

Comprehensive Assessment of Soil Health

What is Soil Health?

Soil health is defined as the continued capacity of the soil to function as a vital living ecosystem that sustains plants, animals and humans (NRCS, 2012). Characteristics of a healthy soil include good soil tilth, sufficient rooting depth, good water storage and drainage, rich and diverse soil life, stored carbon and an adequate supply of nutrients. Climate change, particularly the impacts of CO₂ and N₂O, can be mitigated through improved soil health management while at the same time building soil resilience. The health of a soil can change over time as a result of use and management, therefore it is crucial to measure soil improvement when implementing new or modifying current management practices.

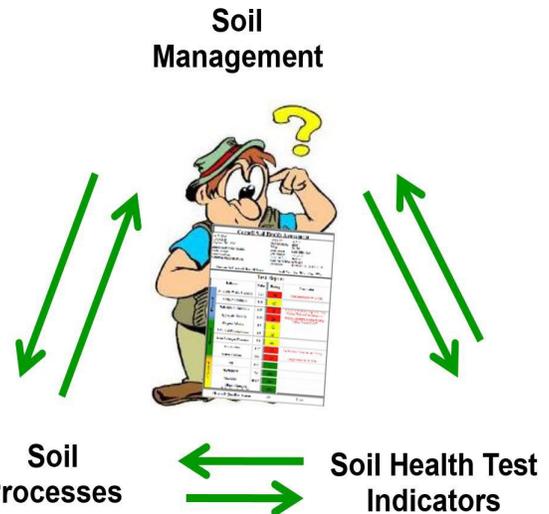
The Cornell Soil Health Management Framework

Each grower is generally faced with a unique production environment and set of management options to address soil health constraints. A more comprehensive understanding of a farm's limitations and opportunities, and soil health status can better guide producers' soil management decisions.

The Cornell approach aims to alleviate field-specific constraints, identified through standard measurements, and then maintain and monitor over time for improved soil health status. To that end, we created a framework for developing Soil Health Management Plans for a farm operation.



Producers will align their needs and abilities to allow for the development of management solutions with guidance from the CASH report.



The Comprehensive Assessment of Soil Health is an integral part of the Cornell Soil Health Management Planning and Implementation framework.

The framework includes:

- Six general steps for the planning and implementation process (below).
- A Comprehensive Assessment of Soil Health report that explicitly provides interpretation, prioritization, and management suggestions (see back).
- Resource concerns identified through soil health assessment are linked to each indicator showing constrained soil functioning for which new management practices may be applied.
- A pilot management plan template that includes purpose, site information, assessment results and interpretation, and planned practices via a multi-year management calendar.

Soil Health Management Planning Process

1. Determine farm background and management history
2. Set goals and sample for soil health
3. For each management unit: identify and explain constraints, prioritize management
4. Identify feasible management options
5. Create short and long term Soil Health Management Plans
6. Implement, monitor and adapt

About the Cornell Soil Health Lab

Developed by researchers at Cornell University, the Comprehensive Assessment of Soil Health (CASH) is a suite of tests evaluating and quantifying a soil's health. CASH was derived from a process where 40 potential indicators were evaluated for their use in standardized, rapid, quantitative assessment of soil health based on relevance to key soil processes, response to management, complexity of measurement, and cost. Our Standard Test currently contains 16 indicators of soil health (below) and is the only comprehensive soil health assessment offered. CASH provides a deeper view by identifying biological and physical constraints in addition to those measured by standard nutrient testing.

Who Is CASH For?

CASH is designed for farmers, gardeners, landscapers and researchers who want to go beyond simply testing the nutrient levels of their soils for more effective management planning and implementation. Our assessment is regarded as the premier tool for soil health measurement by several national initiatives including the USDA-NRCS Soil Health Division, the Soil Health Institute and the Soil Health Partnership.

CASH Indicators Linked to Soil Processes

	<i>Soil Indicator</i>	<i>Soil Process (Function)</i>
PHYSICAL	Soil Texture	all
	Wet Aggregate Stability	aeration, infiltration, shallow rooting, crusting
	Available Water Capacity	plant-available water retention
	Soil Strength (penetrometer)	rooting
BIOLOGICAL	Organic Matter Content	energy/C storage, water and nutrient retention
	Active Carbon Content	organic material to support biological functions
	ACE Soil Protein Index	OM quality, C turnover rates, N mineralization
	Soil Respiration	soil microbial abundance and metabolic activity
	Root Rot Rating*	soil-borne pest pressure
CHEMICAL	pH	toxicity, nutrient availability
	Extractable P	P availability, environmental loss potential
	Extractable K	K availability
	Minor Element Contents	micronutrient avail., elemental imbalances, toxicity
	Soluble Salts*	plant-available water, plant growth
	Heavy Metal Screening*	toxicity
Hot Water-soluble Boron*	toxicity	

*Individual Add-on indicators that are optional with Standard test for additional fee

Sample CASH Summary Report Page

Comprehensive Assessment of Soil Health

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Sample ID: LL8

Field ID: Caldwell Field- intensive management

Date Sampled: 03/11/2015

Given Soil Type: Collamer silt loam

Crops Grown: WHT/WHT/WHT

Tillage: 7-9 inches

Measured Soil Textural Class: silt loam
Sand: **2%** - Silt: **83%** - Clay: **15%**

Group	Indicator	Value	Rating	Constraints
physical	Available Water Capacity	0.14	37	
physical	Surface Hardness	260	12	Rooting, Water Transmission
physical	Subsurface Hardness	340	35	
physical	Aggregate Stability	15.7	19	Aeration, Infiltration, Rooting, Crusting, Sealing, Erosion, Runoff
biological	Organic Matter	2.5	28	
biological	ACE Soil Protein Index	5.1	25	
biological	Soil Respiration	0.5	40	
biological	Active Carbon	288	12	Energy Source for Soil Biota
chemical	Soil pH	6.5	100	
chemical	Extractable Phosphorus	20.0	100	
chemical	Extractable Potassium	150.6	100	
chemical	Minor Elements Mg: 131.0 / Fe: 1.2 / Mn: 12.9 / Zn: 0.3		100	

Overall Quality Score: 51 / Medium

The Soil Health Assessment Report

Each submitted sample receives a multi-page report that includes test results, ratings and identified field constraints (above). In addition, we provide short narrative interpretations and recommendations for short and long-term management to address identified problems. Soil health assessment is an integral part of the a Soil Health Management Planning and Implementation Framework that enables farmers, usually with assistance from Agricultural Service Providers, to find solutions to soil health concerns and improve soil functioning.

Resources

For a more comprehensive guide on soil health and its management, download the Cornell Soil Health Manual at bit.ly/SoilHealthTrainingManual. Simplified hand-outs can be found under the 'Resources' tab on our website.

