

UNIVERSITY OF
MARYLAND

EXTENSION

Solutions in your community

Joseph A. Fiola, Ph.D.

Specialist in Viticulture and Small Fruit

Western MD Research & Education Center

18330 Keedysville Road

Keedysville, MD 21756-1104

301-432-2767 ext. 344; Fax 301-432-4089

jfiola@umd.edu

<http://extension.umd.edu/smallfruit>

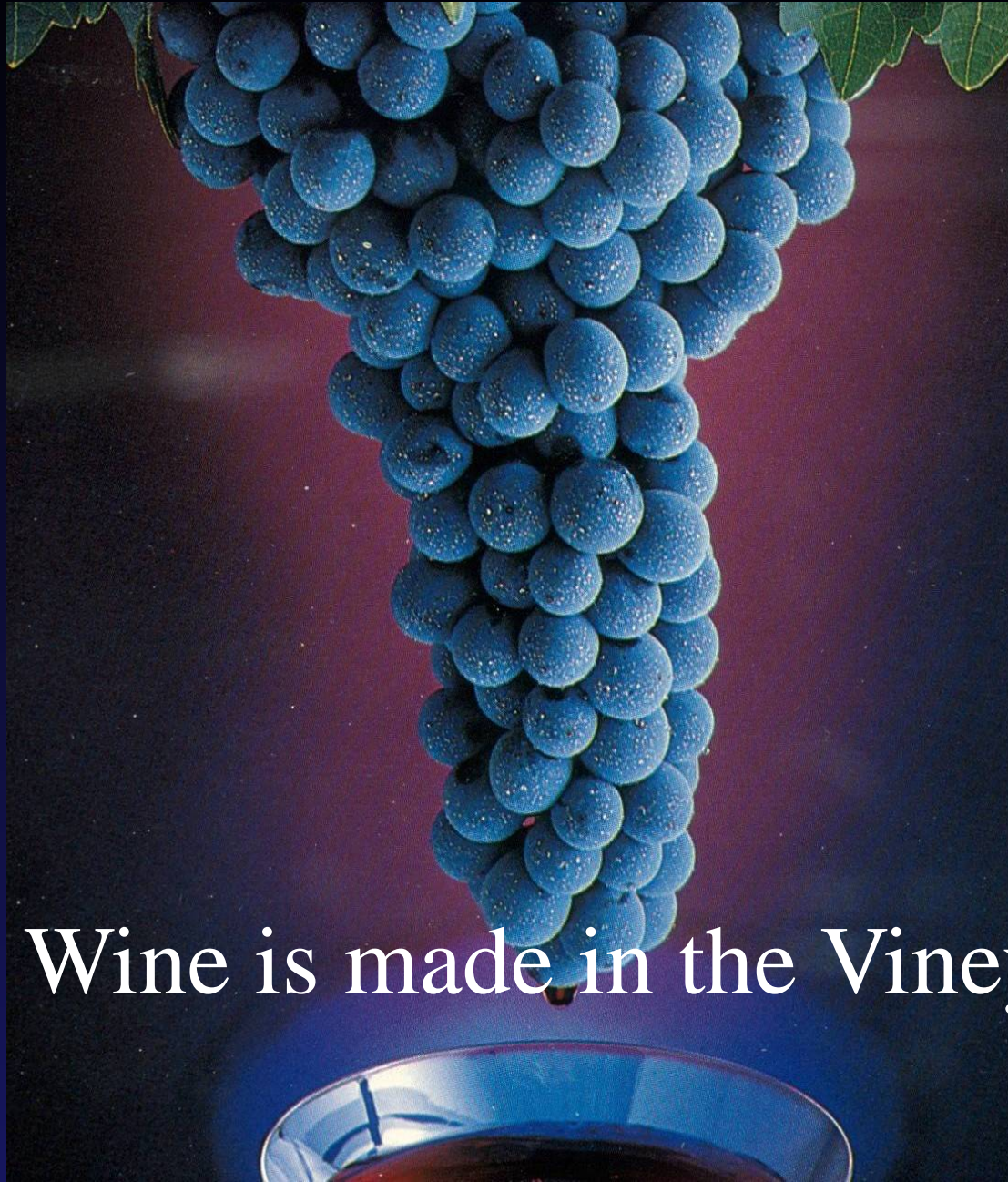
Vineyard Site Selection for Maryland's Diverse Regions

Joseph A. Fiola, Ph.D.

Specialist in Viticulture and Small Fruit

University of Maryland Extension

Vineyard Site Considerations



“The Wine is made in the Vineyard”



Grape Varieties

“The Wine is made in the Vineyard”

“Ripe grapes”

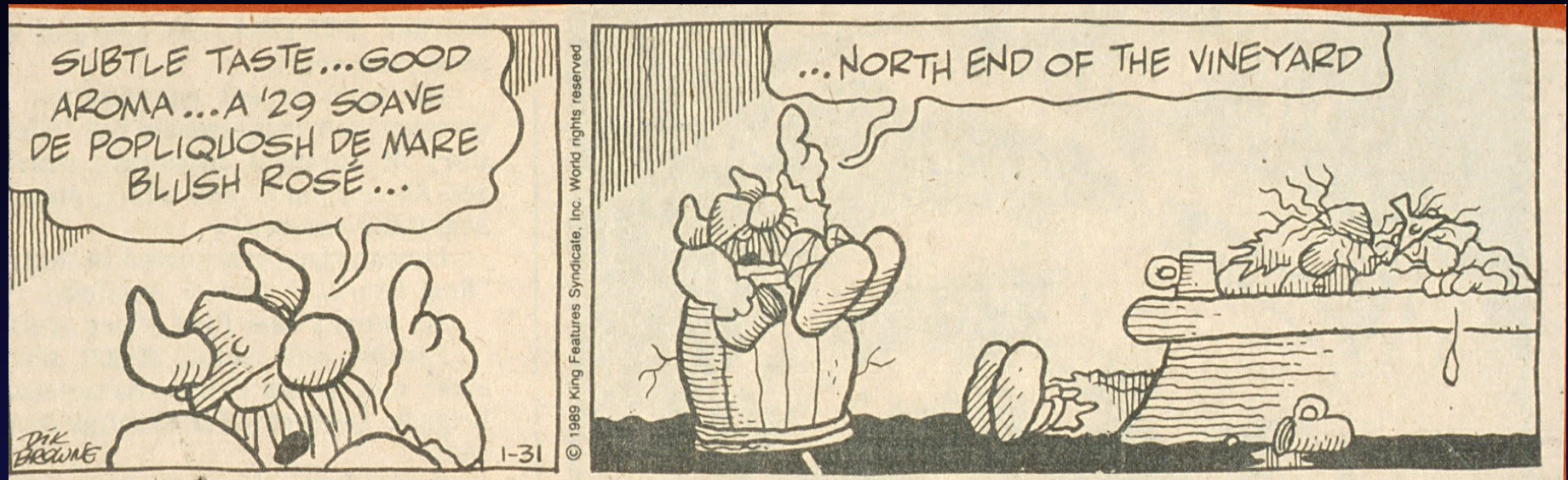
Vineyard Site Considerations

Location, Location, Location...

“The quickest way to get into
quality grape production
....is the slow way!”

Vineyard Site Considerations

Terroir



“Creating a wine that represents the soil and climate where it is grown and the hands of person who made it.”

Primary Consideration

Frequency of low temperature extremes inducing crop/vine damage
– e.g., occurrence of -5 or -10 F

Note: Low temperature damage is the number one limiting factor to consistent grape production in the Eastern US.

Water Management

*Note: Excess water may be the number one limiting factor to consistent **quality** grape production in the Eastern US.*

Contributes to

- winter damage
- excess vegetative vigor
- reduced quality during ripening

Site Considerations

- **Climate**
- **Topography**
- **Soil**
- **Proximity to Vineyard Pests**
- **Logistics**

Climate

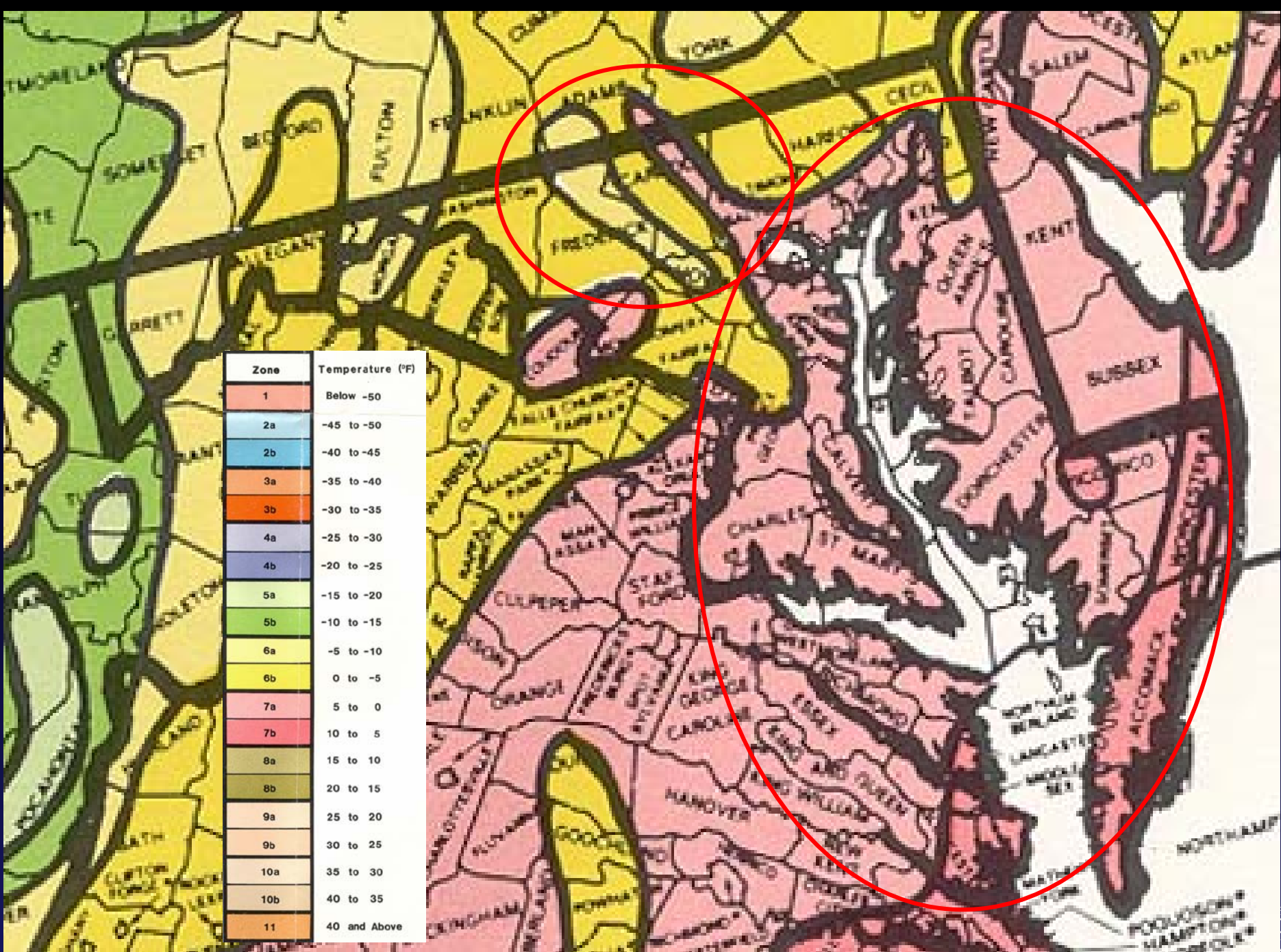
- **Macro-climate - region**
 - minimum winter temperatures
 - summer temperatures
 - Length of growing season and humidity
- **Meso-climate – specific location**
 - slope
 - moderating effect of body of water
- **Micro-climate – specific area**
 - area inside canopy or around a cluster

Vineyard Site Considerations

Macro-Climate considerations

- Length of growing season
 - 165 days generally considered as minimum
 - 180 or more days for long-season varieties
- Frequency of low temperature extremes
 - e.g., occurrence of -5 or -10 F
- Frequency of drought or excessive rains
 - need for irrigation

Zone	Temperature (°F)
1	Below -50
2a	-45 to -50
2b	-40 to -45
3a	-35 to -40
3b	-30 to -35
4a	-25 to -30
4b	-20 to -25
5a	-15 to -20
5b	-10 to -15
6a	-5 to -10
6b	0 to -5
7a	5 to 0
7b	10 to 5
8a	15 to 10
8b	20 to 15
9a	25 to 20
9b	30 to 25
10a	35 to 30
10b	40 to 35
11	40 and Above



Maryland & District of Columbia

Average Annual Extreme Minimum Temperature 1976-2005

Temp (F)	Zone	Temp (C)
-15 to -10	5b	-26.1 to -23.3
-10 to -5	6a	-23.3 to -20.6
-5 to 0	6b	-20.6 to -17.8
0 to 5	7a	-17.8 to -15
5 to 10	7b	-15 to -12.2
10 to 15	8a	-12.2 to -9.4



Vineyard Site Considerations

Macro-Climature considerations



STATION	MEAN DAILY TEMP IN JULY		RECORD LOW	DAYS OVER 90	FFP*	GDD**	UCD***	MTWM****
	Max	Min						
Abedeen	87	66	-12	19	200	3,640	IV	Very Hot
Annapolis	88	68	-8	32	204	3,700	IV	Very Hot
BWI Airport	87	67	-7	31	200	3,640	IV	Very Hot
Beltsville	87	64	-15	28	176	3,625	IV	Very Hot
Chestertown	87	67	-7	30	209	3,630	IV	Very Hot
Conowingo Dam	86	64	-10	24	199	3,500	III	Very Hot
Cumberland	88	63	-14	33	178	2,800	II	Very Hot
Denton	88	65	-11	37	187	3,650	IV	Very Hot
Emmitsburg	86	62	-27	21	162	3,250	III	Very Hot
Hagerstown	86	64	-17	25	187	3,200	III	Very Hot
La Plata	86	66	-8	24	188	3,700	IV	Very Hot
Mechanicsville	87	65	-9	24	199	3,740	IV	Very Hot
Oakland	79	56	-27	2	128	2,400	I	Warm
Owings Ferry	87	66	-8	26	200	3,700	IV	Very Hot
Parkton	84	62	-12	12	170	3,470	III	Hot
Rockville	86	64	-13	25	190	3,590	IV	Very Hot
Royal Oak	87	68	-6	26	215	3,700	IV	Very Hot
Salisbury	86	67	-8	25	196	3,690	IV	Very Hot
Unionville	85	61	-22	22	152	3,330	III	Hot
Woodstock	87	64	-18	27	172	3,500	III	Very Hot

* Average Frost-Free Period ** Medium Growing Degree Days April-October (50 degree F base)

*** Grape region classification number based on UC Davis classification system (Winkler et al, 1974)

**** Mean Temperature of the Warmest Month (July) classification system of grape growing regions (Smart and Dry, 1980)

STATION	MEAN DAILY TEMP IN JULY		RECORD LOW	DAYS OVER 90	FFP*	GDD**	UCD***	MTWM****
	Max	Min						
Abedeen	87	66	-12	19	200	3,640	IV	Very Hot
Annapolis	88	68	-8	32	204	3,700	IV	Very Hot
BWI Airport	87	67	-7	31	200	3,640	IV	Very Hot
Beltsville	87	64	-15	28	176	3,625	IV	Very Hot
Chestertown	87	67	-7	30	209	3,630	IV	Very Hot
Conowingo Dam	86	64	-10	24	199	3,500	III	Very Hot
Cumberland	88	63	-14	33	178	2,800	II	Very Hot
Denton	88	65	-11	37	187	3,650	IV	Very Hot
Emmitsburg	86	62	-27	21	162	3,250	III	Very Hot
Hagerstown	86	64	-17	25	187	3,200	III	Very Hot
La Plata	86	66	-8	24	188	3,700	IV	Very Hot
Mechanicsville	87	65	-9	24	199	3,740	IV	Very Hot
Oakland	79	56	-27	2	128	2,400	I	Warm
Owings Ferry	87	66	-8	26	200	3,700	IV	Very Hot
Parkton	84	62	-12	12	170	3,470	III	Hot
Rockville	86	64	-13	25	190	3,590	IV	Very Hot
Royal Oak	87	68	-6	26	215	3,700	IV	Very Hot
Salisbury	86	67	-8	25	196	3,690	IV	Very Hot
Unionville	85	61	-22	22	152	3,330	III	Hot
Woodstock	87	64	-18	27	172	3,500	III	Very Hot

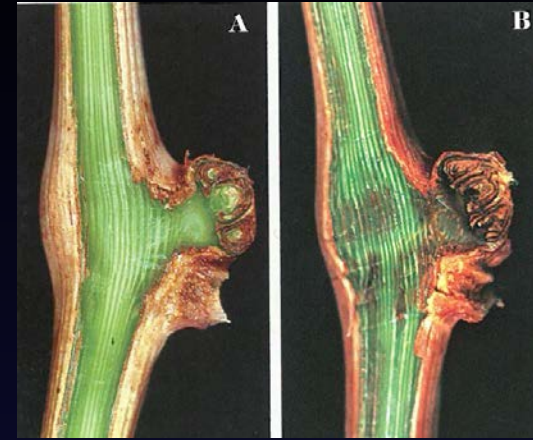
* Average Frost-Free Period ** Medium Growing Degree Days April-October (50 degree F base)

*** Grape region classification number based on UC Davis classification system (Winkler et al, 1974)

**** Mean Temperature of the Warmest Month (July) classification system of grape growing regions (Smart and Dry, 1980)

Cold Hardiness

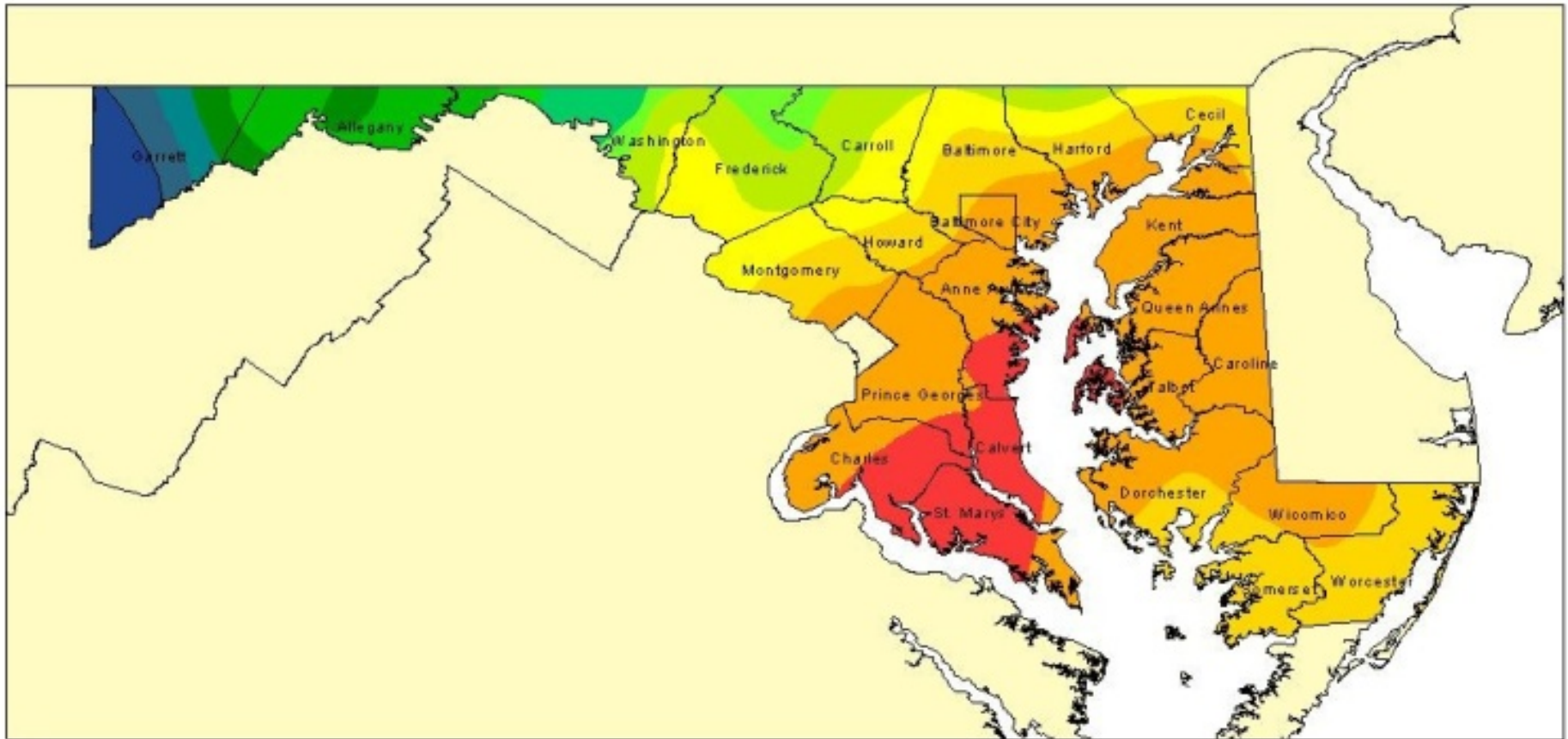
- **Fall Acclimation**
 - hardening of canes
 - Early frosts
- **Minimum Temperature Tolerance**
 - single/multiple events
- **Fluctuating Temperature Tolerance**
 - diurnal large diurnal swings
- **Deacclimation**
 - re-acclimation
 - depends on stage
- **Late Frosts**



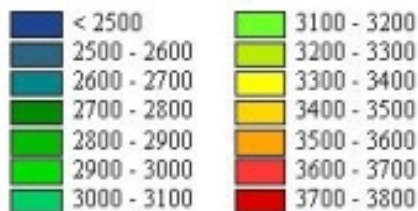
Climate

- **Macro-climate - region**
 - minimum winter temperatures
 - summer temperatures
 - length of growing season and humidity
- **Meso-climate – specific location**
 - slope
 - moderating effect of body of water
- **Micro-climate – specific area**
 - area inside canopy or around a cluster

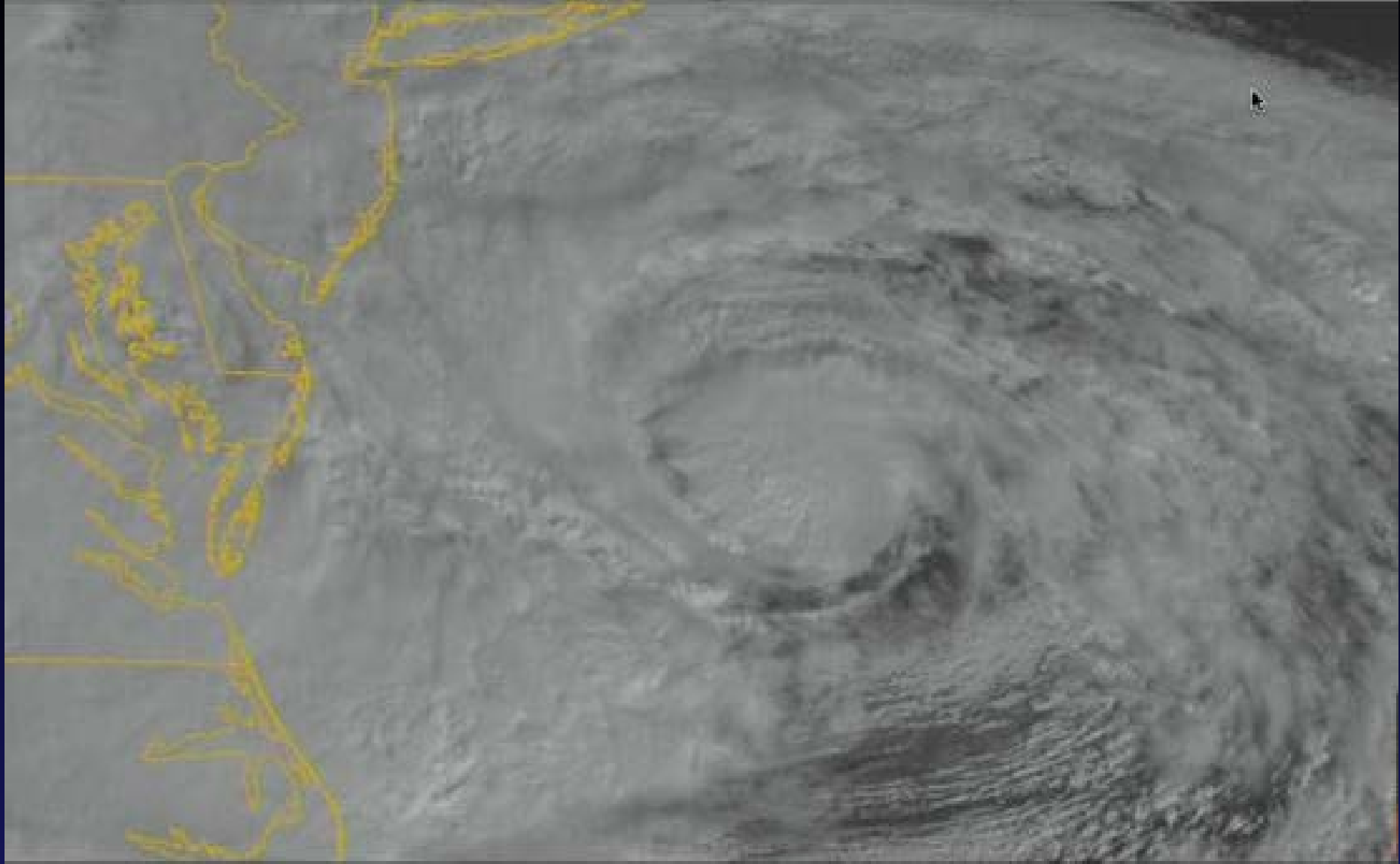
Growing Degree Days - Maryland



Growing Degree Days



Vineyard Site Considerations



Vineyard Site Considerations



Climate

- **Macro-climate - region**
 - minimum winter temperatures
 - summer temperatures
 - length of growing season and humidity
- **Meso-climate – specific location**
 - risk of late frosts
 - slope
 - moderating effect of body of water
- **Micro-climate – specific area**
 - area inside canopy or around a cluster

Vineyard Site Considerations



moderating effect of significant body of water

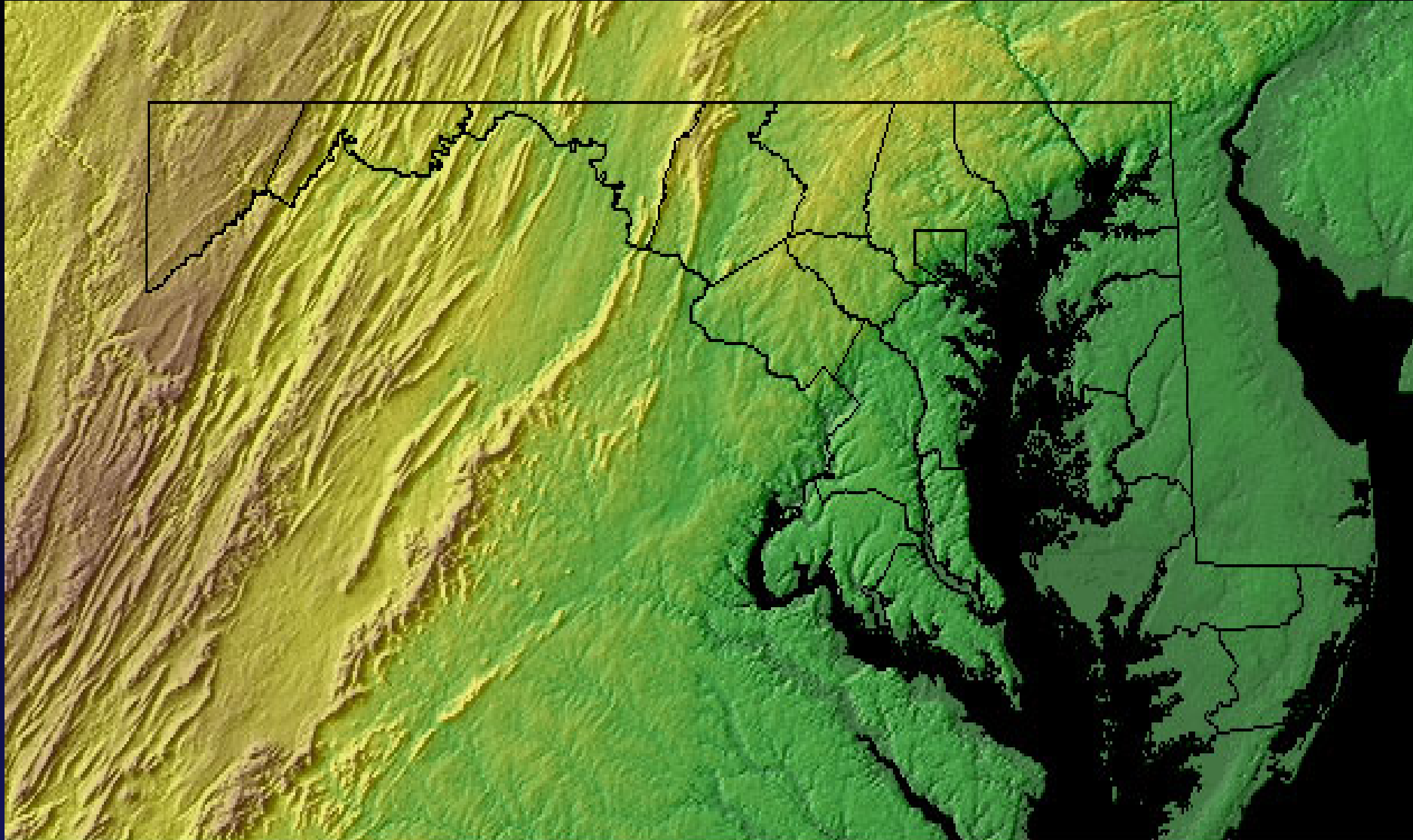
Site Considerations

- **Climate**
- **Topography**
- **Soil**
- **Proximity to Vineyard Pests**
- **Logistics**

Topography

- **Degree of Slope**
 - air movement
 - water movement
- **Aspect of Slope**
 - N, S, E, W+

Vineyard Site Considerations



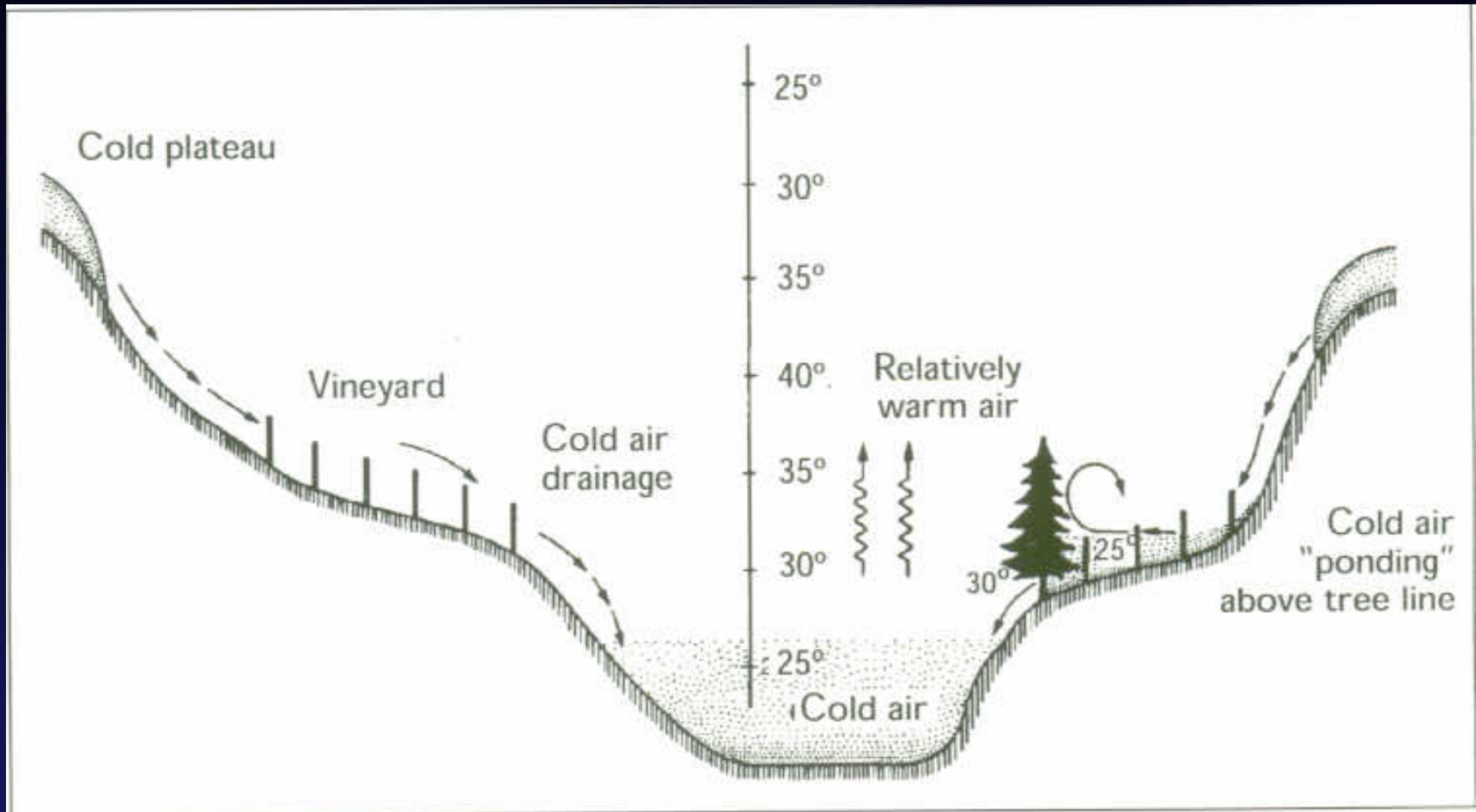
Topography

- Elevation is the single most important vineyard feature in the mid-Atlantic region
 - impacts frequency of low temperature extremes
 - impacts length of growing season

We attempt to minimize risks;
Elimination of risk is not realistic.

Vineyard Site Considerations

Topography and Air Movement



Vineyard Site Considerations

Topography and Air Movement



Topography

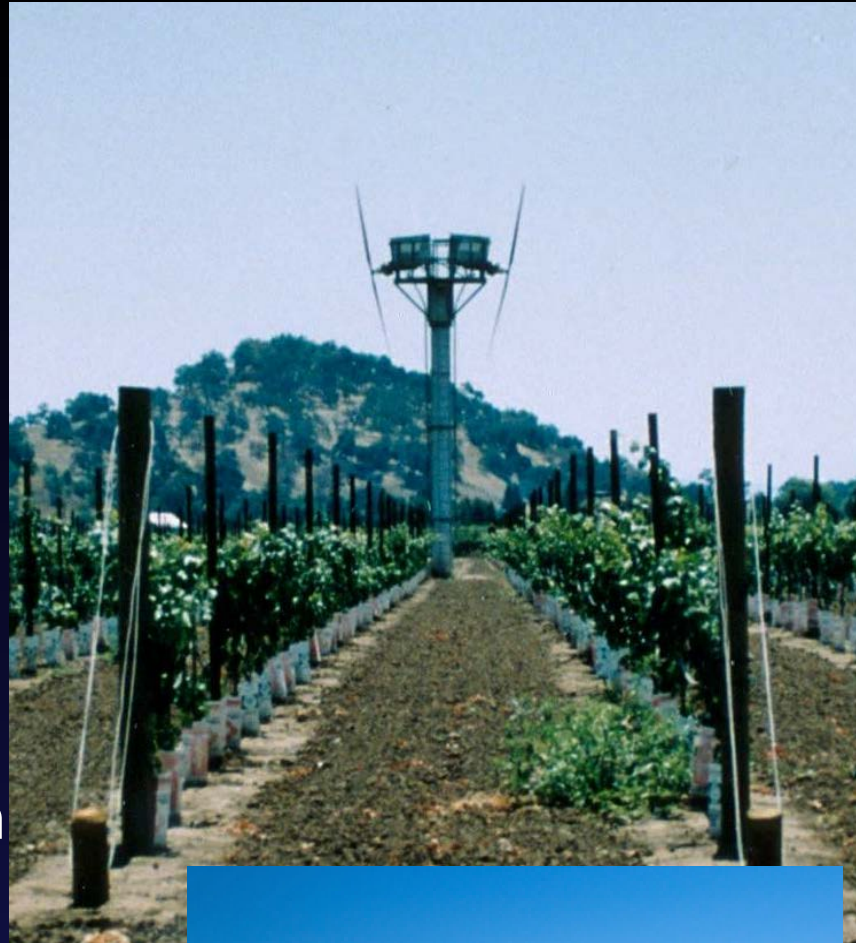
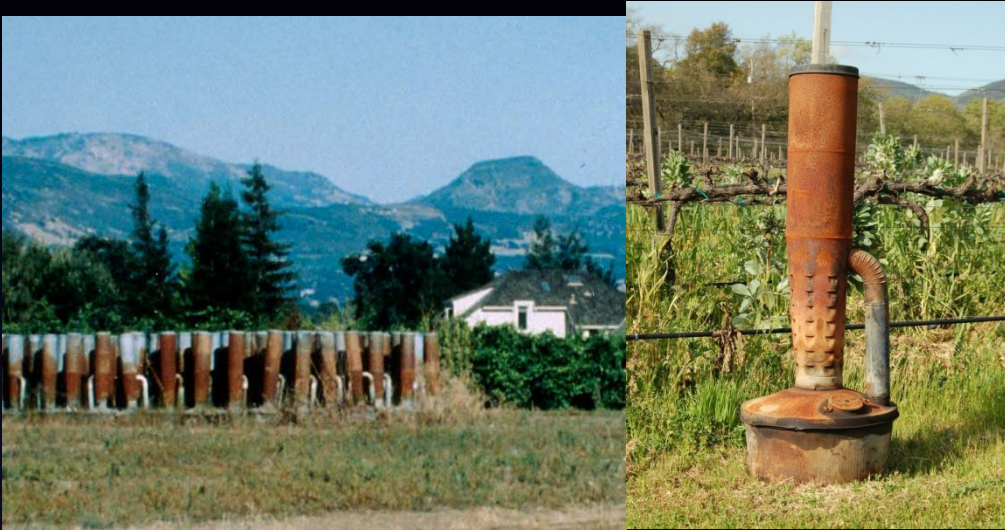
- **Degree of Slope**
 - air movement
 - water movement
- **Aspect of Slope**
 - N, S, E, W+

Vineyard Site Considerations

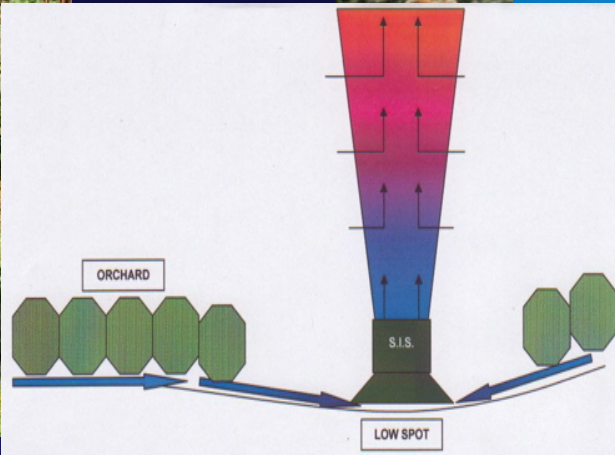
Aspect/Vine Phenology

Phenological Character	North	South	East	West
Spring bud break	Retard	Advance	Retard	Advance
Maximum temperature	Less	Greater	Less	Greater
A.M. foliage drying	-	-	Rapid	Slow
Radiant heat of fruit	Less	Greater	Less	Greater
Radiant heat of vine	Less	Greater	Less	Greater

Vineyard Site Considerations



Frost Mitigation



Site Considerations

- **Climate**
- **Topography**
- **Soil**
- **Proximity to Vineyard Pests**
- **Logistics**

Soils

Type (desirable characteristics)

- ◆ **Well to excessively well drained**
 - No hard pan
 - Adequate aeration
 - **Adequate depth to groundwater/SWT**
- ◆ **Medium to low water holding capacity**
 - Sand/clay ratio
 - Organic matter content
 - pH
- ◆ **Adequate depth**
 - Grapes deep rooted
 - Avoid drought
 - **Adequate depth to groundwater**
 - Saltwater intrusion

Vineyard Site Considerations



Soils

NRCS – Soil Conservation Service

- ◆ NRCS County Office
 - Hard copy
 - A Person with knowledge and experience in your region
- ◆ Web Based

<http://websoilsurvey.nrcs.usda.gov/app/>

- Search by address
- Area of interest
- Soil types and descriptions



Map Unit Legend

Queen Anne's County, Maryland (MD035)

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
IgB	Ingleside sandy loam, 2 to 5 percent slopes	0.4	13.5%
MtA	Mattapex-Butlertown silt loams, 0 to 2 percent slopes	2.0	66.2%
PiA	Pineyneck silt loam, 0 to 2 percent slopes	0.2	7.8%

Queen Anne's County, Maryland

MtA—Mattapex-Butlertown silt loams, 0 to 2 percent slopes

Map Unit Setting

Elevation: 0 to 120 feet

Mean annual precipitation: 38 to 48 inches

Mean annual air temperature: 52 to 57 degrees F

Frost-free period: 190 to 235 days

Map Unit Composition

Mattapex and similar soils: 45 percent

Butlertown and similar soils: 30 percent

Minor components: 25 percent

Description of Mattapex

Properties and qualities

Slope: 0 to 2 percent

Depth to restrictive feature: More than 80 inches

Drainage class: Moderately well drained

Capacity of the most limiting layer to transmit water (Ksat):

Moderately high to high (0.20 to 1.98 in/hr)

Depth to water table: About 18 to 36 inches

Frequency of flooding: None

Frequency of ponding: none

Available water capacity: Very low (about 2.8 inches)

Soils WSS - Soil Evaluation



Map Unit Legend

Queen Anne's County, Maryland (MD035)

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
IgB	Ingleside sandy loam, 2 to 5 percent slopes	0.4	13.5%
MtA	Mattapex-Butlertown silt loams, 0 to 2 percent slopes	2.0	66.2%
PIA	Pineyneck silt loam, 0 to 2 percent slopes	0.2	7.8%
UcB	Unicorn-Saccafrac	0.4	12.5%

Queen Anne's County, Maryland

IgB—Ingleside sandy loam, 2 to 5 percent slopes

Map Unit Setting

Elevation: 10 to 120 feet

Mean annual precipitation: 40 to 48 inches

Mean annual air temperature: 50 to 57 degrees F

Frost-free period: 180 to 235 days

Map Unit Composition

Ingleside and similar soils: 60 percent

Minor components: 40 percent

Description of Ingleside

Properties and qualities

Slope: 2 to 5 percent

Depth to restrictive feature: More than 80 inches

Drainage class: Well drained

Capacity of the most limiting layer to transmit water (Ksat):

Moderately high to high (0.60 to 5.95 in/hr)

Depth to water table: About 42 to 72 inches

Frequency of flooding: None

Frequency of ponding: none

Available water capacity: Very low (about 1.3 inches)

Soils WSS - Soil Evaluation



Vineyard Site Considerations

On-site Investigations

- Soil Pits
 - Rooting depth
 - Soil texture throughout profile
 - Potential problem areas
 - mottling
- Augured Holes
 - Spring - test drainage
 - Indicate need for tiling
- Shovel!



Vineyard Site Considerations

Water Management – Site Remediation

Deep rip to augment water drainage



Vineyard Site Considerations

“Wet feet”



Increased winter cold
damage susceptibility



Vineyard Site Considerations

Irrigation

Critical for establishment and maintenance on well drained soils



GIS/GPS Mapping of MD Counties

UME and MDP



◆ Web Based

- Maryland State summary

<http://www.grapesandfruit.umd.edu/Grapes/Presentations/SiteSuitabilityMaryland122007.pdf>

- Northern tier Counties – Washington

<http://www.grapesandfruit.umd.edu/Grapes/Presentations/SiteSuitabilityWashCo122007.pdf>

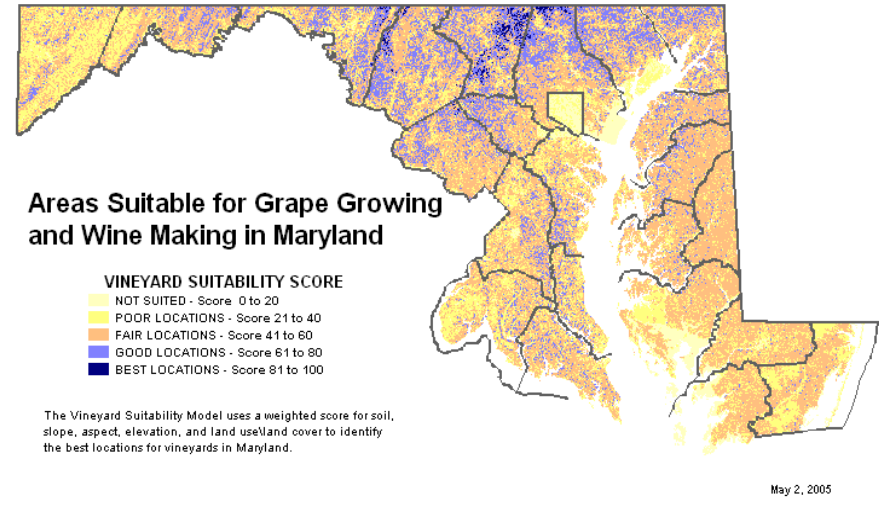
- Print hard copy
- On line power point presentation

Vineyard Site Considerations

Site Evaluation: GIS Vineyards Suitability Maps

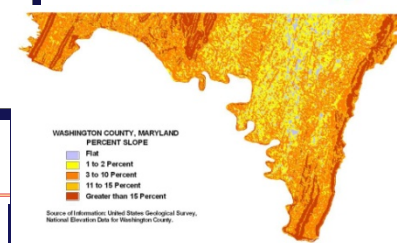
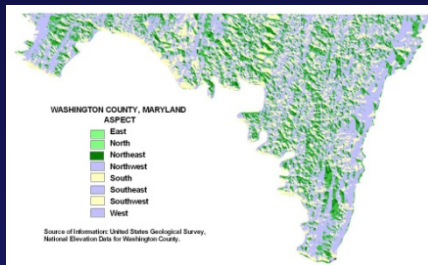
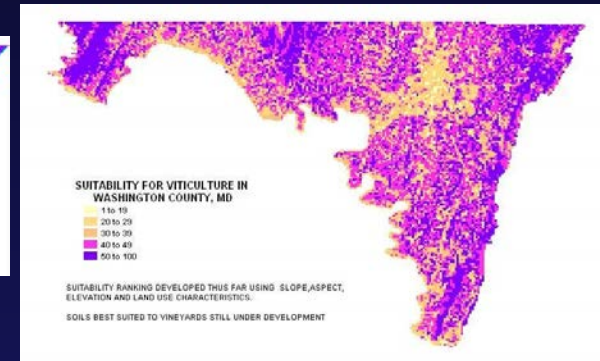
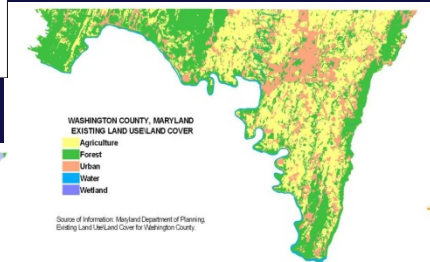
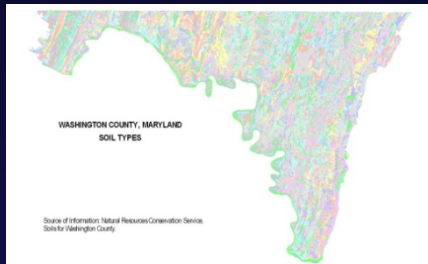
Rating land for suitability for vineyards

- Elevation 30 points
- Soils 25 points
- Land use/Zoning 20 points
- Slope 15 points
- Aspect 10 points
- Total 100 points



Washington County

State Composite

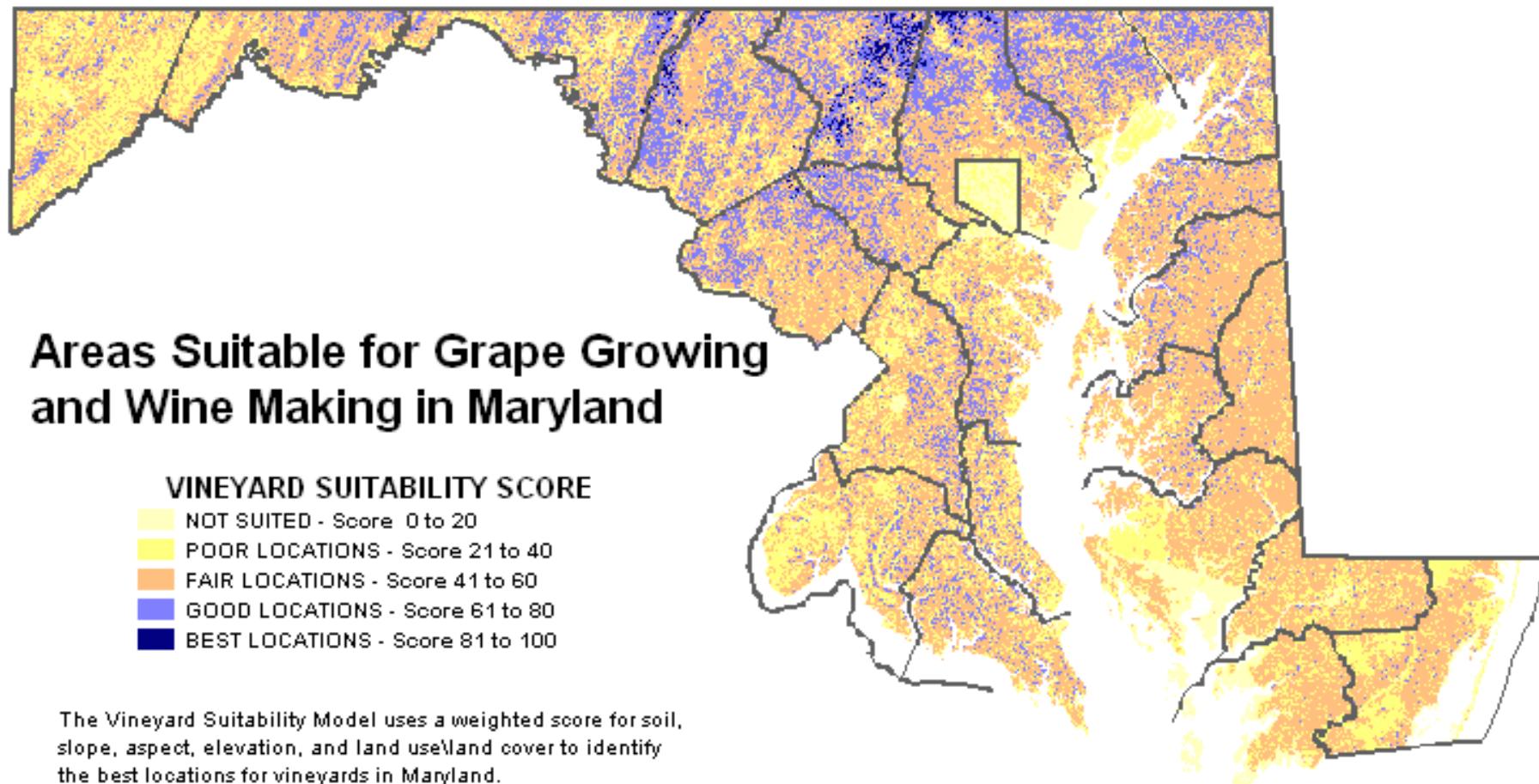


County Composite

Vineyard Site Considerations

GIS/GPS Mapping of Site Suitability

<http://www.grapesandfruit.umd.edu/Grapes/Presentations/SiteSuitabilityMaryland122007.pdf>



Vineyard Site Considerations

GIS/GPS Mapping of Site Suitability

training.gis.vt.edu/eastcoastviticulture/webcontent/flexviewer2/

East Coast Viticulture Suitability Investigative Tool

Wonder if your land is suitable for growing vineyards? Or which grape species is best for your local conditions? Find out here!

Viticulture Suitability Tool

Welcome!

To determine your site's suitability for viticulture follow the simple instructions below.

1. Zoom to your area of interest.
2. Click the Draw Polygon icon to the right.
3. Define Area of Interest:
Place points along border of area of interest.
Double click to complete the polygon.

To view th map layers used in the suitability analysis, select the 'More...' button in the top right corner of the map. Then select the layer you would like to see.

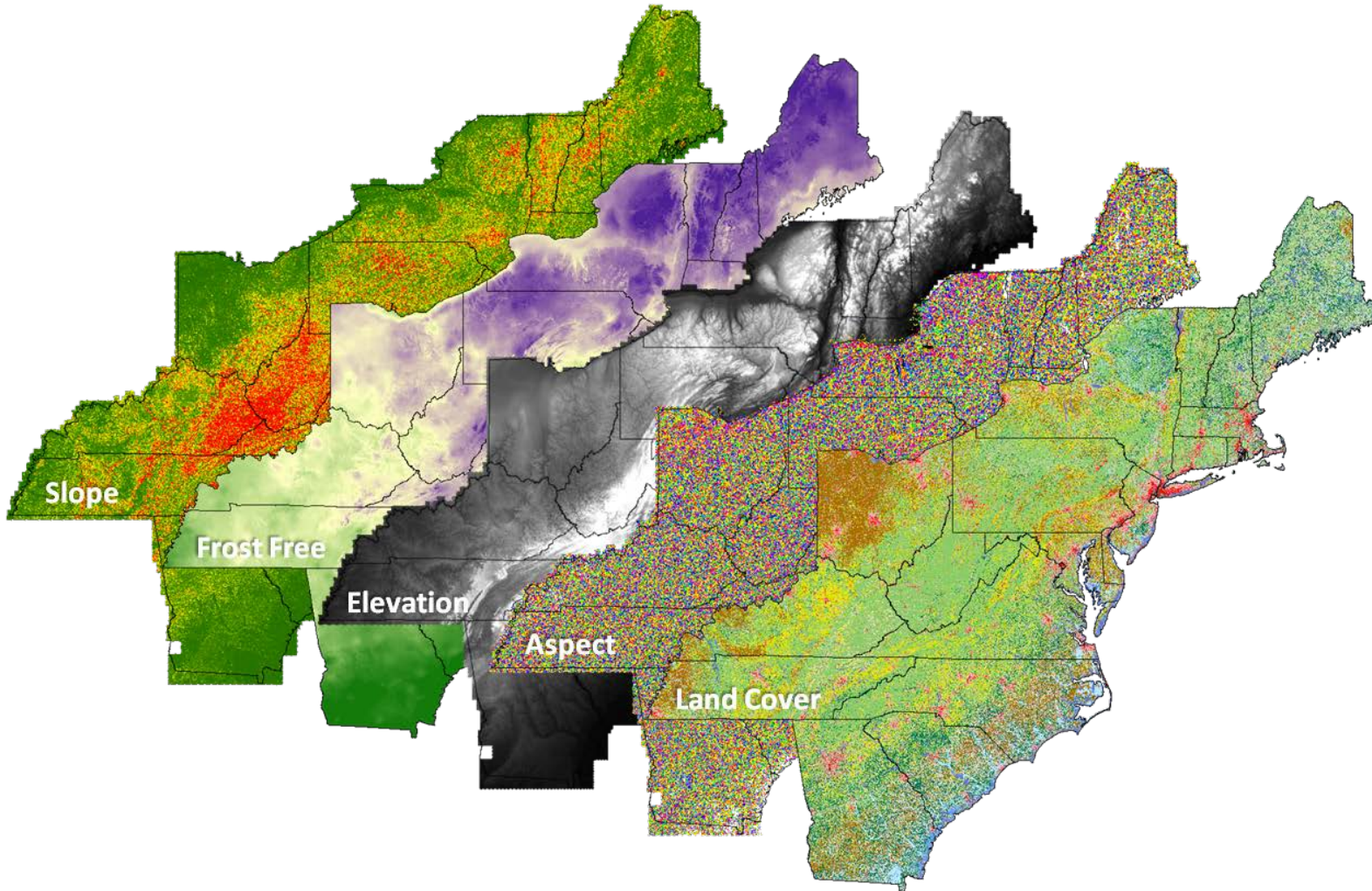
500 km
300 mi

POWERED BY **esri**

Peter Sforza, Virginia Tech; <http://training.gis.vt.edu/EastCoastViticulture/webcontent/flexviewer2>.

Vineyard Site Considerations

GIS/GPS Mapping of Site Suitability



Peter Sforza, Virginia Tech; <http://training.gis.vt.edu/EastCoastViticulture/webcontent/flexviewer2>.

Vineyard Site Considerations

Prioritization of physical features in site selection

Climate considered separately

- Relative elevation
- Absolute elevation
- Soil hydrology (internal and surface drainage)
- Land use (forest vs. pasture; rockiness)
- Proximity to sensitive areas (e.g., schools)
- Proximity to biotic and abiotic hazards
- Other soil features (depth, OM, pH, etc.)
- Slope
- Aspect

Site Considerations

- **Climate**
- **Topography**
- **Soil**
- **Proximity to Vineyard Pests**
 - **Neighbors!**
- **Logistics**

Vineyard Site Considerations

2,4-D Damage

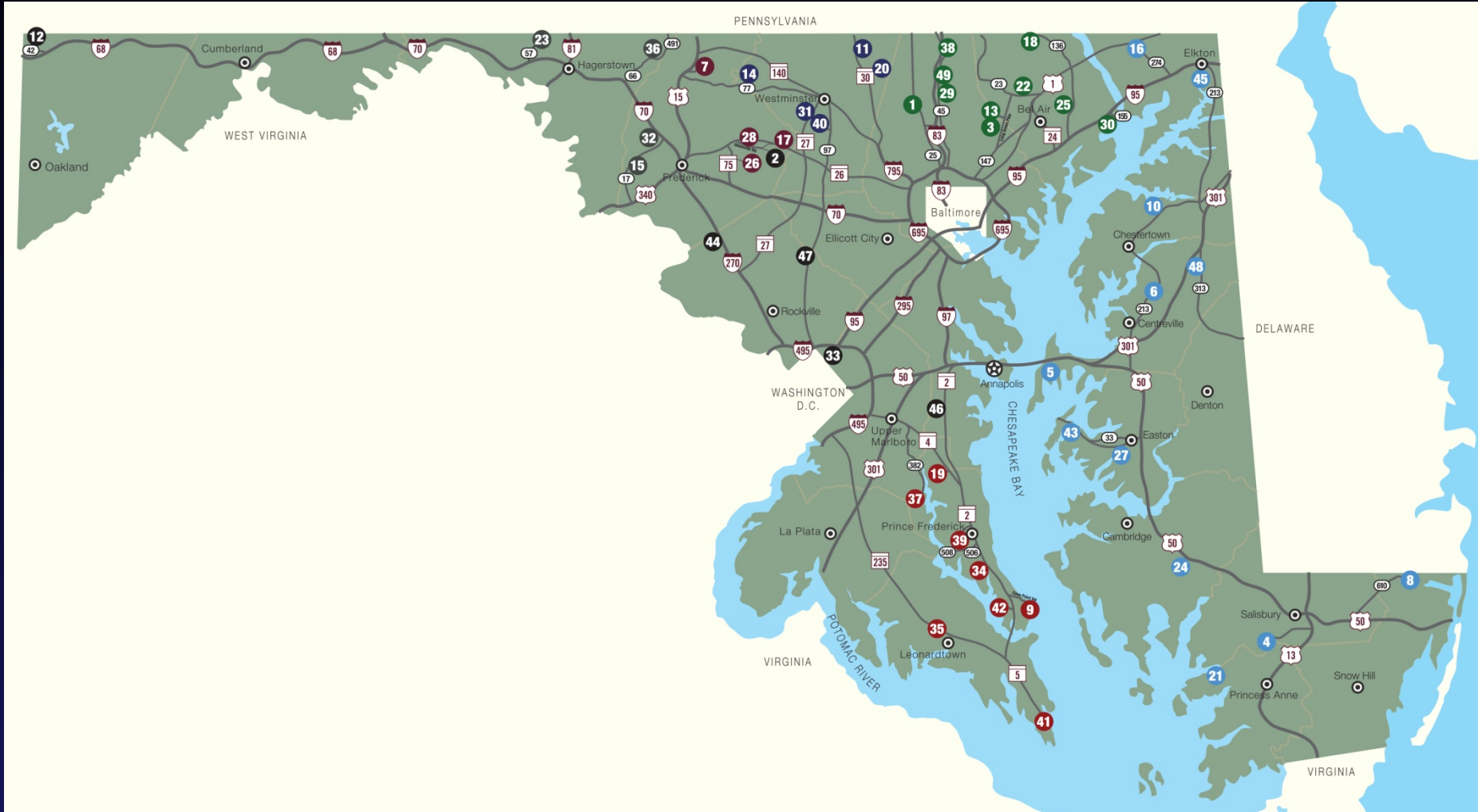


New MDA Sensitive Crop Locator!

<http://www.marylandgrapes.org/growing/SensitiveCropProgram.shtml>

Vineyard Site Considerations

Logistics - Proximity



Take Home/Conclusions

- Site selection should consider the hazards at the macro- as well as meso-scale level.
- Elevation is the single most important vineyard feature in the mid-Atlantic region -- impacts length of growing season and frequency of low temperature extremes.
- Soil hydrology is perhaps the most important feature of soil (prefer very well drained soil)
- We attempt to minimize risks; elimination of risk is not realistic.

“Wine Makes daily living easier,
less hurried, with fewer tensions,
and more tolerance.”

--Benjamin Franklin

UNIVERSITY OF
MARYLAND

EXTENSION

Solutions in your community

Joseph A. Fiola, Ph.D.

Specialist in Viticulture and Small Fruit

Western MD Research & Education Center

18330 Keedysville Road

Keedysville, MD 21756-1104

301-432-2767 ext. 344; Fax 301-432-4089

jfiola@umd.edu

<http://extension.umd.edu/smallfruit>