

Soil Health Testing

Short Guide: Soil Health Testing Conservation Evaluation and Monitoring Activity (CEMA) 216 in Whole Farm Planning



Whole Farm Planning and Soil Health Testing

Whole farm planning is an approach that treats an agricultural operation as an interconnected system and ensures that all resource concerns are addressed together. The soil health testing information provided in Conservation Evaluation and Monitoring Activity (CEMA) 216: Soil Health Testing fits seamlessly into the whole farm planning process.

Whole farm planning integrates participant decision-making across environmental, economic, and production concerns. It works best when there is an opportunity to consider all of an operation's features to promote natural resource conservation and integrate economic and environmental concerns.

Using CEMA 216 during whole farm planning links laboratory indicators to resource concerns, connects soil processes (physical, chemical, biological) to conservation goals, and improves agricultural operation viability and productivity by enabling adaptive management, or adoption or adjustment of practices based on monitored trends and site context.

Soil health testing provides NRCS and partner planners with actionable data to address resource concerns and optimize management systems, and is a critical resource for field employees engaged in conservation planning. Information from consistent soil health testing informs resource management decisions and promotes sustainable, regenerative agricultural practices, increasing an operation's viability.

The CEMA 216 streamlines the soil health testing process by providing a standardized method for assessing and utilizing soil health laboratory data. Incorporating CEMA 216 into conservation planning equips field employees and land managers to make informed, data-driven decisions that promote soil health and elevate overall sustainability on an operation. By leveraging detailed insights from soil health testing, conservation plans can be customized to address specific challenges and opportunities, fostering a more resilient, regenerative, and productive agricultural landscape.

Key Benefits of using soil health testing for conservation planning

- Identify resource concerns: assess the planning unit, detect erosion, compaction, organic matter depletion, and microbial habitat loss.
- Evaluate management changes: monitor the impact of installed conservation practices on soil health objectives, including cover crops, reduced tillage, diversified rotations, and nutrient management.
- Set and track goals: establish baselines, define soil health objectives, and measure progress over time.
- Support economic and environmental outcomes: healthy soils improve natural vitality, reduce input costs, and sustain productivity.

More Information

Farmers and ranchers interested in regenerative agriculture are encouraged to apply through their local NRCS Service Center by their state's ranking dates for consideration in FY2026 funding.

Applications for both EQIP and CSP can now be submitted under the new single regenerative application process.

Scan or click the QR Code for more info.



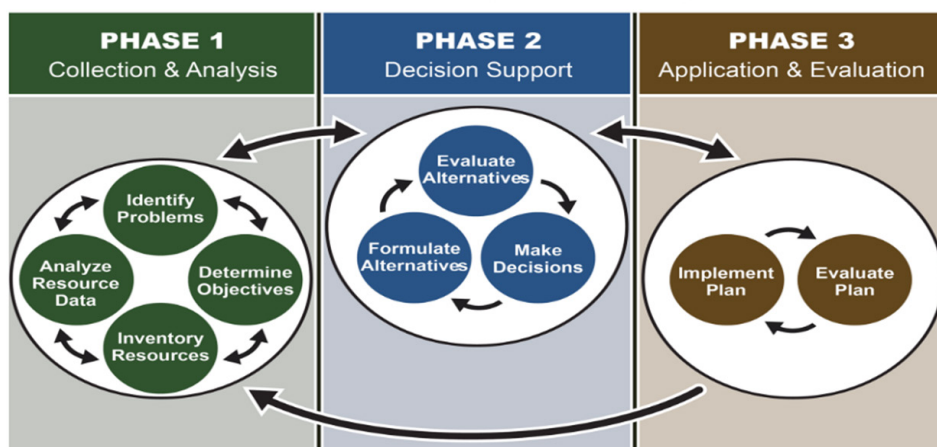
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Integrating Soil Health Testing into the NRCS 9-Step Conservation Planning Process

Helping participants use soil health testing on their operations requires clear, specific planning at each phase of the 9-step Conservation Planning Process.

9-Step Conservation Planning Process



Phase 1 - Identify Problems and Opportunities (Step 1), Determine Objectives (Step 2), Inventory Resources (Step 3), Analyze Resource Data (Step 4)

The conservation planner and participant identify and assess resource concerns. An inventory is more than maps and boundaries. It establishes the current onsite conditions related to resource concerns, and for CEMA 216, this includes the current soil health conditions. The NRCS Soil Health Resource Concerns identify critical issues affecting soil function, with a primary focus on organic matter depletion, compaction, aggregate instability, and loss of soil-organism habitat. By proactively addressing soil health concerns through proven conservation practices such as reduced tillage, cover cropping, and biodiversity enhancement, we can reduce erosion, improve nutrient cycling, and restore water-holding capacity.

Traditional, soil tests have focused primarily on measuring available nutrient levels to support or provide fertilizer recommendations. In contrast, soil health testing offers a more comprehensive approach. It evaluates factors such as soil

organic matter cycling, soil structural stability, microbial activity, carbon as a food source for soil organisms, bioavailable nitrogen (N), and microbial diversity. This holistic approach integrates biological and physical processes, moving beyond a sole focus on soil fertility. When conservation practices are first implemented and periodically thereafter, soil health testing can help identify potential changes that may improve soil health and overall conservation efforts.

Phase 2: Formulate Alternatives (Step 5), Evaluate Alternatives (Step 6), and Make Decisions (Step 7)

Soil health testing can be a useful tool for participants to compare, set goals, and monitor progress on their operations. It is recommended that participants use multiple soil health indicators to obtain the most information about soil health on their operation, and carefully plan before soil sampling. Combining CEMA 216 results with soil survey data for each soil mapping unit within a Planning Land Unit (PLU) can guide discussions on the appropriate conservation practices to address the resource issues that are present. Aligning conservation practices with the operation's specific needs and conditions requires clear planning and the selection of an appropriate option or alternative for successful implementation.

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Phase 3. Implement Plan (Step 8), and Evaluate Plan (Step 9)

Once the participant makes their decisions, the planner develops instructions for each conservation practice and activity in site-specific detail to support implementation of the plan. A regular schedule for soil health testing allows for ongoing monitoring of soil conditions and the effectiveness of implemented practices, enabling timely adjustments and continuous improvement. The conservation planner and participant should regularly evaluate the conservation plan's effectiveness in addressing resource concerns and making necessary adjustments.



Practical Steps for Participants and Conservation Planners

1. Plan the Appropriate Test and Indicators
 - Align with participant goals: improve low production areas, diagnose problem spots, evaluate practice effectiveness (e.g., no-till, cover crops).
 - Choose indicators relevant to the goals (microbial activity, aggregation, nitrogen cycling, labile carbon).
 - Facilitate participant and Qualified Individual (QI) meetings to meet conservation objectives.
2. Sampling Considerations for Participants and Qualified Individuals (Refer to CEMA 216 for detailed technical requirements.)
 - Be consistent year-to-year, including sampling depth, timing, and conditions, and if possible, use the same lab for trend reliability.
 - Avoid field edges and anomalies and target moderate soil moisture. Contact the lab before sampling for guidance on packaging, cooling, and shipping.
3. Interpreting and using soil health test results
 - Know the indicators: Confirm what each soil health indicator measures and which soil process it represents. Use multiple indicators to get a complete picture; expect gradual changes (3–5 years; up to 10 years in dry regions). Indicators are proxies, not direct measures of outcomes; avoid overinterpreting single values. See Table 1 below for a quick reference on laboratory indicators of soil health.
 - Verify methods and laboratory consistency: Maintain consistent sampling and lab methods to ensure trend validity.
 - Add context: Soil texture, pH, climate, annual precipitation, and production system influence expected ranges. Treat results as a snapshot—interpret alongside soil type and texture, pH, climate, production system, and management history. Year-to-year variations in precipitation can significantly affect test results, especially in arid regions. Take all of these factors into consideration when evaluating trends. Watch seasonality and recent disturbances (e.g., tillage can temporarily spike respiration).
 - Compare smartly: Compare results across management systems, reference areas (e.g., fence row), and over time to detect trends. Don't compare across vastly different soils/regions; use peer group or reference comparisons.
 - Model it: Use regionally calibrated frameworks like the Soil Health Assessment Protocol and Evaluation (SHAPE) to place values in peer groups and score against climate/texture context. [Note: The SHAPE is a USDA-developed quantitative tool designed to evaluate soil health by assigning 0–100% scores based on specific soil and climate conditions (soil peer groups). Integrate with production measures (yield, inputs, ease of operations) for holistic planning and adaptive recommendations.]
 - Triangulate: Combine soil health indicators with fertility tests, yield, input records, and field notes.

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Table 1. Laboratory Indicators of Soil Health and Management Recommendations

INDICATOR	DESCRIPTION	MANAGEMENT RECOMMENDATIONS
Carbon Cycling– Soil Organic C (SOC)	Soil organic carbon (SOC) is a major component of soil organic matter and is crucial for soil health. It influences soil structure, water retention, fertility, and provides microbes with food.	- Reduce or optimize disturbances to protect soil aggregates and biological functions. - Use of organic inputs like compost, biochar, and/or manure. - Implement practices like cover crops, pasture and hay planting, grazing management, forest stand improvement, and conservation crop rotation to increase organic matter.
Soil Aggregation– Wet Aggregate Stability	Soil aggregation measures the soil's ability to resist breaking apart in water, which affects water infiltration, erosion resistance, and microbial habitat.	- Reduce or optimize disturbances to protect soil aggregates - Use cover crops to protect and enhance soil structure. - Apply organic amendments like compost and plant biomass.
Microbial Activity– Soil Respiration	Microbial activity in the soil is critical for decomposing organic residues and improving soil health. It's a measure of how active the microbes are in the soil	- Cover cropping and perennialization to provide continuous roots. - Use of fresh organic amendments (manure, compost). - Reduce or optimize disturbances to support microbial growth. - Utilize grazing management or forest stand improvement to increase microbial activity
Carbon Food Source for Microorganisms– Labile Carbon	Labile carbon food that is easily taken up by microbes. It includes substances like root exudates and easily mineralized carbon compounds.	- Implement cover crops and reduced disturbance - Reduce the use of fallow crop land, quickly revegetate forest cutovers with desirable species, and critically assess the need for plantings or prescribed burning of native landscapes - Diversify plant community through plantings, grazing management, crop rotation, and use organic amendments (manure and compost).
Food Source for Organisms– Bioavailable Nitrogen	Available organic nitrogen is crucial for soil microorganisms and plant nutrition, significantly influencing soil function. It is related to protein that is readily available to microbes	- Increase SOM with grazing management, reduced or optimized disturbances, and production systems that promote diverse plant communities. - Add legume species to enhance nitrogen availability.
Microbial Diversity/ Functional Diversity	Diverse microbial communities provide numerous benefits to soil health and agricultural sustainability. Enzyme activity reflects microbial activity and nutrient cycling in the soil.	- Follow soil health principles for: biodiversity, root growth, soil cover, and disturbance. - Manage soil fertility and pH properly. - Use cover crops and perennial systems for continuous root support. - Reduce or optimize disturbances to support microbial growth. - Utilize grazing management or forest stand improvement to increase microbial activity- Apply fresh organic amendments to boost enzyme production.

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