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

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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)
- Stoney 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.
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)
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
  o Virginia Techs Research Station in Winchester, Virginia
  o Seven Willows Farm in Big Cove Tannery, PA
  o Linden Vineyards in Fauquier County
Soils Map Comparison of Virginia Tech's
Alson H. Smith, Jr.
Agricultural Research and Extension Center

Field Work and Map Provided By:

Soil Mapping Legend

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
Soils Map Comparison of Seven Willows Farm

Field Work and Map Provided By:
- Agricultural soils
- B - Bunker loamy sandy loam
- BD - Bunker loamy sand
- MB - Moseley silt loam
- W - Water

Soil Foundations
Blackburn Consulting Services, LLC / Soil Foundations

**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.**

Legend:
- Aa - Agricultural soils
- Bi - Bunker loamy sandy loam
- BD - Bunker loamy sand
- MB - Moseley silt loam
- W - Water

Legend:
- Aa - Agricultural soils
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Soils Map Comparison
of Linden Vineyard

Field Work and Map Provided By:
Blackburn Consulting Services, LLC / Soil Foundations

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"Note not only the differences in the maps but also the mapping legends for each.

Legend:
9A. Monroe silt loam, 0 to 2 percent slopes, very stony, frequently flooded
17B. Molded silt loam, 0 to 1 percent slopes, frequently flooded
32C. Maricopa and Maricopa silt loam, 1 to 5 percent slopes, very stony
60C. Maricopa silt loam, 5 to 15 percent slopes
11D. Pippenroad-Edinboro complex, 15 to 25 percent slopes, very stony
105E. Pippenroad silt loam, 25 to 40 percent slopes, very stony

160. Monroe-Genesee Complex, 2-7% slope
155. Seminole loam, 2-7% slope
17B. Molded silt loam, 2-7% slope
17C. Molded silt loam, 7-15% slope
193D. Tankaquilla loam, Very rocky, 25-30% slope
200. Tankaquilla-Rock Outcrop Complex, 2-7% slope
202D. Tankaquilla loam, Rocky, 25-30% slope
203D. Tankaquilla-Rock Outcrop Complex, 5-10% slope
233B. Puntaville-Tankaquilla Complex, 2-7% slope
235C. Puntaville-Tankaquilla Complex, 7-15% slope
239D. Puntaville-Tankaquilla Complex, Very Stony, 15-25% slope
40D. Puntaville silt loam, Stony, 15-25% slope
42D. Puntaville-Rock Outcrop Complex, 15-25% slope
40B. Maricopa silt loam, Very Stony, 7-15% slope
14A. Puntaville-Althea Complex, Very Stony, 2-7% slope
14D. Puntaville-Althea Complex, Very Stony, 7-15% slope
146. Made Land/Previously Disturbed/Disturbed Fill

0 100 200 300 400 Feet
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 varietals 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?
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