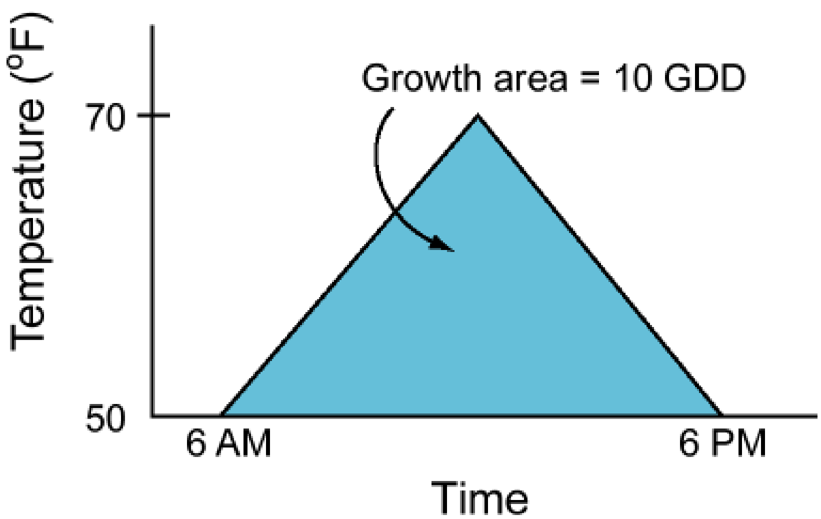


Fig. 3.14 GDD assumes temperature changes linearly throughout the day. Click on figure for actual temperature change.

Now, observe a third inaccuracy of the growing degree day, the condition wherein the low temperature falls below 50° F. At 50° or above, and with averaging over some days, errors would be small. Consider that the high was 70° but the low temperature fell to 40°. Remember the rule. If the low temperature is below 50°, call it 50°. So, move it up and call it 50°. The growing degree day accumulation for that day remains at 10. Even though the night temperature had been 40°, there would still be a 10 just like during the previous day. There is some error involved in this (Fig. 3.15). The plant did not start growing until the temperature reached 50. So there were some hours between the 40° and 50° when it would be assumed that the plant was growing, but it really was not. This error gives the plant more growing degree days than the plant actually recognized or received. So there is an area of error and, of course, the area of error may be compounded by the evening cooling as well.

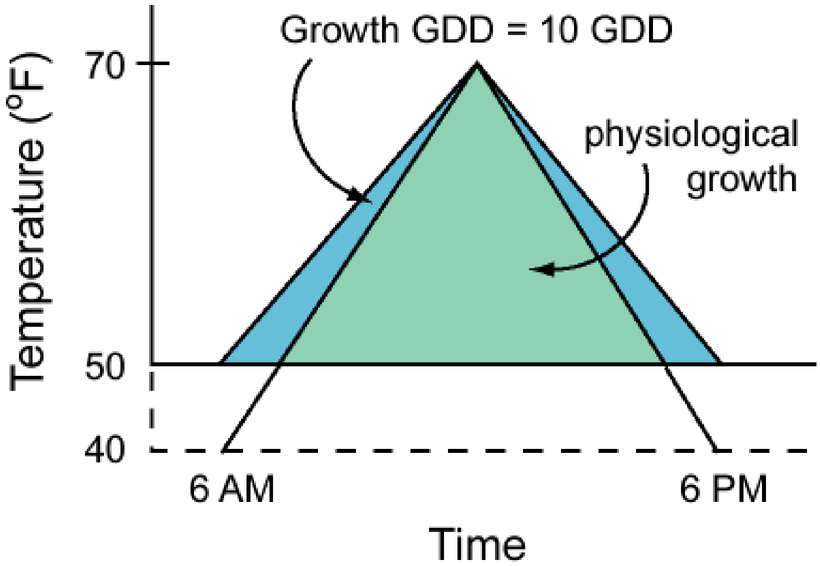


Fig. 3.15 Error in GDD calculation. The GDDs for this day would be 10. But the growth area would actually be less because the crop would not grow until temperatures moved above 50 °F.

With this error, introduced by assuming that the temperature was 50° even though it was only 40°, plants do not grow or develop as fast as anticipated.

There are three inherent errors: First, the inherent error that growing degree days assume linear growth (Fig. 3.11); second, the "shape" of the temperature trend with time (Fig. 3.14); third, the error of adjusting the minimum temperature up to the base when we calculate, so there is a little area of mistake if things under the area of the curve are considered (Fig. 3.15).

Now, someone might say, "Okay, fix it. An account needs to be made for this area that has an error." This has been done. A lot of work was done at Iowa State University, primarily by entomologists, to do just that. During a 24-hour period, there will be a minimum temperature that existed at some time,usually just before sunrise. Soon after the sun comes up, the temperature starts to increase, usually quite rapidly. Then the increase rate diminishes, and a peak is reached for the day. Temperature will fall to whatever the low for the next night might be. It may be different from the previous night. Nevertheless, it will taper off. This peak will probably come around 1 p.m. standard time or at least some time in the afternoon. The low point will probably come around 6 a.m., actually just before sunrise or just the minute or two after sunrise.

A temperature curve of what might happen during a day is shown in Figure 3.16 (warming up quite quickly when the sun comes up, usually if it's a clear day, hitting a peak around 1 p.m. standard time, then tapering off slowly until 6 a.m. the next morning to the minimum for the 24-hour period). Someone might say, "We would do better to draw a curve something like a sine curve rather than a growing degree day straight line that indicates changes from 6 a.m. to 1 p.m. and then another straight line for the period 1 p.m. to 6 a.m. the next day." A method was developed for calculation of growing degree days called the "sine wave method" that assumes that the day heats up slowly and reaches a peak around 1 o'clock. It then cools off in a uniform way according to a smooth sine curve.

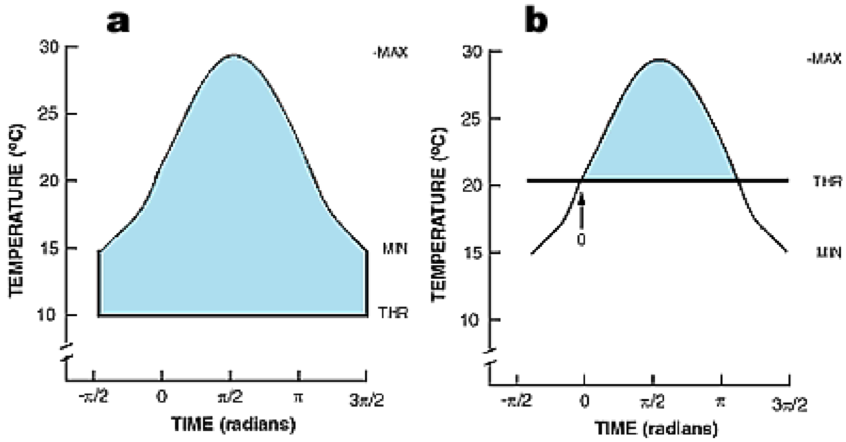


Fig. 3.16 Sine wave approximation to daily temperature.

A growing degree day calculation according to a sine curve makes it possible to correct one of the errors described earlier. If the minimum temperature were somewhat below threshold (Fig. 3.16b), the temperature of the day rose, and attained a peak, the sine wave would define the hour it will cross the threshold temperature. The plant will grow according to the area beneath that curve and be considerably more accurate than the straight line method.

GDD Advantages

This more accurate way is not generally used. An interesting study was done a few years ago. An entomologist in a neighboring state expressed some criticism. He said, "Iowa developed the sine method of calculating growing degree days, while Iowa is not using them. Iowa is using growing degree days by the old Weather Service method which has been used since 1900." The reply was, "There are two reasons we do that! The first reason is, Iowa has used the Weather Service method since 1900. Everyone has that record; hence, ongoing measurements and data are consistent with the historical record. The second reason is, data indicate that the growing degree day method (after the inaccuracies of the growing degree days were adjusted to base 50) gives better results with the Black cutworms than the method that uses the sine wave calculations."

The results are better using the original method, for black cutworms under field conditions at least, than for using the sine wave method. The sine wave method is better for use with insects reared inside the laboratory. For those that are growing outside, the straight line, old-fashioned method turns out to be the best. Why it turned out to be the best is not really known. Some ideas have been suggested. The worms move around to places having different temperatures, Maybe their activity is sort of compensated for in the error in the method. Certainly the worms do move around. If the temperatures get too hot, they dig a hole in the ground and go down to where it is cool enough for them to be comfortable. When the temperatures are appropriate on the surface, they come up to the surface and feed and do the things that cutworms do, as observed by the entomologists and this author. The results of cutworm activities are the reasons why our growing degree day calculations seem to be acceptable for Black cutworms.

There is one more reason to use the old-fashioned method for calculation, which is really the overriding reason, the accuracy of the system. When making a calculation, one does not need to have any calculation better than the accuracy of the system.

What is the biggest error in the system? Is it the calculation of the growing degree day, or is it the measurement of the temperature of the air itself? A thermometer is not perfect. The thermometer reads to the nearest degree or records something on the order of ±1° F. There is a 1° error just in the thermometer. What about the error across a field? From one side of the field to the other? On a south-facing slope, and a north-facing slope, the plants grow differently. Even if the soils are the same, there is different response to temperatures, different emergence times, and different development rates. The temperature variation across the field itself may be on the order of 5° F. If there is a variability of 5° across the field itself, the error that comes from not calculating growing degree days, the very best way pales next to the error of the temperature variability of the environment.

When growing degree days are observed, the hope is that this process is something a little better than the crop calendar that was considered previously. The crop calendar gives the average dates of planting, the average date of emergence, the dates of tasseling, and the dates of maturity as calendar dates. The growing degree day adjusts for temperature and indicates whether or not the temperature effect has been significant enough to move away from the average dates, and about how far. That can be of some benefit, and that is all it is--just SOME benefit. There is no reason to think that a growing degree day will be a perfect model for what a crop will do.