



# CLIMATE CHANGE ADAPTATION PROGRAM

## Soil Quality Test Kit

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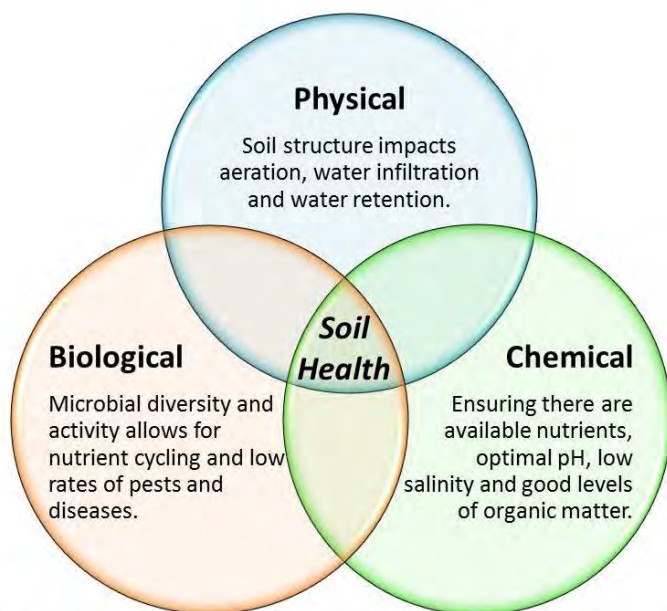




## Soil Quality Test Kit: An applied tool to assess soil physical, chemical & biological health on the farm\*

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### *Cariboo Agriculture Research Alliance*



\*Modified from a diagram from Forage Facts #95 from the Peace River Forage Association of BC

In agriculture, soil quality is assessed through its capacity to support high, sustainable yields, and mitigate pests and disease. Producers have a strong understanding of the chemical aspect to soil health (e.g. nutrients, pH, CEC, etc.), but measuring physical and biological traits of soils can provide the whole picture, and help explain plant growth issues or concerns. The Soil Quality Test Kit can provide the support that is needed to make this link; the kit was first developed by the USDA for use in annual cropping systems in Iowa.

To determine which aspects of the kit would be most valuable to local producers, UNBC researchers partnered with producer associations to test the kit in predominantly perennial systems throughout the Bulkley Valley (2015) and in the Peace River (2015-2017). This factsheet outlines how these test kit might be adapted for use in the Cariboo-Chilcotin Region.

#### **Geographic Applicability**

The soils test kit was evaluated on 35 different agriculture fields in the Bulkley Valley, and can be adapted for any location.

#### **Commodity relevance**

Most of the fields analyzed were in perennial cropping systems (e.g. forage), but the kit was originally designed for annual cropping systems.

### **Study Objectives**

- Determine the utility of the Soil Quality Test Kit for on-farm soil quality assessments;
- Determine which soil quality traits can be easily measured and provide the most useful information to producers;
- Develop baseline soil health data for the Bulkley Valley producers.

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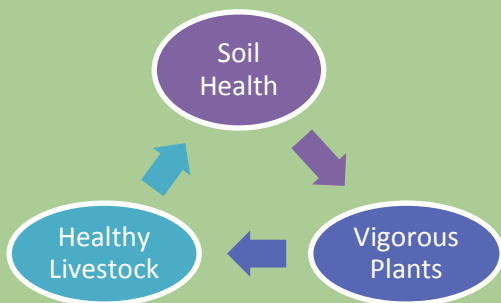
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## Key Findings

- **Soil quality field kit – is best used to analyze soil physical and biological characteristics, such as bulk density, water infiltration, soil respiration, and aggregate stability.**
- The field kit is easy to use and provides valuable information, but initial training with the kit and continued support in analyzing results is necessary.
- Within the sample region, soil quality varied significantly between fields and within fields. Understanding the quality of your soil will better inform management decisions.
- The soil test kit does NOT replace, but complements, professional lab testing for nutrient levels and pH values.

### Key Message:



## Definitions

**Bulk Density:** the weight of the soil for a given volume, measuring how much compaction there is in the soil.

**Water Infiltration:** The rate at which water enters the soil, influenced by soil structure and soil texture. Compacted soils have less pore space, and lower infiltration rates.

**Soil Respiration:** the production of carbon dioxide from the biological activity of soil roots, microorganisms, and soil fauna.

**Soil Aggregates:** soil particles that are bound together to make clumps, impacting bulk density and moisture retention.

## Design

**Bulkley Valley** – researchers partnered with the Smithers Farmers’ Institute and worked with 12 producers to measure soil quality at 35 agricultural fields around the region.

**Peace River** – researchers partnered with the Peace River Forage Association of BC, and utilized the kit to help measure soil health traits under different management systems.

## Soil Test Kit: Limitations

- 1) Time Restraints – the best time to collect data coincides with the busy times on the farm – planting and/or harvesting. Strategic planning is important.
- 2) Organic Matter – a guide to help identify humus layer development would increase the utility of the kit.

## Next steps

To bring this tool to the Cariboo, the first step required would be to build the “next generation” Soil Quality Kit. From this study, we suggest the kit **must** include:

- Bulk Density Test
- Water Infiltration Test
- Soil Respiration Test
- Aggregate Stability Test

The second step would be to design a project to implement the soil test kit in an applicable research project that provides training opportunities on how to use, and analyze the results, of the kit.

## Climate Adaptation Implications

Soil impacts all producers and a healthy soil can improve **soil water retention**, **reduce erosion**, and provide **reliable yields**. Adopting management strategies that improve soil health will help the farm adapt to changing climatic conditions, and maintain economically viable operations.

Farm:			
Field:			
	Indicator	Site	Rating
Physical Traits	Structure Index	Soil Pit	12.50
	Infiltration (2nd rate - in/hr)	J-01	6.49
		J-02	1.00
		J-03	3.75
	Bulk Density (g/cm <sup>3</sup> )	J-01	0.91
		J-02	1.23
		J-03	1.05
	Aggregate Stability %	J-01	53.75
		J-02	47.33
		J-03	47.72
	Organic Matter %	J-01	4.98
		J-02	3.31
J-03		4.09	
Chemical Traits	Electrical Conductivity (dS/m)	J-01	0.06
		J-02	0.04
		J-03	0.06
	pH	J-01	6.09
		J-02	6.22
		J-03	6.43



**Figure 1 and 2 (Above).** Pictures of the infiltration test (above left) and an soil sample with good aggregation (above right).

**Figure 3 (Left).** Sample Soil Report developed from data collected with the Soil Test Kit (except for the Organic Matter). A minimum of three locations per field were sampled separately. **Green=good, Yellow=moderate, Orange=needs improvement.**

The project developed an easy Excel worksheet that translates raw data collection into final numbers, and colour codes the results. This allows producers using the kit to have a final “report card” for a field. Since a minimum of three sites (e.g. ‘J-01’, ‘J-02’ and ‘J-03’) are sampled per field, producers are also able to identify variation of soil quality throughout a single field.

## For more information:

To conduct additional soils tests (e.g. water holding capacity, organic matter), contact NALS:

<https://www.unbc.ca/northern-analytical-lab-service>

### Original USDA Guide:

[https://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/health/assessment/?cid=nrcs142p2\\_053873](https://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/health/assessment/?cid=nrcs142p2_053873)

### Smithers Farmers’ Institute: Final Project Report

<http://www.smithersfarmersinstitute.com/unbc-soils-health.html>

Peace River Forage Association of BC has in-depth Fact Sheets on assessing soil quality based on their use of the kit that are extremely informative:

- **#95: Soil Quality Field Kit: Part I**  
[http://www.peaceforage.bc.ca/forage\\_facts\\_pdfs/FF\\_95\\_Soil\\_Quality\\_Part\\_I.pdf](http://www.peaceforage.bc.ca/forage_facts_pdfs/FF_95_Soil_Quality_Part_I.pdf)
- **#96: Soil Quality Field Kit: Part II**  
[http://www.peaceforage.bc.ca/forage\\_facts\\_pdfs/FF\\_95\\_Soil\\_Quality\\_Part\\_I.pdf](http://www.peaceforage.bc.ca/forage_facts_pdfs/FF_95_Soil_Quality_Part_I.pdf)
- **#106: Soil Quality for Resiliency**  
[http://www.peaceforage.bc.ca/forage\\_facts\\_pdfs/FF\\_106\\_Soil\\_Quality\\_for\\_Resiliency\\_jaf6.pdf](http://www.peaceforage.bc.ca/forage_facts_pdfs/FF_106_Soil_Quality_for_Resiliency_jaf6.pdf)
- **#107: Soil Water and Resiliency**  
[http://www.peaceforage.bc.ca/forage\\_facts\\_pdfs/FF\\_107\\_Soil\\_Water&Resiliency\\_aif6.pdf](http://www.peaceforage.bc.ca/forage_facts_pdfs/FF_107_Soil_Water&Resiliency_aif6.pdf)

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