Vineyard Site Evaluation


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TEXAS A&M AGRILIFE EXTENSION

Selecting a Vineyard Site

You only get one chance – make it good!

Critical Site Selection Criteria

- Irrigation water quantity & quality
- Soil depth & drainage
- Cold air drainage (topography)
- Macroclimate & Mesoclimate
- Diseases and Pests

TEXAS A&M AGRILIFE EXTENSION

Potential Vineyard Site Assessment Form

Name:_____ Location: _____ Date:_____

	Yes	No
1. Irrigation Water Quantity & Quality (water sample analysis required)		
Water source can continuously supply ≥ 20 gal/min per acre of vineyard with 7 or more acres. Vineyards smaller than 7 acres can succeed with less than 20 gal/min water source capacity if total water needs are pre-determined and proper scheduling is planned.		
Sodium Absorption Ratio (SAR) < 6.0		
Salinity: Total Dissolved Solids < 640 (mg/L or ppm), **or** Electrical Conductivity < 1.0 mmhos/cm		
Sodium (Na) < 460 (mg/L or ppm)		
Chloride (Cl) < 140 (mg/L or ppm)		
Boron (B) < 1 (mg/L or ppm)		
pH 6.5 to 8.4		
2. Soil Characteristics: Preliminary Assessment from Soil Survey		
Depth to Any Soil Restrictive Layer ≥ 61 cm (24 inches) if irrigated or ≥ 100 cm if no irrigation		
Drainage Class: Well drained or Moderately well drained		
Salinity: Electrical Conductivity < 2.5 mmhos/cm		
Sodium Absorption Ratio (SAR) < 13		
Soil Reaction: pH between 5.2 and 8.2		
Saturated Hydraulic Conductivity ≥ 4.0 to 14.0 micro m/sec		
Available Water Capacity between 0.10 to 0.20 Inches/Inch		
3. Soil Characteristics: Soil Sample Analysis and On-Site Assessment		
Depth to Any Soil Restrictive Layer ≥ 61 cm (24 inches) if irrigated or ≥ 100 cm if no irrigation		

Critical Site Selection Criteria

- **Irrigation water quantity & quality**
- Soil depth & drainage
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- Diseases and Pests

How Much Water Will Your Vineyard Need?

Estimating Irrigation Water Needs

Assumptions:

- Grapevine Evapotranspiration = 1.0 in/acre/week
- Water replacement rate of 80% = 0.8 in
- Replace 0.8 inch in one 18-hour irrigation event
- 1 acre-inch = 27,154 gal/acre

27,154 gal/acre X 0.8 = **21,723 gal/acre**

21,723 gallons ÷ **18 hrs** = 1207 gal/hr

1207 gal/hr ÷ 60 min/hr = **20 gal/min/acre**

Estimating Irrigation Water Needs

Example Assumptions:

- **20 gal/min water source**
- Replace 0.8 inch in one 18-hour irrigation event

How many acres can I irrigate 0.8 inch in one 18-hour irrigation event?

Probably maximum 7 acres, 1 acre per day
18 hr On/6 hr Off (*depends on recharge rate*)

If vineyard < 7 acres, well output can be less than **20 gal/min** with extended duration of irrigation event

Estimating Irrigation Water Needs

EXAMPLE: well capacity *= 20 gal/min*

- Is daily schedule 18 hr On/6 hr Off sustainable?
- What is recharge rate of well?
- How reliable is the aquifer?
- Can well deliver 20 gal/min 5 years from today?
- Plan for minimum of 2X today's GPM need
- Even more GPM if vineyard expansion plans

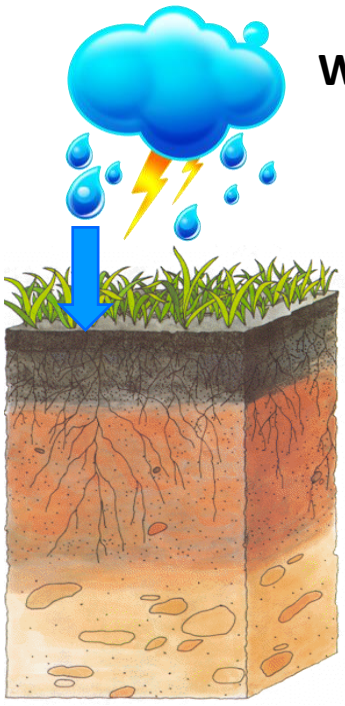
Irrigation Water Quality for Grapes

Salinity	Increasing Problems
Electrical Conductivity	> 1.0 mmhos/cm
Total Dissolved Solids	> 640 ppm

Soil Permeability to Water

Sodium Absorption Ratio (SAR)

Increasing Problems SAR ≥ 6



Water Infiltration Rate (Permeability)

Irrigation water with high sodium levels causes soil clay particles to disperse

Water infiltration is reduced

Irrigation Water Mineral Toxicity

	Increasing Problems
Sodium	> 460 ppm
Chloride	≥ 140 ppm
Boron	≥ 1 ppm

Critical Site Selection Criteria

- Irrigation water quantity & quality
- **Soil depth & drainage**
- Cold air drainage (topography)
- Macroclimate & Mesoclimate
- Diseases and Pests

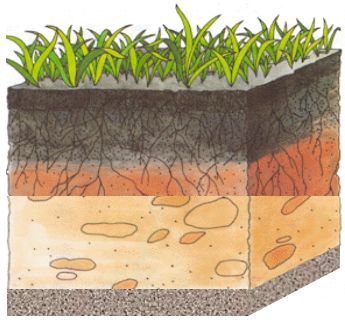
Successful Vineyards Exist on Many Different Soils

General Criteria for a Suitable Vineyard Soil

- Minimum depth of 3 ft
- Good water-holding capacity
- Moderate to high water infiltration rate
- Good internal drainage
- pH between 5.5-8.0 in the root zone
- Absence of toxic concentrations of salts or nutrients

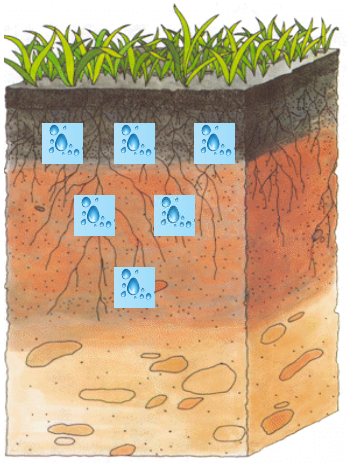
Source: Nicholas, 2004. Soil, Irrigation and Nutrition

Soil Depth Influences Water Availability



Minimum depth of 3 ft

Available Water Capacity



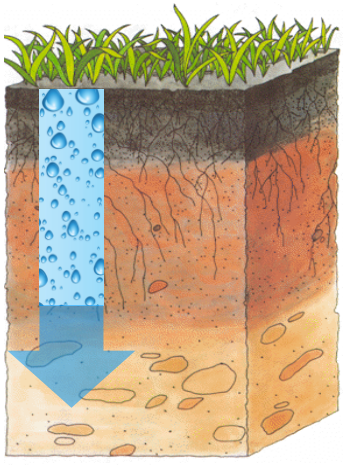
Desirable Value

< 0.10 inches water per inch soil depth

Acceptable Value

0.10 to 0.14 inches/inch

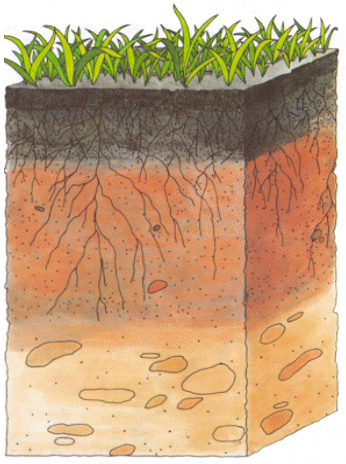
Internal Water Drainage



Drainage Class:
Moderately well-drained to well-drained

Saturated Hydraulic Conductivity
≥ 4.0 – 14.0 micro m/sec

Soil Chemical Properties



pH 5.5 to 8.0

Absence of toxicity

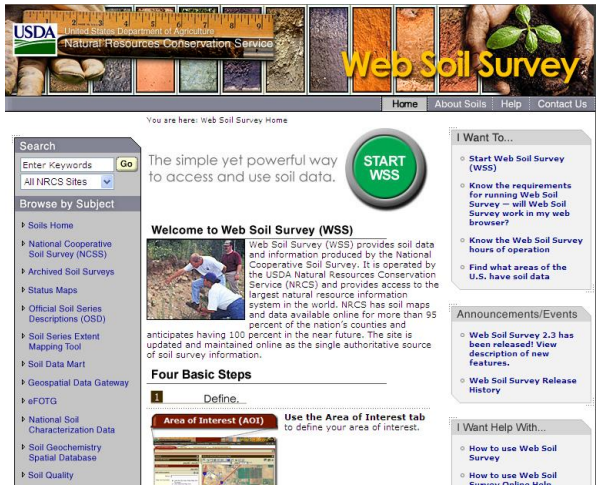
Sodium	< 690 mg/L
Chloride	< 350 mg/L
Boron	< 1 mg/L

Salinity

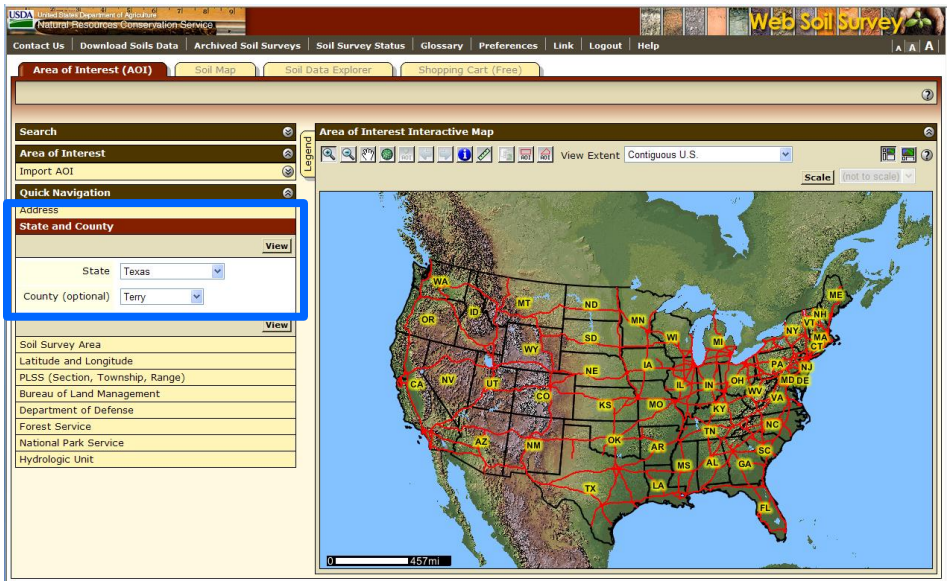
conductivity < 2.5 mmhos/cm

Where to Find Soil Information?

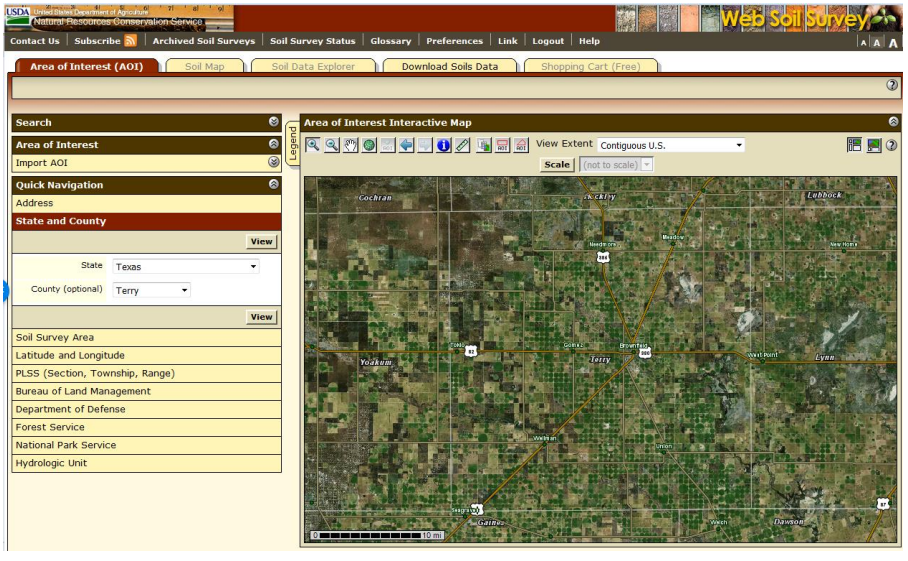
http://websoilsurvey.nrcs.usda.gov



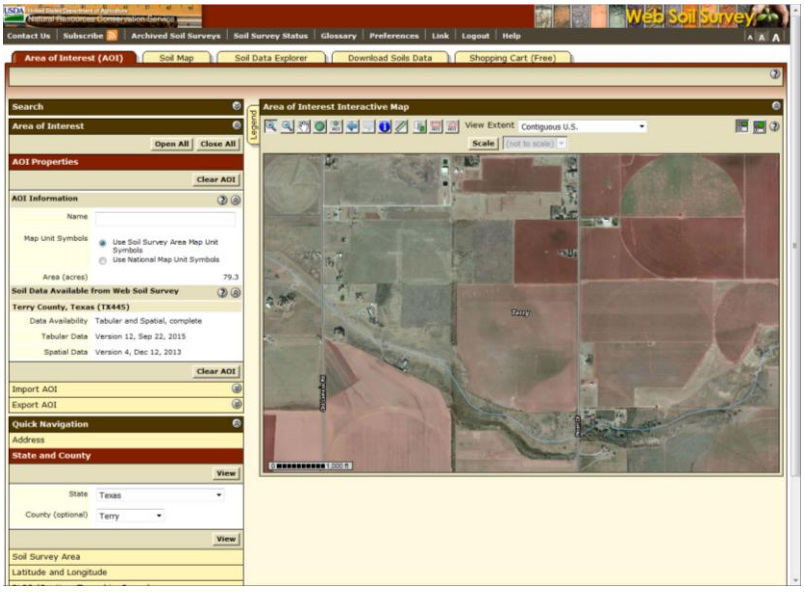
Soil Survey for Entire U.S.



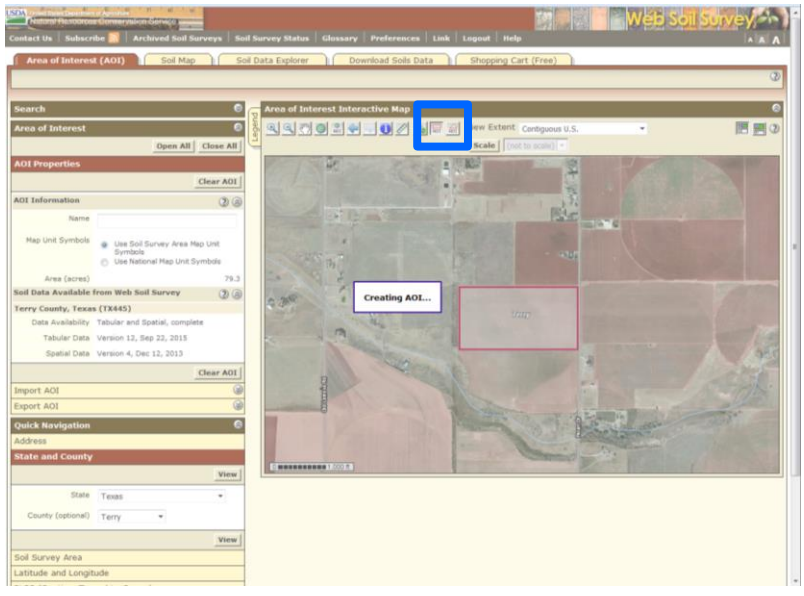
Find your location



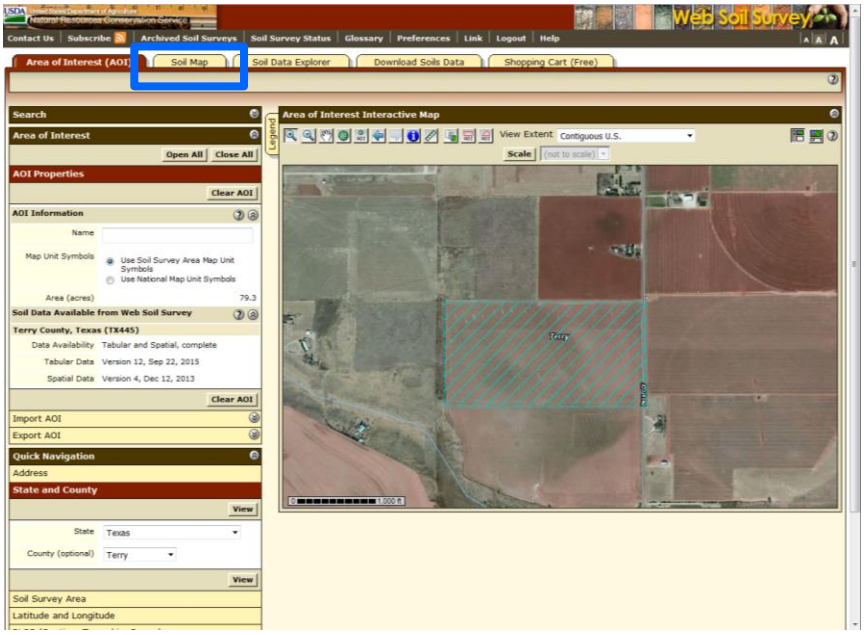
Zoom in to your location



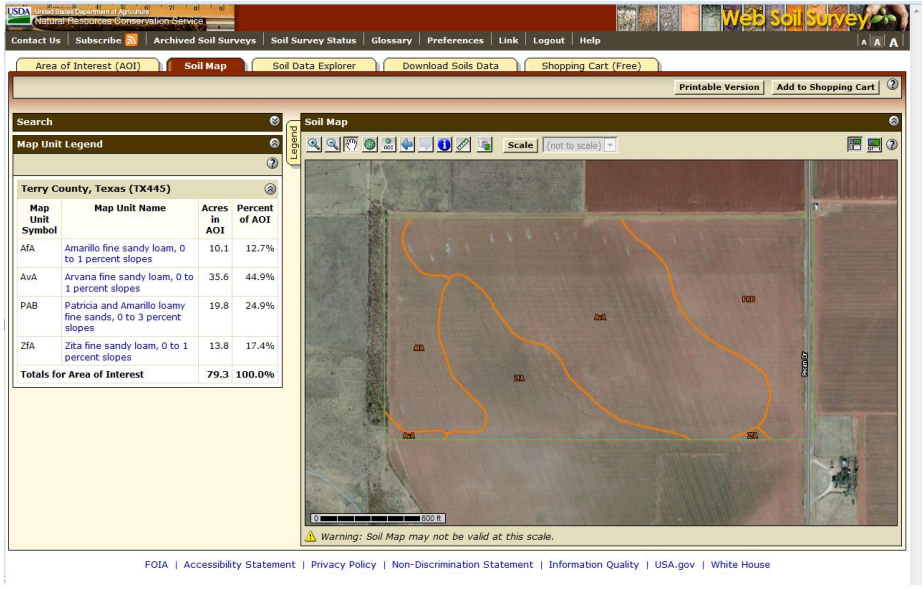
Outline your “Area of Interest” in red



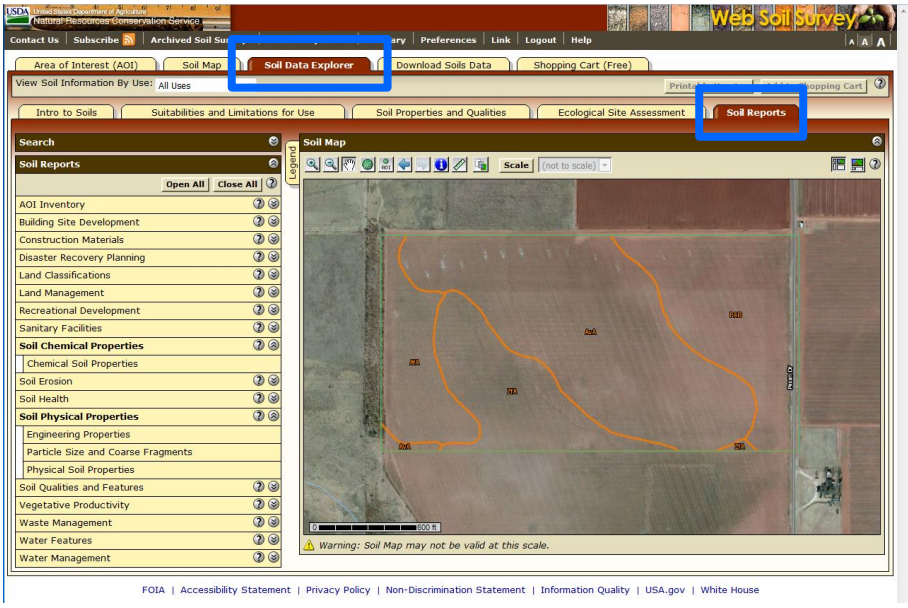
Select Soil Map tab



Soil Map



Select Soil Data Explore, Soil Reports



Report – Chemical Soil Properties

Chemical Soil Properties– Terry County, Texas

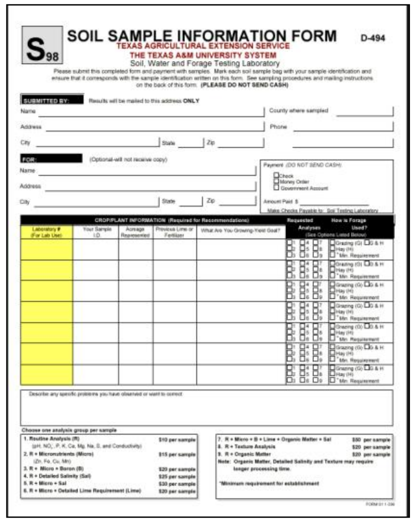
Map symbol and soil name	Depth	Cation-exchange capacity	Effective cation-exchange capacity	Soil reaction	Calcium carbonate	Gypsum	Salinity	Sodium adsorption ratio
	In	*meq/100g*	*meq/100g*	*pH*	*Pct*	*Pct*	*mmhos/cm*	
AfA—Amarillo fine sandy loam, 0 to 1 percent slopes								
Amarillo	0						0	0
	1						0	0
	2						0	0
	3						0	0
	5						0	0
ApB—Arvana loamy fine sand, 1 to 5 percent slopes								
Arvana	0							0
	1							0
	18-28	10-18	—	6.6-8.4	0-15	0	0	0
	28-38	—	—	7.9-8.4	50-90	0	0	0
	38-60	10-18	—	7.9-8.4	40-60	0	0	0
	60-80	10-18	—	7.9-8.4	40-60	0	0	0
MdA—Midessa fine sandy loam, 0 to 1 percent slopes								
Midessa	0-10	5.0-10	—	7.9-8.4	0-5	0	0.0-2.0	0
	10-30	10-20	—	7.9-8.4	0-10	0	0.0-2.0	0
	30-60	10-20	—	7.9-8.4	15-60	0	0.0-2.0	0

- Depth
- Soil reaction (pH)
- Calcium carbonate
- Salinity
- Sodium Adsorption ratio

Verify Soil Chemical Properties
Collect soil samples from throughout site

Texas A&M University
Soil, Water & Forage Testing Laboratory
Assisting Agricultural & Urban Clientele with Research-Based Analysis

http://soiltesting.tamu.edu



Report – Physical Soil Properties

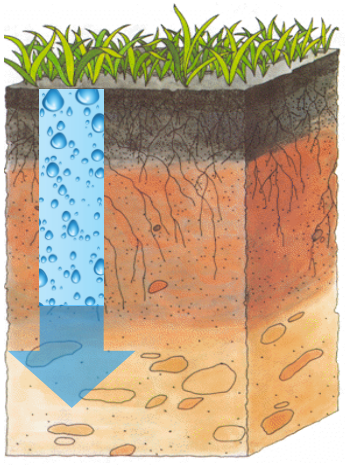
Physical Soil Properties– Terry County, Texas														
Map symbol and soil name	Depth	Sand	Silt	Clay	Moist bulk density	Saturated hydraulic conductivity	Available water capacity	Linear extensibility	Organic matter	Erosion factors			Wind erodibility group	Wind erodibility index
										Kw	Kf	T		
	In	Pct												
AfA—Amarillo fine sandy loam, 0 to 1 percent slopes														
Amarillo	0-11	55-66- 85											3	86
	11-27	25-58- 70												
	27-38	25-61- 70												
	38-56	25-63- 70												
	56-80	25-50- 70												
ApB—Arvana loamy fine sand, 1 to 5 percent slopes														
Arvana	0-11	55-79- 88	2-16- 30	5- 5- 15	1.30-1.60	4.00-42.00	0.08-0.12	0.0-2.9	0.5-1.0	.17	.17	2	2	134
	11-18	35-66- 75	5-14- 40	15-21- 35	1.45-1.65	4.00-14.00	0.12-0.18	0.0-2.9	0.5-1.0	.32	.32			
	18-28	35-63- 70	5-16- 40	15-21- 35	1.45-1.65	4.00-14.00	0.12-0.18	0.0-2.9	0.1-0.5	.32	.32			
	28-38	—	—	—	—	0.01-1.40	0.00	—	—					
	38-60	25-48- 70	10-30- 45	18-22- 35	1.50-1.70	4.00-14.00	0.08-0.17	0.0-2.9	0.1-0.5	.32	.32			
	60-80	25-41- 70	10-26- 45	20-33- 35	1.50-1.70	4.00-14.00	0.08-0.17	0.0-2.9	0.1-0.5	.32	.32			

- Depth
- Texture (Sand:Silt:Clay)
- Saturated hydraulic conductivity
- Available water capacity
- Organic matter

Verify Soil Physical Properties
Dig soil pits throughout site

- Compare with soil survey
- Observe:
  - Depth
  - Texture
  - Variability
  - Problems

Internal Water Drainage



Drainage Class:
Moderately well-drained to well-drained

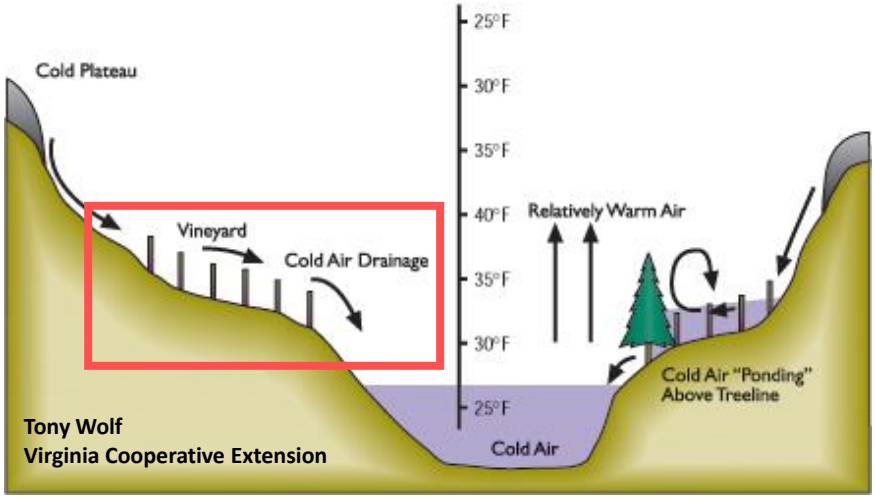
Saturated Hydraulic Conductivity
≥ 4.0 – 14.0 micro m/sec

Percolation Test
> 2 inches/hour

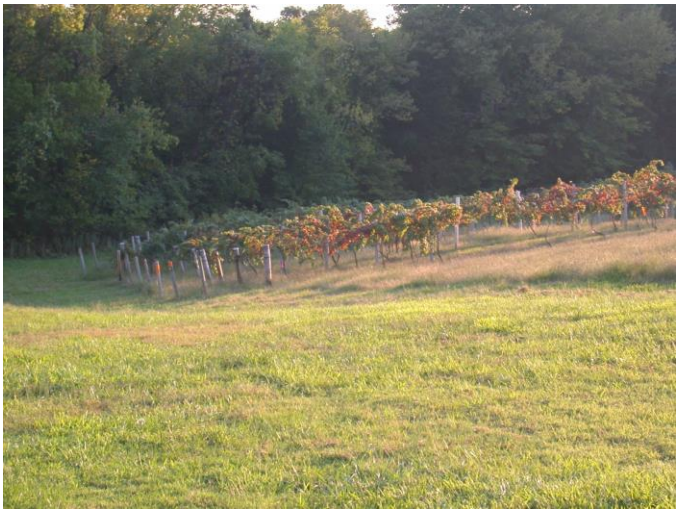
Critical Site Selection Criteria

- Irrigation water quantity & quality
- Soil depth & drainage
- **Cold air drainage (topography)**
- Macroclimate & Mesoclimate
- Diseases and Pests

Cold Air Flows Downhill



Avoid “Frost Pockets”



Critical Site Selection Criteria

- Irrigation water quantity & quality
- Soil depth & drainage
- Cold air drainage (topography)
- **Macroclimate & Mesoclimate**
- Diseases and Pests

Site Assessment – Climate

Macroclimate (Region)

- Temperature
- Sunlight
- Precipitation
- Relative Humidity

Mesoclimate (Site)

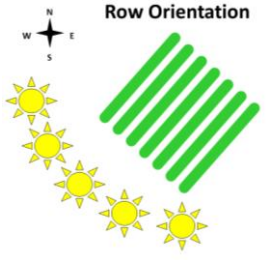
- Temperature
- Sunlight
- Precipitation
- Relative Humidity
- Wind & air circulation
- Cold air drainage (topography)

Site Assessment – Climate

Macroclimate (Region) **Mesoclimate (Site)**

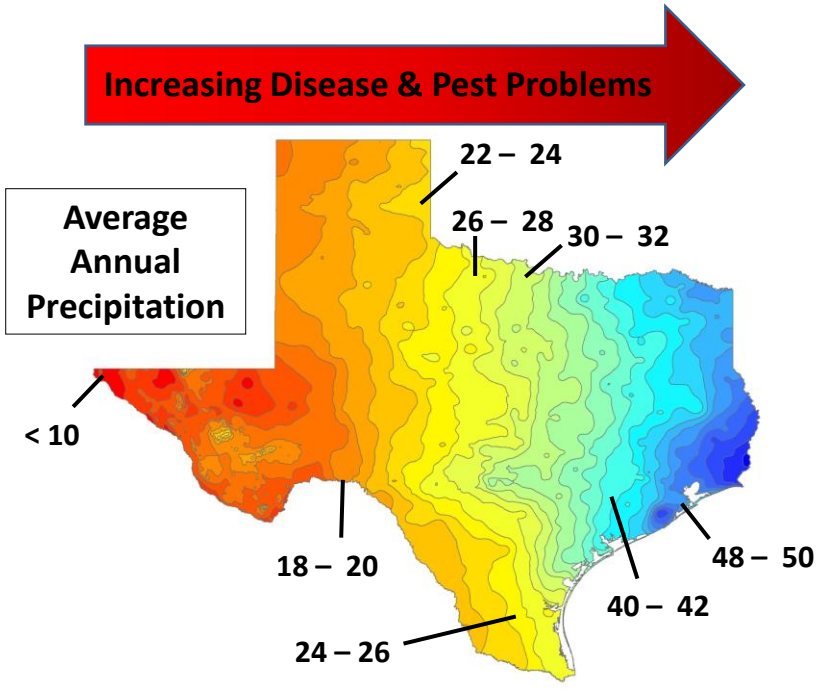
Climate Influences:

- **Choice of grape varieties**
- **Vineyard design**

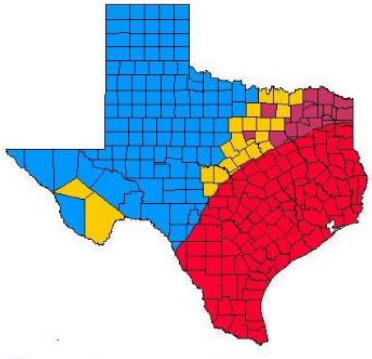


Critical Site Selection Criteria

- Irrigation water quantity & quality
- Soil depth & drainage
- Cold air drainage (topography)
- Macroclimate & Mesoclimate
- **Diseases and Pests**

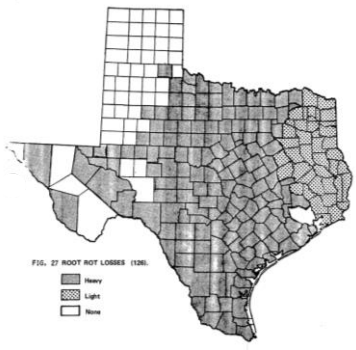


Pierce's disease
Probability Map - 2012



- Zone of Extremely High PD Probability
- PD Confirmed Through Diagnostic Testing
- PD Probable, But Not Confirmed
- No Known PD

Cotton Root Rot
Losses Map - 1974



- Heavy
- Light
- None

Hybrid Varieties Tolerant or Resistant to Pierce's Disease

Blanc du Bois

Lenoir
(Black Spanish)

Less than Ideal Vineyard Site

Less than Ideal Vineyard Site

Compromise

- accept lower yields
- accept lower fruit quality
- accept higher loss risk

} Reduced Returns

Remediation

- modify soil drainage
- hedging vigorous canopy
- disease & pest control practices
- frost protection

} Increased Costs

If Site Assessment is Favorable Proceed to Vineyard Design