Grape Growers

Soils and Site Assessments

December 7, 2023

Caitlin McCavour, Soil Specialist

Introduction

Soil Specialist at Perennia

Bachelor of Science (Agriculture) Major in Environmental Science, Focus in Biology

- Dalhousie University Agriculture Campus

Master of Science in Earth and Environmental Science

- Conducting research in forest liming and reducing soil acidification in NS

Goal: Help promote economic growth in Nova Scotia in environmentally sustainable ways through best soil management practices and help producers better understand their soils to make informed decisions.

Today's Talk

The elements of a site assessment and why they are important

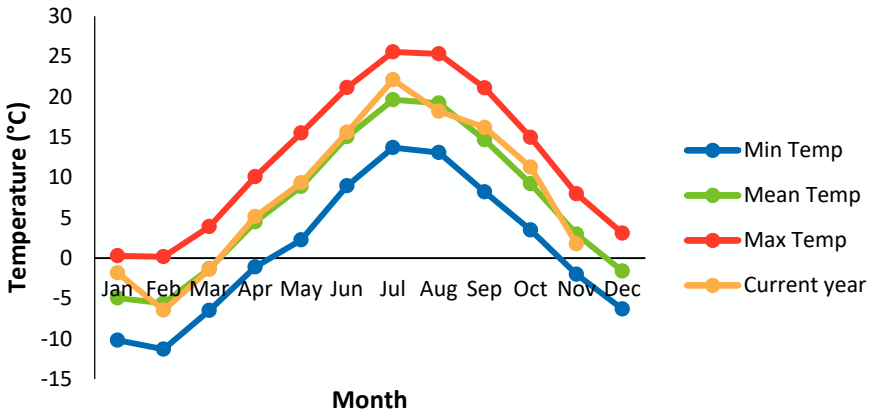
- Climate
- Soil Surveys and Maps
- Soil Sampling
- Soil Test Interpretation
- Soil Classification
  - Soil Structure, Texture, and Colour
  - Soil Compaction
- Infiltration and Percolation
- LiDAR Mapping
- When to Consider a Site Assessment

Site Assessment Contents

3 Sections

1. Climate
2. Soils
3. Vineyard

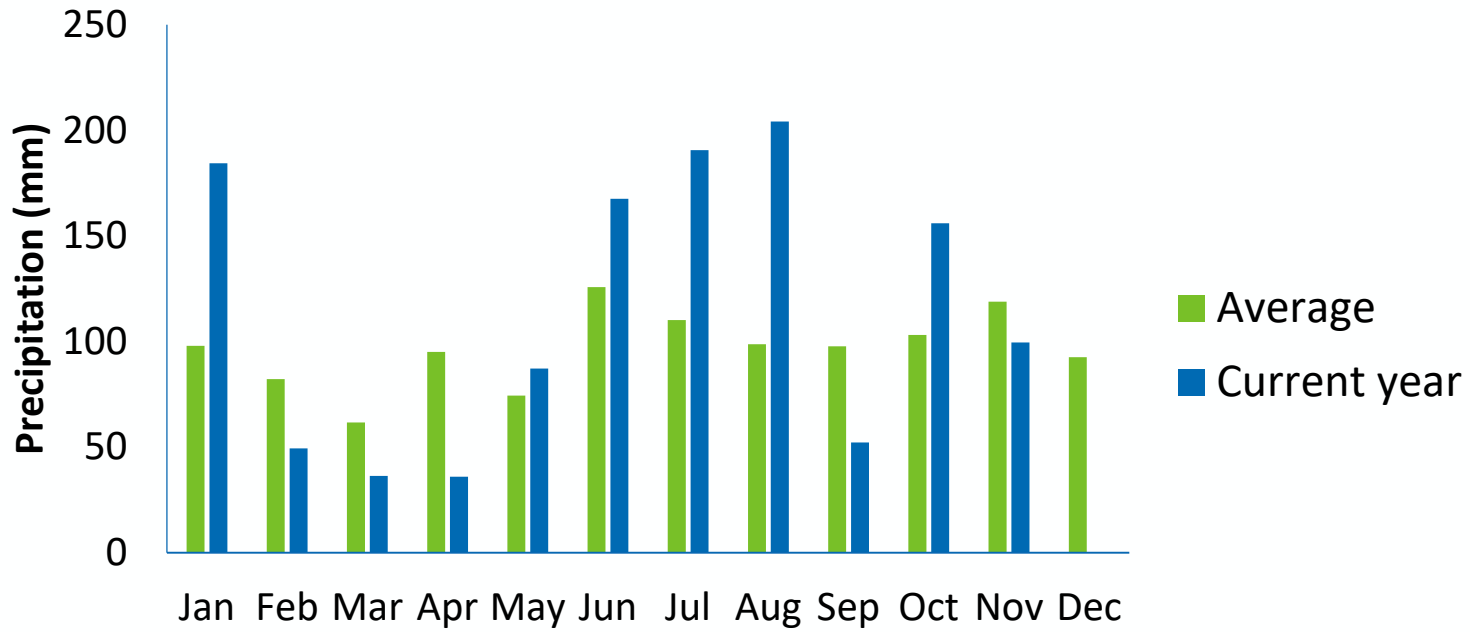
Considerations and/or recommendations.



Climate

What are important factors that impact grape production.

- Precipitation
- Temperature
- Temperature extremes
- Frost Free Days
- Growing Degree Days



	Lowest Temperature		Highest Temperature		Number of days with ≤ -21.0°C
	Date	Temperature (°C)	Date	Temperature (°C)	
2017	11-Feb	-18.1	11-Jun	30.6	0
2018	7-Jan	-17.5	5-Jul	33.4	0
2019	10-Mar	-16.6	5-Jul	32.0	0
2020	15-Feb	-21.9	19-Jun	33.1	1
2021	10-Feb	-15.8	7-Jun	32.7	0
2022	22-Jan	-22.4	21-Jul	33.4	2

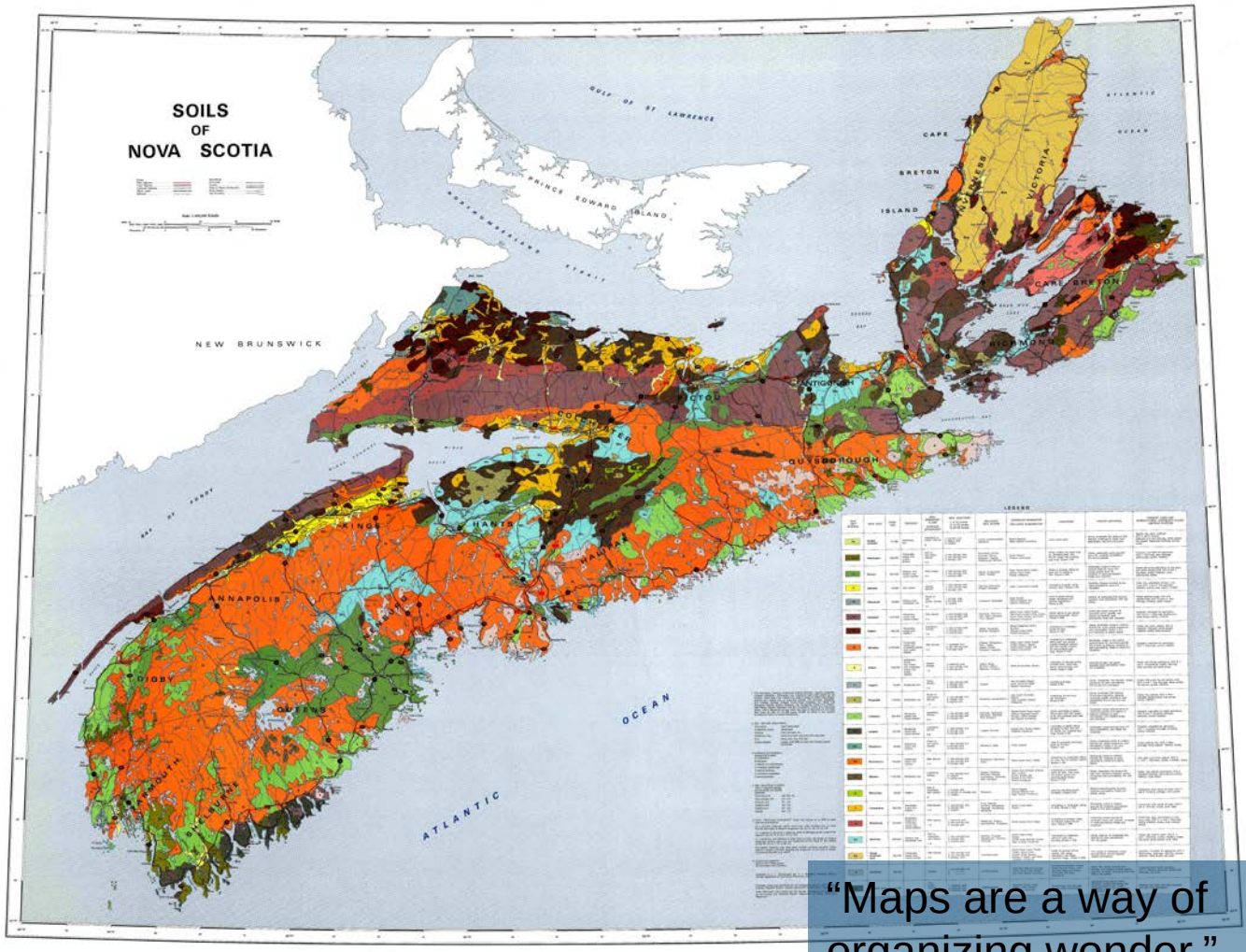
Perennia

Soil Surveys and Maps

The Nova Scotia soil surveys were conducted from 1963-1975

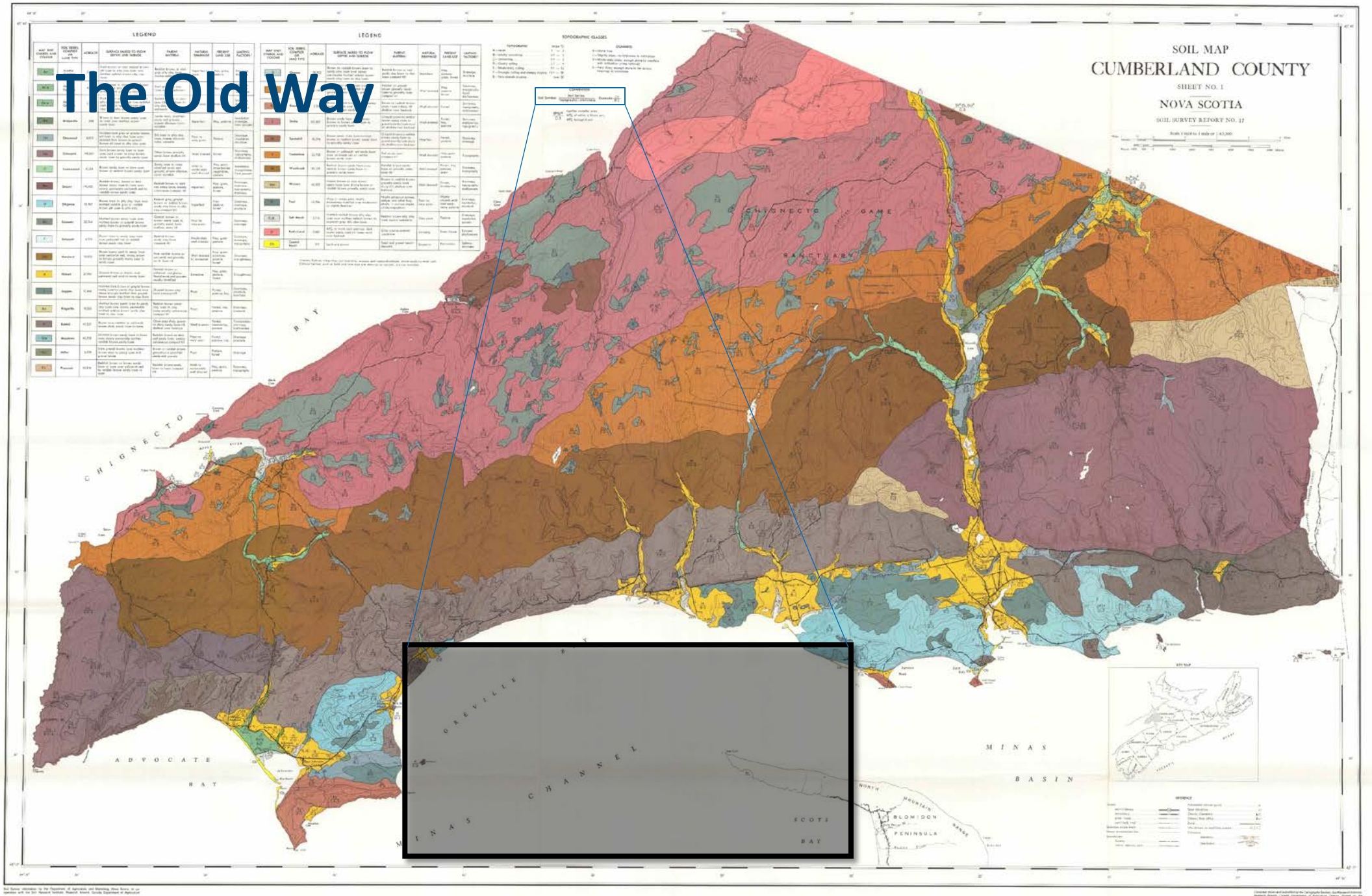
These soil maps and adjoining reports can provide information about:

- Soil texture
- Soil drainage
- Crops use
- Land capability



"Maps are a way of organizing wonder." -- *Peter Steinhart, 1986*

The Old Way


SOIL MAP
CUMBERLAND COUNTY
SHEET NO. 1
NOVA SCOTIA
SOIL SURVEY REPORT NO. 17
LEGEND
LEGEND
TOPOGRAPHIC CLASSES
CHIGNECTO GAME SANCTUARY
CHIGNECTO BAY
ADVOCATE BAY
MINAS BASIN
MINAS CHANNEL
GREVILLE
NORTH MOUNTAIN
BLOMIDON PENINSULA
SCOTE BAY
CUMBERLAND COUNTY SHEET 1

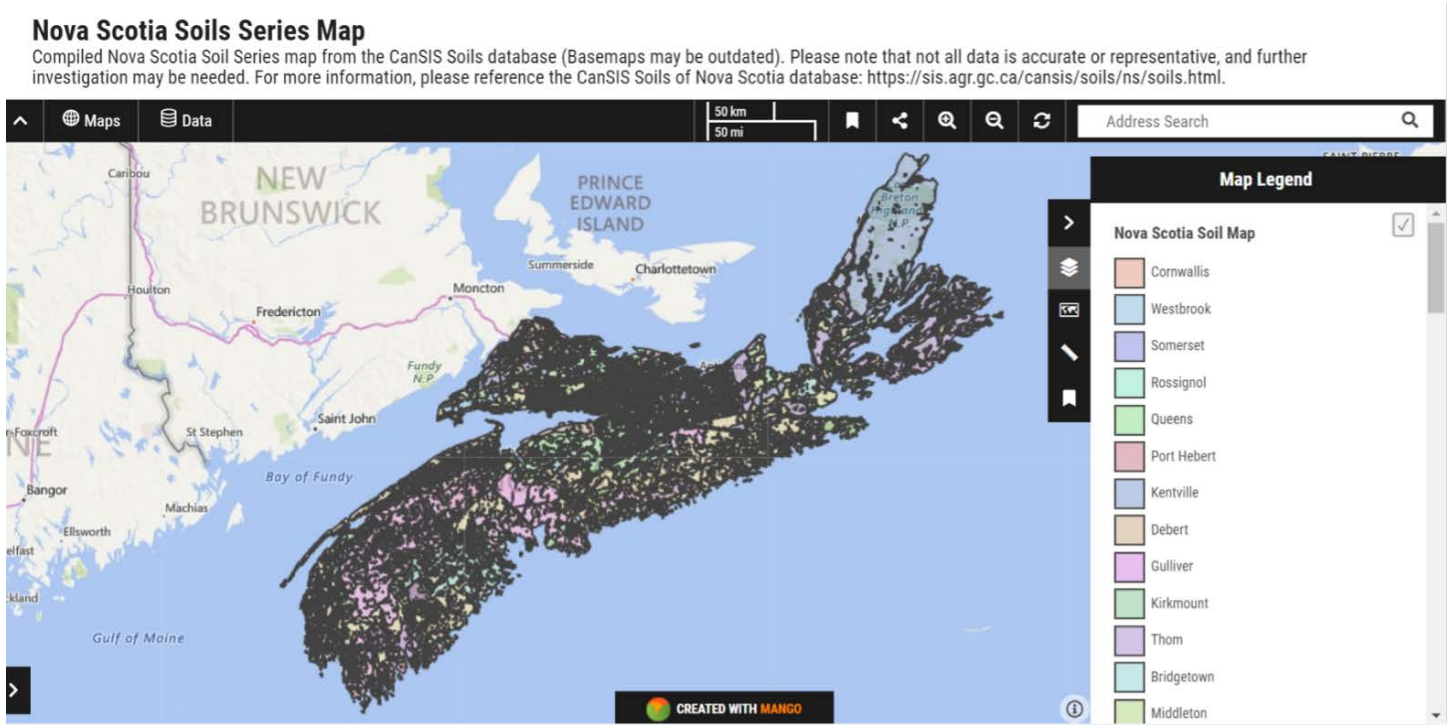
The Old Way

Each report contains:

1. A general description of the county
2. Information about soil formation, classification, and survey and mapping methods
3. Information about each soil series present in that county.
4. Soil interpretation for agriculture, community development, forestry, and material.
5. Information about plants, soil profiles, and additional data.

The New Way

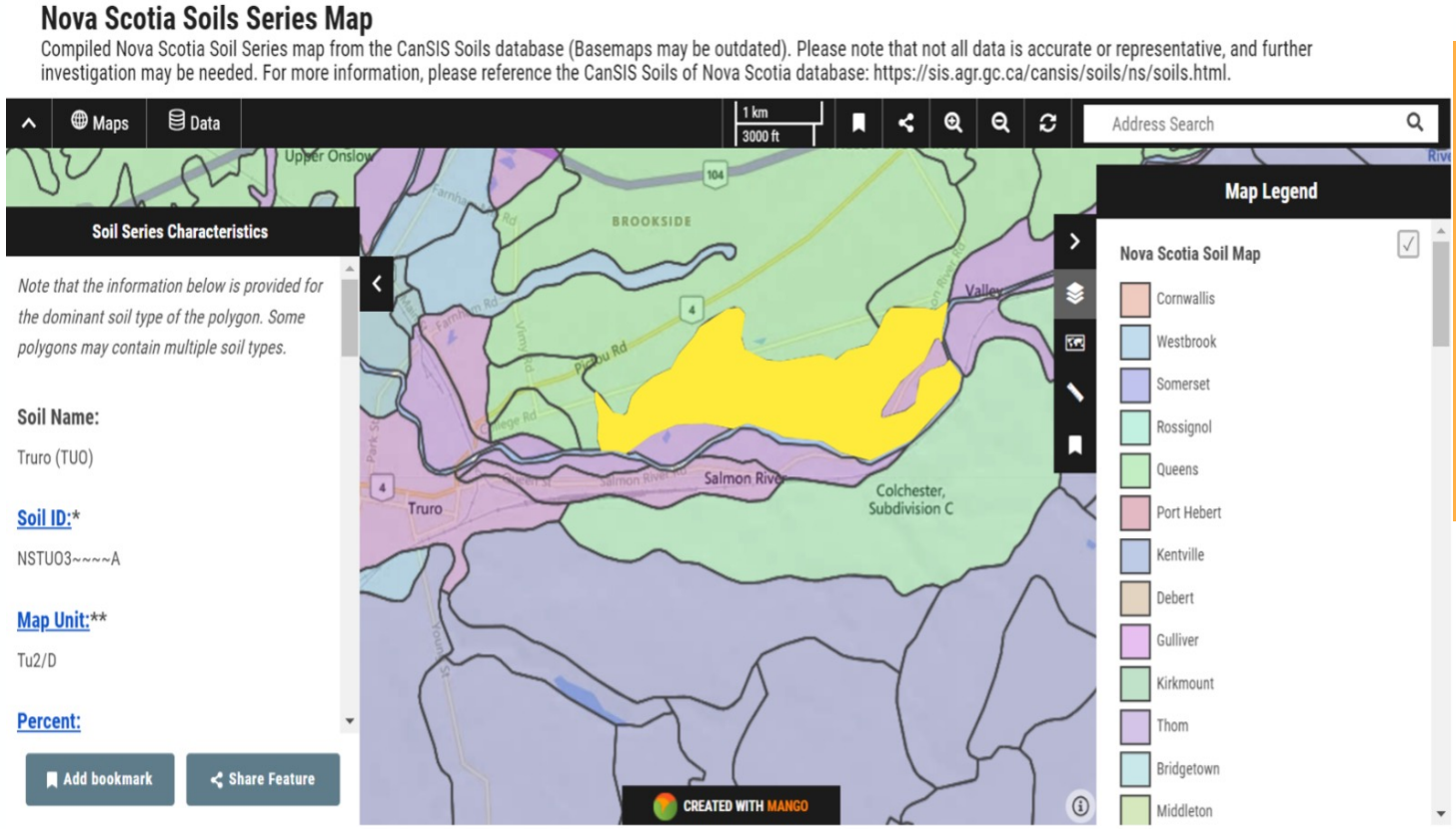
- Data that is open access, but only available with a mapping program is now available on farm data tools.



The New Way

How To?

1. Visit farmdatatools.ca
2. Make an account (it's free)
3. Navigate to Soil maps and surveys
4. Find your property on the map and click on it



The New Way

What does it tell you?

- Soil name
- Soil ID
- Map Unit (from the paper surveys)
- If multiple soil types are present, the percentage of the dominant soil type
- The size of the polygon
- The type of soil profiled (agricultural or native)
- The kind of surface material
- The mode of material deposition
- Soil classification from the Canadian System of Soil Classification
- Slope steepness class
- Surface stoniness class
- Soil layer that restricts root growth
- Type of root-restricting layer
- Drainage class
- Parent material chemical properties in the uppermost soil horizon
- Texture class and percent sand, silt and clay in the upper soil horizon

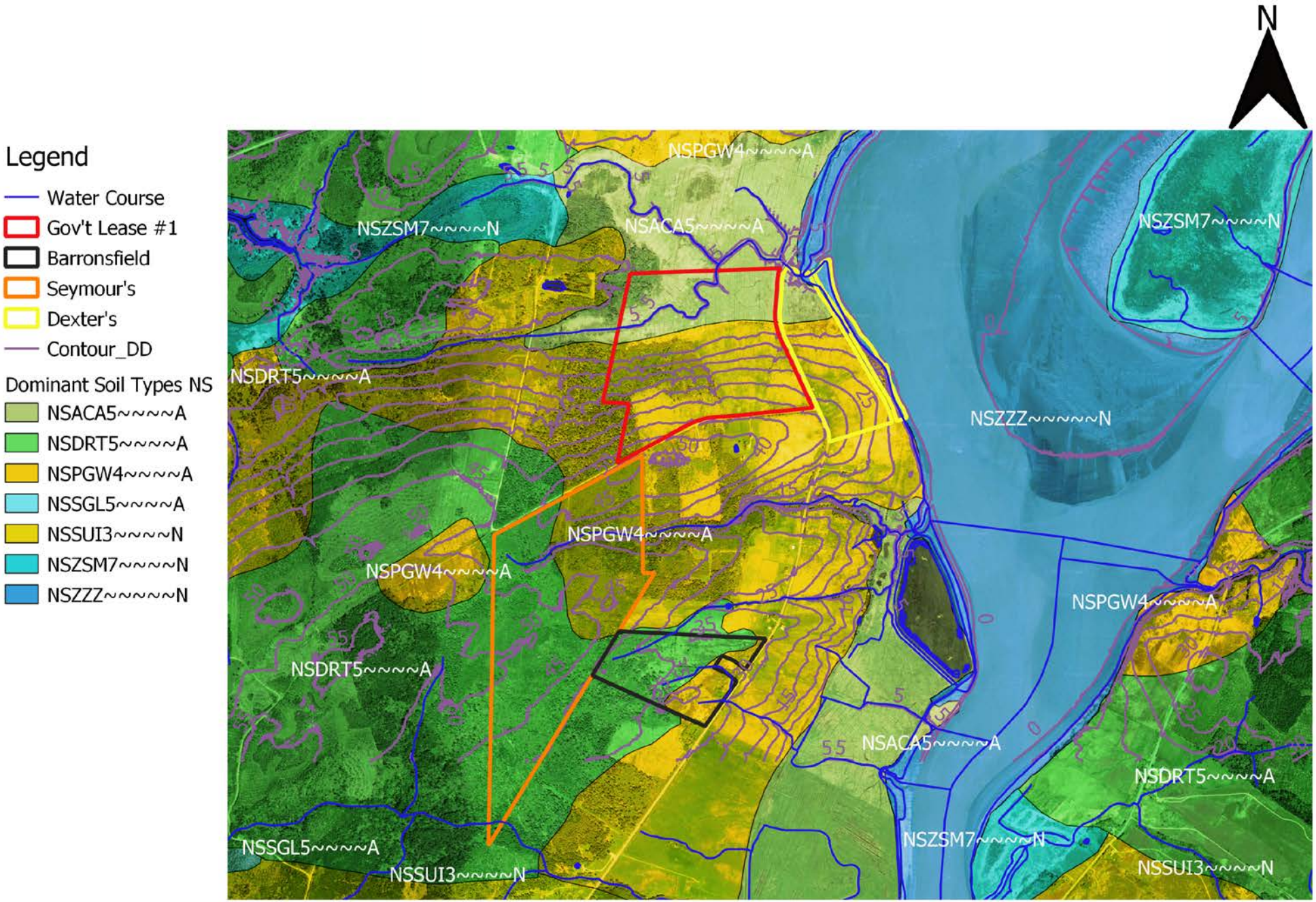
The New Way

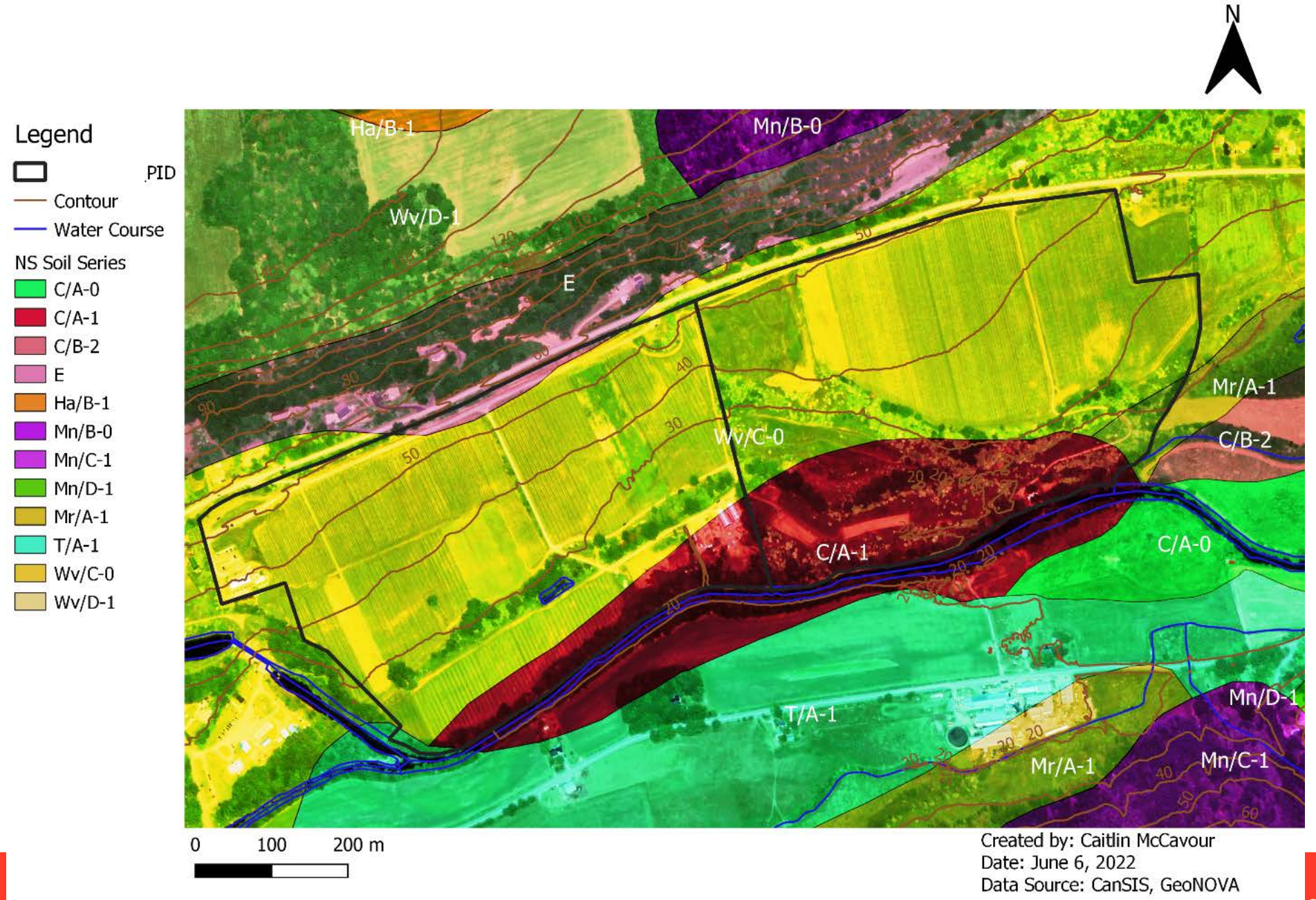
Attribute definition

Attribute Label	STONINESS
Title	Surface Stoniness Class
Description	Rock fragments on the surface of a soil or those protruding above ground have important effects on soil use and management. The limitations they impose are related to their number, size, and spacing at the surface. The terminology that follows is further defined in the CanSIS Manual for Describing Soils in the Field.
Classes	Stoniness: 7 classes. First used in DSS 1.0

Classes

Code	Class	Description
0	Nonstony	No stones or too few are present to interfere with cultivation (<0.01% of surface, stones more than 25 m apart).
1	Slightly stony	Some stones are present that hinder cultivation slightly or not at all (0.01-0.1% of surface, stones 8-25 m apart).
2	Moderately stony	Enough stones are present to cause some interference with cultivation (0.1-3% of surface, stones 1-8m apart).


N
Legend
Water Course
Gov't Lease #1
Barronsfield
Seymour's
Dexter's
Contour_DD
Dominant Soil Types NS
NSACA5~~~~A
NSDRT5~~~~A
NSPGW4~~~~A
NSSGL5~~~~A
NSSUI3~~~~N
NSZSM7~~~~N
NSZZZ~~~~~N
NSPGW4~~~~A
NSZSM7~~~~N
NSACA5~~~~A
NSZSM7~~~~N
NSDRT5~~~~A
NSZZZ~~~~~N
NSPGW4~~~~A
NSPGW4~~~~A
NSPGW4~~~~A
NSDRT5~~~~A
NSACA5~~~~A
NSDRT5~~~~A
NSSGL5~~~~A
NSZSM7~~~~N
NSSUI3~~~~N
NSSUI3~~~~N
0 250 500 m
August 15, 2022
Created by: Caitlin McCavour
Data Source: GeoNOVA, CanSIS


N
Legend
PID
Contour
Water Course
NS Soil Series
C/A-0
C/A-1
C/B-2
E
Ha/B-1
Mn/B-0
Mn/C-1
Mn/D-1
Mr/A-1
T/A-1
Wv/C-0
Wv/D-1
Ha/B-1
Mn/B-0
Wv/D-1
E
Wv/C-0
Mr/A-1
C/B-2
C/A-1
C/A-0
T/A-1
Mn/D-1
Mr/A-1
Mn/C-1
0
100
200 m
Created by: Caitlin McCavour
Date: June 6, 2022
Data Source: CanSIS, GeoNOVA

Soil Sampling

Who, What, When, Where, Why, How?

Who does it?

- Typically, a farm manager or employee takes the sample.
- Perennia Conducts soil sampling for Site Assessments.

Soil Sampling

Who, What, When, Where, Why, How?

What do you need?

- Soil probe, soil auger, or shovel.
- Probes can be acquired from a local NSDA office.
- Augers are useful in rockier ground.

Soil Probe

Auger

Shovel

Soil Sampling

Who, What, When, Where, Why, How?

When to Sample?

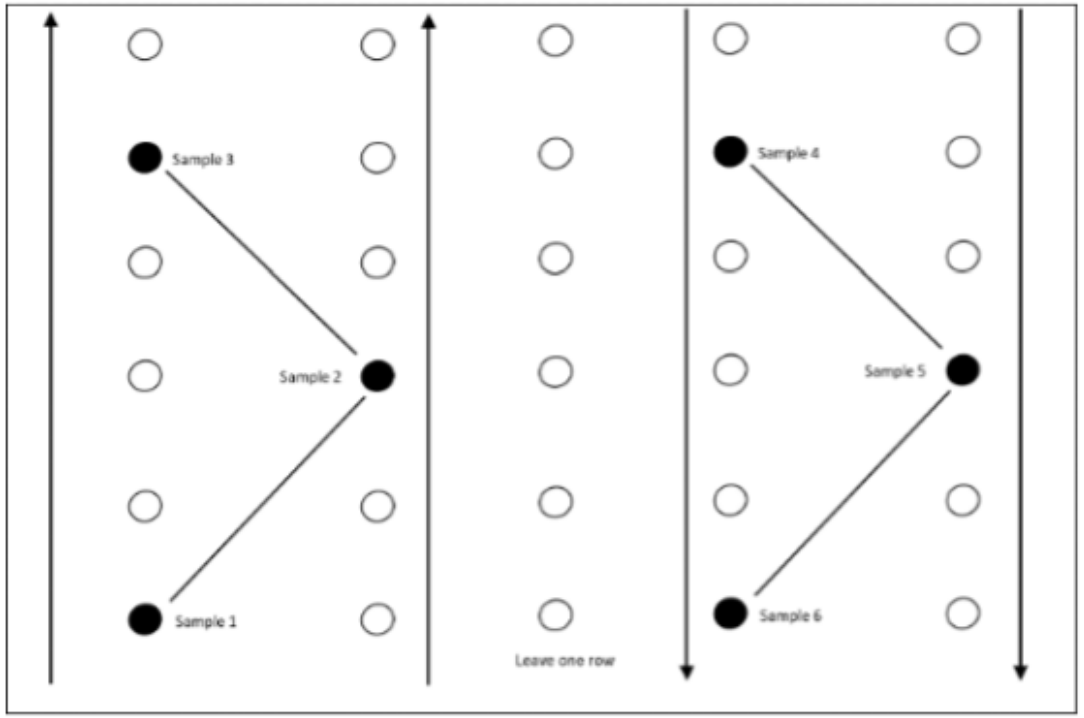
- Samples can be taken anytime of year. Often taken after harvest to prepare for next year.
- Sample at the same time of year everything time you sample.
- Sample every 2-3 years. Sample more frequently if there are issues, or management practices change.

Soil Sampling

Who, What, When, Where, Why, How?

Where to Sample?

- Take a composite sample (15-20 samples combined) after dividing your property into reasonable blocks.
- You want to take a new sample when there is a change in topography, soil type, management history, crop variety, and drainage.
- Walking in a zigzag pattern throughout your field.
- Sampling back and forth between rows and skipping one.
- Depth in vineyards is 0-15 and 15-30 cm



Soil Sampling

Who, What, When, Where, Why, How?

Why Sample?

Soil sampling helps make informed decisions on:

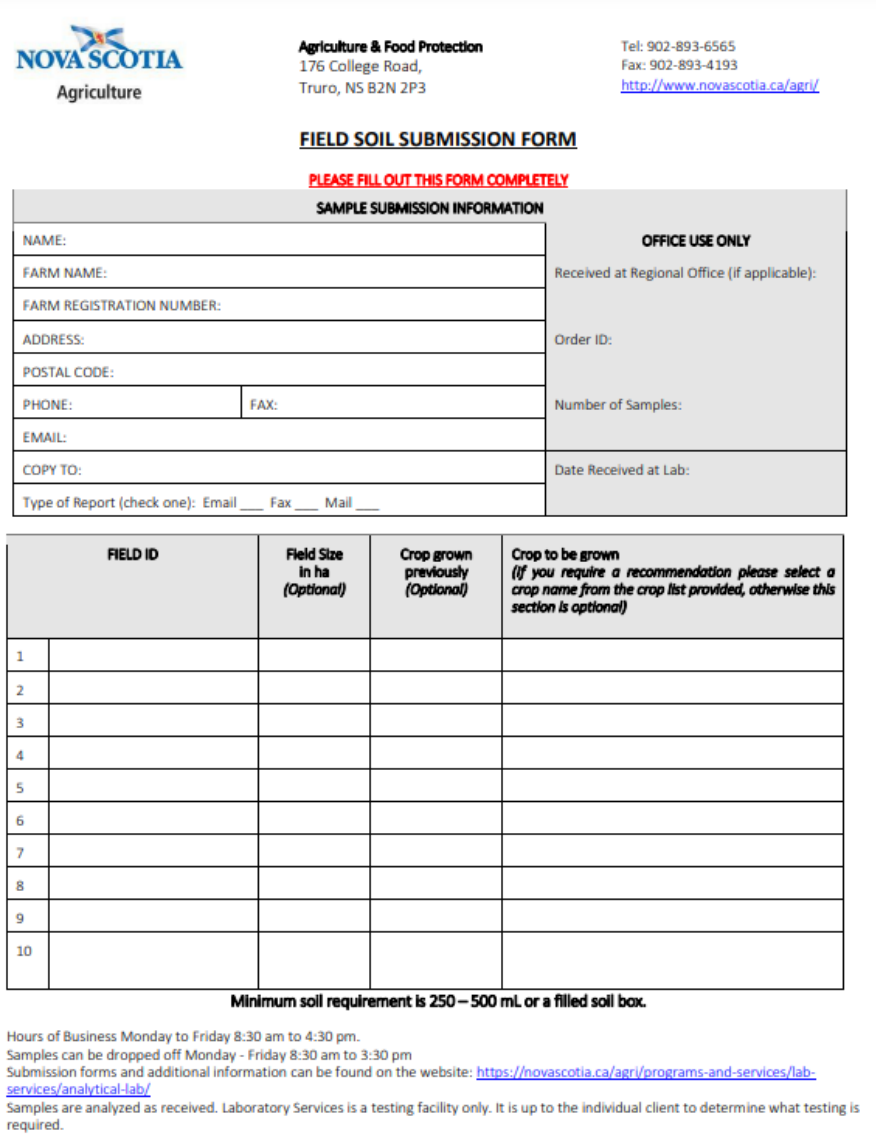
- Inputs required for economical and efficient crop production
- Fertilizer and lime requirements
- Diagnose problem areas

Soil Sampling

Who, What, When, Where, Why, How?

How to get the Sample analyzed?

- Place into sampling boxes or plastic bags with the label and fill out the sheet for the NSDA Analytical lab.
- Make sure to include your crop!
- Results will be returned.



NOVA SCOTIA
Agriculture

Agriculture & Food Protection
176 College Road,
Truro, NS B2N 2P3

Tel: 902-893-6565
Fax: 902-893-4193
http://www.novascotia.ca/agri/

FIELD SOIL SUBMISSION FORM

PLEASE FILL OUT THIS FORM COMPLETELY

SAMPLE SUBMISSION INFORMATION		
NAME:		**OFFICE USE ONLY**
FARM NAME:		Received at Regional Office (if applicable):
FARM REGISTRATION NUMBER:		
ADDRESS:		Order ID:
POSTAL CODE:		
PHONE:	FAX:	Number of Samples:
EMAIL:		
COPY TO:		Date Received at Lab:
Type of Report (check one): Email ___ Fax ___ Mail ___		

	FIELD ID	Field Size in ha *(Optional)*	Crop grown previously *(Optional)*	Crop to be grown *(If you require a recommendation please select a crop name from the crop list provided, otherwise this section is optional)*
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				

Minimum soil requirement is 250 – 500 mL or a filled soil box.

Hours of Business Monday to Friday 8:30 am to 4:30 pm.
Samples can be dropped off Monday - Friday 8:30 am to 3:30 pm
Submission forms and additional information can be found on the website: https://novascotia.ca/agri/programs-and-services/lab-services/analytical-lab/
Samples are analyzed as received. Laboratory Services is a testing facility only. It is up to the individual client to determine what testing is required.

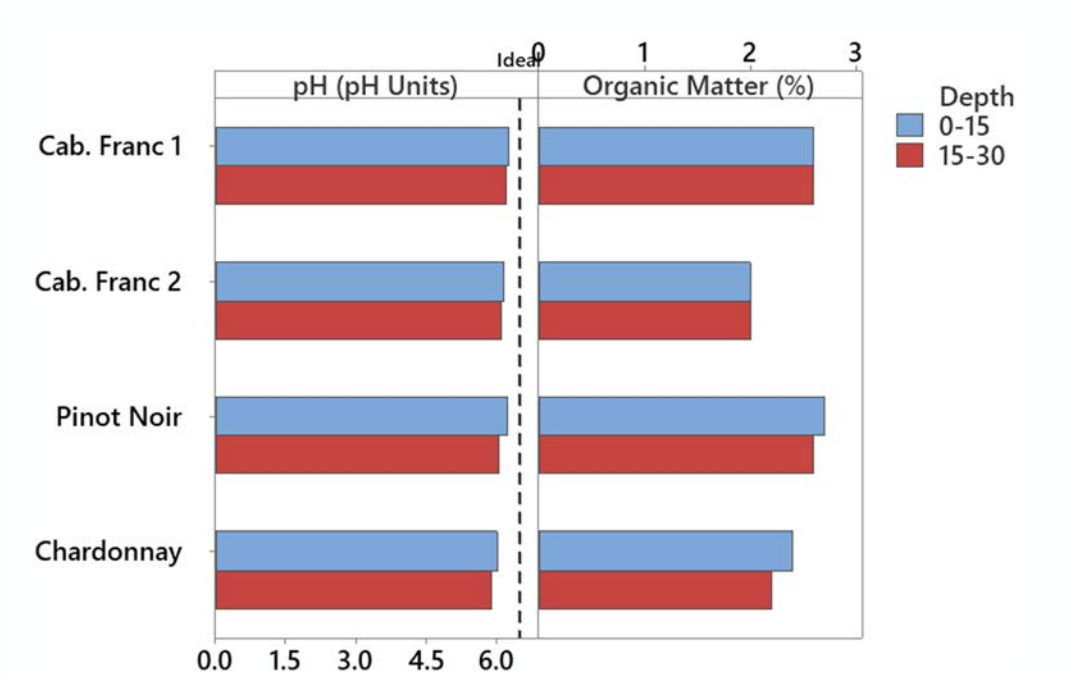
Soil Test Interpretation

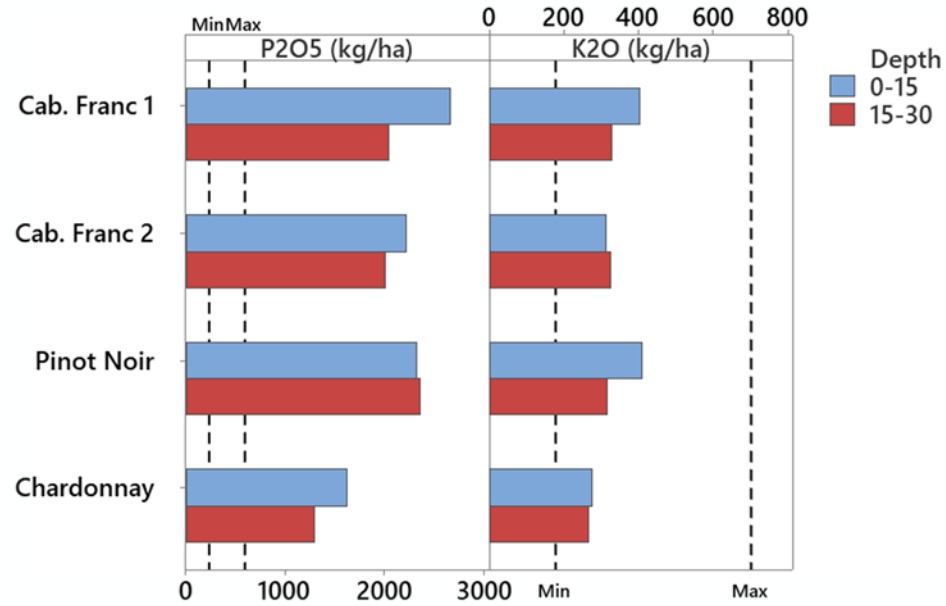
- pH
- Soil Organic Matter
- Macronutrients
- Micronutrients
- Cation Exchange Capacity
- Lime Recommendation

PARAMETER	ANALYSIS	RATING	ANALYSIS	RATING
pH (pH Units)	5.14		5.70	
Buffer pH (pH Units)	7.37		7.62	
Organic Matter (%)	3.6		4.2	
P205 (kg/ha)	277	L+	2093	E
K20 (kg/ha)	151	L+	1191	E
Calcium (kg/ha)	327	L-	2226	M-
Magnesium (kg/ha)	60	L-	363	M+
Sodium (kg/ha)	23		47	
Sulfur (kg/ha)	42		40	
Aluminum (ppm)	1569		1160	
Boron (ppm)	< 0.50		0.56	
Copper (ppm)	1.75		2.79	
Iron (ppm)	169		264	
Manganese (ppm)	149		294	
Zinc (ppm)	3.72		26.97	
CEC (meq/100g)	6.3		11.5	
Base sat. K (%)	2.5		11.0	
Base sat. Ca (%)	12.9		48.5	
Base sat. Mg (%)	3.9		13.2	
Base sat. Na (%)	0.8		0.9	
Base sat. H (%)	79.8		26.5	
LR CaCO3 (t/ha to pH 6.5)	8		4	

Required Nutrient (kg/ha)	N	P205	K20	N	P205	K20
	140	225	130	140	0	0

Soil Test Interpretation





Soil Physical Properties

Soil Classification

- Classify soil pits based on the Canadian System of Soil Classification.
- Horizons are identified (horizontal layers in the soil distinguished by structure and colour).

Soil Classification

What am I looking for?

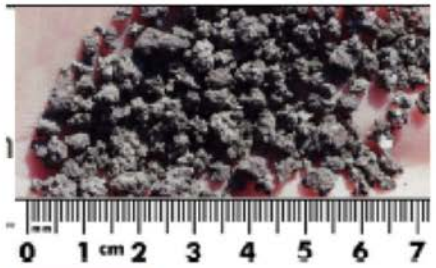
- Soil Structure
  - Compaction
- Soil Texture
- Soil Colour
- Other things

Soil Classification

Soil Structure

The arrangement of primary soil particles into secondary soil particles (aggregates).

- Inherent properties of soil formation
- Biological activity
- Wetting and drying
- Ploughing
- Freezing and thawing.

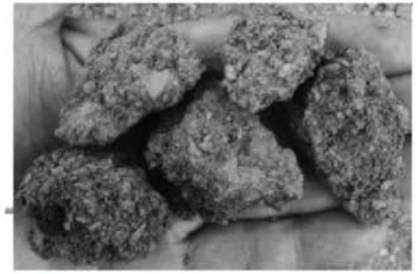


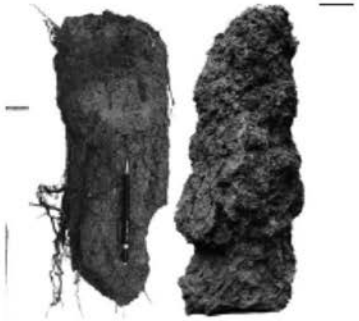
Granular


Angular blocky


Prismatic


Platy


Sub-angular blocky


Columnar

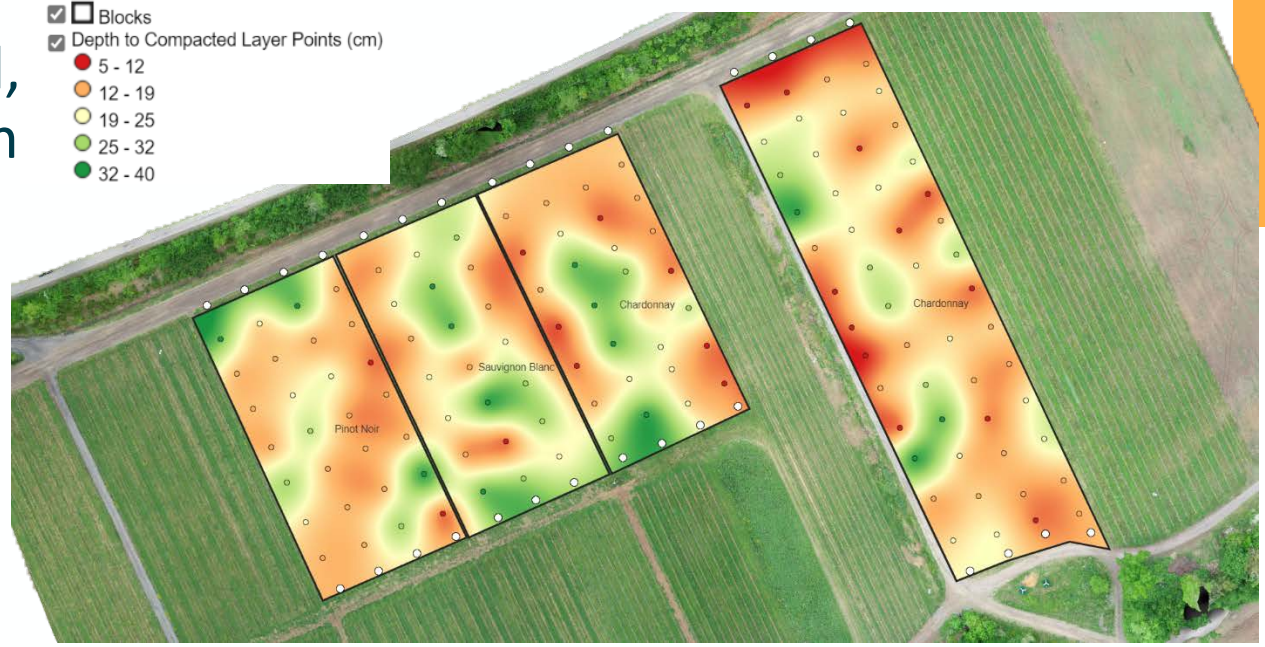





Soil Structure

Compaction

- Compaction is a major concern for many vineyards.
- Compaction is often human-induced, but cemented horizons are natural in some soil types.
- Look for compaction within the pit.
- Take compaction readings throughout the site using a penetrometer.
- Surface vs. subsurface compaction.



Soil Classification

Soil Texture

Soil texture refers to the relative abundance of sand, silt, and clay in soil.

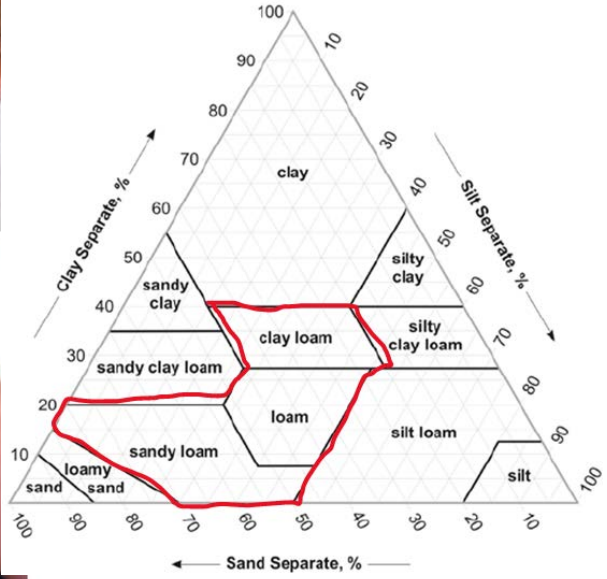
- Clay has the smallest particle size, while sand has the largest.
- Soil texture cannot be changed.
- Important because it can give an indication of nutrient retention and drainage in soil.

Soil sample before moistening

Soil sample after moistening, ready for texture / particle size class determination

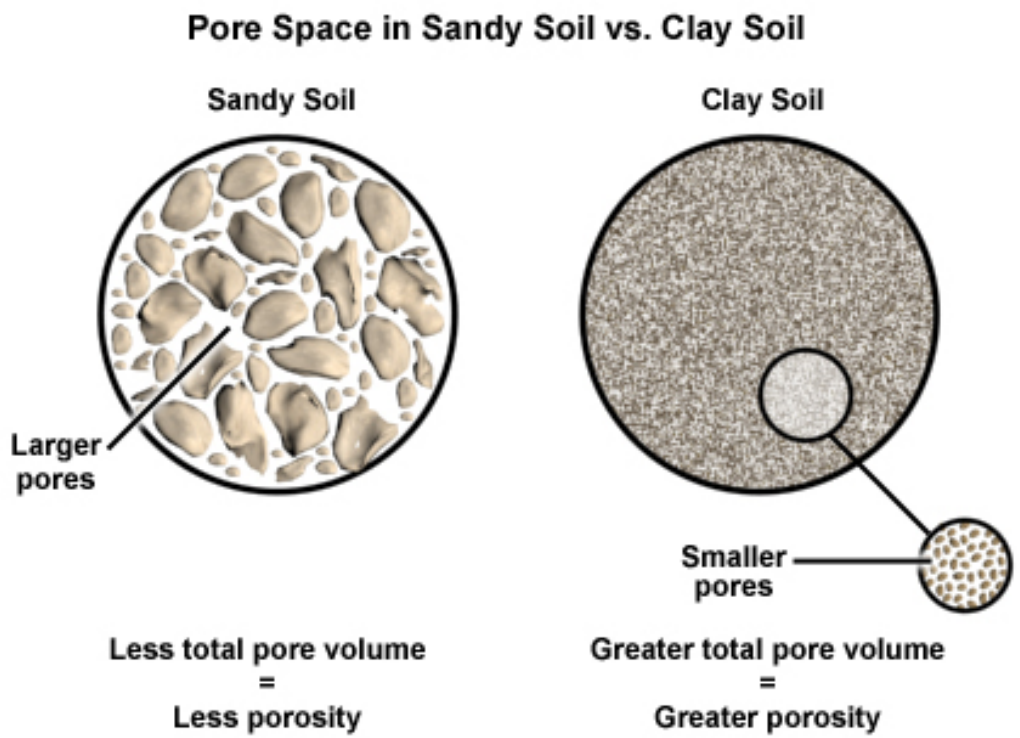
Rubbing sample hard to a thin film between the thumb and fingers to ensure all sand sizes are being assessed — if sample is not rubbed hard, sand content will be underestimated

Lifting thumb from fingers to assess relative clay content (stickiness) — if the sample is too dry or too wet, stickiness (clay content) will be underestimated



Soil Classification

Soil Texture



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Soil Classification

Soil Colour

- Dark grey/ black – high organic matter content
- Light grey – leaching
- Pockets of red – iron and aluminum deposits, sign of poor drainage
- Darker – more oxygen

A rainbow of soil is under our feet; red as a barn and black as a peat. It's yellow as lemon and white as the snow; bluish gray. So many colors below. Hidden in darkness as thick as the night; The only rainbow that can form without light. Dig you a pit, or bore you a hole, you'll find enough colors to well rest your soil. --- *F.D. Hole, A Rainbow of Soil Words, 1985*

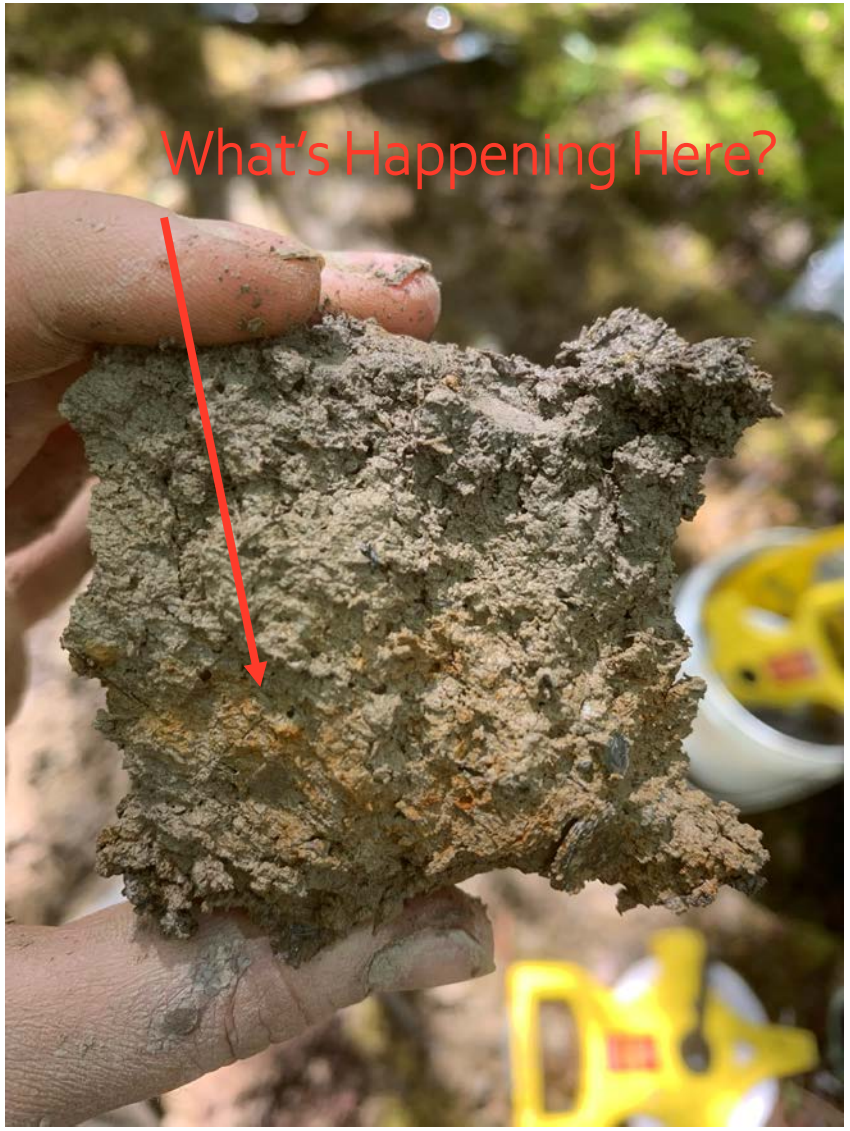



What's Happening Here?

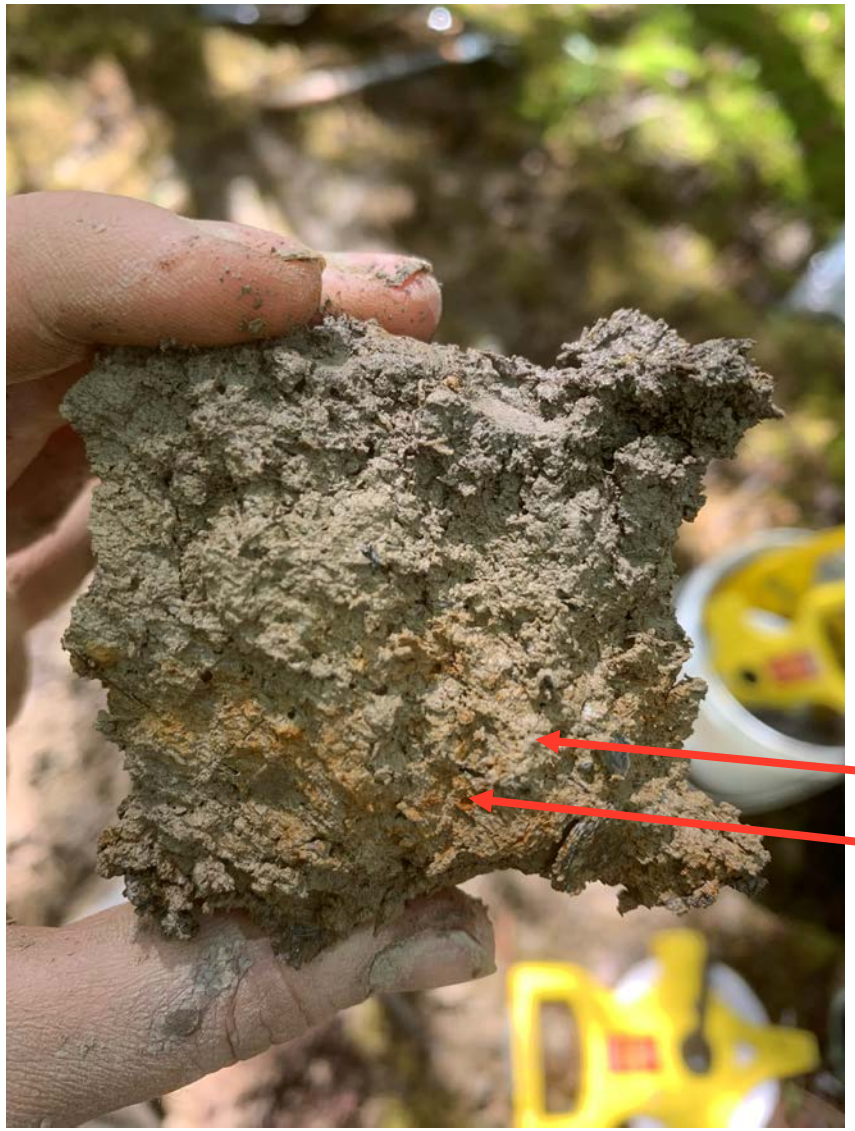



The plow layer is a darker colour and therefore, likely has higher amounts of soil organic matter.




What's Happening Here?



Reduction oxidation features are present, indicating an imperfectly drained soil.




What's Happening Here?




Plow horizon

Old leached horizon from before cultivation

Accumulation of iron and a**luminum and other nutrient**

Soil Physical Properties

Infiltration

- Infiltration rate is measured to understand the impact of heavy rainfall and surface compaction.

Infiltration rate (minutes per inch)	Infiltration rate (inches per hour)	Infiltration class
< 3	>20	Very rapid
3 to 10	6 to 20	Rapid
10 to 30	2 to 6	Moderately rapid
30 to 100	0.6 to 2	Moderate
100 to 300	0.2 to 0.6	Moderately slow
300 to 1000	0.06 to 2	Slow
1000 to 40000	0.0015 to 0.06	Very slow
> 40000	<0.0015	Impermeable

Mapping

- LiDAR mapping
  - Flow accumulation on fields
  - More accurate topographical lines
  - Detailed maps

Site Assessments

Conclusions

- Overview of what is involved and why.
- What are some key things to look for when wanting a site assessment.
- Some of these things can be looked at on your own.
- You may have multiple problems, or a site assessment will help determine why something is an issue.
- Provides considerations for replanting or extensive renovations.
- Suggested to do before establishing a vineyard.

Thank you!

Questions?

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