



UNIVERSITY OF GEORGIA
EXTENSION

SES-026872 Advising New Vineyards

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Every vine can take only so much...

acidic soils



pest and disease pressure



spring frosts



**Vine
stress
bucket**

labor



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Site selection

For vineyard – Possibly the most important decision a grower can make

- Choosing a good site can
 - Reduce crop loss
 - Make a good grape variety better!
 - (and) Make an okay grape variety better!

For winery –

- Where people will visit



Cultivars

- Choosing:
 - *V. vinifera*
 - Hybrids
 - American bunch grapes
 - Muscadines

Wine? Table?
Commercial? Home?



Site selection

No location is perfect.
Some are just better.

More
suitable



Less
suitable

Depending on vineyard goals, Georgia is not a cheap place to have a vineyard

Vineyard Site Score Sheet

Accessibility		
Elevation		
Direction of slope		
Degree of slope		
Soil characteristics		
Water		
Wildlife		
Adjacent Agricultural Operations		
Suitability for desired vineyard goals		

Cultivar/Variety Selection

- Your (potential) site
 - Do you already have a site? What CAN you grow there?
 - What are the stressors?
- Business goals
 - What do you want to grow? Making wine? Selling grapes – to whom?
- Effort
 - How much labor are you willing to put in long term? Do you know where/how you can get help?



Site selection - Climate



Human Factors

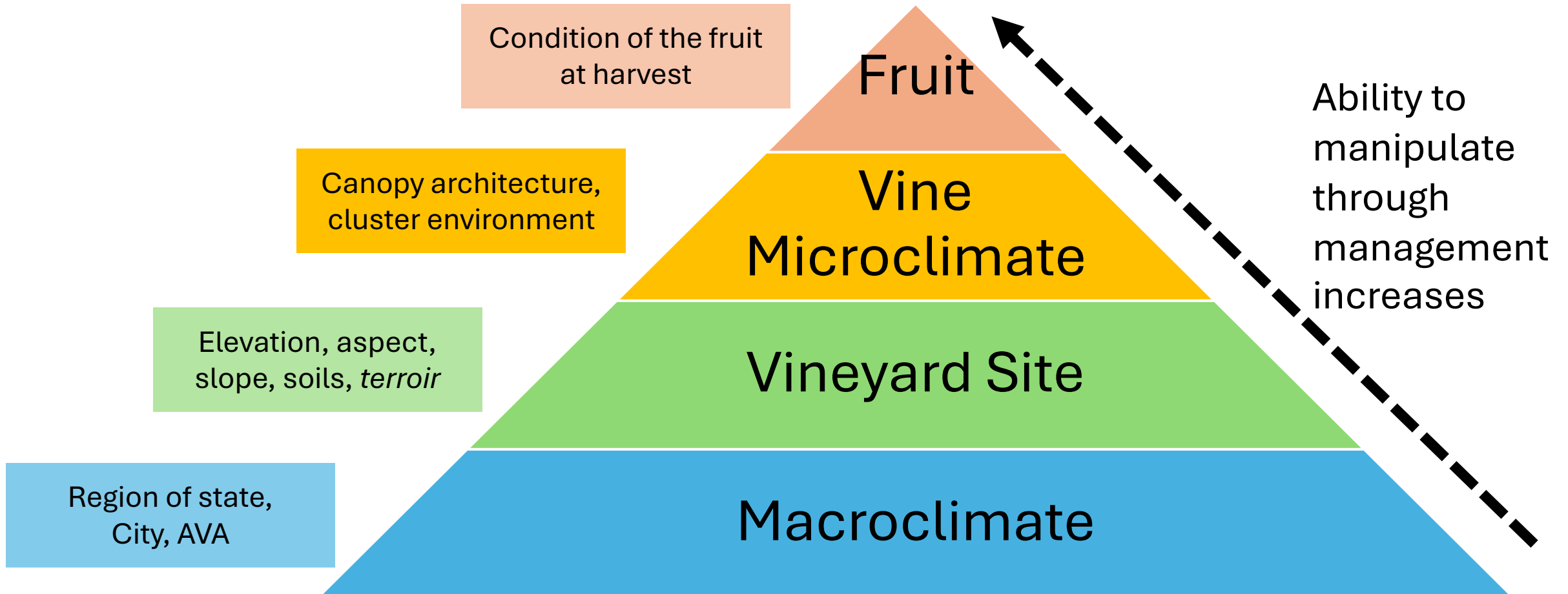
Vineyard decisions

- Variety/rootstock
- Type of trellis & training system
- Pruning
- Irrigation
- Fertilization
- Pest control
- Floor management
- Time of harvest

Winery decisions

- Time of harvest
- Use of oak
- Cultured or wild yeast
- Length of maceration
- Time in contact with lees
- Fermentation temperature
- Filtration

Levels of site suitability and management



Vineyard Requirements

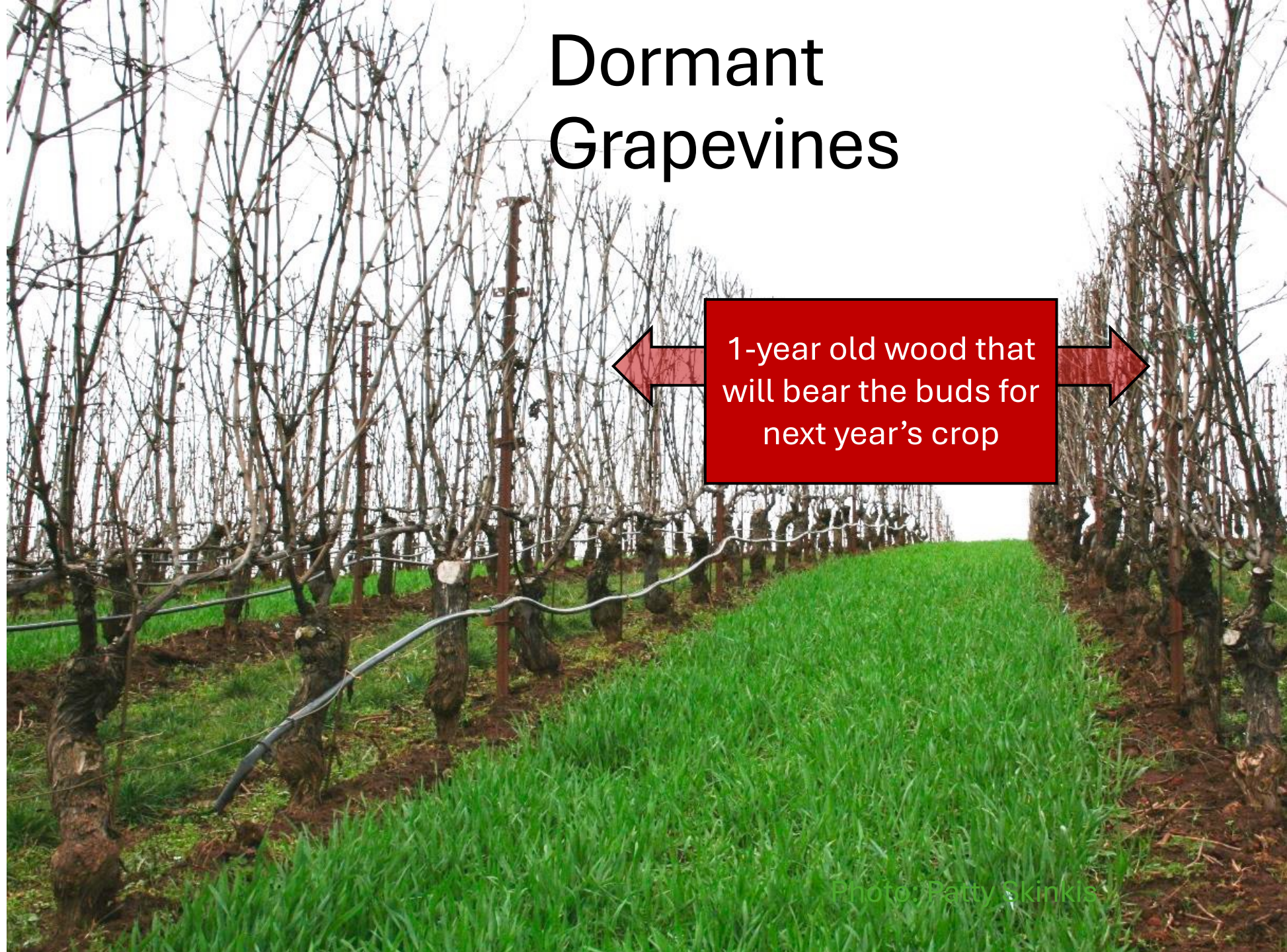
- Minimum winter temperature
- Season length (frost window)
- Heat summation – growing season
- Manageable disease
- Topography – not too steep
- Soils – good drainage

Minimum winter temperatures

In GA, when thinking about winter temps, we are talking about:

- > # of chilling hours in the winter = > synchronization of phenological stages
- Fluctuating winter temperatures are a concern (vine acclimation and deacclimation)
- In Vinifera/bunch grapes, first chilling concern are the buds
- Muscadines, more likely to see damage to permanent vine structure

Dormant Grapevines

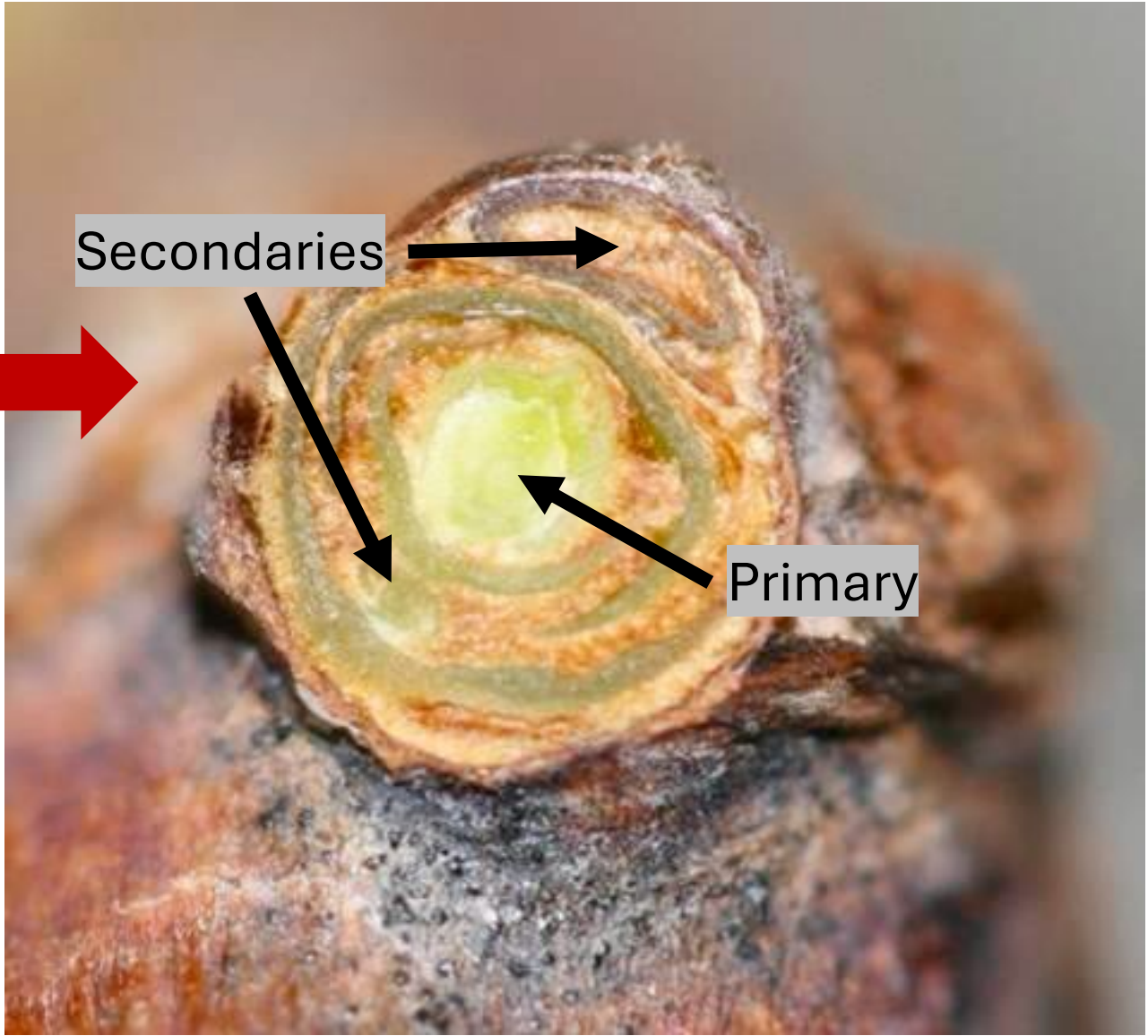


1-year old wood that
will bear the buds for
next year's crop

Photo: Barry Skinkis



Photos: Patty Skinkis



Bud cold hardiness

Prosser, Washington

Mills et al. 2006

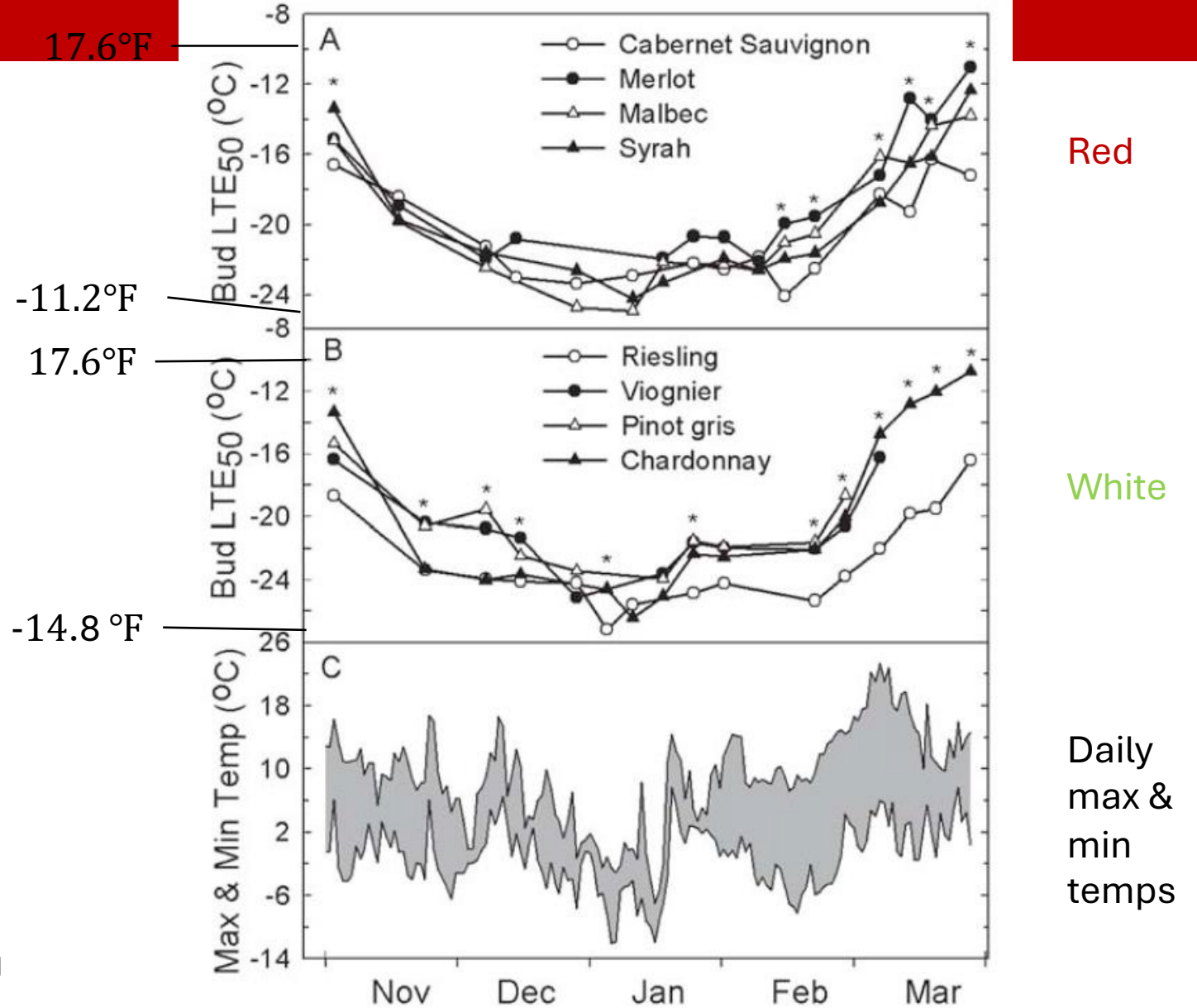


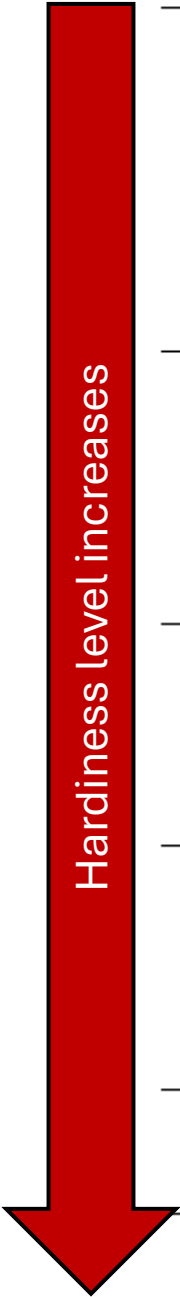
Figure 5 Bud cold hardiness (based on LTE_{50}) of eight *V. vinifera* cultivars from November 2004 through March 2005 in Prosser, WA. Red winegrape cultivars (A), white winegrape cultivars (B), and daily maximum and minimum temperature (C). Asterisk (*) indicates dates at which differences in LTE_{50} were significant at $p \leq 0.05$ (n = 4).

Vine Cold Hardiness

- Avoiding winter damage by:
 - Site selection
 - Cultivar selection
- At greater risk when:
 - vines are stressed
 - recent warm weather

	Minimum winter temperature*
<i>Vitis vinifera</i>	-5°F
American <i>Vitis</i> species	-20°F (or lower)
Interspecific hybrids	-10 to -30 °F (or lower)
Muscadines	0°F (????)

*Approximate -> depends on acclimatation



Cold hardiness class	Range of critical temperatures*	Species	Example of varieties
Very tender	5 to -5°F	Most <i>Vitis rotundifolia</i>	Carlos, Cowart, Scuppernong, Supreme
		Most <i>Vitis vinifera</i>	Chenin blanc, Merlot, Semillon, Syrah (Shiraz), Sauvignon blanc, Zinfandel
Tender	0 to -8°F	Most <i>Vitis vinifera</i>	Chardonnay, Cabernet Sauvignon, Gewurztraminer, Pinot gris, Pinot noir, Sangiovese, Viognier
Moderately tender	-5 to -10°F	Some <i>Vitis vinifera</i> Some hybrids	White Riesling, Cabernet franc, Lemberger, Gamay noir, Chambourcin
Moderately hardy	-10 to -15°F	Most hybrids	Cayuga White, Chardonnay, Traminette, Norton, Seyval blanc, Vignoles
Hardy	-15 to -20°F	Most <i>Vitis labrusca</i>	Catawba, Concord, Delaware, Niagara
Very hardy	-20 to -30°F	Some hybrids	Frontenac, Foch, LaCrescent

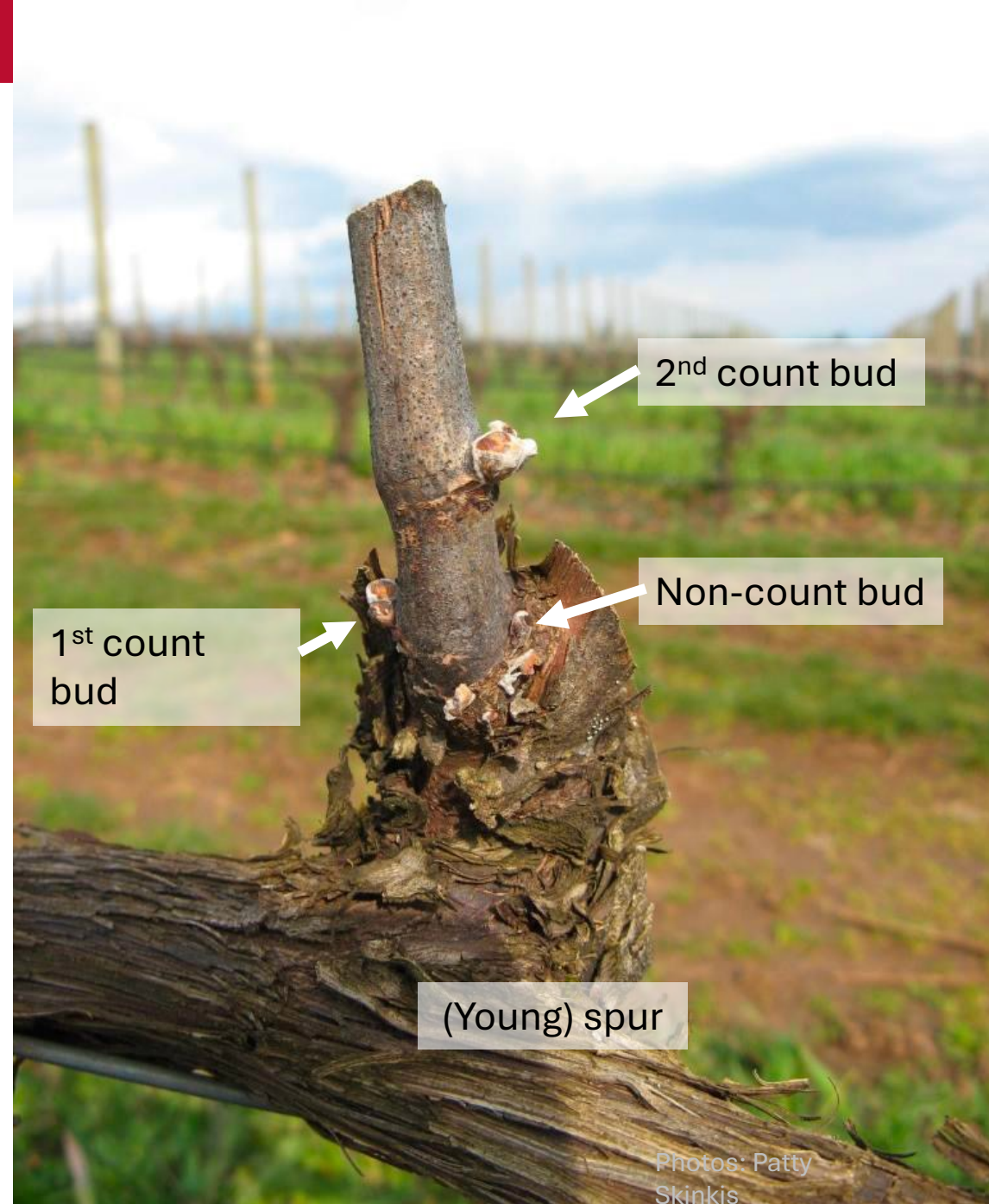


Cold damage
stress
responses
(Post-cold
incident)

Structure of a spur

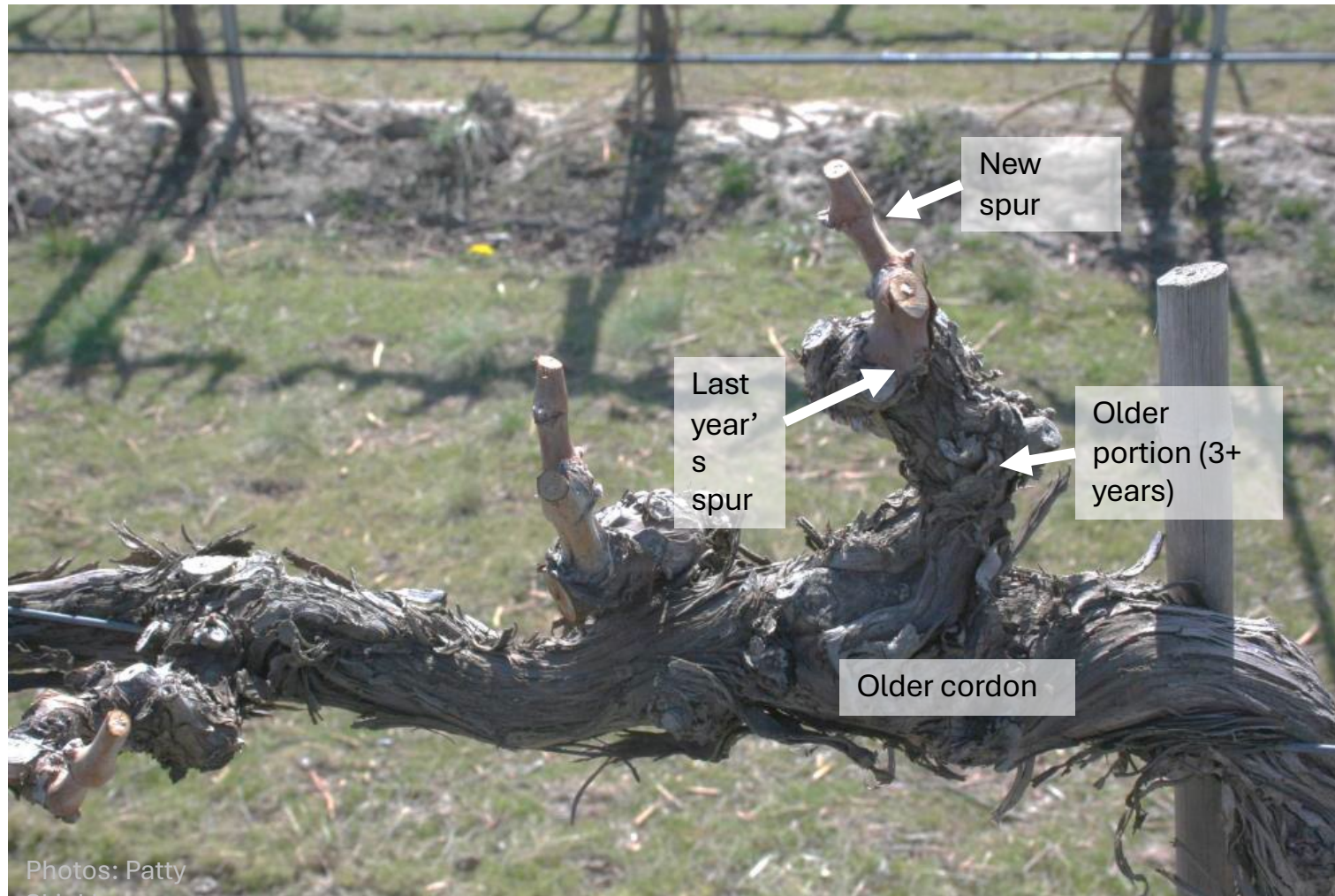
Pruning to 2 buds per spur, spurs
3-8 inches apart

When pruning is done later in the
season (February), can adjust for #
of dead buds



Photos: Patty
Skinkis

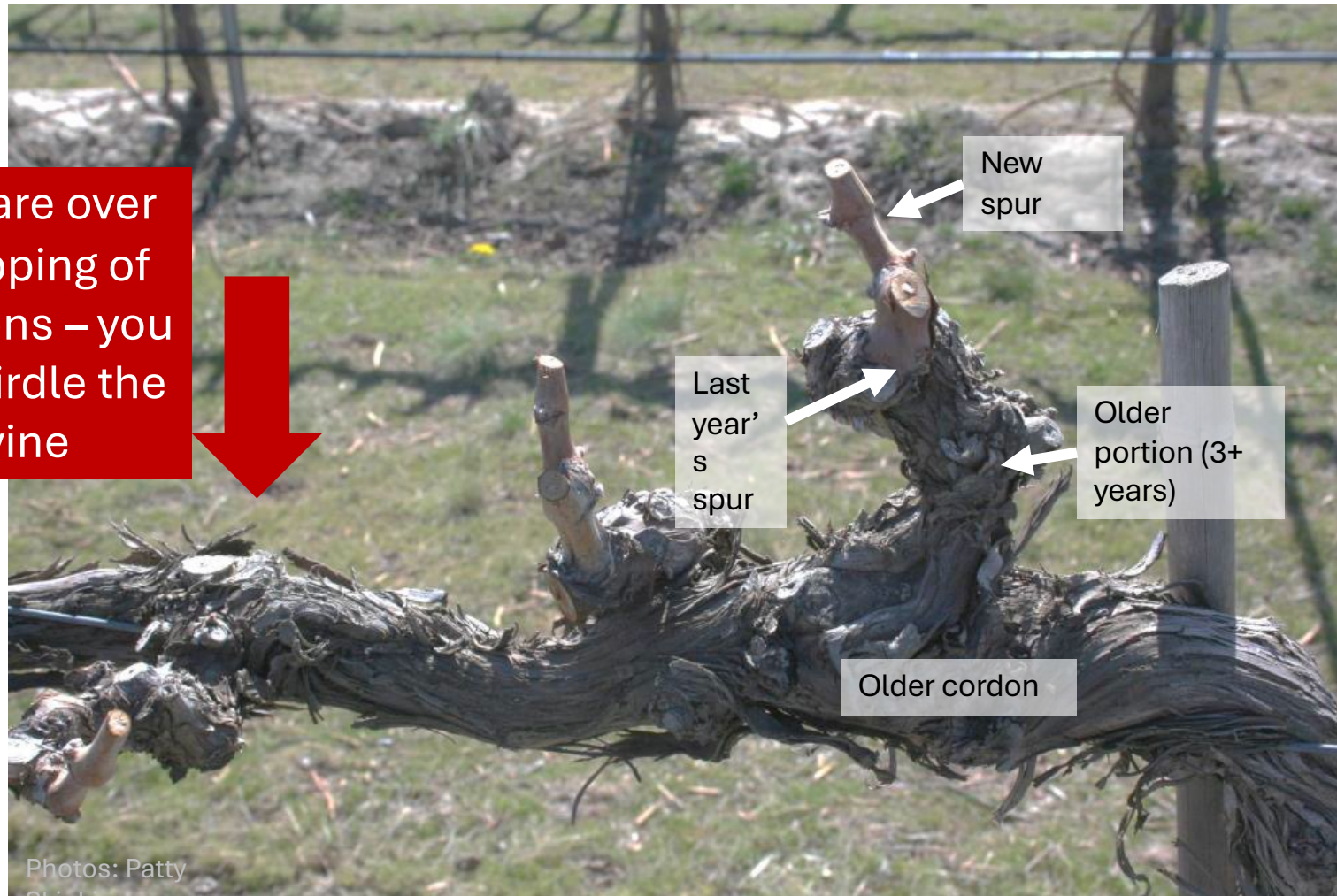
Structure of a spur



Photos: Patty
Skinkis

Structure of a spur

Beware over wrapping of cordons – you will girdle the vine



Photos: Patty Skinkis

Pencil rule

- Canes kept should be:
- **AT LEAST as thick as a pencil**
- **LESS thick than a quarter (bull cane)**



Photos: Patty Skunks

Winter damage ≠ Frost Damage

- Different vine susceptibility AND prevention/protection methods

Damage Type	State of Vine	Timing	What is damaged?
Winter cold damage	Dormant	Winter	Buds, phloem
Frost Damage	Growing	Spring/Fall	Leaves, shoots, flowers/fruit

Spring frost events

- Damage
 - Early Spring: emerging buds
 - Spring: young tissues (leaves, shoot tips, flowers)

Meristem of primary shoot killed



Secondary + tertiary buds will grow



Delay in growth

Yields are reduced



March 22, 2023
1 week after
frost event



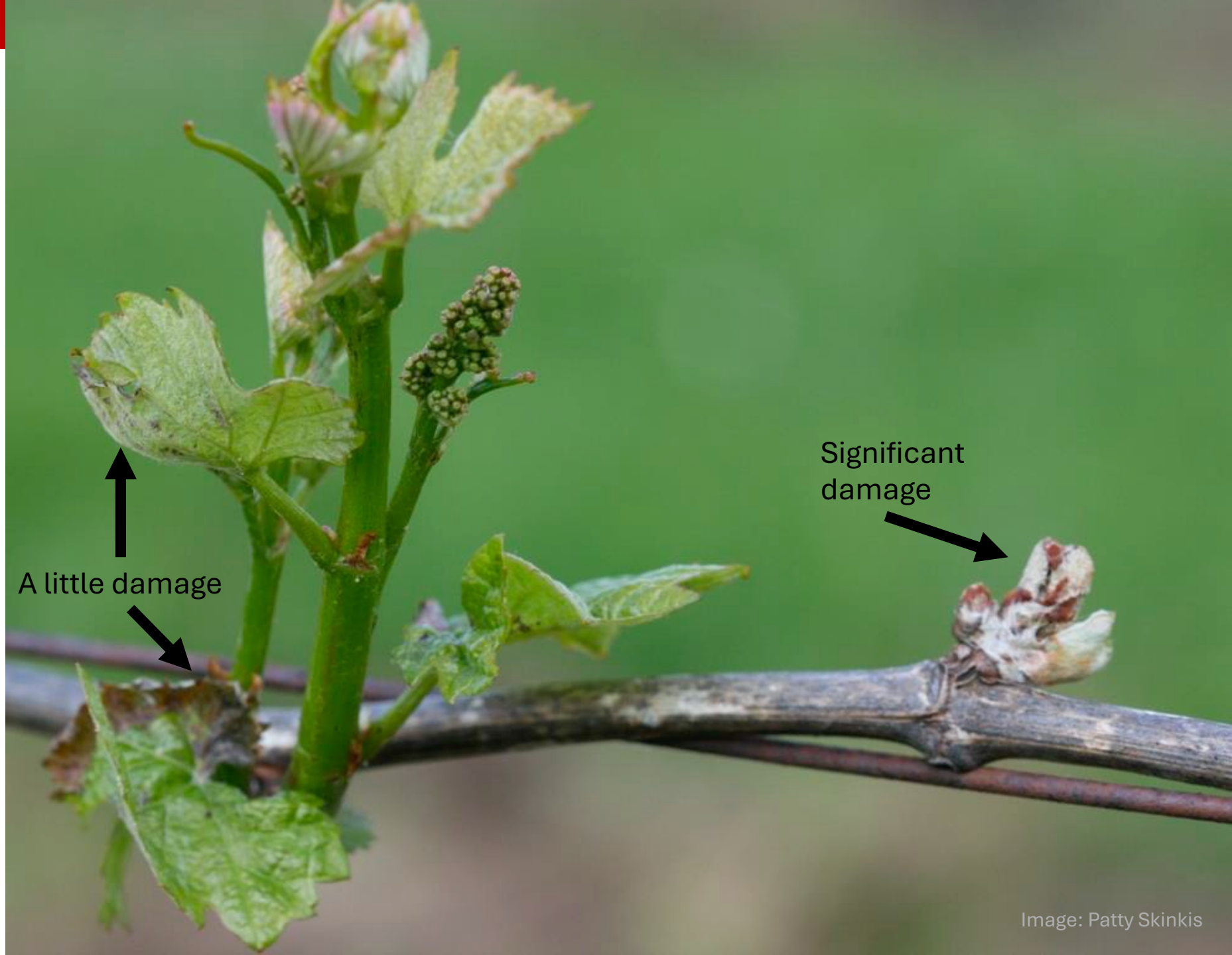
June 22, 2023

Primary shoot - shoot that began growing from bud in spring. Damaged by frost.

Secondary shoot - shoot begins to grow since loss of primary.

Cane - shoot that grew last year and maintained at pruning.

Node contains 1 compound bud



A little damage

Significant
damage

Fall frost events

Damage potential:

- Canopy
- Fruit
- Buds for next year

Impacts:

- Fruit ripening
- Carbohydrate and nutrients going into storage reserves



We see these issues more often when there is also high disease levels in the canopy

Image: Patty Skinkis

Determining Probability of FFDs

- Use historical climate data (long-term)
- Use temperatures ~ 30°F

UGA Weather Network:
Georgiaweather.net

Weather Stations

Select a station from drop down list below

Select a Station ▼

Nearest Stations

Enter a GA ZIP Code to check three nearest stations

First Frost Date

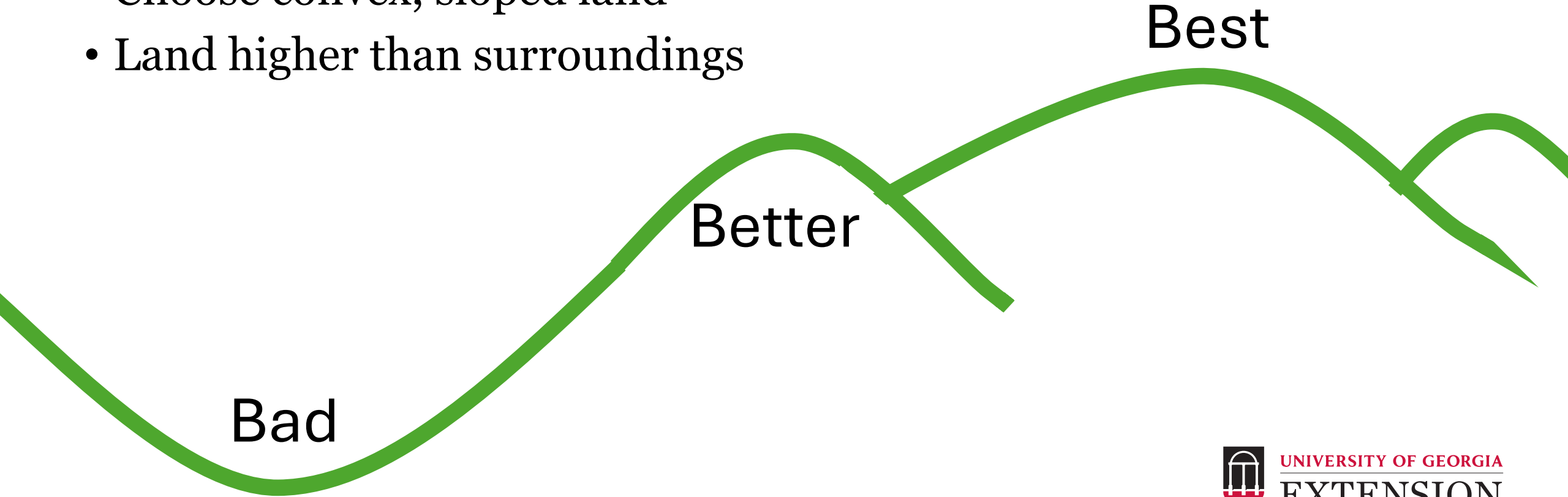
Choose a station :

BLAIRSVI

From Sep - 1 to - Dec 31	First Frost Date	Frost Temperature (°F)
2023	Oct 09	31.4
2022	Sep 29	31.9
2021	Nov 07	25.9
2020	Nov 02	29.9
2019	Oct 18	30.4
2018	Oct 22	29.2
2017	Oct 26	28.9
2016	Oct 23	29.3
2015	Oct 17	30.1
2014	Oct 05	29
2013	Oct 24	28.8
2012	Nov 01	31.1
2011	Oct 03	31
2010	Oct 05	31.5
2009	Oct 18	30.2
2008	Oct 19	29.8

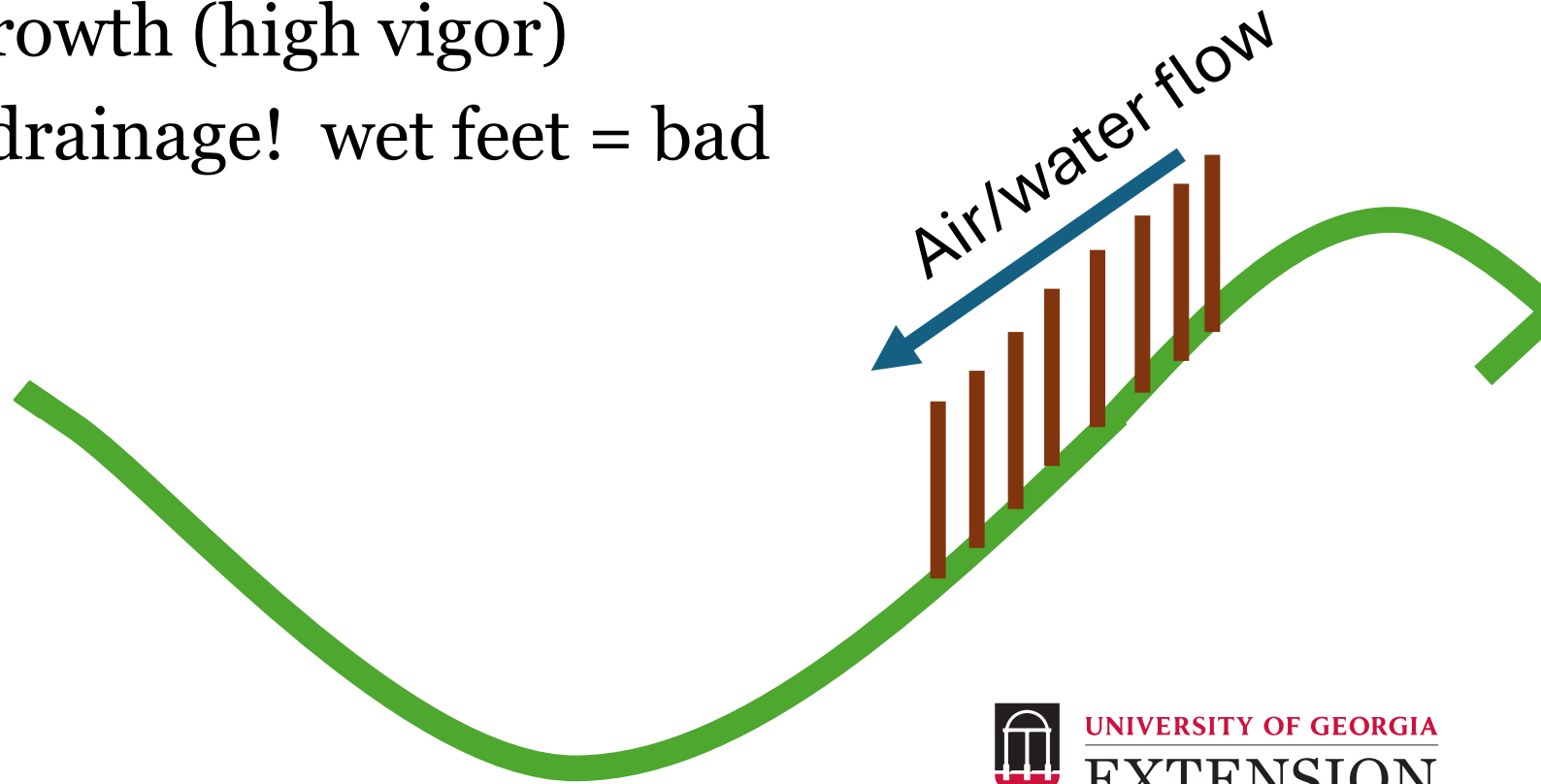
Vineyard site selection for frost protection

- Choose convex, sloped land
- Land higher than surroundings



Vineyard Site Selection

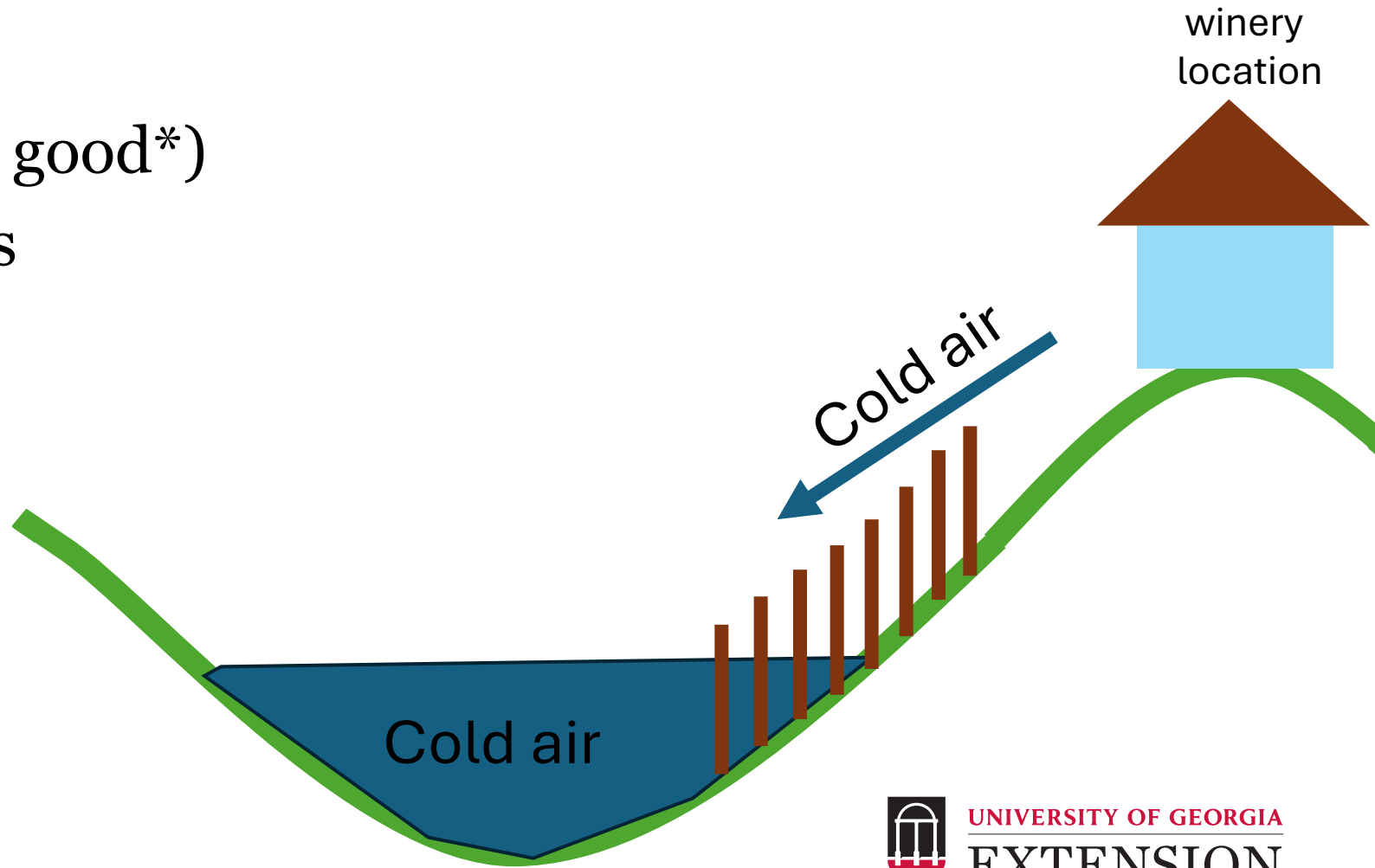
- Humid climate, often vines have more water than they need
- Causes excess canopy growth (high vigor)
- Vines need good water drainage! wet feet = bad
- Air flow can help dry canopy (reducing disease pressure)



Vineyard site selection

- Air movement (windy = good*)
- Beware the frost pockets

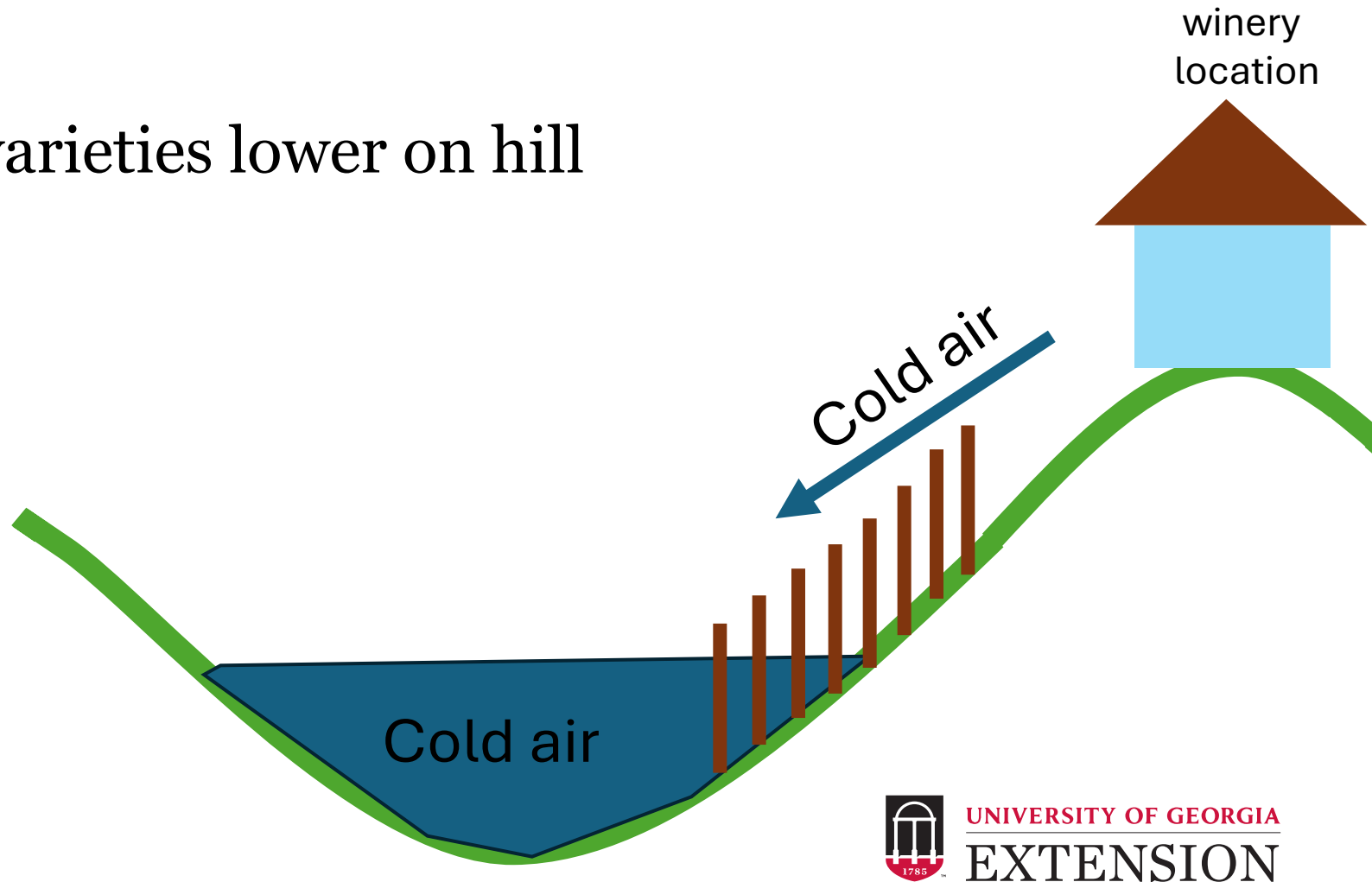
*good for frost protection
and somewhat disease control



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Vineyard site selection

- Put later bud breaking varieties lower on hill



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Vineyard site selection- Topography

Important factors for sunlight interception and cold air drainage

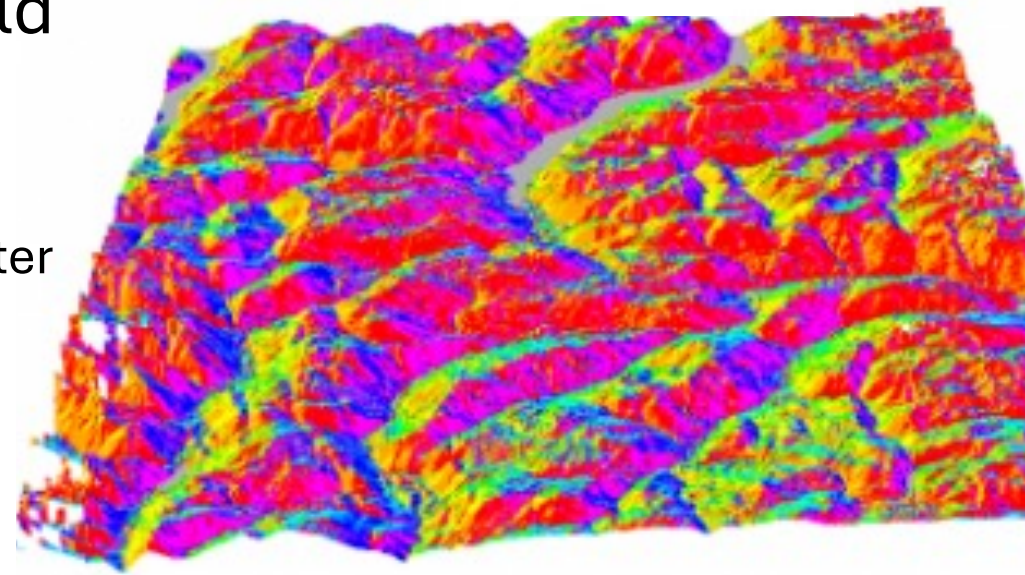
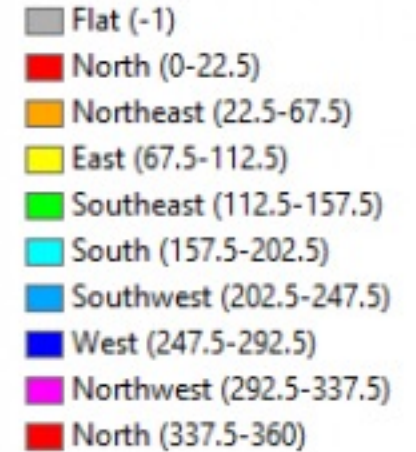
- **Aspect** = direction (N, S, E, W)
 - Solar radiation, heat accumulation
 - South slopes will increase heat units (unnecessary)
 - East slopes dry off earlier in day
- **Slope** = Percent grade
 - Machinery operation/working conditions
 - Water runoff and soil erosion
 - Water, air drainage
 - No steeper than 15%
- **Elevation** – relative and absolute
 - **GA** – 1800' or higher for Pierce's Disease



Vineyard site selection

Aspect (direction of slope)

- Areas with cooler climates:
 - Choose south to southwest facing slopes
 - Allow mx. Heat accumulation to grow & ripen grapes
- Areas with warm or hot summers and cold winters:
 - Choose north to northeastern facing slopes
 - Vines stay dormant longer, less potential for winter injury & spring frosts
- **Areas with high disease pressure:**
 - Choose east facing
 - for morning sun to dry canopy faster



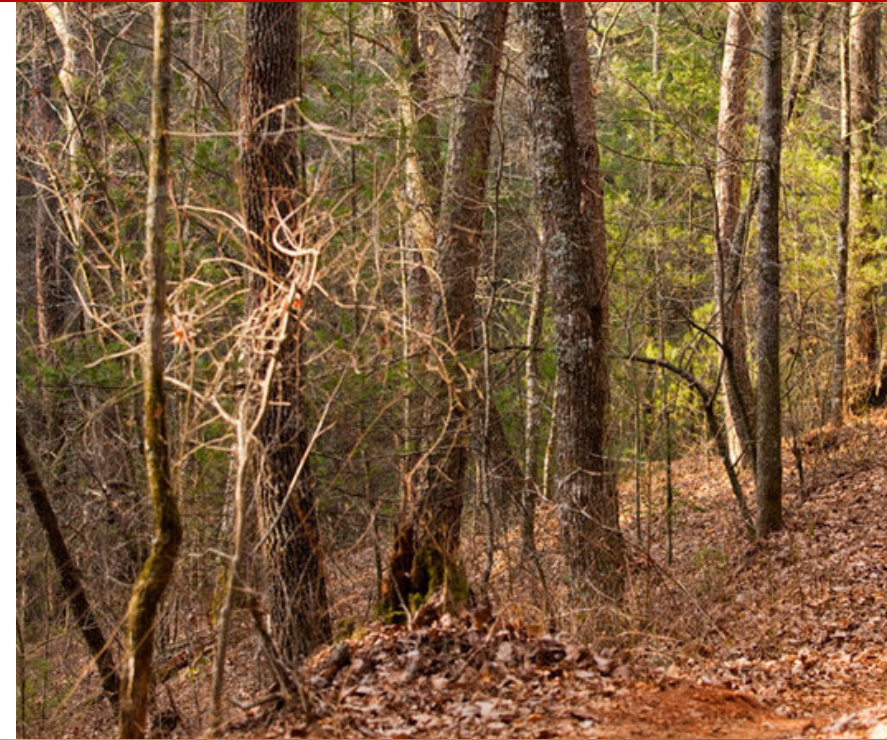
Vineyard Site Development

- Cropping history
- Soil test:
 - pH, P, K, Mg
- Eliminate noxious weeds
- Address shade issues
- Eliminate wet areas in field
- Remove barriers to good air drainage
- Establish a good ground cover on vineyard floor (though there can be lots of variability here...)



Previous land use

- How was the land previously used?
 - (other crops? Forest?)
- What is in the surrounding crops/plant life?
- Land-use and zoning considerations?
- Proximity to urban areas



Soils for Vineyards

- Soil pH – 6.0 to 6.5
- Deep, Minimum rooting depth 30 to 36 in.
- Low to moderate fertility
- Organic matter content < 3.5%
- Good water supplying capacity,
but well-drained, both internally and surface



**Adjusting the soil is very hard once
the vines are in the ground**



A little lime may be needed...



- Many soil testing recommendations for lime (such as UGAs AESL reports) provide recommendations for 6 inches of soil depth.
- AKA, you'll need to probably at least triple the recommendation to get to the depth needed in vineyards

Organic Matter

- Why less than 3.5 % O.M?
 - 30 to 60 pounds of actual nitrogen are released per 1% organic matter per year due to mineralization
 - At 3.5% O.M., between 105 and 210# actual N may be released
 - ~ 1/2 of this is available to vines
 - This exceeds the per acre recommended rate of N for bunch grapes resulting in excess vegetative growth delayed fruit ripening & poor fruit quality

Soil physical properties influence root development

- Vertical root distribution determined by:

- Soil texture
- Stoniness
- Depth of water table
- Depth of restrictive barrier
- Genetics

- Fine textured soils (silt, clay) have

- Higher water-holding capacities
- Lower infiltration rates
 - Therefore, roots tend to be small & fine textured



Root System of Grapevines

- Depth
 - 60% of roots in the top 2 ft. of soil
 - Roots may extend down over 18 ft. in some soils
- Lateral spread
 - Possibly up to 30 ft.
 - ~ 15% of total biomass between 4 and 5 ft. from the trunk

Grapevine rooting patterns: A comprehensive analysis and review. D. Smart, E. Schwass, A. Lakso & L. Morano. Am. J. Enol. Vitic. 57(1): 89 – 104. 2006



Photo (Mike Trought; [Wines & Vines](#)): Grapevine root system

Water Drainage

- Vines will not tolerate “wet feet” during the growing season
- Eliminate wet areas in fields
 - Ditching
 - Tile drainage
 - Find another site



Soil Features Summary

Soil Feature	Importance	Desirable Value	Undesirable Value	Ability to Modify
Internal water drainage	xxxxxx	> 2"/hour	< 2"/hour	Ditching, tile drainage
Water holding capacity	xxxxx	> 0.15inch/inch of soil	< 0.1 inch/inch of soil	Increase organic matter level
Fertility	xxx	Low to medium	High fertility	Vine/rootstocks, spacing, ground cover competition
Effective rooting depth	xxx	> 3 feet	< 1 ft.	Deep ripping, irrigation
Texture (sand/silt/clay)	xxx	Loam, sandy loam, sandy clay loam	> 50% silt	
Soil pH	xxx	6.0 – 6.5 (6.5 for <i>vinifera</i>)	< 5.0 (Al toxicity)	Preplant <u>liming</u> to raise pH or acidification to lower pH
Organic matter content	xx	1.0 – 3.0 %	> 3.5%	Vine spacing, ground covers

Adjacent Agricultural Operations

- Need for buffer zones
 - An area separating a certified production area from an adjacent land area not maintained under organic management

- Potential for herbicide drift

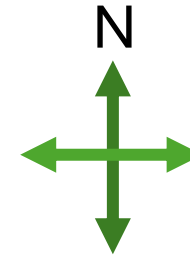


Row Orientation

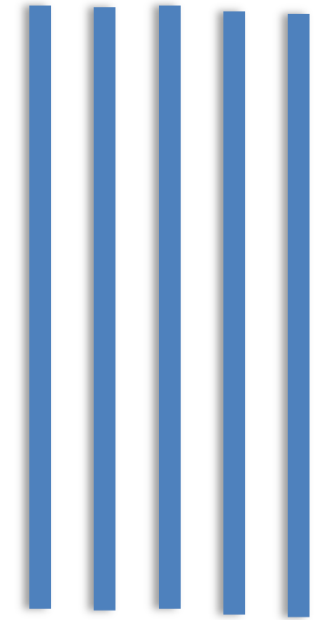
- Orientation = Cardinal Direction
- Less impactful in wider spacing and open canopies (non-VSP)

Practical considerations:

- Contour to prevent erosion
- Wind control
- Reduce risk of frost damage
- Safe operation of tractors and equipment
 - Terracing (running rows across the landscape) for slopes >30%



N-S orientation



E-W orientation



Row Orientation

Steep slopes – don't contour up and down the hill

(ideally <15%,
definitely <30%)

Willamette Valley,
Oregon site



Image: Patty Sinkis

Row Spacing

Narrow row spacing =
more linear feet of
vines per acre

Calculation of linear
ft/acre:
 $43,560 \text{ ft}^2 / \text{row spacing in ft}$

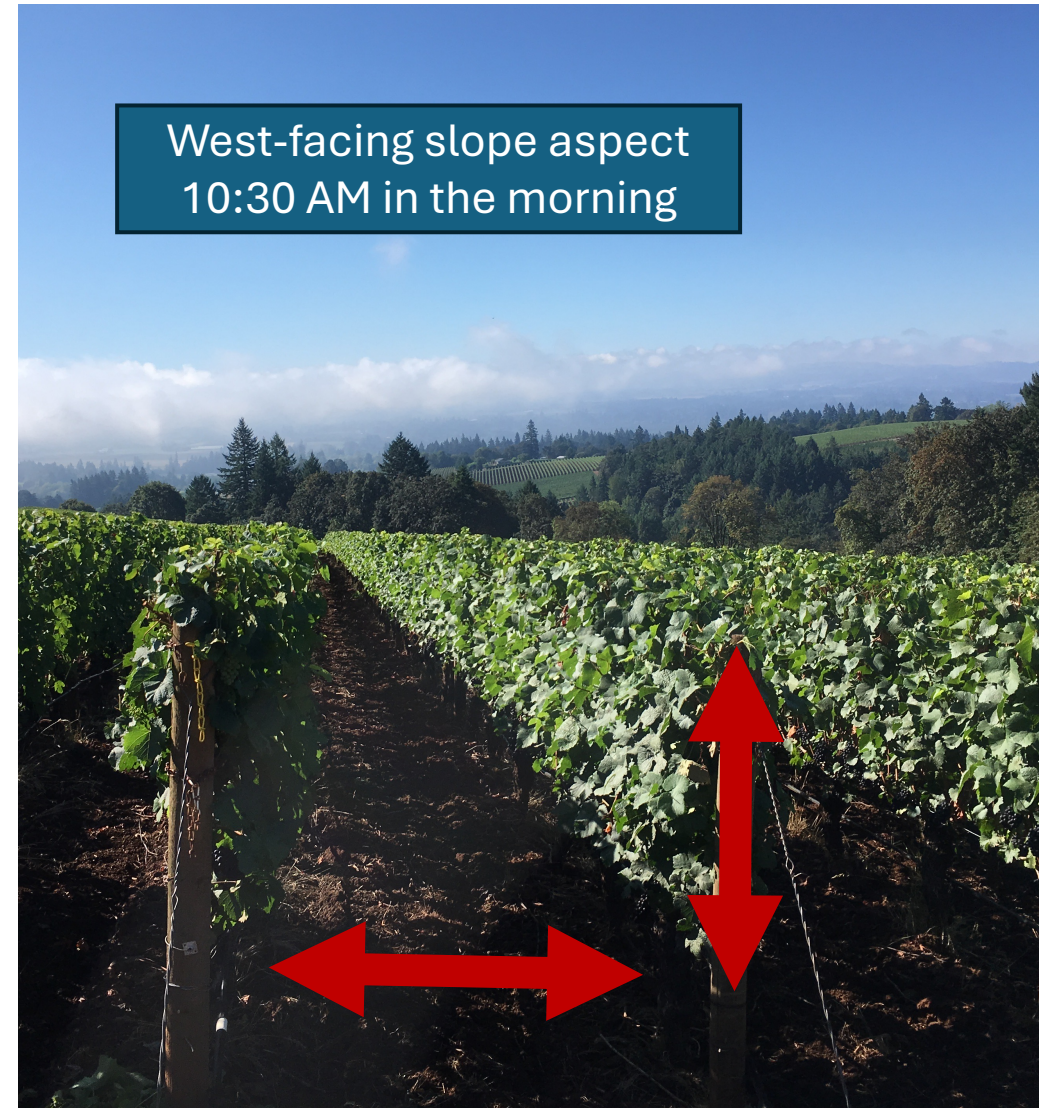
West-facing slope
aspect
10:30 AM in the morning



Row Spacing

- **Goal: to maximize area**
- With enough space for equipment (at least 1.5 ft on each side of equipment) but also not too much space (so you can spray in both directions)
- Rule of thumb: No less than 1:1
 - trellis height: row spacing
- In east coast US, generally 9-12 ft depending on trellis/training system, slope, vine vigor, soils, equipment

Keep full-sun vine requirement in mind!



Vine Spacing in eastern US



- Often high vigor sites/varieties
- General vine spacing recommendations:
 - *Vinifera* –4-6 ft
 - Hybrids - 6-10 ft
 - Muscadines – 12-20 ft
 - Higher vigor vines can be spaced further apart, but bigger vines can be more stressed, lose productivity on ends
- Trellis System will change interrow spacing requirements
- Site water availability is important here!
 - More water = bigger vines = lower vine density
 - Less water = smaller vines = higher vine density
- Allow at least 24 - 35 ft. turning room at ends of rows

Vertical Shoot Positioned Trellis (**VSP**)



Vertical Shoot Positioned Trellis (VSP)

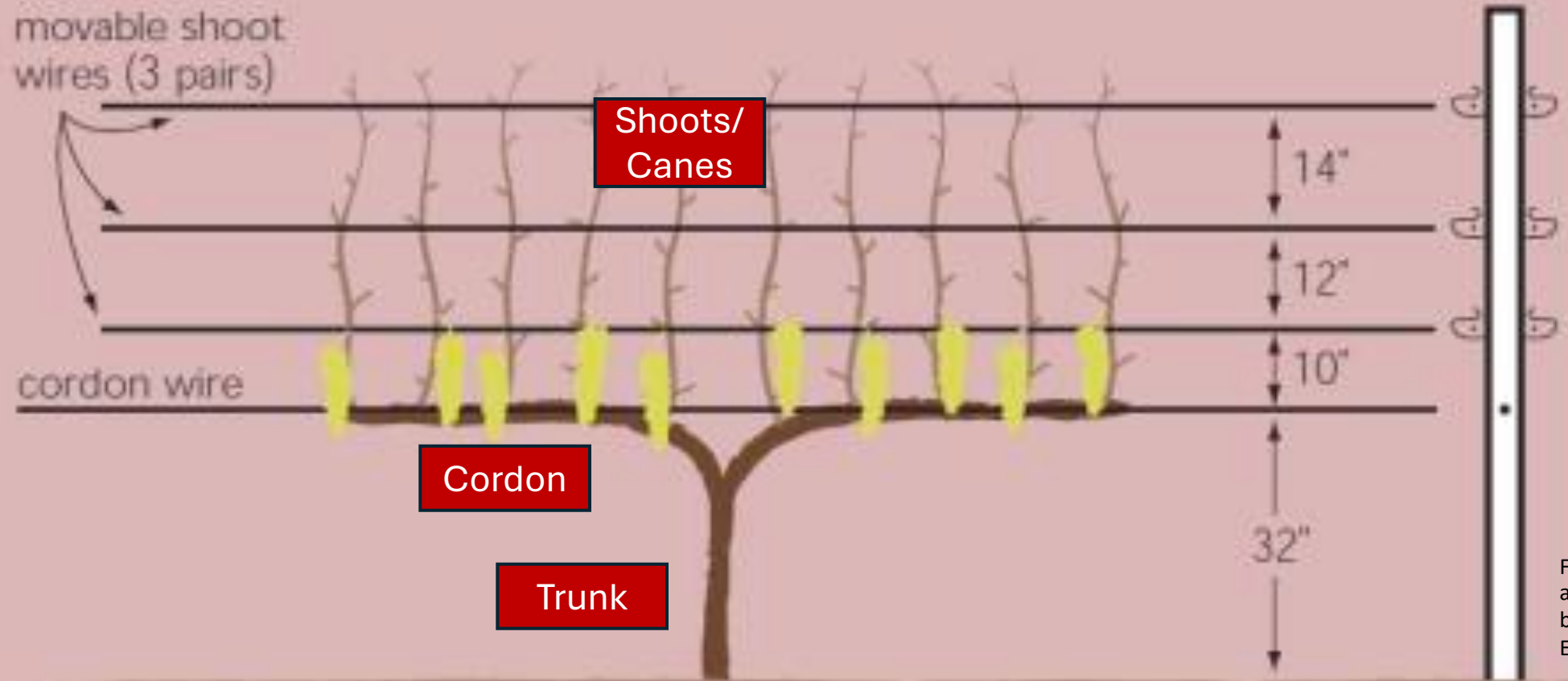


Figure: Trellis Selection and Canopy Management by UC Cooperative Extension.

Most common or, at least, most quintessential vineyard trellis system



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High-wire/ Hanging

- Low cost for establishment
- Mechanizable
- Accommodates vines with low, moderate, and high vigor
- Requires hedging to prevent shoots touching the ground
- Heavy (fruit laden) shoots can break



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Diseases referenced from: Compendium of Grape Diseases,
Coombs, and Pests Second edition, 2015. Editors W.F. Walcott,
W.D. Gubler, and J.K. Speckard. APS Press.

Bitter rot photo: Scott Alvar, University of Missouri

Anthracnose photo: Bruce Baskin, professor, Horticulture and
Landscape Architecture, Purdue University

Grape flea beetle photo: Natasha Wright, Cock's Pest Control,
Bogwood.org

extension.uga.edu

Circular 1151

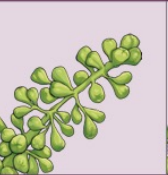
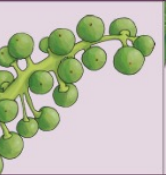
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CULTURAL PRACTICES

Viticultural practices optimize
vineyard health, profitability, and
sustainability and improve crop
quantity and quality. Like pest
management, viticultural practices
should be implemented in a timely
fashion throughout the growing
season to maximize practice
efficiency and benefit gain.

1	2	3	4	5	6	7	8	9	10	11	12	13
DORMANT	BUD SWELL	BUD BREAK	PREBLOOM	BLOOM	FRUIT SET	BB-SIZED FRUIT	PEA-SIZED FRUIT	BERRY TOUCH	BUNCH CLOSURE	VERAISON	PREHARVEST	HARVEST
												
CANE AND SPUR PRUNING should be completed during vine dormancy. Pruning is typically completed from December through March in Southeastern U.S. vineyards. Pruning sets the crop potential by retaining buds that are anticipated to bear fruitful shoots. Pruning is also used to remove dead or diseased grapevine wood.   Any frost pruning should be completed during bud swell. Bud swell alarms growers of impending bud break, a critical stage for frost protection and the first stage when green tissues are observed.		SHOOT THINNING should occur when shoots are about 3-7" long, preferably as early as it's possible to identify fruitful vs. non-fruitful shoots and before tendrils grab neighboring shoots. Shoots should be thinned to roughly 3-5 shoots per linear foot of cordon or cane. 	SAMPLING involves collecting leaf tissues (petioles and/or blades) from opposite lower clusters at the bottom of the shoot. Tissues should be submitted for nutritional analyses, particularly in suspect cultivars or blocks. If needed, administer ground-applied fertilizer. 	LEAF REMOVAL should be implemented immediately after fruit set, optimally before the growth of BB-sized berries. Leaf removal at this early stage acclimates grapes to ambient radiation and temperatures, reducing the threat of severe fruit sunburn relative to leaf removal after berries reach pea size. Fruit zone leaf removal hastens cluster drying, improves spray penetration, and therefore offers better bunch rot control relative to unmanaged fruit zones.  					LEAF REMOVAL amounting to a "cleanup pass" may be required around bunch closure to remove foliage that has regrown into the fruit zone. 	SAMPLING involves removing leaf tissues from fully expanded leaves at the top of primary shoots for nutritional analyses. Growers can choose to sample specific vines or regions if deficiency symptoms are evident at veraison. 	SCOUTING for nutrient disorders and systemic infections should occur throughout the entire post-veraison to preharvest period, when vines become stressed and are allocating resources away from leaves to ripening fruit. Red leaves are indicative of nutrient disorders but may also indicate systemic infections. If time is limited, flag vines and plan to tend to them after harvest. 	HARVEST decisions are cultivar-, region-, and site-specific. Use grape chemistry analyses, sensory perception (taste, color, fruit integrity), intended wine style, and predicted weather patterns to make judicious harvest decisions. 
DORMANT	BUD SWELL	BUD BREAK AND NEW SHOOT SPRAYS*	PREBLOOM	BLOOM	POSTBLOOM*	FRUIT SET*	EARLY COVER SPRAYS*	BERRY TOUCH AND BUNCH CLOSURE*	LATE COVER SPRAYS*	VERAISON	PREHARVEST	POSTHARVEST*



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***Discover the secrets to growing
Georgia's finest grapes and
unlock the path to a thriving
vineyard in the heart of the
South.***

[See the Growing Regions](#)

<https://viticulture.uga.edu/>

Latest Posts



Mancozeb Update



**Disease Management
Webinar tomorrow!**



**Call for UGA
Winegrower Internship
Hosts!**



Bud Dissections for winter d



Conversions Cheat Sheet:

- 1 acre = 43,560 square feet
 - ~0.4 hectares
- 1 hectare = 2.47 acres
- 1 foot = 0.3048 meters
- 1 meter = 39.37 inches (3.28 feet)

43,560 sq ft/acre

row spacing (ft)  vine spacing (ft)



vines/acre

Vines per Acre/Hectare

Row spacing in feet/meters

Vine spacing in feet/meters		6 1.83	7 2.13	8 2.44	9 2.74	10 3.02	11 3.35	12 3.66
	3 0.91	2420 5977	2074 5122	1815 4483	1613 3984	1452 3586	1320 3260	1210 2988
	4 1.22	1815 4483	1556 3843	1361 3361	1212 2993	1089 2689	990 2445	908 2242
	5 1.52	1452 3586	1245 3075	1089 2689	968 2390	871 2151	792 1956	726 1793
	6 1.83	1210 2988	1037 2656	908 2242	807 1993	726 1793	660 1630	605 1494
	7 2.13	1037 2561	889 2195	778 1921	691 1706	622 1536	566 1398	519 1281
	8 2.44	908 2242	778 1921	681 1682	605 1494	545 1346	495 1222	454 1121