

Measuring the Impacts of Farm Practices on Soil Health

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Soil health refers to the capacity of a soil to function. Soil functions include maintaining biodiversity and productivity, partitioning water and solute flow, filtering and buffering, cycling nutrients and providing physical support. We use certain soil properties as indicators of a soil's health and its ability to perform these functions. Generally, these are "dynamic" or "use dependent" soil properties that are sensitive to changes in soil functions as a result of management, are easily measured and reproducible, and respond to management changes in a relatively short time period.

To assess the effects of farming practices on soil health, selected properties (indicators) should be monitored on a site over a number of years and compared to a baseline condition. Another option is to compare management systems to a reference site on the same soil.

Soil health cards have been developed and used since the mid-nineties to evaluate differences or changes in soil quality. This field tool is generally developed collaboratively by local farmers, NRCS, universities, conservation partners, and others. Indicators and ratings are selected using regionally appropriate properties and terminology. The card can be used to assess the current status of soil quality or, when used over time, can help determine changes in soil quality that are affected by field management. For best results, the evaluation should be performed by the same person, at the same time (or times) of year and under the same general moisture conditions. Evaluating several areas in a management unit will provide more meaningful results.

In 2003, development of a soil health card was initiated in Maine. A template from another state was adapted to fit conditions in the northeast and used as a sample card to generate input. The card was trialed and circulated at training sessions, field days, trade shows, and via email lists in order to generate comments and suggestions. A survey was included with the card which asked questions about the wording, ratings, indicators, format, and potential uses for the card. Most comments and suggestions came in jotted on the card itself. Over a period of 2 years the card was continuously adapted in response to these comments.

The Maine soil health card combines whole field observations (drainage, moisture holding, erosion, and crop vigor) and soil evaluations (crusting, color, tilth, structure, compaction, and organisms). Descriptive ratings: describing the best (1), worst (10), and intermediate (5) conditions for each indicator are included to help users evaluate their site on a scale of 1 to 10. The card has instructions for use and room to keep brief records on field activities.

More on soil health cards is available at http://soils.usda.gov/sqi/assessment/sq_card.html

A soil health card offers a qualitative assessment of soil response. It is an inexpensive, accessible, and practical way to understand a soil's response to management. Other evaluation tools are available that provide a more quantitative analysis.

Soil quality test kits allow measurement of chemical, physical, and biological indicators such as pH, bulk density and aggregate stability, respiration and number of earthworms. Like the health card assessment, soil quality kit evaluations used to monitor changes due to farm practices should be completed over a number of years, at the same approximate time and soil moisture level, and replicated throughout a management unit. Additional information on the soil health kit can be found at http://soils.usda.gov/sqi/assessment/test_kit.html

Soil testing programs that expand beyond chemical properties are available. One recently developed program is at Cornell University. In addition to nutrient testing, several physical and biological properties are also measured. See <http://soilhealth.cals.cornell.edu/> to learn more.

- Turn over a shovel full of soil (about 6-8" deep) and rate each indicator (6-10) by making an "X" or shading out the box that best represents the value for the
- Determine soil compaction by simply pushing the probe or wire flag into undisturbed soil and noting the resistance.

Date: _____ Evaluation by: _____ County: _____ Farm: _____ Field: _____ Crop Rotation: _____
 Tillage System: _____ Soil Moisture Level (check one) Good for planting _____ Too wet for planting _____ Too dry _____

Indicator	Best -----> Worst										Indicator Rating		
	1	2	3	4	5	6	7	8	9	10	1	5	10
1. Soil Erosion											Little or no soil erosion	Some visible soil movement	Excessive soil movement
2. Drainage, Infiltration											No ponding or runoff, water moves through soil steadily Soils drain and warm quickly in the spring. Limited delays in field operations. Yield reductions only in very wet years.	Water ponds for short periods and/or some runoff occurs. Field may be water-logged after heavy rains, causing minimal yield reduction. Soils drain and warm somewhat slowly in the spring. Some delays in field operations.	Water ponds for long periods of time and evaporates more than it drains. There may be excessive runoff. Soils stay wet for long periods and delay field operations, reducing yields.
3. Soil Moisture											Soils hold water for long periods of time without ponding. Crop stress rare.	Water runs out after a week or so. Crops occasionally are stressed.	Plant stress two days after a good rain.
4. Crop Growth											Even stand, vigorous and uniform.	Somewhat uneven stand or somewhat stunted or discolored	Uneven stand or stunted or discolored
5. Crusting											Soil maintains an open and porous surface all growing season, seedling emergence is not impeded.	Some surface sealing, minimal effect on seedling emergence	Soil surface seals after rain events or tillage. Seedling emergence inhibited. Rain soaks in slowly.
6. Soil Color (org. matter)											Topsoil clearly defined and darker than the subsoil.	Surface color closer to subsoil color.	Topsoil color similar to subsoil color.
7. Soil Tilth, Friability											Crumbly, easily worked, breaks apart easily	Some visible crumbly structure, Somewhat cloddy, Somewhat difficult to work, breaks apart with some pressure.	Cloddy, hard, crusty, or difficult to work. Difficult to break apart clods or soil is dust like and blows easily
8. Soil Structure and stability											Soil aggregates remain intact and easily seen after soil disturbance.	Observable, intact soil aggregates make up less than half of the soil mass after disturbance.	Soil aggregates are not observed after disturbance. Soil is too loose or too cloddy.
9. Compaction											Probe or flag enters soil easily; unrestricted root penetration	Can push probe or wire flag in soil with force; some restricted root growth	Can not push probe or wire flag into soil severely restricted root growth
10. Biological Activity / Earthworms											Many signs of animals in the soil, earthworms, holes or casts. Soil has fresh earthy smell	Some living organisms or signs of life in the soil Some earthworms, few holes and casts	Little or no sign or animal life in the soil of animal
Other													

Maine Soil Quality Assessment Card



Questions or Comments?
Contact Lisa Krall, Soil Scientist
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Instructions

How to Use the Card

Tools Required

- A shovel, a wire flag, and a pencil!

Soil Quality Assessment

- Select a field for evaluation and record the field and/or farm ID and the date on an assessment sheet.
- Soil erosion, drainage, and infiltration are “whole field” observations and can be recorded via “windshield surveys” during rain events.
- Keep track of your crop’s health throughout the growing season. Pay attention to responses to water stress to assess your soil’s ability to maintain adequate moisture.
- Pick a day when the soil is somewhat moist to examine the soil and record what you see.
- Turn over a shovel full of soil about 6”- 8” deep.
- On the Assessment Sheet, rate each indicator by marking an X or shading out the box that best represents the value for that indicator. Refer to the explanations for ratings of 1,5, and 10 for help in determining your choice. Enter additional observations and comments (such as weather conditions and additional dates of observations) in the space provided for “observations”.

Do this yearly and track progress towards your soil quality goals.

- This card is most effective when filled out by the same user over time and under similar soil moisture levels.
- Using the card in more than one spot per field will improve accuracy.

Other activities, comments, observations

Additional records about this field

Use this space to record planting, tillage, and soil amendments as well as additional activities and observations that are significant. This will help you determine

Last Soil Sample Taken: / /

Notes:

Crop History

Date	Crop (s)	Comments (seed rate, germination rate, etc.)

Soil Amendments Added

Date	Material	Rate	Comments (application method, weather)

Tillage Operations

Date	Operation	Comments (weather, soil conditions, etc.)

Rotations Planned:

Year	Crop