Soil & Climate Initiative
Soil Testing Guidance & Methodology

Rapidly scaling regenerative agriculture through commitments and verification

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Soil & Climate Initiative

The Soil & Climate Initiative Soil Testing Guidance & Methodology is an accompaniment guidance document to the Farm Commitment & Verification Standard that was published and took effect on September 12, 2023. The Farm Commitment & Verification Standard is a normative document under the Soil & Climate Initiative's Soil and Climate Health Initiative Commitment & Verification Program. English is the original and official language of this document. In case of any inconsistencies between this document and any translation, default to the official language version.

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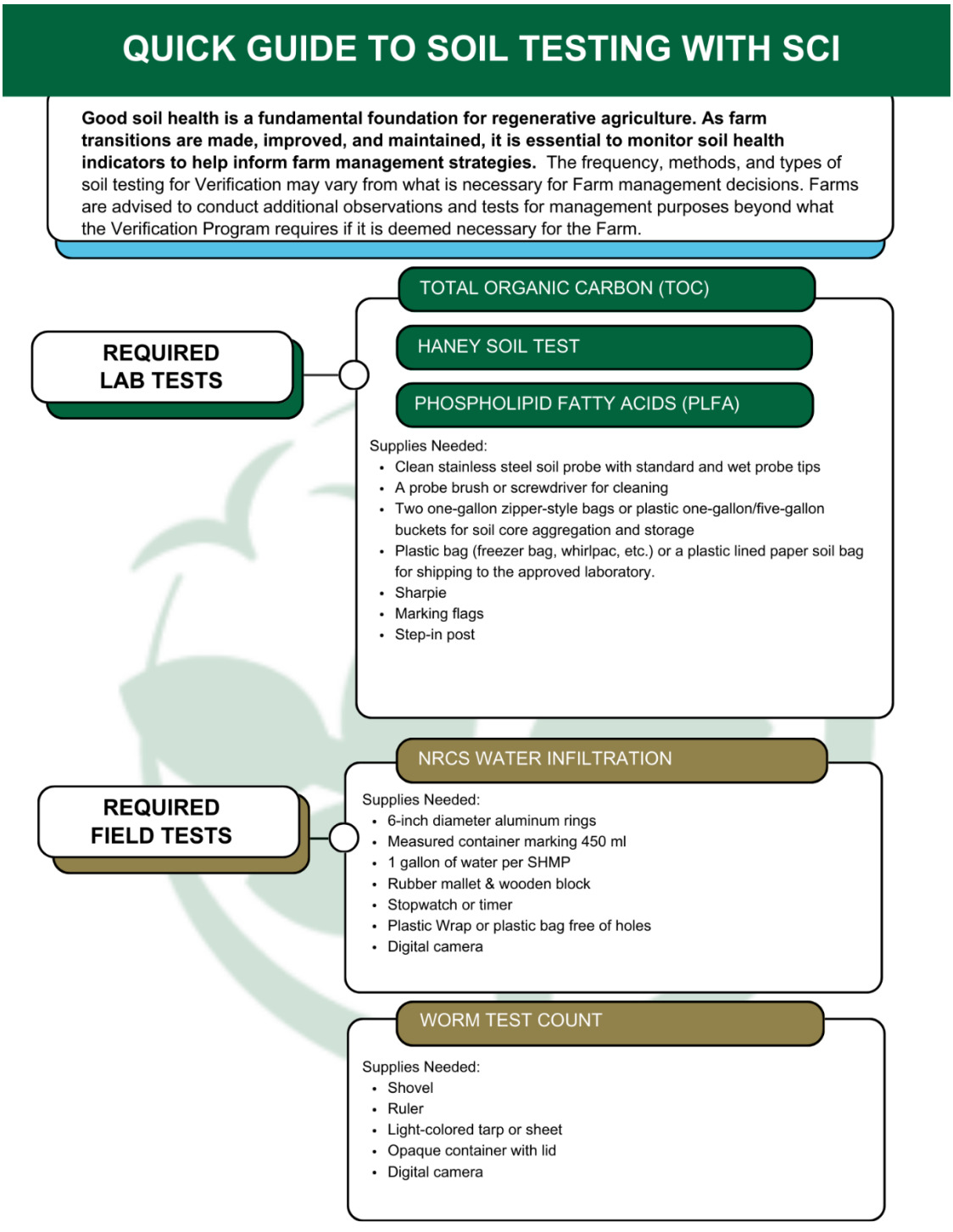

QUICK GUIDE TO SOIL TESTING WITH SCI

FARMERS CHOOSE ONE OF THESE TESTS DURING THE BASELINE YEAR AND WILL REPLICATE IT YEARLY.

SOIL HEALTH VISUAL EVALUATIONS

VISUAL EVALUATION OF SOIL STRUCTURE

Supplies Needed:

- Garden spade approx. 7- 8 inches wide,8 -10 inches long.
- Light-colored tarp or sheet
- 30-inch, small knife,
- Digital camera.
- SRUC Research Soil Structure Quality Visual Reference Guide

SLAKE TEST

Supplies Needed:

- Two clear glass jars or containers
- Water to fill glass jars/containers
- Wire mesh or screens to fit inside jars to hold soil
- Digital camera

PENETROMETER COMPACTION

Supplies Needed:

- Soil compaction probe or penetrometer
- Digital camera

3. Document Use

This document provides an overview of the soil sampling methodology and soil testing directions needed to comply with the Farm Commitment & Verification Standard (Farm Standard). It is important to note that this document does not supersede any requirements for soil testing outlined in the Farm Standard. The Soil & Climate Initiative Soil Testing Methodology provides Non-Normative Guidance for executing soil sampling and Field Tests required to meet verification requirements for the Soil & Climate Initiative's Soil and Climate Health Initiative Commitment & Verification Program.

Section 5.3 Soil Sampling Guidance for Lab Tests outlines the steps and equipment needed to properly take soil cores and ship them to the lab. This section provides additional hyperlinks for further clarification and instruction.

Section 6. Field Testing Guidance provides all the directions needed for performing the required Field Tests.

4. Soil Testing

Good soil health is a fundamental foundation for regenerative agriculture. As farm transitions are made, improved, and maintained, it is essential to monitor soil health indicators to help inform farm management strategies. Three key areas are vital for monitoring: Soil Organic Matter (SOM), Soil Biology, and Soil Structure. SCI measures 17 indicators to track soil health progress and to help inform farm management. These indicators are detailed in the Farm Standard.

It is important to note that the frequency, methods, and types of soil testing for the Verification Program may vary from those necessary for Farm management decisions. Farms are advised to conduct additional observations and tests for management purposes beyond what the Verification Program requires, if it is deemed necessary for the Farm.

Soil sampling and Field testing may be conducted by a third party at the Farmer's discretion. Farmers must be present during Field Testing. It is the Farmer's responsibility to ensure soil sampling completed on their behalf complies with the Farm Standard and the guidance provided in this document.

Soil sampling for Lab Tests is conducted every three years.

Field Tests are conducted annually. Results are to be documented by SCI approved methods that will be provided by SCI. All Field Test documentation must be shared with SCI within 14 business days of testing completion.

Soil sampling and Field Tests will be conducted via an approved soil sampling map showing the coordinates for sampling and testing sites.

Renewal soil testing must be conducted within 30 days before or after the initial baseline testing date, as long as the weather conditions are similar. For instance, if the baseline testing was conducted on a sunny day with a temperature of 70 degrees Fahrenheit on March 28th, the next annual or triennial testing should be conducted on a sunny day within five degrees of the baseline testing temperature, and it can't be done earlier than February 28th or later than April 28th. Farmers who are unable to complete the soil testing within the given timeframe due to weather-related events can request an exception by submitting for written approval from SCI. All exception inquiries should be sent to verification@soilclimateinitiative.org. Climatic conditions for the testing and sampling day must be recorded.

4.1 Required Lab Tests

Lab Tests are laboratory analyses that are conducted by an SCI-approved laboratory using composite soil samples collected according to the sampling methodology described in this document.

Lab tests are required every three years after taking the initial baseline test, as shown in Figure 1. Lab Testing Timeline Guidance.

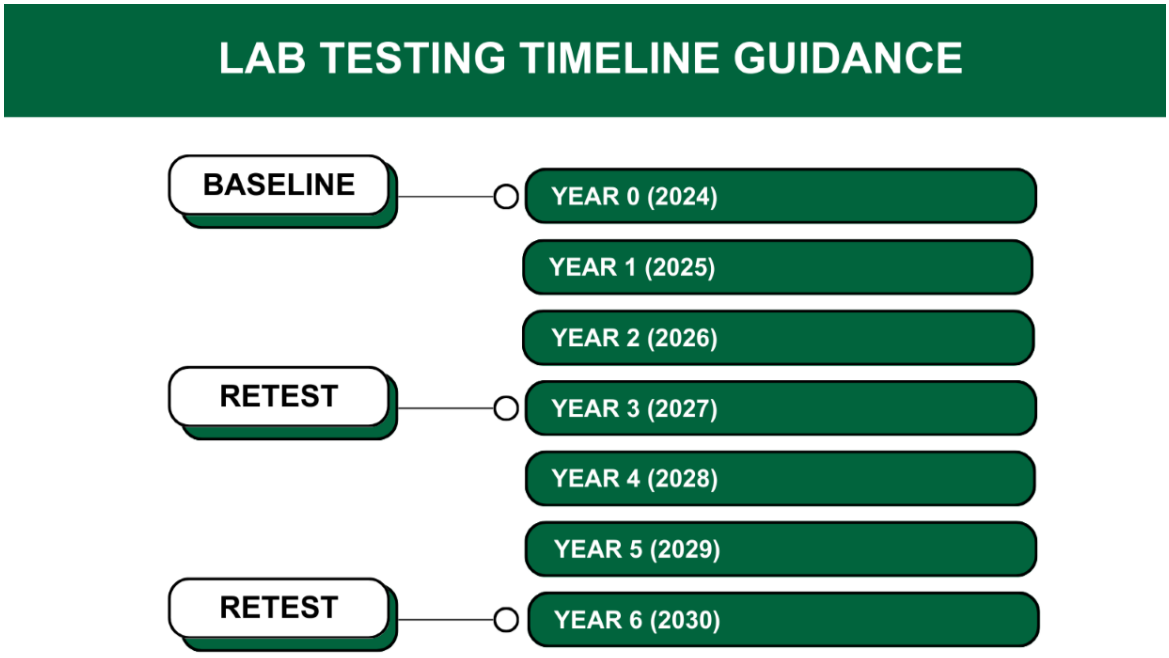

Figure 1. Lab Testing Timeline Guidance

Total Organic Carbon (TOC): Total organic carbon measures the amount of carbon stored in soil organic matter. The measurement of (TOC) is a crucial aspect of soil characterization and ecological assessment. It is the only accurate way to determine the amount of organic carbon present in the soil. Its presence or absence can significantly influence how chemicals will react in the soil.

Haney Soil Health Test: The Haney Soil Health Test is a comprehensive method of evaluating the overall health of the soil. It combines both chemical and biological measurements to assess nutrient availability, microbial biomass, and other aspects of the microbial habitat. The test also suggests cover crops that can be used to improve soil fertility and increase crop yield. The test is designed to simulate the natural process of nutrient availability in soil, making it a crucial tool for making informed decisions about how to improve soil fertility and productivity. A few of the metrics SCI utilizes from the Haney Test are listed below.

- Soil Health Score
- Water Extractable Organic Carbon
- Water Extractable Organic Nitrogen
- Organic Matter
- Organic C:N Ratio
- Soil Respiration CO2-C

For more information on the Haney Soil Health Test, refer to the Haney Test Interpretation Guide and the Haney Report Definition documents.

Phospholipid Fatty Acids (PLFA): The PLFA test is a technique that uses specific biomarkers of phospholipid fatty acids to identify the living microbial biomass in soil and recognize the different functional groups present or absent in the soil. Soil microbes are vital for important functions such as plant growth, nutrient cycling, and carbon sequestration. Changes in soil microbial communities due to processes such as tillage, planting cover crops, or manure applications can be detected by analyzing the microbial reaction using the PLFA test. This test is an effective tool to track the type of soil microbes and microbial community composition, which helps to monitor soil health over time. A few of the metrics SCI utilizes from the PLFA test are listed below.

- Total Living Microbial Biomass
- Arbuscular Mycorrhizal Fungi (AMF) Biomass
- Percentage of AMF in Total Biomass

4.2 Field Tests

Field Tests are in-field assessments of key soil-based indicators that do not require laboratory analysis. They can be conducted relatively rapidly and cost-effectively.

4.2.1 Required Field Tests

The NRCS Water Infiltration and the Worm Count Test are required yearly.

NRCS Water Infiltration: The infiltration rate measures how fast water enters the soil. The infiltration rate measures how fast water enters the soil, allowing for informed cropping, irrigation, and conservation decisions based on knowledge of the soil's water-holding capacity.

Worm Count Test: Provides an Indicator of the amount of organic matter and fertility of the soil. Earthworms play a vital role in soil health, fertility, and productivity and are responsible for breaking down organic matter, improving soil structure, and cycling nutrients. Earthworms can indicate the health of soil in many ways, including aeration, organic matter breakdown, nutrient availability, and soil structure. When earthworms are present in soil, it is a good indication that the soil is healthy and productive.

4.2.2 Soil Health Visual Evaluations

Farmers choose one of these tests during the baseline year and will replicate it yearly.

Visual Evaluation of Soil Structure (VESS): Provides a straightforward framework for quantitatively scoring soil structure quality. A visual evaluation of soil structure is a useful way to assess the quality and health of your soil. It can help you identify problems such as compaction, poor drainage, low organic matter, and lack of biological activity.

Slake Test: This test demonstrates the stability of soil aggregates when placed in water. It evaluates soil stability and susceptibility to erosion and measures the structural stability of soil aggregates. Stable soil structure with good aggregation is an important indicator of overall soil health.

Penetrometer Compaction: A soil penetrometer is used to test the compaction of the soil. A soil compaction test evaluates the density and penetration resistance of soil. Compacted soils have higher bulk density and require more force for roots or probes to penetrate through. Compaction negatively impacts soil health, crop growth and field trafficability. Annual compaction tests identify problems early before impacts worsen.

5. Methodology and Process

SCI has one main soil testing protocol centered around Soil Health Monitoring Points (SHMP). This protocol is required for Verification.

SCI also offers Farmers a soil testing program called Farm Transition Support (FTS), which provides more extensive soil testing which can inform a fertility program. FTS is not necessary for Verification. If Farmers choose the FTS program, SHMPs will be designated and included in the testing protocol.

Soil Health Monitoring Points are representative areas used to understand how Farm management changes are progressing soil and ecosystem health over time.

The number of Enrolled Acres determines the number of SHMPs. SCI has determined acre ranges using a formula developed to ensure statistical relevance to the number of soil cores needed and the amount of soil volume needed to run the required lab tests.

- SCI Formula: Square root of the Enrolled Acres plus one rounded to the nearest whole
- SHMPs are geolocated and placed in the top two predominant soil types.
- SHMPs are preferably located in an area the farmer designates as having average production yields; however, SCI understands not all farmers may have this level of data.
- When an odd number of SHMPs are required, the allocation of SHMPs shall defer to the predominant soil type, which shall have an odd number of SHMPs, and the secondary soil type shall have an even number.

SHMP allocations for Enrolled Acres are in Table 1, Soil Health Monitoring Point Allocation. For Farms larger than 9,000 Acres, contact SCI for details.

Table 1 Soil Health Monitoring Point Allocation

Acre Ranges	SHMP Required	Predominant Soil Type Allocation	Secondary Soil Type Allocation
550 or less	2	1	1
> 550 - 1200	3	2	1
> 1200 - 2200	4	2	2
> 2200 - 3500	5	3	2
> 3500 - 5100	6	3	3
> 5100 - 6900	7	4	3
> 6900 - 9000	8	4	4
> 9000	Contact SCI		

Farm Transition Support is an optional testing program centered on creating stratified sampling points across the Enrolled Acres. This level of testing provides information that can inform fertility and cover crop programs. Farmers may include this program in their soil testing protocol at any time they deem helpful for their regenerative transition, and they may also remove it at any time they choose. These tests do not replace and are in addition to the SHMP testing.

An SCI-approved service provider divides fields by soil type, management practice, and, where applicable, slope. The maximum field size is 100 acres. Lab Testing frequency can vary at the Farmer's discretion with consultation from SCI's approved agronomy consultant(s) as long as It occurs at least every three years. FTS can include soil testing protocols for agricultural-based carbon credit programs if desired.

Farmers enrolled in this program will receive a Modified SHMP centered around a single sampling point. This SHMP will inform and create parameters for the execution of the Field Tests. In cases where farmers remove this program, the modified SHMP will become the full SHMP and testing, as detailed in section 5.1 Sampling Protocol for Soil Health Monitoring Points, will begin.

5.1 Sampling Protocol for Soil Health Monitoring Points (SHMP)

The sampling protocol for the SHMP centers around sampling zones. During SCI program onboarding, the sampling locations are identified as part of the farm and field enrollment and field mapping processes.

If new acres are enrolled to an existing farm in the program, they will be reviewed for the proper SHMP establishment. In most circumstances, additional enrolled acres will be treated as a new enrollment and will follow the process designated in this guidance document for the establishment of SHMPs.

The Midpoint of the sampling zone is geolocated during testing for accuracy and precision. The sampling map reflects the location of the SHMP midpoint. The Farmer will use the soil sampling map to find the SHMP midpoint, and they will measure and track the geolocation points for the 12 soil cores and field tests as described below. Directions for executing the Lab and Field Tests are found in section 5.3 Soil Sampling Guidance for Lab Tests, and section 6 Field Test Guidance. Visual clarity is provided in Figure 2. Soil Health Monitoring Points on the next page.

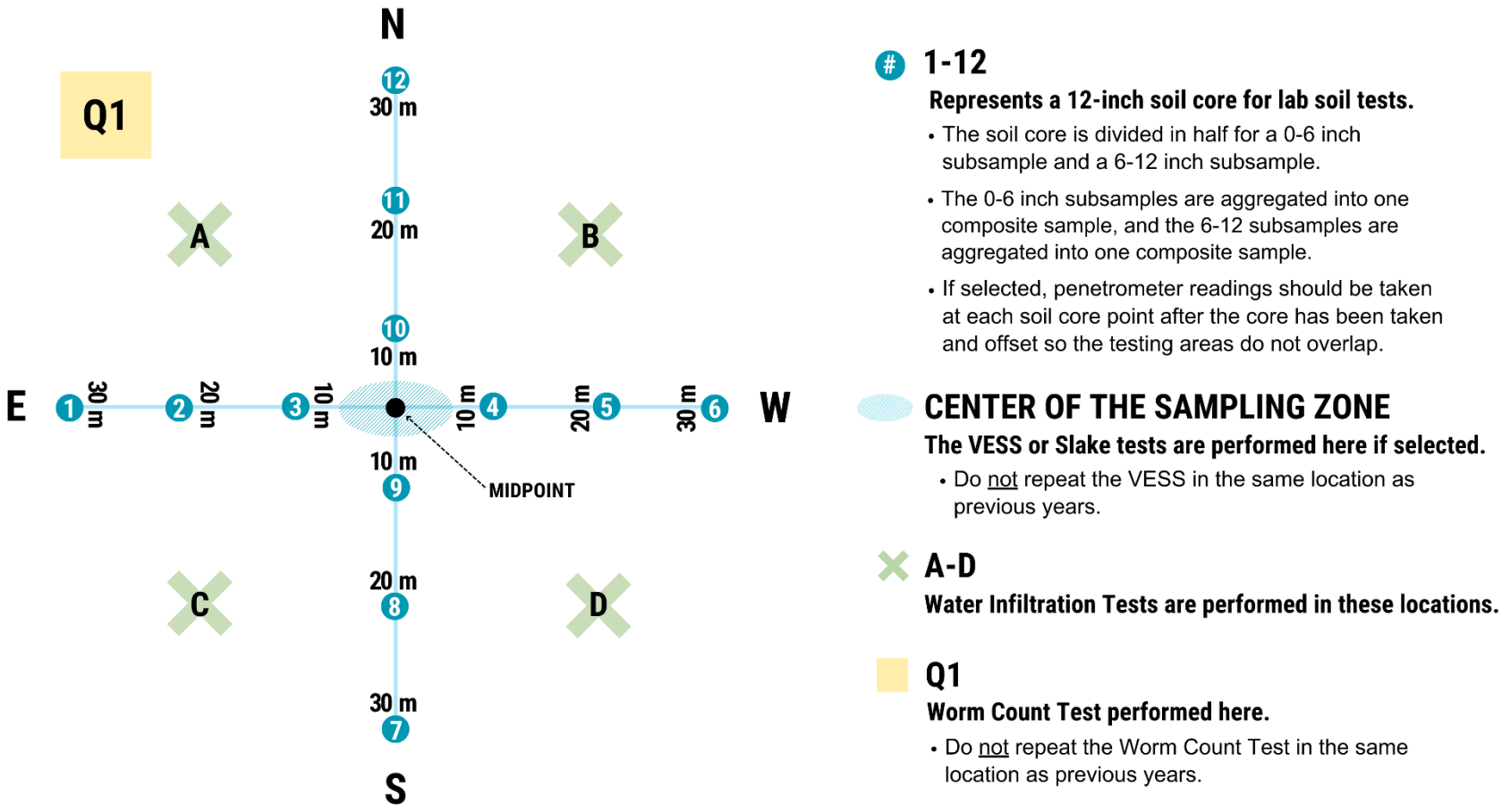

Figure 2. Soil Health Monitoring Points

From the Midpoint, a soil core will be pulled at 10, 20, and 30 meters in each direction, facing North, South, East and West. Refer to the blue points labeled 1-12 on Figure 1 Soil Health Monitoring Points.

- Each soil core is taken at a 12-inch depth and divided in half to create two sample depths (0-6 inches and 6-12 inches).
- 0–6-inch soil cores are aggregated into one sample, and the 6-12 inch soil cores are aggregated into a separate sample.
- If selected, penetrometer readings for compaction should be taken within a 0.5-meter radius of each 1-12 soil core point.

If using a Modified SHMP, the Midpoint will be the sampling point and the following instructions apply for performing the Field Tests.

If selected, the VESS or the Slake test is performed within the 10-meter center of the SHMP zone. The VESS is to be geolocated at the time of testing and not repeated in the same location in subsequent testing years. These tests can be taken anywhere in the center of the sampling zone so long as the geolocated spot isn't repeated for at least 3 years.

Water Infiltration Tests are performed at four separate points of the sampling zone as follows from the Midpoint:

A. N 20 m, E 20 m

B. N 20 m, W 20 m

C. S 20 m, E 20 m

D. S 20 m, W 20 m

For example, N 20 m, E 20 m, means moving to a point that is both 20 m North of the Midpoint, and 20 m East of the Midpoint. To do this, start at the Midpoint and walk 20 meters North, then turn to face East and walk 20 meters East. This would be Point A for the Water Infiltration Test .

The Worm Count Test is to be performed in quadrant Q1 of the SHMP. It is to be geolocated at the time of testing and not repeated in the same location in subsequent testing years. These tests can be taken anywhere in the quadrant as long as the geolocated spot isn't repeated for at least 6 years.

5.2 Farm Transition Support

Farm Transition Support is an optional testing program centered on creating stratified sampling plans across the Enrolled Acres. This level of testing provides information that informs fertility and cover crop programs. Farmers may include this program in their soil testing protocol at any time they deem helpful for their regenerative transition, and they may also remove it at any time they choose.

An SCI-approved agronomic service provider divides fields by soil type, management practice, and, where applicable, slope. The maximum field size is 100 acres. Lab Testing frequency can vary at the Farmer's discretion with consultation from SCI's approved agronomy consultant(s). FTS can include soil testing protocols for agricultural-based carbon credit programs if desired.

These tests do not replace and are in addition to the SHMP testing.

5.3 Soil Sampling Guidance for Lab Tests

As the Approved Soil Laboratory, Regen Ag Lab, has provided users with a Soil Health Sampling Instructions document that provides helpful information for soil sampling, it is important to note that this document does not supersede any requirements for soil testing outlined in either the Farm Standard or the Soil Testing Guidance & Methodology. This document only provides additional guidance and tips for pulling soil samples in the field.

5.3.1 Equipment Considerations

- Clean stainless steel soil probe with standard and wet probe tips
    - A step probe works well for soil sampling, but other sampling tools can be used in lieu of a probe, such as an auger bit or a spade for taking a furrow slice.
    - Farmers may wish to use a Giddings Probe or other soil core probing machinery. SCI does not require the use of such equipment.
- A probe brush or screwdriver for cleaning
- Two one-gallon zipper-style bags (sample bags) for soil core aggregation and storage.
    - Plastic one-gallon/five-gallon buckets can be used to aggregate samples at the 0-6 and 6-12-inch depths.
    - These can be transferred into a plastic bag (freezer bag, whirlpac, etc.) or a plastic lined paper soil bag for shipping to the approved laboratory.
- Sharpie or other supplies for labeling sample containers.
- Marking flags
- Step-in post

5.3.2 Process Considerations

- Document the weather conditions using the approved documentation process.
- Soil temperatures should be at a minimum of 50° F.
- Find the geolocated pin and use it as the SHMP Midpoint.
    - Review the video for instructions on how to find and use geolocated pins.
- Place a step-in post at the Midpoint and use a compass to orient and a meter-style tape measure to locate the 12 soil core points. (see Figure 1)
- Place a marking flag at each soil core and testing point if desired.
- Geolocate each soil core point.
- Confirm that the stainless-steel probe and sample containers are clean.
- Label each sample bag with the following:
    - Farmer name
    - Farm name
    - Field name
    - Field number
    - Date
    - Core depth (0-6 inch or 6-12)

- Farm's SCI ID number
- Choose and attach the appropriate probe tip. At a minimum, use a 5/8-inch tip.
- Clear vegetation and residue to expose the soil surface at the soil core point.
- Insert the probe without twisting at a 90° angle to a depth of 12".
  - Use a rubber mallet as needed to drive the probe to the desired 12-inch depth.
- Twist the probe a quarter turn in any direction and then pull straight up to remove the probe. Each probe yields one core, which is split into two samples.
- Once a good core is collected, divide the core in half and place the 0–6-inch portion of the core and the 6-12 inch portion of the core into their respective sample containers.
  - A good core fills the entirety of the stainless steel probe with soil, is not compacted, and does not contain gaps, holes, organic material, or large rocks.
  - If the soil has clearly compacted more than 1 inch within the probe, clean out the probe with the probe brush or screwdriver and discard the compacted soil before reattempting to pull a new core.
- Remove any excess soil from the probe prior to taking the next core. Probes used for the same Field Samples do not need to be thoroughly cleaned between samplings.
- Repeat the above steps for each of the 12 soil core points.
- Continue to aggregate the 0-6 inch cores into one sample using the labeled sample container and the 6-12 inch cores into another using the labeled sample container.
- Sample volume should equal roughly two cups.
- Samples taken from different Fields and at different core depths cannot be mixed.

5.3.3 Sampling Handling and Shipping Considerations

- Samples can be stored in a relatively cool and shaded location for up to 2 days before shipping to the Laboratory. Samples can also be stored in a standard refrigerator for up to 2 weeks before being sent to the Laboratory. If samples need to be stored longer than 2 weeks, they must be frozen in a standard freezer before shipping to the lab.
- Include the provided Soil Submittal form.
- Samples may be shipped "field moist" to the lab, either fresh or frozen.
- Samples can be shipped with UPS, FedEx, USPS or any other major carrier. We recommend overnight shipping if daytime temperatures are over 80°F. Otherwise, 2-3 days is fine.

6. Field Testing Guidance

Guidance for all required Field Tests is detailed in the following sections.

Results must be submitted to SCI within 14 business days of testing completion.

6.1 NRCS Water Infiltration

Image credit

For verification purposes, required in-field tests, including this Infiltration Test, must be conducted annually in the designated locations within the SHMP notated as points A, B, C, and D. (see Figure 1) Below are instructions for conducting an Infiltration Test at your designated testing sites. Adapted from NRCS Soil Health – Infiltration testing guidance.

Why does SCI require an annual Infiltration Test?

A soil infiltration test measures how fast water enters and moves through the soil and is usually measured in inches per hour. Infiltration can affect the soil's ability to store and supply water, nutrients, and oxygen to plants and soil organisms. Infiltration tests can tell us about the health of a soil's:

- Porosity: the amount of pore space in the soil
- Permeability: the ease with which water can flow through the soil
- Structure: the arrangement of soil particles and aggregates
- Texture: the proportion of sand, silt, and clay in the soil
- Organic matter content: the amount of decomposed plant and animal material in the soil
- Biological activity: the presence and diversity of soil organisms

What do the results indicate?

A moderate to high infiltration rate indicates healthy soil, where water can infiltrate the soil quickly and evenly without causing runoff, erosion, or ponding. A low infiltration rate can indicate that the soil is compacted, crusted, or has a high clay or salt content. A very high infiltration rate can indicate that the soil is sandy, has low water-holding capacity, or is prone to leaching of nutrients and contaminants.

Steps:

1. Locate testing location A, geolocate and record the testing coordinates.
2. Clear all residue from the soil surface. Drive the ring into the soil to a depth of 3" using the mallet and block of wood. Drive the ring down evenly and vertically. Gently tamp down the soil inside the ring to eliminate gaps.
3. Cover the inside of the ring with plastic wrap and drape it over the rim.
4. Pour 450 mL water into the plastic-lined ring.

5. Gently and quickly pull the plastic wrap away. Record the time it takes for the water to infiltrate the soil. Stop the timer when the soil "glistens".
6. Take a photo from above the soil ring to show the inside of the ring and position the timer in the photo to show the time.
7. Repeat Steps 2, 3 and 4 for a second reading.
8. Record both results on the provided documentation form.
9. Repeat Steps 1-7 for testing sites B, C, and D.
10. Label all photos with the test name, location, and test number (1 or 2)

Supplies Needed:

- 6-inch diameter aluminum rings - (a resource to purchase infiltration rings)
- Measured container marking 450 ml
- 1 gallon of water per SHMP
- Rubber mallet - for driving the aluminum ring into the soil
- Wooden block – protects from damage to the infiltration ring when driving it into the soil
- Stopwatch or timer
- Plastic Wrap or plastic bag free of holes
- Cell phone with location services turned on for photos.
- Means for following SCI's approved documentation process.

Considerations & Further Resources:

Avoid areas that are not typical, such as animal burrows.

- Read: NRCS, Soil Health Guides for Educators, Soil Infiltration
- Watch: CropWatch, Soil Infiltration Overview Video
- Watch: CropWatch, Soil Infiltration Test Video

6.2 Worm Count Test

Image credit

For verification purposes, required in-field tests, including this Worm Count, must be conducted annually in the designated location within the SHMP notated as Q1 (see Figure 1). Below are instructions for conducting a Worm Count at your designated soil sampling area. Adapted from NRCS Soil Quality Test Kit Guide: Earthworms (page 22).

Why does SCI require an annual Worm Count Test?

Earthworms are an important indicator of soil health, and their presence (or absence) is one way that SCI measures improvements in soil health.

Earthworms are a crucial component of soil ecosystems. They play a vital role in soil health, fertility, and productivity and are responsible for breaking down organic matter, improving soil structure, and cycling nutrients. Earthworms can indicate the health of soil in many ways, including aeration, organic matter breakdown, nutrient availability, and soil structure. When earthworms are present in soil, it is a good indication that the soil is healthy and productive. They provide valuable insight into the potential benefits for plant productivity and specific benefits like carbon cycling and nutrient mobilization. Counting earthworms can provide insight into the potential benefits for plant productivity and specific benefits like carbon cycling and nutrient mobilization. By counting earthworms, Farmers can make informed decisions about soil management and improve soil conditions. So, it is important to take care of earthworms and promote their growth in soil for better productivity.

What do the results indicate?

The presence of earthworms in your soil can indicate the amount of organic matter it contains. A low or absent population of earthworms may suggest that there are minimal or no organic residues in the soil. Additionally, high soil temperature and low soil moisture can cause stress to earthworms and, in some cases, reduce crop productivity.

Steps:

1. Take a worm count in quadrant Q1 of the SHMP. Geolocate each testing site and avoid replicating the spot in future years.
2. At Each testing site
    a. Measure out a 12" x 12" square area on soil.
    b. Dig up the soil 12" deep and place it on a tarp or sheet.

c. Gently search through the soil and find worms (any type of worm, adult or juvenile).
d. Put worms in a container as you find them.
e. Count & record the total number of worms.
f. Gently place the worms on the tarp or sheet and take a photo.
g. Carefully return worms and soil to the hole.
h. Label the photo with the test name.

Supplies Needed:

- Shovel
- Ruler
- Light-colored tarp or sheet
- Opaque container with lid
- Cell phone with location services turned on for photos.
- Means for following SCI's approved documentation process.

Considerations and Additional Resources:

- Test when soil is moist, not dry.
- Test is best when taken in the spring or fall. A generalized range for earthworm activity is 32 – 86 degrees F.
- Work slowly and gently.
- Return worms to soil quickly.

6.3 Visual Evaluation of Soil Structure (VESS)

For verification purposes, required in-field tests, including this Soil Structure test if selected, must be conducted annually in the designated location within the SHMP notated as the Midpoint (see Figure 1). Below are instructions for conducting a VESS test at your SHMP. Adapted from Scottland's Rural College (SRUC) VESS Guidance form.

Image Credit

Why perform an annual VESS Test?

A VESS is a useful way to assess the quality and health of your soil. It can help you identify problems such as compaction, poor drainage, low organic matter, and lack of biological activity. To do this, you dig out a block of soil with a spade and observe its appearance and feel.

What do the results indicate?

The Soil Quality (Sq) scale ranges from Sq1, which indicates good structure, to Sq5, which indicates poor structure. VESS helps you understand and improve your soil. You can see how your soil changes and responds to different management practices. It is a simple and quick way to check your soil health and productivity.

- A score of Sq1 or Sq2 is good and should only require further monitoring.
- A score of Sq3 is moderate and may require more frequent further monitoring.
- Scores of Sq4 and Sq5 are poor and require management action.

Steps:

1. Geolocate the SHMP Midpoint and follow the detailed procedures in the Visual Evaluation of Soil Structure guide. Generalized steps are detailed below.
2. Soil Removal
   a. Push the spade vertically into the soil and dig out a spade full down to a depth of about 25-30cm, roughly 10-12 inches.
   b. Cut down on three sides and then lever the block out, leaving one side undisturbed.
   c. c. Alternatively, dig out a block and then take a slice from the undisturbed face. Carefully lay the block on a plastic sheet or tray.
3. Soil Assessment

a. Gently open the undisturbed side of the block like a book and start to break it up.
b. If the block breaks up easily into small fragments, the structure will likely be good.
c. c. If the block is hard to break up, it could either be held together by roots, which you will need to pull apart to expose the soil fragments, or it is compacted and breaks into large lumps.
d. Break up the block enough to allow you to discover if there are any distinct layers of differing structure. If the block is uniform, assess it as a whole. If there are two or more such layers, then score separately.
e. Take a photo of the block to show the layers

4. Soil Scoring
    a. Break up the soil with your hands into smaller structural units (known as aggregates).
    b. Score each layer by matching what you see to the descriptions and photos in the chart.
        i. Create a weighted average of individual layers to create a score for the soil block.

5. Label the photo with the test name and submit it with the documentation form.

Supplies Needed:

- Garden spade approx. 7- 8 inches wide,8 -10 inches long.
- Light-colored tarp or sheet
- 30-inch, small knife,
- Cell phone with location services turned on for photos.
- Means for following SCI's approved documentation process.
- Soil Structure Quality Visual Reference Guide

Considerations & Additional Resources:

- Test when the soil is moist if the soil is too dry or too wet it can be difficult to distinguish signs of poor structure. Spring or autumn should be the best time of the year and allow management decisions to be made to improve soil structure.
- Field Crop News, includes this video.

6.4 Slake Test

Image Credit

For verification purposes, required in-field tests, including this Slake Test if selected, must be conducted annually in the designated location within the SHMP notated as the Midpoint (see Figure 1). Below are instructions for conducting a Slake Test. Adapted from University of Wisconsin-Madison, The slake test – a simple way to evaluate soil structure.

Why perform an annual Slake Test?

A soil slake test evaluates soil stability and susceptibility to erosion. The slake test measures the structural stability of soil aggregates. Stable soil structure with good aggregation is an important indicator of overall soil health. Soils with poor structure are more vulnerable to erosion and surface crusting. It can identify soils that may need additional organic matter or changes in management to improve soil health and reduce erosion potential.

What do the results indicate?

A slake test can provide some useful insights into potential improvements in agronomic practices based on the soil's stability response:

- If soil aggregates quickly slake and disperse:
    - Boost soil organic matter - use cover crops, compost, manures
    - Add organic residues with lignin
    - Improve soil biology and microbial communities
    - Enhance drainage, reduce wet-dry cycles
- If soil aggregates remain intact and resilient:
    - Maintain practices that build aggregation like reduced tillage
    - Consider controlled traffic to prevent compaction
    - Reduce chemical inputs that may disrupt biology
    - Avoid over-saturation and plowing wet soils
    - Monitor soil organic matter and fertility

Steps:

1. Geolocate two locations within the Midpoint of the SHMP.
2. Take enough soil from each of these points to fit into your hand.
3. Place wire mesh screens into the top of each jar. These should be deep enough to allow the soil samples to be submerged in the water while being held within the top 1/3 of the jar.
4. Fill the jars with water.
5. Place each section of soil onto the wire mesh screens in each jar.
6. Record the time from immersion until complete slaking occurs. Longer times indicate higher stability.
7. Take a photo once each jar reaches complete slaking. Position the timer showing the final time in the photo.
8. Record your results on the provided documentation form.
9. Label the photo with the test name and test number (1 or 2) and submit with the documentation form.

Supplies Needed:

- Two clear glass jars or containers
- Water to fill glass jars or containers
- Wire mesh or screens to fit inside jars to hold soil
- Cell phone with location services turned on for photos.
- Means for following SCI's approved documentation process.

Considerations & Additional Resources:

There are no universally standardized metrics for quantifying or measuring results in the Slake test.

- Read: Healthy Soils Are: Well Structured

6.5 Penetrometer Compaction Test

Image credit

For verification purposes, required in-field tests, including this Soil Compaction Test if selected, must be conducted annually in the designated locations within the SHMP notated within 0.5 meters of points 1-12 (see Figure 1). Below are instructions for conducting a basic compaction test. Adapted from Rutgers, Use of A Penetrometer to Assess Soil Compaction.

Why perform an annual Compaction Test?

A soil compaction test evaluates the density and penetration resistance of soil. Compacted soils have higher bulk density and require more force for roots or probes to penetrate through. Compaction negatively impacts soil health, crop growth and field trafficability. Annual compaction tests identify problems early before impacts worsen.

What do the results indicate?

The results of a soil compaction test provide information about the density and strength of the soil at various depths. Overall, compaction test psi readings quantify the extent, severity and location of compacted zones. This helps identify issues requiring changes in field practices to alleviate compaction and improve soil function.

Some key things that compaction test results indicate:

- Indicators of Compaction:
    - Higher psi readings than threshold values.
    - Visible plow pans or platy structures.
    - Poor water infiltration.
    - Poor root development.
    - Reduced crop growth/yields.
- Managing Compaction:
    - Reduce field traffic and use controlled traffic patterns.
    - Addition of organic matter to improve soil structure.
    - Deep tillage such as subsoiling to fracture compacted layers.
    - Avoiding tilling wet soils.
    - Using cover crops with deep rooting systems.

Steps:

1. Take a penetrometer reading within 0.5 meters of each soil core point (1-12) on the SHMP. Do not overlap in the exact spots where the soil core was taken.
2. The indicator gauge should read “0” before sampling.
3. Prepare to take the reading by clearing the surface debris from the test area.
4. Insert the probe vertically into the soil, perpendicular to the surface.
5. The penetrometer is pushed into the soil within each test area until the gauge reads 300 psi.
6. The distance that the rod penetrates the soil up to the 300 psi reading is measured and recorded on the provided documentation form, with deeper penetrometer depths indicating less compact soils.
7. Take a photo showing the distance measurement of each point.
8. Repeat the process for all SHMP 1-12
9. Label the photos with the test and SHMP number and submit them with the documentation form.

Supplies Needed:

- Soil compaction probe or penetrometer
- Cell phone with location services turned on for photos.
- Means for following SCI’s approved documentation process.

Considerations & Additional Resources:

- Compaction is often higher in traversed areas.
- It can be useful to compare field measurements with undisturbed reference areas like fence rows.
- Test when the soil is moist. If the soil is too dry or too wet, it can affect the penetrometer readings.
- Watch: Using a penetrometer to detect soil compaction

7. Key Terms and Definitions

Approved Laboratory/Laboratory: A laboratory identified by the standard operator as capable of providing soil testing services in alignment with the soil testing requirements of the Soil & Climate Initiative Farm Commitment & Verification Standard lab.

Farm: One or more tracts of working lands under the control and management of a Farmer.

Farmer: The working lands manager with primary responsibility for decisions related to management practices of crops or livestock and demonstrable authority to implement changes in management and to obligate a Farm to comply with the Soil & Climate Initiative Farm Commitment & Verification Standard.

Farm Standard: The shortened term used to refer to the Farm Commitment & Verification Standard.

Field: A set of Enrolled Acres with similar soil and production types and practices across those Acres. In certain situations, slope may be a factor in determining appropriate Field organization.

Field Tests: In-field tests and methodologies required by the SCI Farm Commitment & Verification Standard, that provide a visual and tactile means for assessing the relative health of the soil.

Guidance: Within the Soil & Climate Initiative Farm Commitment & Verification Standard, language providing additional interpretation or anecdotal information on a specific standard requirement for the purposes of clarification.

Lab Tests: Laboratory soil testing and methodologies required by the SCI Farm Commitment & Verification Standard, that provide a means for assessing the health of the soil.

Midpoint: A geolocated spot on the soil sampling map that designates the center of the Soil Health Monitoring Point(s) and includes a 10-meter radius in the middle for performing the designated Field Tests.

Modified Soil Health Monitoring Point(s) are sampling points designated in the Farm Transition Support sampling protocol used to anchor the Field Tests. The soil core taken will serve as the Midpoint, and the Field Tests will be measured and performed according to this guidance document.

Non-normative guidance: The non-prescriptive, or 'descriptive', part of the program and aims to provide substantive direction for the scope, scale, and/or action required to meet the program's design intentions. This may include analogies, synonyms, explanations, illustrations, context, and examples. In the event that non-normative content contradicts normative content, the normative content is to be followed.

Soil & Climate Initiative (SCI): A commitment and verification program with an intent to scale the Acres under Regenerative Management in order to deliver regenerative outcomes: soil health, increased biodiversity, improved water quality and nutrient density, climate resiliency and greater Farm and rural prosperity.

Soil Health Monitoring Point(s): Soil Health Monitoring Points are representative areas used to understand how Farm management changes are progressing soil and ecosystem health over time. Lab and Field Tests soil health testing are centered around these points.

Soil Health Visual Evaluations: A set of three soil health tests performed in the Field. The Farmer chooses to execute one of the three tests.

Verification Program: The shortened term used to refer to the Soil & Climate Health Initiative Commitment & Verification Program

8. List of Figures and Tables