

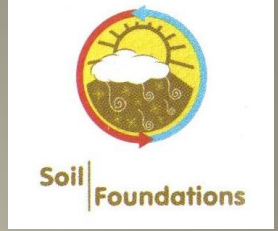


**“Mapping soil variation and  
geomorphology to improve  
vineyard design and  
performance”**

***Alex Blackburn, Blackburn  
Consulting Services, LLC***

**Soil**

**Foundations**



*Soils are like people!*

***Each of us look and act a little differently***



*We generally understand how an individual will react based on their mood!*



*We need to understand how our vines moods will change due to differences in the soil*

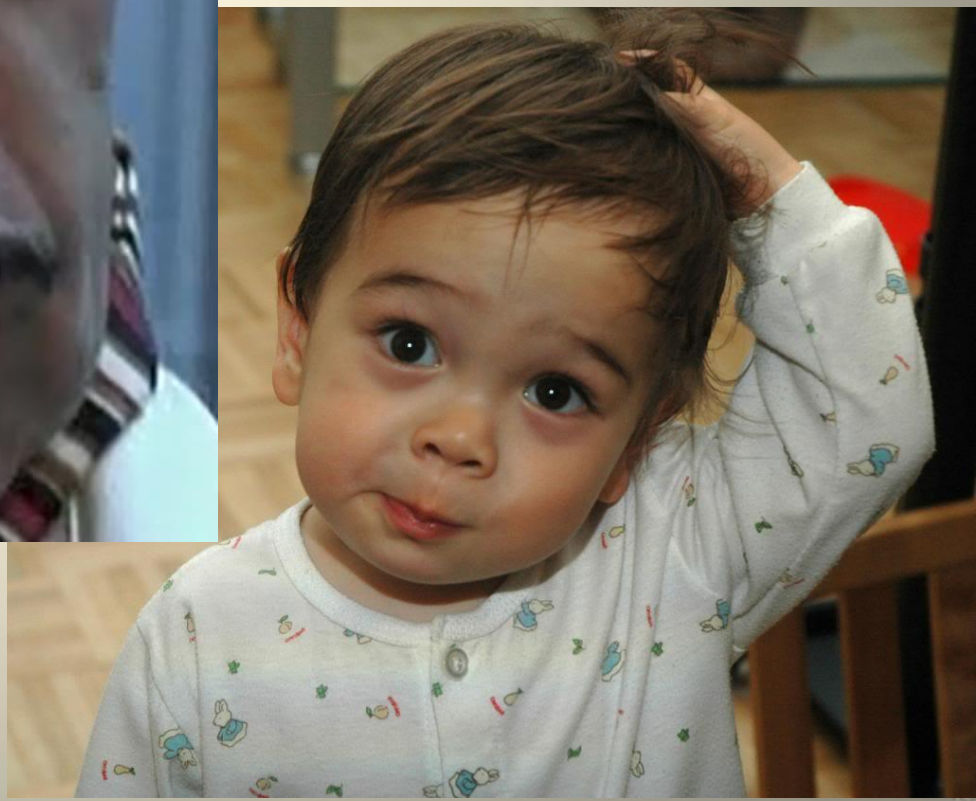
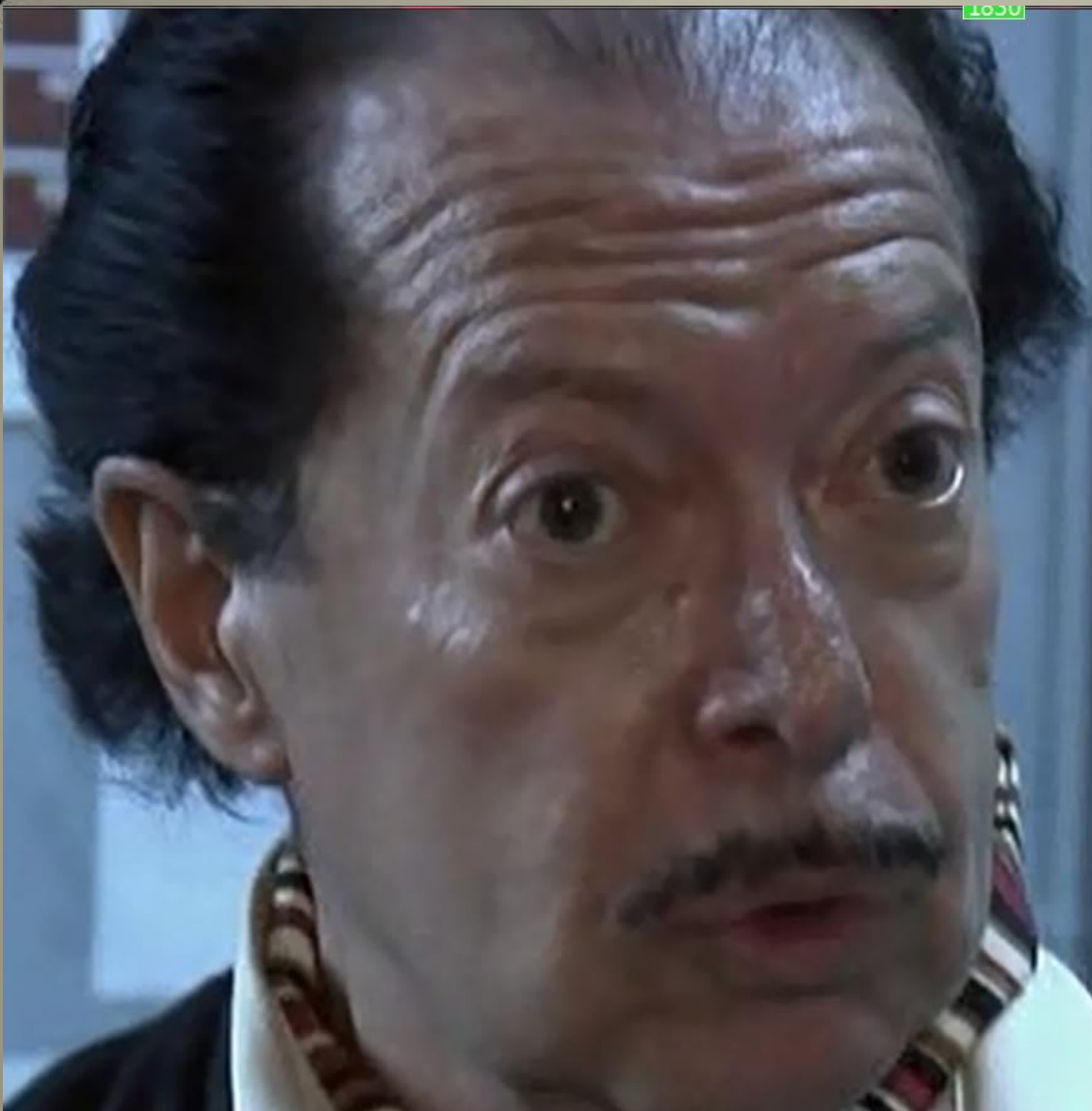


***We often see differences in our vineyards that we can't readily explain***

***Most of the time these differences can be explained by what we see under the ground surface or on the ground surface itself***

# *Today we will discuss*

- *A few Soil Characteristics considered in detailed soil mapping*
- *Major Landforms*
- *Micro-relief (minor landforms)*
  - *Other influencing features*
- *Tools available to help understand your soils*





**Soil characteristics can and do affect  
variability in growth and quality of any crop**





# Soil depth

Variability in Soil Depth – Impacts:  
Rooting depths, Plant Available Water (PAW),  
sometimes soil chemistry (acid vs basic rocks)

What dictates soil depth? Bedrock, Fragipans  
or Discontinuities (different periods layers of  
deposition)

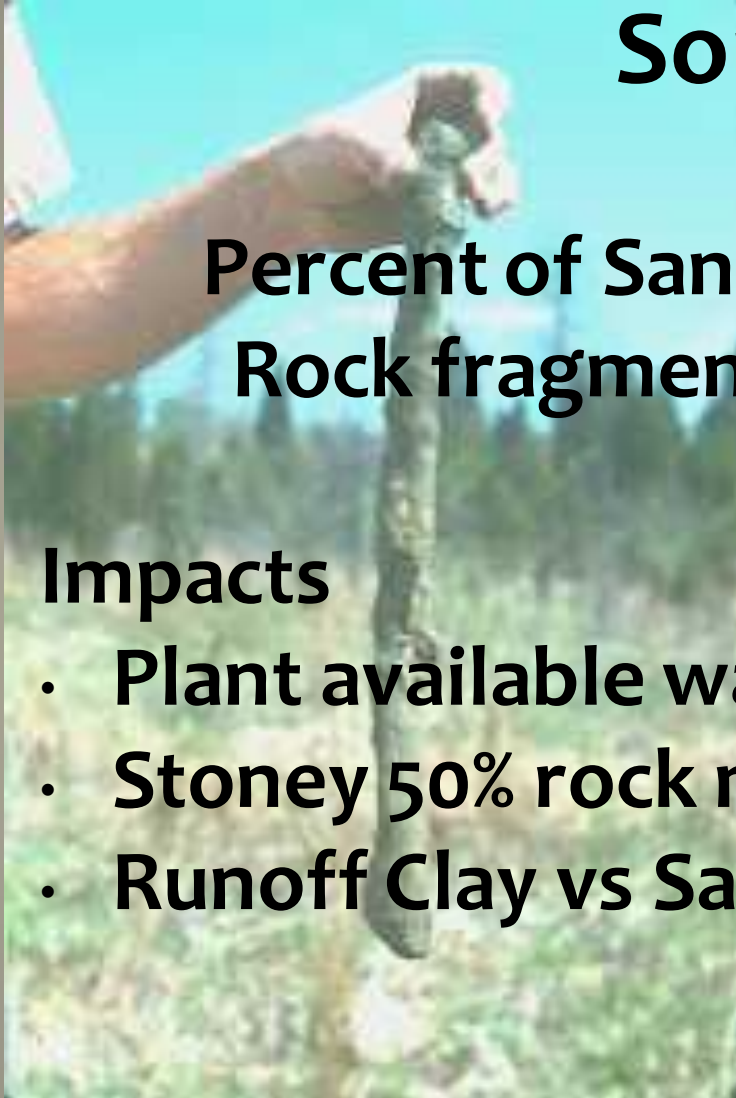
- In addition each of these can hold  
up/perch water further restricting root  
growth and depth

# Soil Texture

Percent of Sand, Silt, Clay and Rock fragments

## Impacts

- Plant available water (PAW)
- Stony 50% rock means 50% less PAW
- Runoff Clay vs Sandy



# Soil Structure

Very important for internal soil drainage and root development

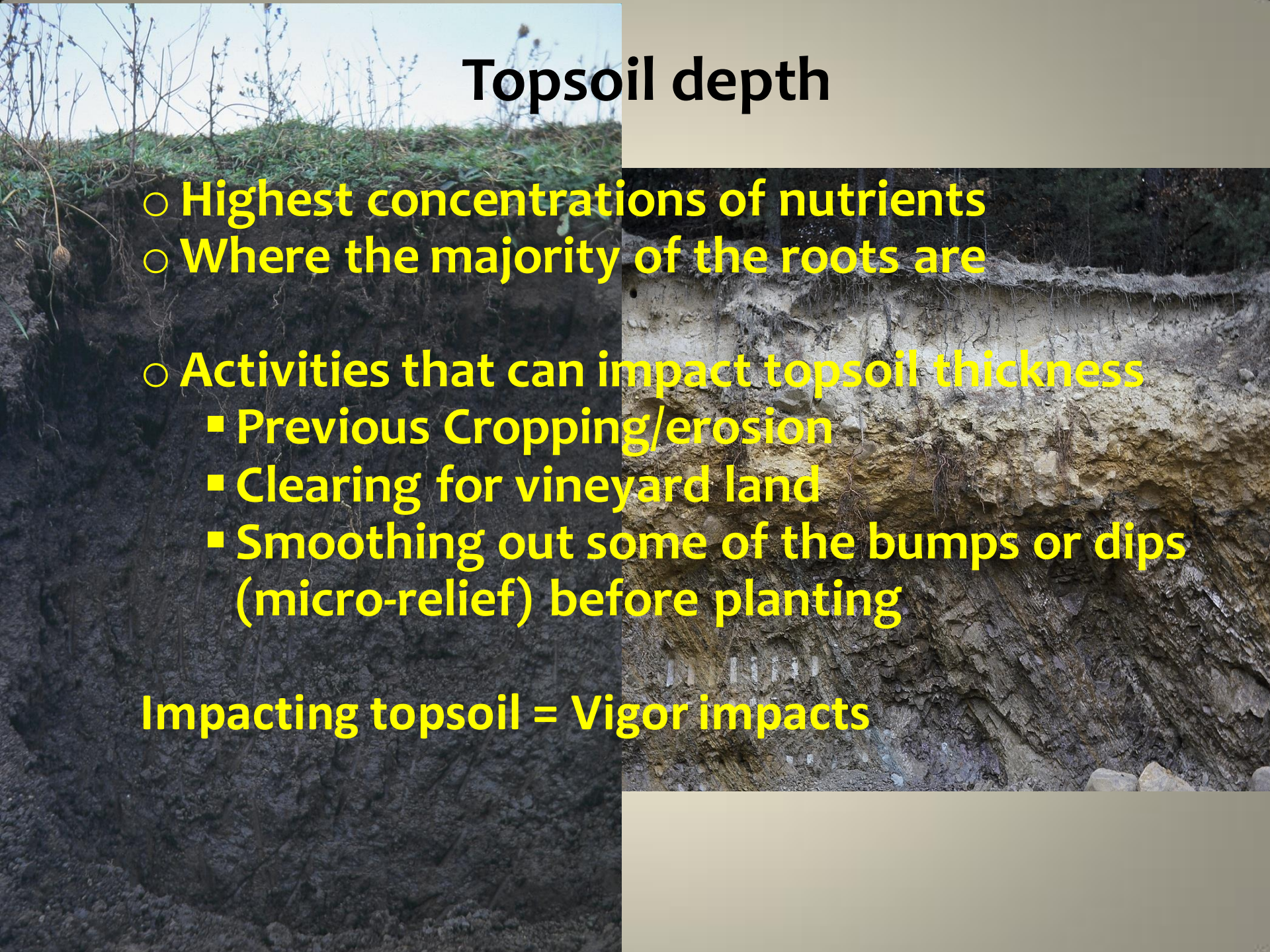
What is soil structure?

- Soil structure can be impacted any time we work the soil while it is at field capacity or wetter.
- Clearing a wooded site, ripping or tilling the soil while it is wet and sometimes even driving over wet soil with equipment can damage soil structure and internal drainage

# Topsoil depth

- Highest concentrations of nutrients
- Where the majority of the roots are
- Activities that can impact topsoil thickness
  - Previous Cropping/erosion
  - Clearing for vineyard land
  - Smoothing out some of the bumps or dips (micro-relief) before planting

**Impacting topsoil = Vigor impacts**





# Soil Chemistry

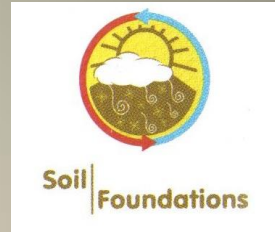
## Before planting:

- Sample blocks (topsoil & upper 24")  
easiest time to get the nutrients applied

## After planting

- Nutrient toxicity and deficiencies in soils are usually apparent in the vegetation.
- Talk to your Extension specialist or Vineyard consultant

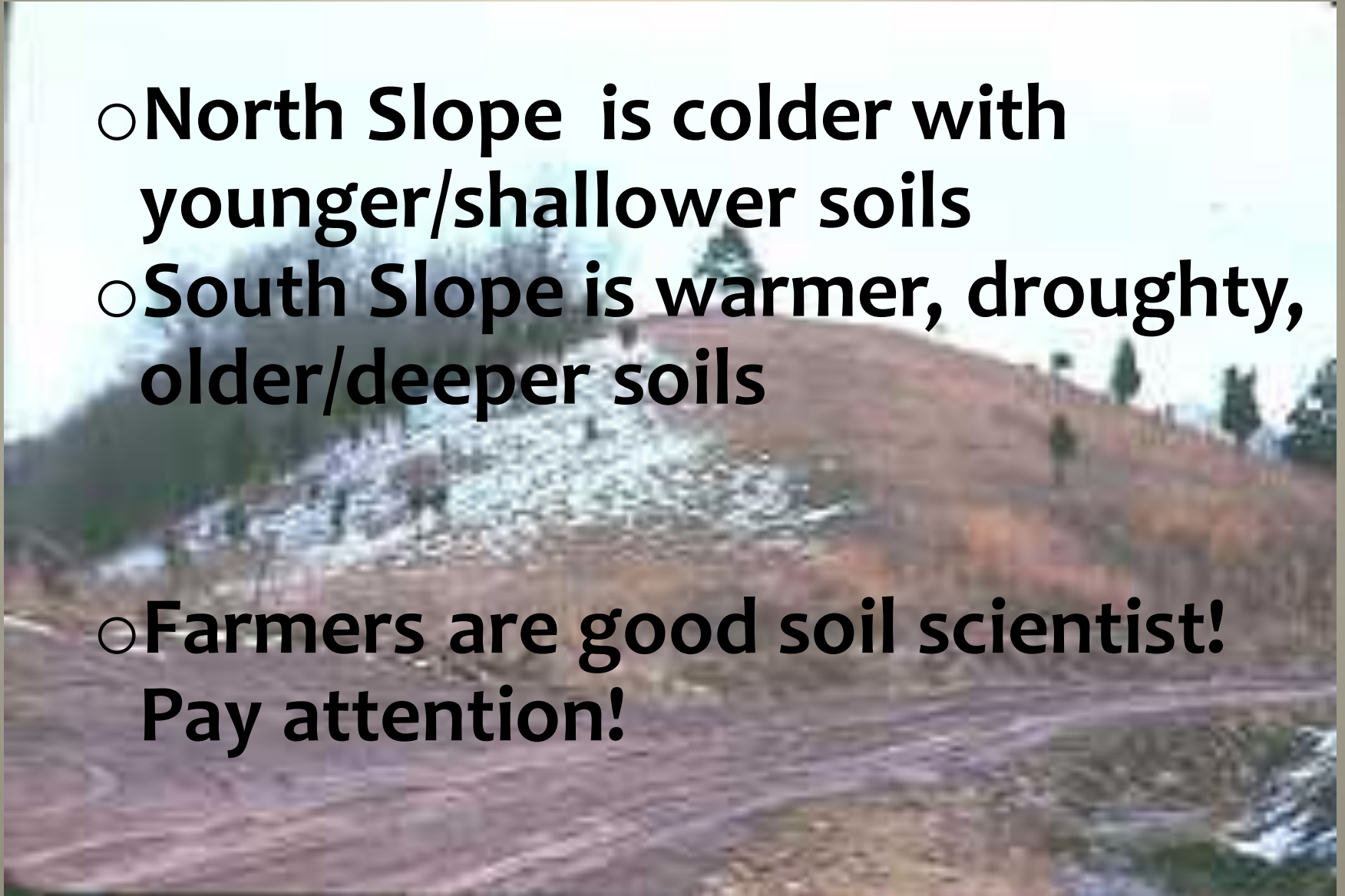
**Soils and soil characteristics are not one dimensional!**



**Careful evaluation of landforms in combination with the soil characteristics is required to understand how vines will grow and what quality of fruit to expect.**

# Aspect (North vs South)

- **North Slope is colder with younger/shallower soils**
- **South Slope is warmer, droughty, older/deeper soils**
- **Farmers are good soil scientist!  
Pay attention!**



# Most everyone understands MAJOR LANDFORMS

- **Ridge top**

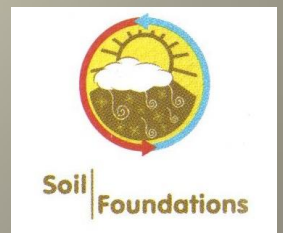
- Higher elevations
- Considered dryer landforms... but be cautious
- Slope ?

- **Sideslopes**

- Concave vs convex
- How much slope?

- **Drainageways with running water**

- Obvious to most to stay out of these positions (Cold and Wet)
  - But how far?





# MICRO RELIEF (Minor Landforms)

- Very subtle differences/variations in the landform.



Soil Foundations



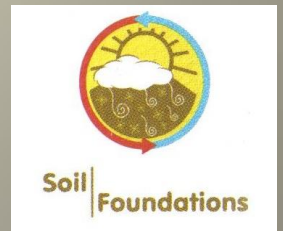


# Smaller bumps and dips

- Underlying rock
- An old tree throw
- An old fence line or road (man made)
- Remnants of cultivated rows/plow furrows

# Upland drainage ways/concave areas

- Very inconspicuous with a potentially large affect
- Concave positions=High vigor
  - Higher PAW, thicker topsoil and nutrients
- Slope either increases or decreases the effect of these swales



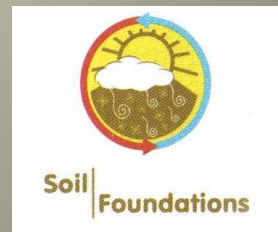
# Texture and Geomorphology



- **Sandy textures generally increase infiltration into the soil**
- **Clayey textures generally reduce infiltration into the soil**
  - Therefore, depending on the slope of the land you may want to be looking for soil textures that either increase infiltration or increase runoff

# Tools for evaluating your soils

- **Web Soil Survey is available on the Web**  
([www.websoilsurvey.nrcs.usda.gov](http://www.websoilsurvey.nrcs.usda.gov))





- ☑ **Great tool to start with**
  - **Can provide information as to the underlying geology or parent material**
  - **Can provide some information on what soil characteristics to expect**

# Web Soil Survey



## ☑ Caution

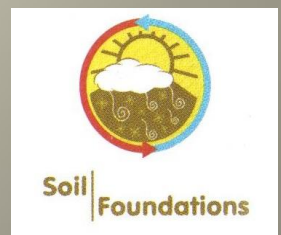
- **Not site specific** (created for interpretation at the County or Statewide level)
- **Not mapped with vineyards in mind**
  - (soils that corn, wheat and soybeans grow well in seldom produce high quality wine grapes)
  - Web SS mapped at a scale of 1"=24000" where drainageway soils are not even shown!
  - Micro relief which can be very important in understanding variability in the vineyard is not considered when mapping for NRCS National Soil Survey

# Use a Licensed Professional Soil Scientist

- Make sure they have :
  - experience mapping soils
  - an understanding of vineyard needs

## **Example of Web Soil Survey vs. Site specific Soil Survey**

- Virginia Techs Research Station in Winchester, Virginia
- Seven Willows Farm in Big Cove Tannery, PA
- Linden Vineyards in Fauquier County





Web Soil Survey

USDA  
Natural Resources  
Conservation Service (NRCS)  
Web Soil Survey



# Soils Map Comparison of Virginia Tech's

*Alson H. Smith, Jr.  
Agricultural Research  
and Extension Center*

Detailed Soil Survey

Blackburn Consulting  
Services, LLC / Soil Foundations  
Soil Survey



Field Work and Map  
Provided By:



Blackburn Consulting Services, LLC  
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<http://www.soilfoundations.com/>

Soil Mapping Legend

17E	Frederick-Poplimento-Rock Outcrop Complex	15 - 45 % slopes
17C	Frederick-Poplimento-Rock Outcrop Complex	2 - 15 % slopes
14D	Frederick-Poplimento Loams	15 - 25 % slopes
14B	Frederick-Poplimento Loams	2 - 7 % slopes
14C	Frederick-Poplimento Loams	7 - 15 % slopes
16D	Frederick-Poplimento Loams, Very Rocky	15 - 25 % slopes
16B	Frederick-Poplimento Loams, Very Rocky	2 - 7 % slopes
16C	Frederick-Poplimento Loams, Very Rocky	7 - 15 % slopes
40B	Timberville Silt Loam	2 - 7 % slopes

Narrative:

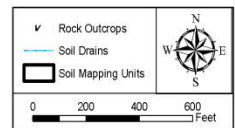
Web Soil Survey on the LEFT

Site Specific Soil Survey prepared by Blackburn Consulting Services, LLC / Soil Foundations on the RIGHT

\*\* Note not only the differences in the maps but also the mapping legends for each

Soil Mapping Legend

1B	Opequon - Rock Outcrop	> 25 % slopes
2C	Hagerstown - Rock Outcrop	7 - 15 % slopes
2E	Hagerstown - Rock Outcrop	> 25 % slopes
3C	Hagerstown silty clay loam	7 - 15 % slopes
4B	Lodi - Poplimento complex	2 - 7 % slopes
4C	Lodi - Poplimento complex	7 - 15 % slopes
4D	Lodi - Poplimento complex	15 - 25 % slopes
5B	Poplimento Silt Loam	2 - 7 % slopes
5C	Poplimento Silt Loam	7 - 15 % slopes
5D	Poplimento Silt Loam	15 - 25 % slopes
6B	Marble - Wyrick complex, gravelly	2 - 7 % slopes
6C	Marble - Wyrick complex, gravelly	7 - 15 % slopes
7B	Timberville silt loam	2 - 7 % slopes
8B	Poplimento - Hagerstown Complex	2 - 7 % slopes
8C	Poplimento - Hagerstown Complex	7 - 15 % slopes
8D	Poplimento - Hagerstown Complex	15 - 25 % slopes
9C	Braddock Cobby loam	7 - 15 % slopes
MM	Man made (disturbed land)	



# Soils Map Comparison of Seven Willows Farm

## Web Soil Survey

USDA  
Natural Resources  
Conservation Service (NRCS)  
Web Soil Survey

## Detailed Soil Survey

Blackburn Consulting  
Services, LLC / Soil Foundations  
Soil Survey



### Field Work and Map Provided By:



Blackburn Consulting Services, LLC  
Visit us online at:  
<http://www.soilfoundations.com/>

As - Atkins silt loam  
Bf - Basher fine sandy loam  
BkD - Berks channery silt loam, 15 to 25 percent slopes  
MoB - Monongahela silt loam, 3 to 8 percent slopes  
W - Water  
WeC - Weikert channery silt loam, 8 to 15 percent slopes

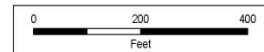
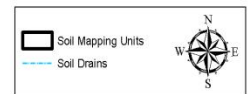
### Narrative:

Web Soil Survey on the LEFT

Site Specific Soil Survey prepared by Blackburn Consulting  
Services, LLC / Soil Foundations on the RIGHT

\*\*\* Note not only the differences in the maps but also the  
mapping legends for each

KwE - Klinesville-Weikert Complex (25-80% slope)  
Bk-WeC - Berks-Weikert Complex (7-15% slope)  
EgC - Elliber Very Channery Silt Loam (7-15% slope)  
MoB - Monogahela Cobby Silt Loam (2-7% slope)  
CsB - Clarksburg (2-7% slope)  
CsC - Clarksburg Silt Loam (7-15% slope)  
As - Atkins Silt Loam (0-3% slope)  
Bb - Basher Silt Loam (2-7% slope)  
GyC - Guernsey Silt Loam (7-15% slope)  
CEM - Cemetery



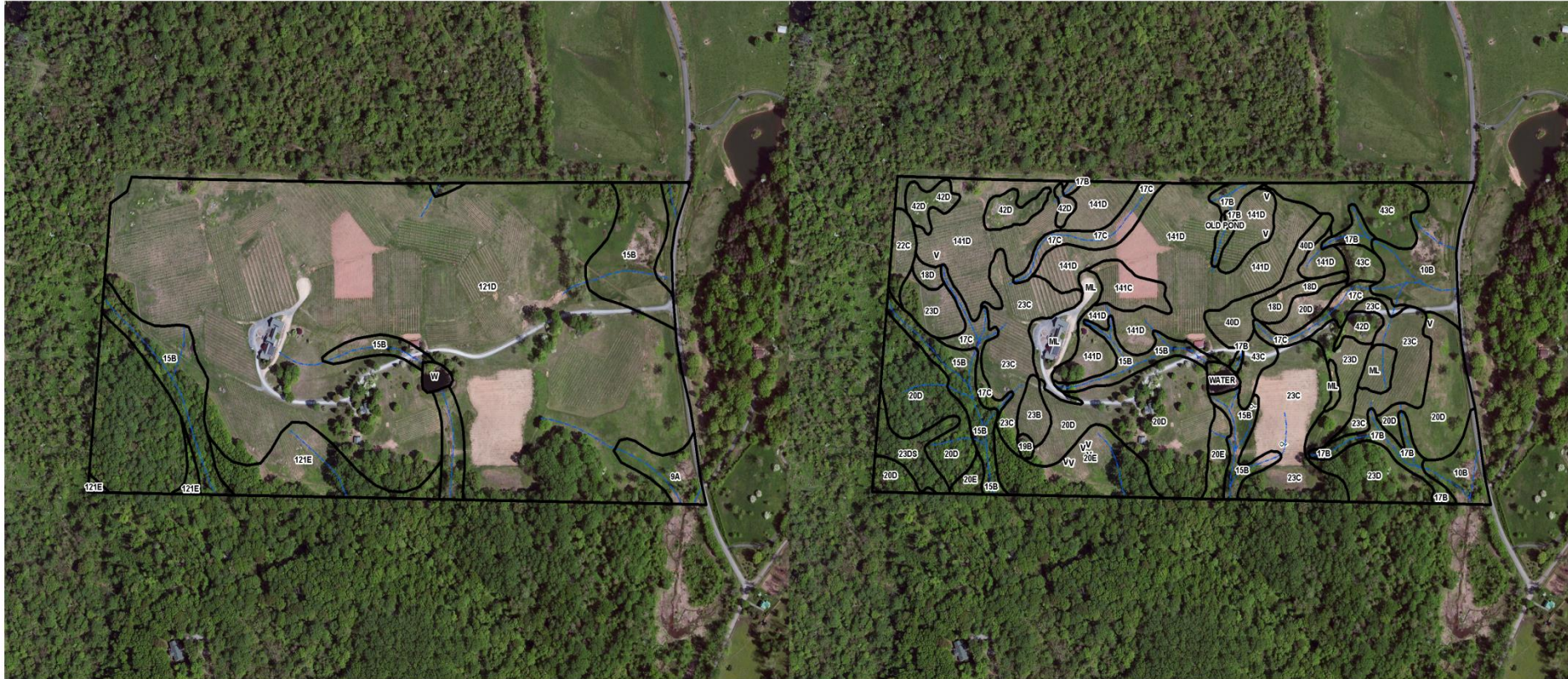
# Soils Map Comparison of Linden Vineyard

## Web Soil Survey

USDA  
Natural Resources  
Conservation Service (NRCS)  
Web Soil Survey

## Detailed Soil Survey

Blackburn Consulting  
Services, LLC / Soil Foundations  
Soil Survey



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9A Mongie silt loam, 0 to 2 percent slopes, very stony, frequently flooded  
17B Middleburg loam, 2 to 7 percent slopes, frequently flooded  
32C Myersville and Montalto soils, 7 to 15 percent slopes, very stony  
87C Tate loam, 7 to 15 percent slopes  
121D Pigeonroost-Edneytown complex, 15 to 25 percent slopes, very stony  
121E Pigeonroost loam, 25 to 45 percent slopes, very stony

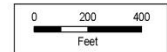
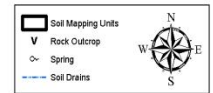
### Narrative:

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Site Specific Soil Survey prepared by Blackburn Consulting  
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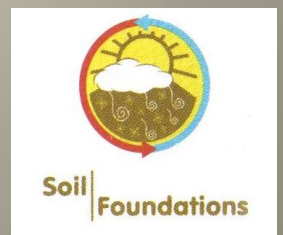
\*\* Note not only the differences in the maps but also the  
mapping legends for each

10B Mongie-Seneca Complex, 2-7% slope  
15B Seneca loam, 2-7% slope  
17B Middleburg silt loam, 2-7% slope  
17C Middleburg silt loam, 7-15% slope  
18D Tankerville loam, Very rocky, 15-25% slope  
19B Tankerville-Rock Outcrop Complex, 2-7% slope  
20D Tankerville-Purcellville Complex, 15-25% slope  
20E Tankerville loam, Rocky, 25-45% slope  
22C Swampoodle-Purcellville Complex, 7-15% slope  
23B Purcellville-Tankerville Complex, 2-7% slope  
23C Purcellville-Tankerville Complex, 7-15% slope  
23D Purcellville-Tankerville Complex, 15-25% slope  
23DS Purcellville-Tankerville Complex, Very Stony, 15-25% slope  
40D Pignut silt loam, Stony, 15-25% slope  
42D Pignut-Rock Outcrop Complex, 15-25% slope  
43C Myersville silt loam, 7-15% slope  
141C Pignut-Alantus Complex, Very Stony, 7-15% slope  
141D Pignut-Alantus Complex, Very Stony, 15-25% slope  
ML Made Land/Previously Disturbed/Cut and Fill

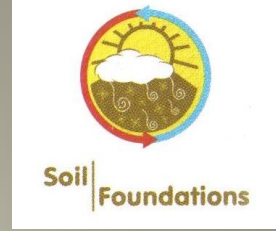


# What does a detailed soils map get you?

- **Understanding your soils and how vines will respond**
- **Blocks designed to ensure:**
  - **Uniform management**
    - What differences to expect if not laid out based on soils
    - How changing weather will impact fruit quality
- **Information to help choose varieties and rootstocks suited to your site**
- **Success**



# Geophysical Mapping



- Ground Penetrating Radar (GPR)
- Electromagnetic Conductivity
- Research being conducted and these may prove to be good tools to supplement and further improve physically mapping the soil.
  - They show: Variability in soil depth, contrasting textures, soil moisture and possibly soil chemistry

# Thank You!

## Questions?

**Blackburn Consulting Services, LLC**

**Alex. C. Blackburn, LPSS**

- Web Site [www.SoilFoundations.com](http://www.SoilFoundations.com)
- Email [Moosecaller@aol.com](mailto:Moosecaller@aol.com)
- Phone 540-539-1307

