Soil Health Report

North Coast Soil Health Hub

Soil Health of Vineyards in the North Coast

Soil health describes the capacity of a soil to provide a profoundly invaluable set of functions upon which the world's societies depend. To better understand the impacts of land management choices, it is important to take measurements that indicate how well various components of the soil system are performing given the climate, soil type, and production system. With that in mind, the North Coast Soil Health Hub coordinated and collected soil samples from hundreds of working vineyards from across northern California to understand the impacts of land management decisions. Results were used to establish data-based insights regarding vineyard soil health considering the effects of the climate, soil type, and specific viticultural practices. This report uses data submitted by grape growers within the North Coast region to establish the relative health of vineyard soils and to develop appropriate recommendations for action.

About this Report

This report contains: 1.) Your overall soil health score which is calculated as the average of three primary indicators; 2.) The score and individual interpretation of the three primary indicators; 3.) A measured value for some additional soil tests that can be useful to further characterize agronomically relevant carbon and nitrogen cycling processes; 4.) General recommendations of management practices tailored to California vineyard soils which can be adopted to address specific components of your vineyards soil health; and 5.) Information regarding how climate and inherent soil characteristics affect how your results are calculated and how each site might respond to management

About the Primary Indicators

Soil Organic Carbon (SOC) is the main source of energy for soil microorganisms. Soil microorganisms are responsible for cycling nutrients and helping to build soil structural stability which means they influence several major functions we need from soil. Because SOC is essential for microbes, and microbes are essential for soil function, SOC is normally positively correlated with each soil function we measure. Just like us, many soil organisms including plant roots, respire carbon dioxide (CO_2) as their metabolic by-product. Often referred to as a "soil respiration" test, we have chosen to be consistent with work from the Soil Health Institute and describe this as potential C mineralization (Cmin). It measures the amount of CO_2 released over 24 hours, after dried soil has been rewetted. This measurement is highly correlated to the size and activity of the microbial community which is indicative of the rate that nutrients can be recycled and made plant available. Soil aggregates are groups of soil particles that bind to each other more strongly than to adjacent particles. The water stable aggregate (WSA) test measures the percent of aggregates that stay together after a simulated heavy rain. The percent stability indicates the ability to resist disintegration when disruptive forces are applied which relates to the ability to resist erosion and maintain a pore structure that allows for water and gas exchange in the soil. Together these three measurements represent the food/energy potentially available to soil organisms (SOC), a biological indicator of the rate of microbial activity (Cmin), and a physical infrastructure attribute that can be enhanced by a healthy soil community (WSA).

Interpreting your Scores

Each score ranges from 0 to 100 with a score of 50 meaning your soil is right at the average value for that indicator, for vineyard soils, in your climate region. A score of 80 means that only 20% of soils tested have a higher value than your soil and is considered very good. This report is best used as a tool for comparison among similar soils. We recommend that you assess the results of two different management zones within your farm or the change in scores of the same field over time, as you adjust management practices. When viewing scores from different fields, consider that moisture and texture do influence how likely your soil is to hold on to and cycle carbon and form stable aggregates.

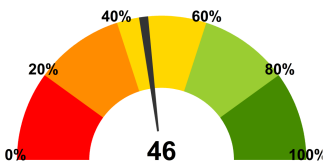
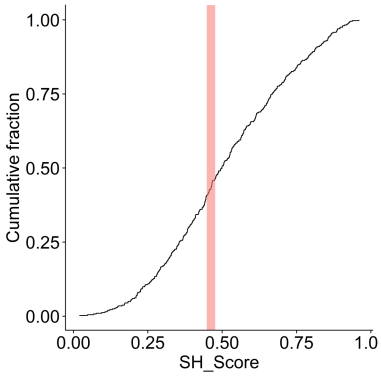
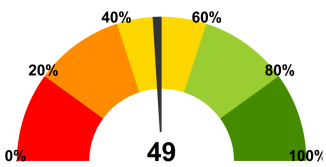
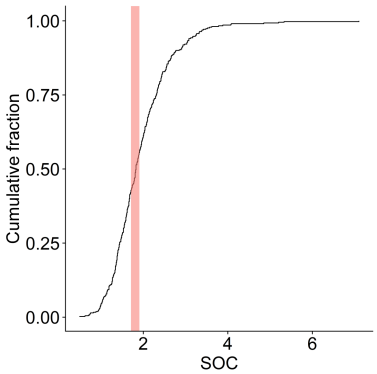
sample_names	Year	Block	Location	Moisture Regime	Tillage	Texture	Cover %	SH Score	WSA Score	SOC Score	C Min. Score
SRCD_201103_01	20	Block 16	Alley	Xeric	No till	Loam	95	46	49	9	80
SRCD_201103_02	20	Block 3	Alley	Xeric	No till	Loam	95	38	23	25	65
SRCD_201103_04	20	Block 4	Alley	Xeric	No till	Loam	95	45	19	49	69
SRCD_201103_05	20	Block 8	Alley	Xeric	No till	Loam	95	58	58	27	88
SRCD_201103_03	20	Block 3	Undervine	Xeric	No till	Loam	90	38	37	4	74
SRCD_201103_06	20	Block 8	Undervine	Xeric	No till	Loam	10	43	16	46	65

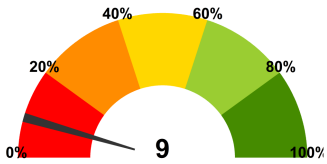
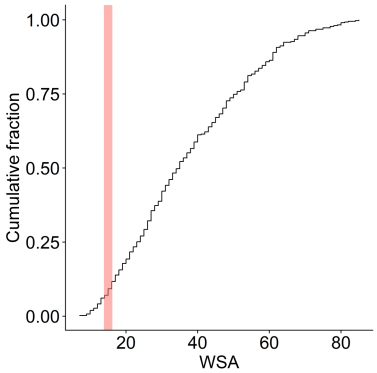
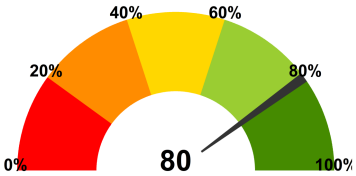
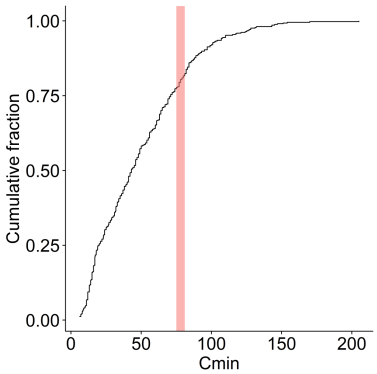
* Reported texture from which the sample was obtained. For information on how texture and climate interact with the soil health, please see the section on the Effect of Set and Setting.

The following pages report your soil health score, the values and scores of the primary soil health indicators, and the values of several secondary soil health indicators. The figures which accompany the primary indicators include a graphical representation of each indicator's score represented as a gauge, along with the measured value of the indicator plotted in relation to the other samples from the same moisture regime.. The interpretation of each indicator's score can be found in the right-hand side of each sub-report. The secondary indicators are presented using histograms which display the distribution of the data including a red line indicating your soils value. Additional information about soil health in the context of vineyards and the soil health indicators can be found on the pages that follow each sub-report.

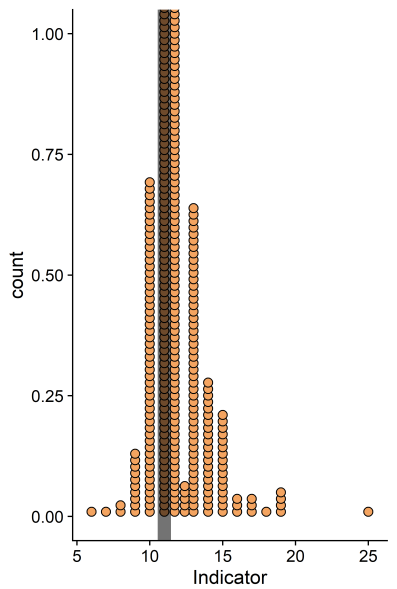
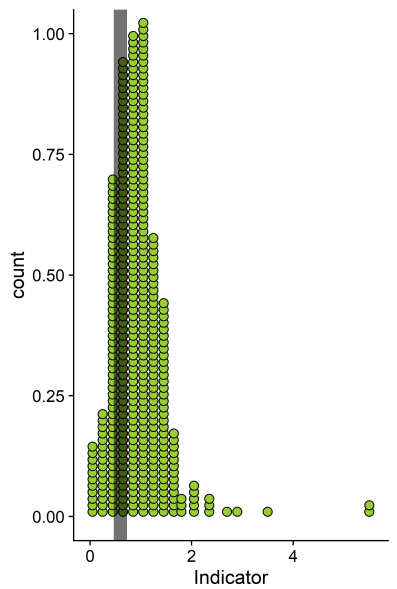
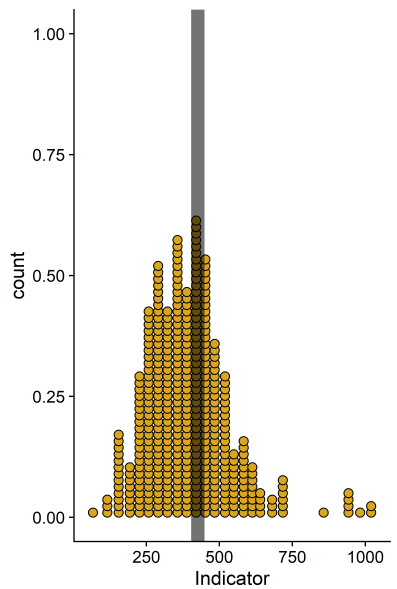
Soil health evaluations of submitted samples:

Site: SRCD_201103_01 , Year: 20 , Block 16 , Moisture Regime: Xeric , Texture: Loam , Tillage: No till

Score	Distribution	Indicator	Value	Units	Interpretation
Primary Soil Health Indicators					
		SH Score	46.2		You have plenty of room to improve. Increasing the total area and time with living plants along with reducing disturbance can help you get to the next level up.
		SOC value	1.8	%	Decrease soil disturbance activities that breakdown or remove plant organic matter, or disrupt the soil surface. Keep the soil covered to avoid soil bare for extended periods of time. Increase organic matter with living plants and organic matter additions

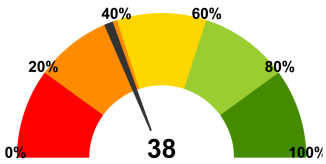
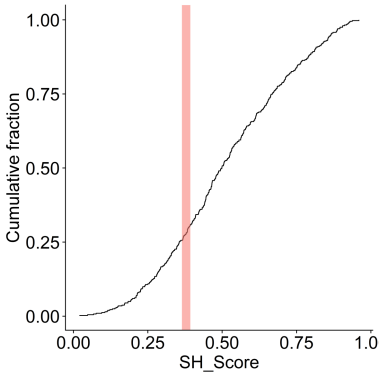
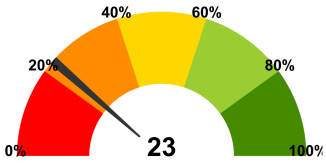
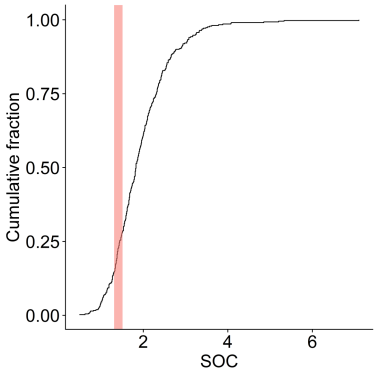
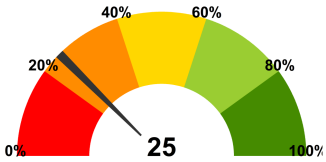
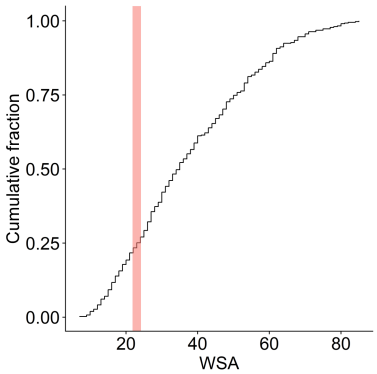
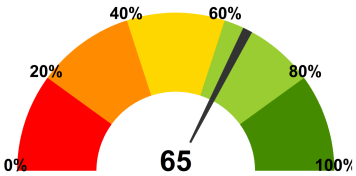
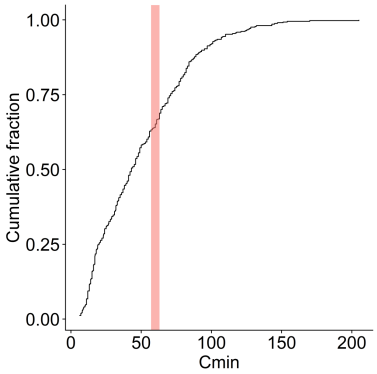
Score	Distribution	Indicator	Value	Units	Interpretation
		WSA value	15.0	%	With this health level, your microbes may be doing enough work that you could also consider backing off your chemical applications which may further increase microbial activity.
		Cmin	78.0	PPM C/day	Consider making changes that will increase organic matter. This can be through direct OM additions or by increasing the amount and time plants are growing in the alleys.

Secondary Indicators

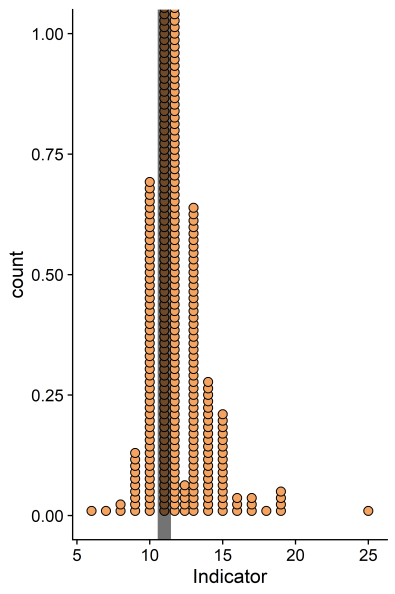
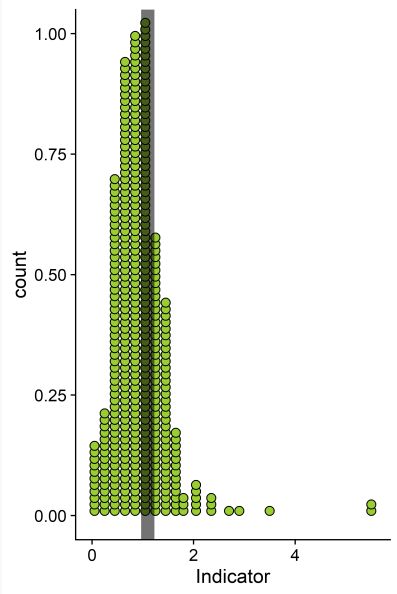
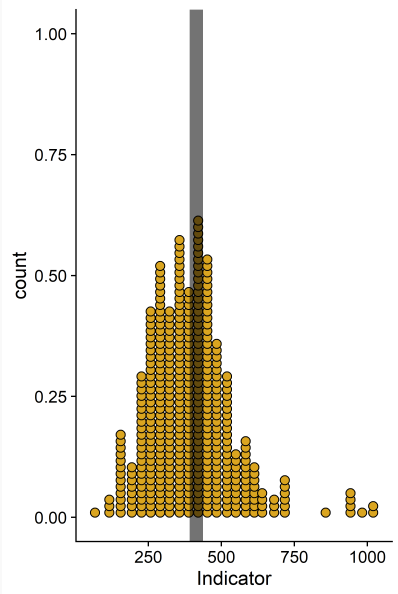
	C:N	POXc	PMN
Distribution			
Value	11	426	0.6
Units	Unitless	PPM	PPM N/day

Site: SRCD_201103_02 , Year: 20 , Block 3 , Moisture Regime: Xeric , Texture: Loam , Tillage: No till

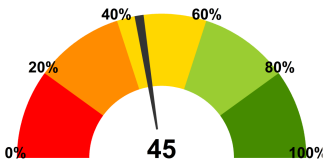
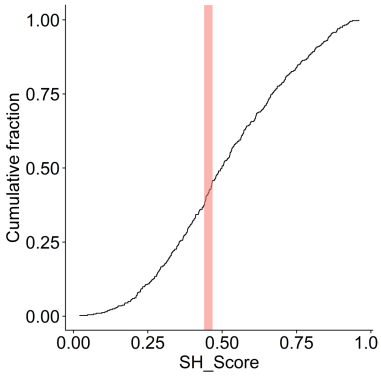
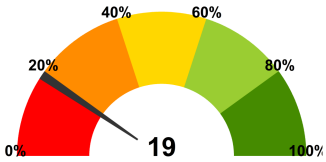
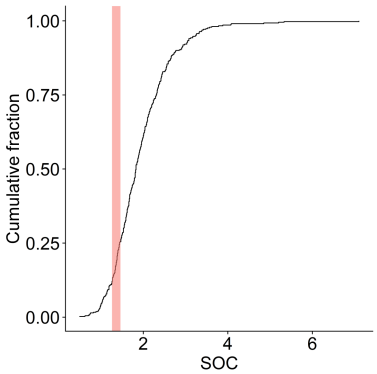
Score	Distribution	Indicator	Value	Units	Interpretation
Primary Soil Health Indicators					

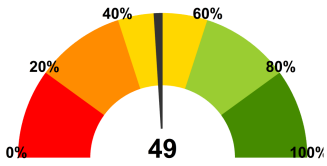
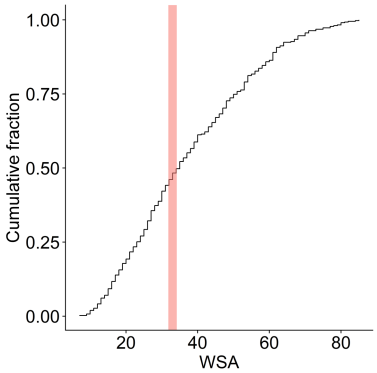
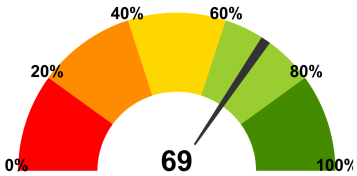
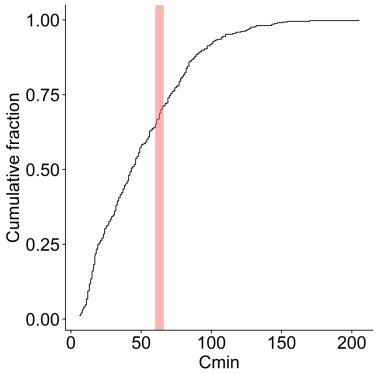
Score	Distribution	Indicator	Value	Units	Interpretation
		SH Score	37.9		Increase living plants as much as possible and consider directly adding mulch, compost, or manure.
		SOC value	1.4	%	Decrease soil disturbance activities that breakdown or remove plant organic matter, or disrupt the soil surface. Keep the soil covered to avoid soil bare for extended periods of time. Increase organic matter with living plants and organic matter additions
		WSA value	23.0	%	To increase activity above the average level you may consider diversifying your cover crops to increase the types of exudates feeding the microbes. You can also adopt any other soil health priciples you have not added to your system yet.
		Cmin	60.0	PPM C/day	Consider making changes that will increase organic matter. This can be through direct OM additions or by increasing the amount and time plants are growing in the alleys.

Secondary Indicators

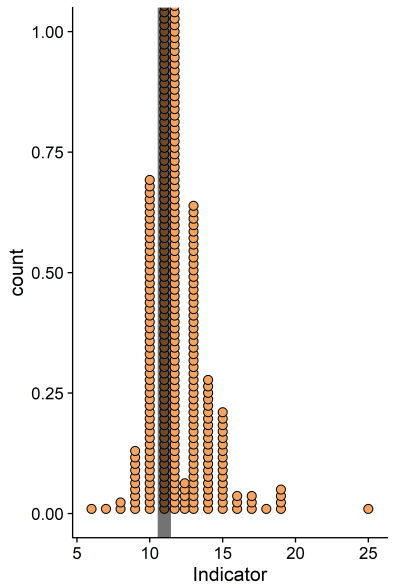
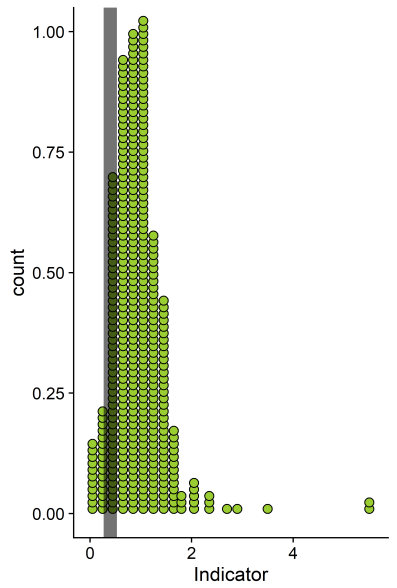
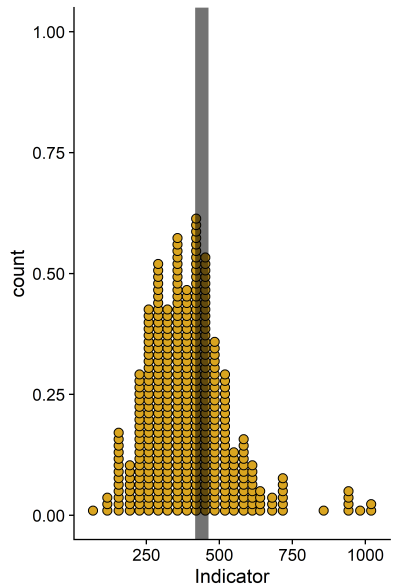
	C:N	POXc	PMN
Distribution			
Value	11	414	1.1
Units	Unitless	PPM	PPM N/day

Site: SRCD_201103_04 , Year: 20 , Block 4 , Moisture Regime: Xeric , Texture: Loam , Tillage: No till

Score	Distribution	Indicator	Value	Units	Interpretation
Primary Soil Health Indicators					
		SH Score	45.3		Increase living plants as much as possible and consider directly adding mulch, compost, or manure.
		SOC value	1.4	%	Decrease soil disturbance to allow the aggregates that are there to get stronger. Living roots and mycorrhizae that associate with grasses are a great way to increase aggregation.

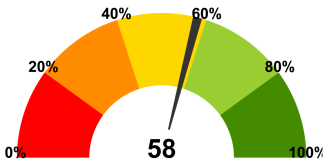
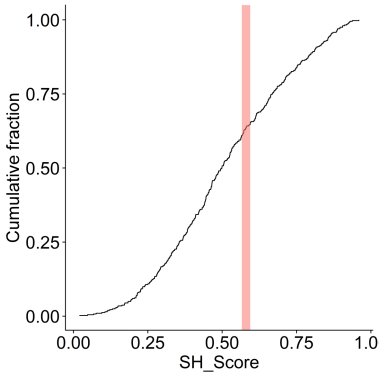
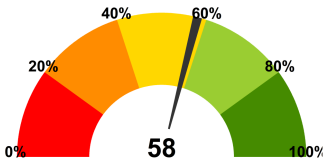
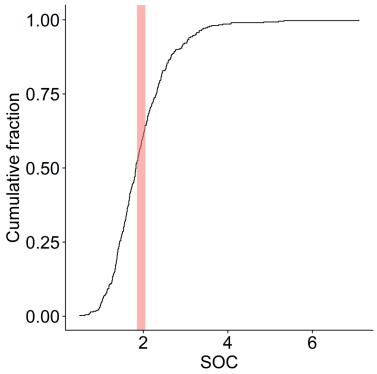
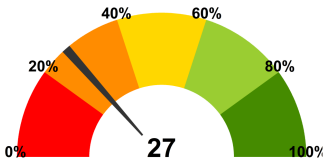
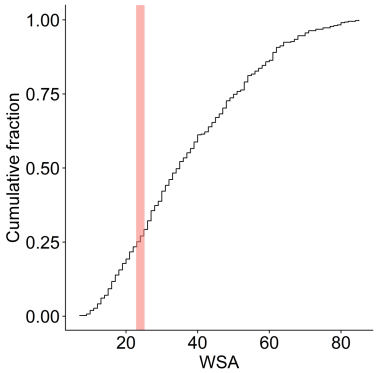
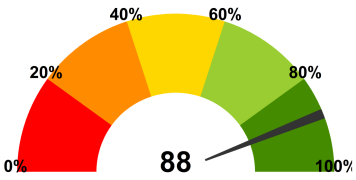
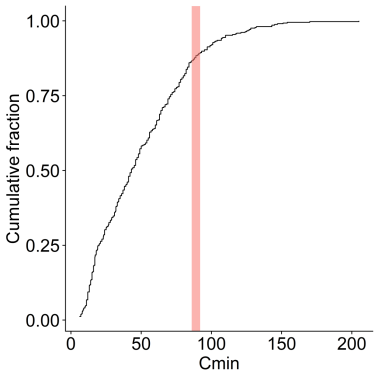
Score	Distribution	Indicator	Value	Units	Interpretation
		WSA value	33.0	%	To increase activity above the average level you may consider diversifying your cover crops to increase the types of exudates feeding the microbes. You can also adopt any other soil health priciples you have not added to your system yet.
		Cmin	63.0	PPM C/day	Consider making changes that will increase organic matter. This can be through direct OM additions or by increasing the amount and time plants are growing in the alleys.

Secondary Indicators

	C:N	POXc	PMN
Distribution			
Value	11	440	0.4
Units	Unitless	PPM	PPM N/day

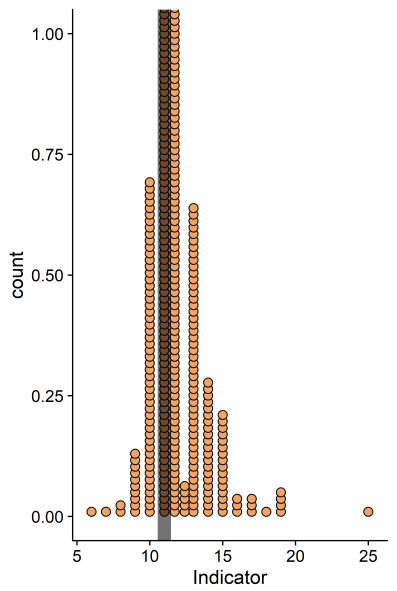
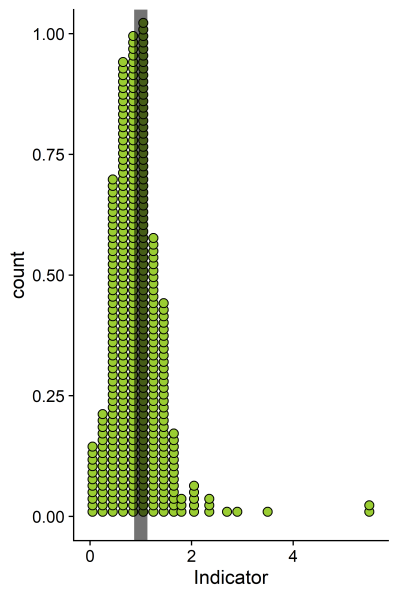
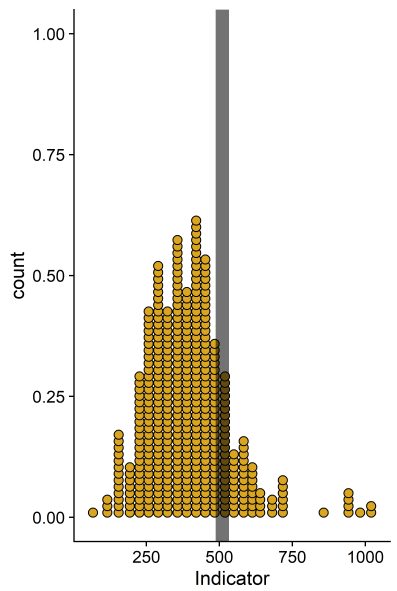
Site: SRCD_201103_05 , Year: 20 , Block 8 , Moisture Regime: Xeric , Texture: Loam , Tillage: No till

Score	Distribution	Indicator	Value	Units	Interpretation
Primary Soil Health Indicators					

Score	Distribution	Indicator	Value	Units	Interpretation
		SH Score	58		To increase above normal you will need to add more plants, organic matter, and further decrease disturbance.
		SOC value	2	%	Decrease soil disturbance activities that breakdown or remove plant organic matter, or disrupt the soil surface. Keep the soil covered to avoid soil bare for extended periods of time. Increase organic matter with living plants and organic matter additions
		WSA value	24	%	With this health level, your microbes may be doing enough work that you could also consider backing off your chemical applications which may further increase microbial activity.
		Cmin	89	PPM C/day	Consider adding another step in your soil health management program, perhaps cover crops, organic matter, and reduced tillage. Utilizing all of the principles together tend to have an additive effect.

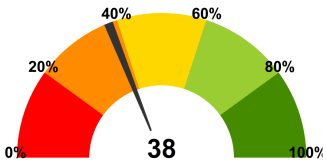
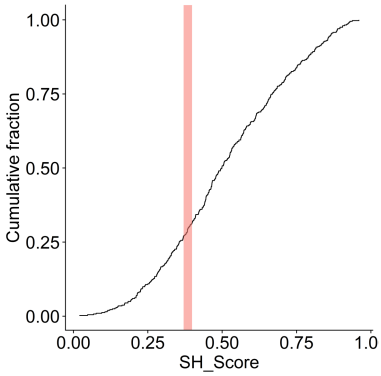
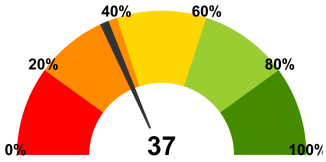
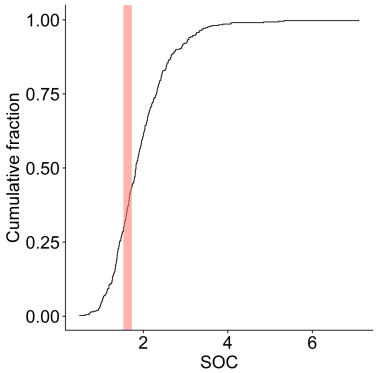
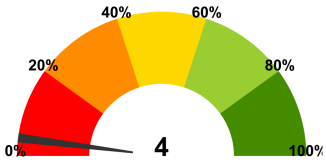
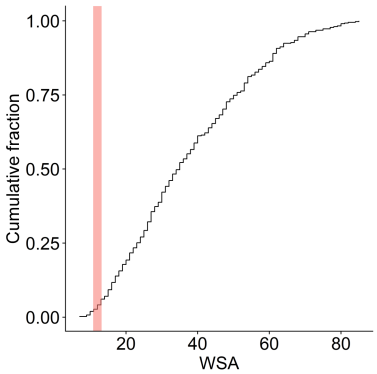
Score	Distribution	Indicator	Value	Units	Interpretation

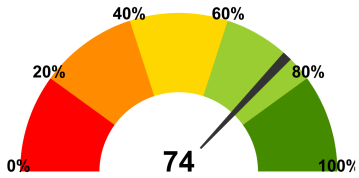
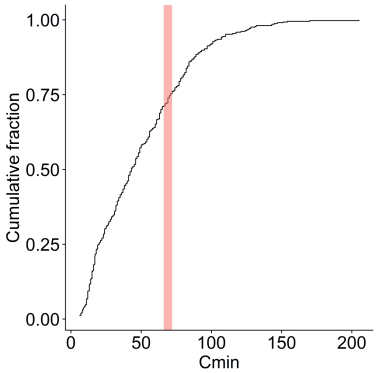
Secondary Indicators

	C:N	POXc	PMN
Distribution			
Value	11	510	1
Units	Unitless	PPM	PPM N/day

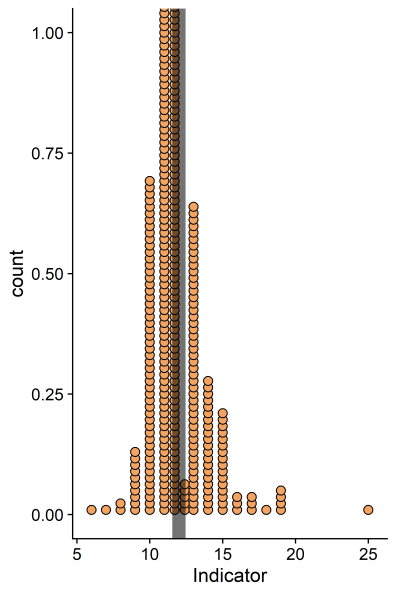
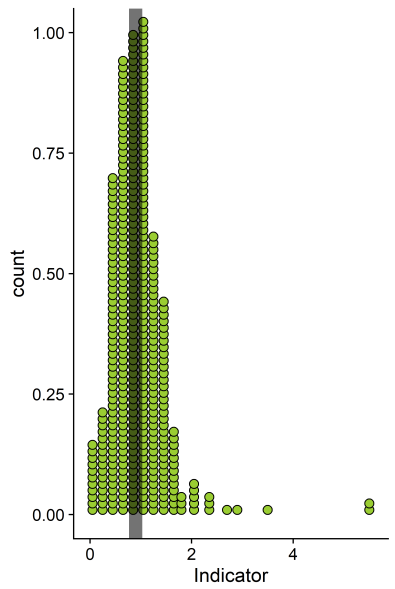
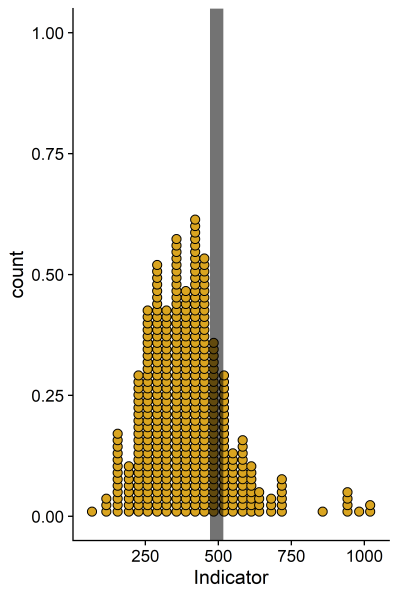
Site: SRCD_201103_03 , Year: 20 , Block 3 , Moisture Regime: Xeric , Texture: Loam , Tillage: No till

Score	Distribution	Indicator	Value	Units	Interpretation
Primary Soil Health Indicators					

Score	Distribution	Indicator	Value	Units	Interpretation
		SH Score	38.4		You have plenty of room to improve. Increasing the total area and time with living plants along with reducing disturbance can help you get to the next level up.
		SOC value	1.6	%	Decrease soil disturbance activities that breakdown or remove plant organic matter, or disrupt the soil surface. Keep the soil covered to avoid soil bare for extended periods of time. Increase organic matter with living plants and organic matter additions
		WSA value	12.0	%	With this health level, your microbes may be doing enough work that you could also consider backing off your chemical applications which may further increase microbial activity.

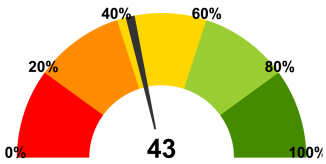
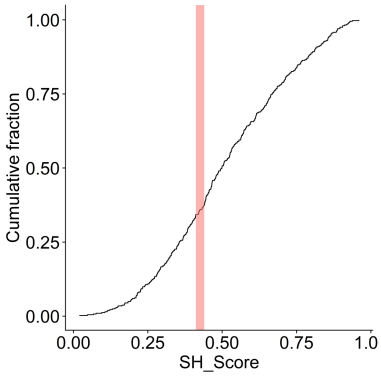
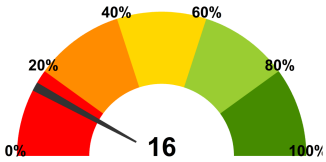
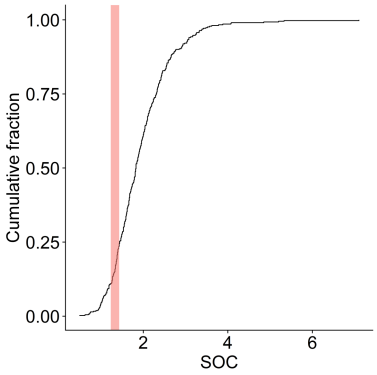
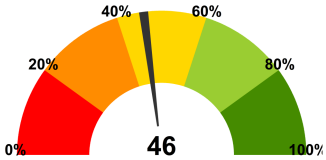
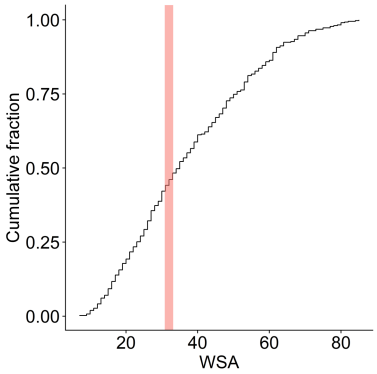
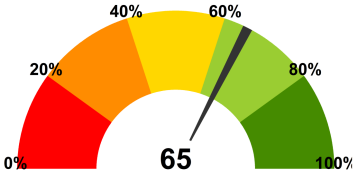
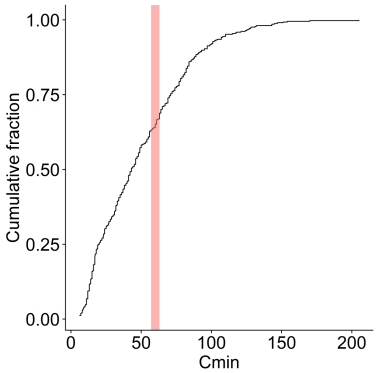
Score	Distribution	Indicator	Value	Units	Interpretation
		Cmin	69.0	PPM C/day	Consider making changes that will increase organic matter. This can be through direct OM additions or by increasing the amount and time plants are growing in the alleys.

Secondary Indicators

	C:N	POXc	PMN
Distribution			
Value	12	494	0.9
Units	Unitless	PPM	PPM N/day

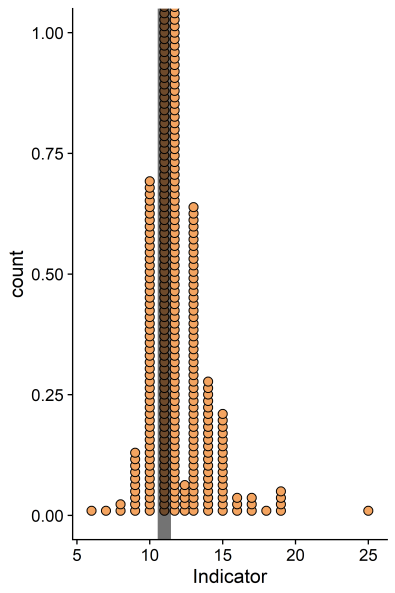
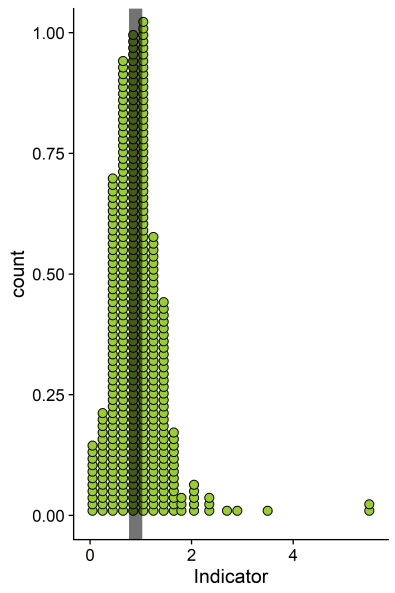
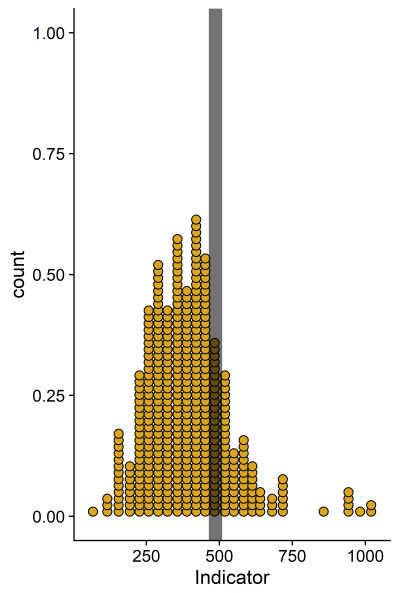
Site: SRCD_201103_06 , Year: 20 , Block 8 , Moisture Regime: Xeric , Texture: Loam , Tillage: No till

Score	Distribution	Indicator	Value	Units	Interpretation
Primary Soil Health Indicators					

Score	Distribution	Indicator	Value	Units	Interpretation
		SH Score	42.6		Increase living plants as much as possible and consider directly adding mulch, compost, or manure.
		SOC value	1.3	%	Decrease soil disturbance to allow the aggregates that are there to get stronger. Living roots and mycorrhizae that associate with grasses are a great way to increase aggregation.
		WSA value	32.0	%	To increase activity above the average level you may consider diversifying your cover crops to increase the types of exudates feeding the microbes. You can also adopt any other soil health priciples you have not added to your system yet.
		Cmin	60.0	PPM C/day	Consider making changes that will increase organic matter. This can be through direct OM additions or by increasing the amount and time plants are growing in the alleys.

Secondary Indicators

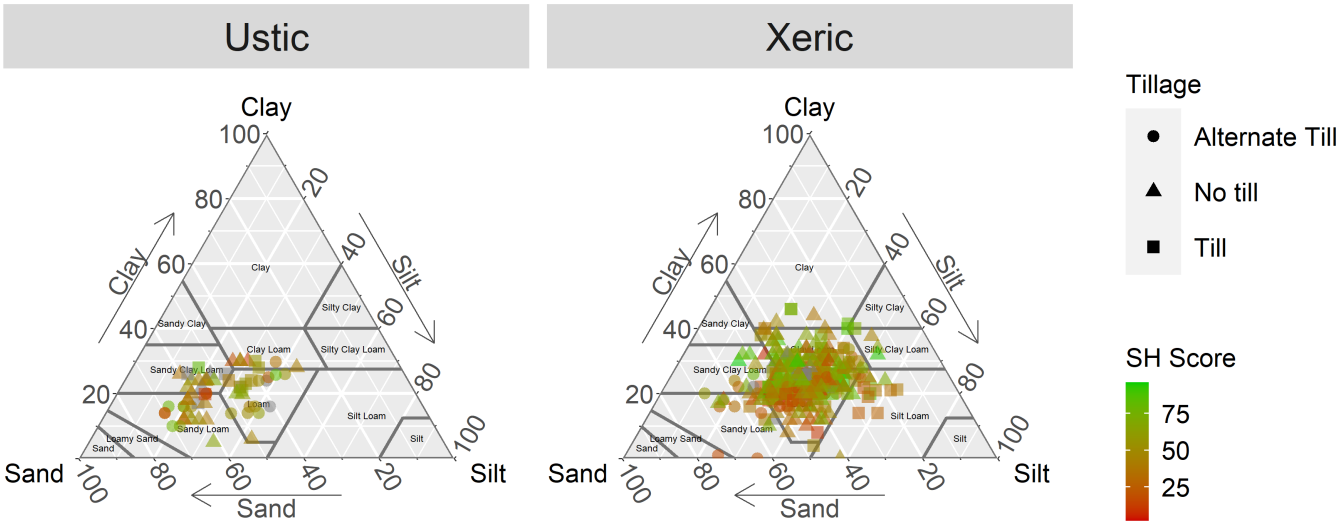
C:N	POXc	PMN

	C:N	POXc	PMN
Distribution			
Value	11	487	0.9
Units	Unitless	PPM	PPM N/day

The effects of set and setting:

Soil Texture:

Soil texture refers to the proportion of sand, silt, and clay sized particles in a soil sample. Soil texture is a strong determinant of a soil's physical, chemical, and biological characteristics and therefore affects a wide range of soil properties such as air, water, and nutrient storage and movement. Consequently, differences in soil texture significantly contribute to whether a soil response to a specific management practice. The 21 formally recognized texture classes were grouped into three categories: coarse, medium, and fine, with separate scoring curves for each category. Statistical analysis indicated no significant difference between soil texture groups and three primary measures of soil health: soil carbon content (SOC), Carbon mineralization (Cmin), nor measures of water stable aggregation (WSA). Additionally, no strong evidence emerged to suggest that textural differences alter management effects on soil health following changing practices such as tillage and cover cropping. It is likely that once sufficient data and time have accumulated, improved data-backed recommendations will be available. For these reasons, we did not establish separate scoring curves based on textural classes, however, we highly recommend that you consider soil texture when comparing results among fields and to discuss this inherent soil characteristic of your fields with your conservation specialist.

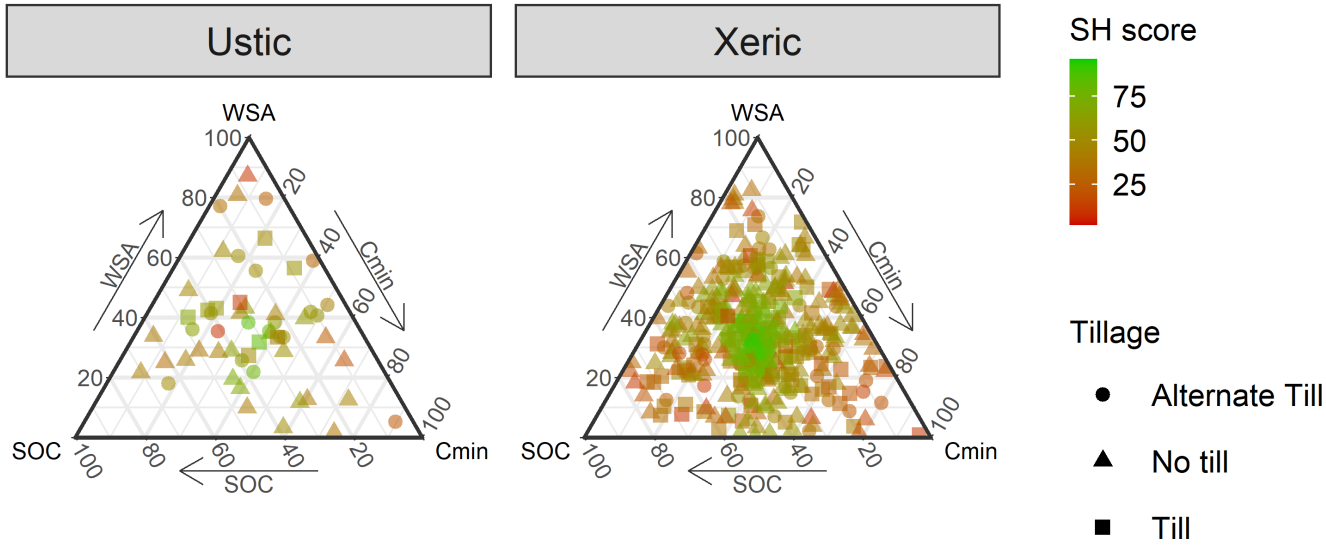


Texture Group	USDA Particle Size Classes
Coarse	sand, sandy loam, loamy sand, fine sandy loam, loamy fine sand, fine sand, coarse sand, fine sand, very fine sand, loamy coarse sand, loamy very fine sand, coarse sandy loam, very fine sandy loam
Medium	loam, silt loam, sandy clay loam, clay loam, silty clay loam, sandy clay
Fine	silty clay, clay, silt

Soil Moisture Regime:

Soil moisture regimes are defined based on the water table level and the presence or absence of available water (water that can be used by plants). Soil moisture regimes are used as a soil classification criterion because they affect soil formation, optimal use and management of soils, and can be used to group soils with similar properties. The soil moisture regime classes represented in this study area are Xeric and Ustic. A Xeric soil moisture regime is one with a majority of the annual precipitation arriving during winter instead of during the typical agricultural growing season. An Ustic soil moisture regime is one which is characterized by precipitation falling during the growing season, though the absolute volume of water is insufficient to meet evapo-transpirative demands for common crops for long periods throughout the growing season (45-65 days). In this dataset the soils in the Ustic moisture regime tend to be closer to the coast, slope aspects (S, SW, W) where increased sunlight causes the soils to be warmer and drier, or the soils may be shallow, with bedrock not far below the surface.

As we analyzed how the inherent features of the soil and climate influence soil health, the moisture regime was the grouping factor that resulted in significant variation in soil health potential. The data presented here uses two scoring curves for each indicator, one for soils within the xeric moisture regime and one for ustic. Your score is specific to the moisture regime mapped for your soil.



Terroir and soil health

Terroir, or the 'imprint of place', is a unique profile of sensory characteristics used to describe wine grapes grown in a particular area. Soils exert a profound influence on plant growth and changes in soil properties and processes are one of the primary, non-human, factors which contribute to a given wine's terroir. As if to compliment terroir, one of the guiding principles when managing for soil health is about working with the inherent characteristics of a soil to optimize soil functionality and resilience. While much remains on the scientific frontier, it is possible that managing for soil health may be accompanied by favorable changes in the expression of terroir.

Overall Soil Health Score

Soil health, like the health of the economy or your own health, is complex and cannot be directly measured using just one indicator or test. Rather we rely on several robust metrics which together paint a picture of the potential for your soil to perform a broad range of agronomically and environmentally important functions. To draw an analogy from the economic evaluation of a nation, the amount of soil organic carbon (SOC) is akin to material wealth, water stable aggregation (WSA) is akin to infrastructure, and the 24 mineralized carbon (Cmin) is akin to Gross domestic product, that is, how the wealth and infrastructure contribute to general productivity. In this way, these three indicators can be used to efficiently capture broad trends in your soil's capacity to function in response to management.

What it measures:

This cumulative soil health score is the calculated average of three primary indicators: soil organic carbon (SOC), water stable aggregates (WSA), and potential C mineralization rate (Cmin) in order to easily gauge the total change in all-around soil health.

Why it's important:

Managing for soil health has demonstrated numerous environmental, economic, agronomic, and social benefits which may begin on the farm but extend well beyond the footprint of the fields. While viticulture has a long tradition of considering the effect of soil characteristics on grape growth and quality, the relationship between managing for soil health and viticultural outcomes is unclear due to the relatively recent adoption of this concept.. Because there are many dimensions to soil health, we calculated the average value of the primary indicators to provide a Soil Health score as a useful tool for gauging your progress along the way and to compare the different effects associated with specific management practices or variations in soil conditions.

Means of improvement:

Research through this project and numerous others from around the world has shown that increasing the amount of area and the time that plants are actively growing is the most effective overall way to improve soil's functional capacity and resilience. The fundamental principles for improving soil health are: reducing disturbance, increasing species diversity, and keeping your soil covered, with living plants whenever possible. The right approach to implementing these principles is flexible and highly dependent on your operation and the soils you manage.

Soil Function	Goal	Producer Benefits	Societal Benefits
Store Carbon	Increase soil organic carbon	Carbon credits, reduced inputs	Climate change mitigation,reduced eutrophication
Cycle Carbon	Decompose organic matter	Reduced fertilizer costs	Reduced non-point source pollution
Cycle Nitrogen	Make plant available nitrogen	Reduced fertilizer costs	Reduce eutrophication, reduced GHG emissions
Water storage	Increase favorable hydraulic properties	Less irrigation costs, drought resistance/resilience	Reduced use of surface and groundwater for irrigation
Resist Erosion	Decrease loss of soil and nutrients	Reduced fertilizer costs, maintenance of natural capitol	Reduced eutrophication, reduced dust emissions

Digging deeper: Understanding the Soil Health Indicators

Soil Organic Carbon

Soil organic carbon is the basis of a healthy soil capable of sustaining healthy plants, waterways, and ultimately a healthy ecosystem. In fact, roughly 50% of the organic matter in your soil is pure carbon. For fun, we took the average value of all vineyard soil samples in this dataset, and found that within just the top 6 inches of the average soil, there is more than 17,000lbs of carbon per acre, the equivalent weight of 390 bushels of grapes!

What it measures:

Soil organic carbon (SOC) measures the percentage of soil that is carbon on a mass basis (% by weight, mg/kg)). Soil samples were prepared and heated to more than 1000 deg.C in order to measure the amount of organic carbon that was combusted.

Why it's important:

Soil organic matter (SOM) has a multitude of beneficial impacts on soil physical, chemical, and biological properties. SOC is used as a

proxy measurement for total SOM which also includes a host of other nutrients. SOM is the main food source of many if not most soil organisms, ranging from worms and arthropods to bacteria and fungi. Thus, SOM largely forms the basis of the soil ecosystem which makes it a vital key to what is agronomically useful work such as microbially-mediated nutrient cycling, aggregate formation and stabilization, and even protecting crops from many soil-borne pathogens. Because of this centrality to many soil functions, managing for soil health places emphasis on increasing SOC as one of the primary steps to a healthy soil, healthy plants, healthy waterways, and a healthy ecosystem.

Means of improvement:

As with wealth, the amount of organic carbon contained in the soil is a balance between income (additions) and expenses (removals). Plants send ~50% of the carbon they get from photosynthesis through their roots into the soil, thus providing a reliable source of carbon additions (income) to the soil. As a result, implementing management strategies which increasing the area and the time occupied by living plants is one of the best ways to increase SOC. In addition to increasing plant cover, directly adding mulch, compost, and manures (animal and green) are all excellent strategies which can increase SOC while also supporting microbial growth and functioning. Soil organic carbon can also be increased, albeit more slowly, by reducing the rates of carbon loss (expenses) from your soil. The primary strategies for reducing carbon loss while also supporting a healthy microbial population include reduced tillage, reduce erosion (which erodes organic-rich topsoil), and proper nutrient management.

Functional benefits of a high score:

SOC is the primary constituent that is related to all soil functions. Increasing SOC has been related to increased water holding capacity, nutrient cycling, water infiltration, above and below ground biodiversity, and decreased erosion.

Water Stable aggregates

Soil aggregates are unique structures that form when soil particles cluster together, forming a sort of miniature sponge. While texture and mineralogy have an influence on the propensity of a soil to form aggregates, all soils, including sandy soils develop secondary soil structure. Desirable soil structure is often recognizable as being “crumb-like” whereas poor soil structure is loose and powder-like. Aside from the abundance of soil aggregates, soil structures are also assessed for their ability to withstand physical forces such as raindrop impact. The higher the percentage of stable aggregates, the higher your soil health is likely to be.

What it measures:

This test measures the percentage of a soil sample that remains stuck together in aggregates (0.25-2mm) after being subjected to the laboratory equivalent of a hard rain.

Why it’s important:

Aggregates serve as building blocks for soil structure and are a key indicator of erosion resistance. Having a well-structured soil supports a wide range of beneficial characteristics which arise due to changes in the pore space including higher water infiltration rates, optimal balance of water storage and drainage, and better root system development. Pore spaces are the habitat of soil organisms, and size variation also allows for greater diversity of organisms who can perform more jobs, including gluing more soil minerals together into more complex aggregate structures. The higher the percentage of stable aggregation, the better the infrastructure for processes to be carried out.

Means of improvement:

Consider a hurricane coming through your town once a year, or even six times a year, consider the impact this could have on your life. Losing a few shingles may not affect much, but what about nearly complete destruction? The analogy of a hurricane is an apt analogy to the effect which tillage appears to have on soil functioning in the long run. The more intense and frequent the tillage, the more thorough the destruction of soil structure and the more profound the alteration in soil function can be. The first step toward stabilizing soil aggregates is to reduce the volume and frequency of soil disturbance. Additionally, increasing SOM, through the addition of organic amendments or through cover cropping will help to bind small aggregates into larger aggregates, and if you don’t disrupt them with tillage or other erosive forces, the overall aggregate stability and the abundance of beneficial soil structures will improve with time.

Functional benefits of a high score:

High WSA has been related to decreased erosion, increased water infiltration, increased gas exchange, and diversity of soil habitats that can accommodate higher below ground diversity, capture more of the water that falls, and keep your topsoil in place, improving your natural capital.

CMin (Carbon Mineralization at 24 hr)

The core of soil health research is aimed at understanding more about the immense work that soil organisms contribute to soil development and nutrient cycling processes which affect nearly every aspect of agronomic productivity. This measurement is focused on assessing how much work the microbes are doing.

What it measures:

This incubation-based test measures the amount of carbon dioxide (CO_2) released from soil in the first 24 hours after an air-dried sample is re-wet. #### Why it’s important Many soil microbes exhale CO_2 just as we do. As a result, the size or functional activity of your microbial population can be estimated by measuring the elevated burst of activity (CO_2) when water is added to a soil sample after a period of

drought. The bigger or healthier the population of microbes, the more work they do, the more CO_2 is respired. The great value of this measurement is that it provides a very general but robust correlated to both microbial biomass and the rate that they cycle nutrients. It can be used along with SOC and texture to estimate N mineralization and is often highly correlated to specific microbial processes.

Means of improvement:

Microbes are the essential workers supporting healthy soil functioning. When soil microbes are provided sufficient resources for growth and thriving (food, nutrients) and a proper infrastructure (soil structure, aggregate stability), they support an equally abundant and stable population above ground. So feed your microbial herd a diverse diet by maintaining living plants as much as possible. Plant roots provide C foods for microbes to use, and diversity in root types appears to provide a more balanced diet. Other forms of organic matter inputs, especially those with a low C:N, also increase the rate of activity and the potential for the community to increase. Finally, protect the structural habitat by reducing or eliminating tillage and planning traffic wisely to prevent compaction.

Functional benefits of a high score:

A large portion of the microbially mediated work in the soil is related to decomposing organic matter which cycles nutrients from dead tissues into forms that plants can use again. High Cmin scores have been related to increased nitrogen availability, disease and pest suppression, and stronger aggregates.

Secondary Indicators

C:N ratio

Organisms and the products they make have a specific ratio between carbon and nitrogen. For example bacteria on average have a C:N of 6:1, whereas enzymes are around 3:1 and fungi are around 12:1. This ratio then tells you about the relative portion of C and N a microbe will need to build new biomass or produce an enzyme.

What it measures:

The ratio of soil organic carbon to total nitrogen in the soil. As a ratio, it does not provide information on the absolute amount of either carbon or nitrogen, instead it provides a general understanding of the nutrient cycling and availability to be expected.

Why it’s important:

The C:N ratio of un-managed soils is generally ranges between 10:1 to 12:1. Soil organisms need both C and N, and when there is a lot more carbon than nitrogen, they will often mineralize more carbon in a search for N and keep all of the nitrogen they can to themselves. This “nitrogen hoarding” can result in both a decreased N availability and an increase in C loss. On the other hand, in some situations, this can be used to reduce nitrogen availability and therefore slow vegetative growth effectively in the vineyard. If a soil has a high C:N and high respiration, we tend to see lower N mineralization rates that would otherwise be predicted.

Means of improvement:

Assess the C:N ratio of your organic matter inputs. Many mulches and nearly all wood chips have a very high amount of carbon relative to their nitrogen which will have an effect on the soil C:N as well. Aim for amendments that have a C:N ratio near 25:1 or 30:1 to maintain high activity and nutrient availability. For questions about sources of readily available composts which meet your needs, contact your RCD.

Why it is not scored:

A balanced C:N, near the average means it is not a likely cause of limitations on nutrient cycling or soil community diversity. However, this indicator is not directly linked to a single functional outcome and should primarily be used to help interpret other results. A soil with balanced C:N can still have low soil health because the total SOC can be low.

Permanganate Oxidizable Carbon (POXc):

POXc is alternatively referred to as ‘Active Carbon’ because it was thought to be indicative of the most readily available microbial food. However, research on what carbon compounds are oxidized in this reaction shows us this term is not a good descriptor of the carbon pool measured and is challenging soil scientists to re-evaluate our interpretation and the significance of this indicator. This remains an active area of research.

What it measures:

This test measures the portion of soil organic carbon that is oxidized using a chemical reaction that is thought to be a suitable equivalent to the mechanism of organic matter decomposition frequently used by microbes.

Why it’s important:

Many field trials have shown that this indicator is the most closely related singular measure to overall soil health score calculated using the Cornell method. Additionally, POXc can be used as an early indicator of changes in your soil organic carbon pool because changes in POXc can be detected within a year of making a change to management, whereas change in SOC may take up to 10 years.

Means of improvement:

Generally, all soil health practices tend to have a positive impact on POXc. It is often considerably earlier to respond than either SOC or aggregate stability but it is highly correlated to both.

Why it is not scored:

This indicator is not used to calculate the cumulative score because it would effectively double the weight given to SOC rather than add new information on soil health. However, we it is still useful to provide on this report because of the numerous soil health studies that have used this test, its use as an early indicator for changes in soil health, and how responsive this indicator is to differences in management practices. At this time, scientific research is still ongoing and the interpretation of changes in this indicators value are underway.

Potentially Mineralizable Nitrogen (PMN):

Nitrogen is considered the most commonly limiting nutrient for agricultural production. Roughly 5% of all soil organic matter is nitrogen. Nitrogen mineralization refers to the process of converting nitrogen contained in soil organic matter into inorganic nitrogen like ammonium. So, for a soil with 2% SOM, there are roughly 2000lbs of N per acre, yet only 1-4% of that N is made plant available in a growing season.

What it measures:

The amount of soil N converted to Nitrate (NO3) over a 28-day incubation at standard lab temperature and optimized moisture content.

Why it's important:

Every living organism needs nitrogen to grow and reproduce. Nitrate is among the most readily available forms of nitrogen available to plants, but it is not the only source to consider. The potential rate nitrogen mineralization (PMN) reported herein can be used alongside other agronomic tests to help make decisions related to fertilizer requirements. A high rate of nitrogen mineralization suggests you can decrease your N fertilizer inputs without sacrificing yield because the soil microbes are releasing enough available N from soil organic matter. In addition to enhancing nitrogen use efficiency, when your microbes are cycling a lot of N, it is likely they are also cycling nutrients such as phosphorus, sulfur and manganese.

Means of improvement:

Adding organic matter, specifically ones with a low C:N ratio, and leguminous cover crops are the most sure-fire ways to increase the rate of nitrogen mineralization in your soil.

Why it is not scored:

It is not part of the core score because it is so strongly related to CO_2 that the Cmin measurement can be used along with SOC and texture to adequately estimate the rate of N mineralization. This test, and the 7-day anaerobic N mineralization test both take too long for most commercial labs to integrate into their operations.

Thank you for participating !

We applaud you for taking a soil health journey and hope that this information inspires and encourages you to adjust practices with an eye toward considering and supporting the living organisms under your feet that provide the natural capital and ecosystem services that we all depend on. The North Coast Soil Health Hub Team will continue to push forward to provide information related to tangible benefits, realistic goals, and effective actions to help you continue to improve your land stewardship strategies.

This report has been brought to you by the North Coast Soil Health Hub in collaboration with:

About the North Coast Soil Health Hub

The North Coast Soil Hub network addresses region-specific needs, successes and challenges in order to support the diversity of producers farming and ranching in the North Coast. We started with the vineyard industry in 2016 and our network now includes other agricultural industries across Humboldt, Lake, Marin, Mendocino, Napa, & Sonoma counties.

Our Goals

1. Directly support producers in making decisions that promote soil health, enhance environmental quality, improve agricultural production, sequester carbon, and sustain and protect agricultural lands, in a way that is rooted in the unique needs and challenges of the Northern California Coastal region.
2. Inspire producers to implement soil health practices by providing opportunities and educational resources for producers and agricultural professionals to share and learn more about soil health and climate-friendly practices.
3. Improve understanding of how soil health practices can be successfully implemented in the region through applied research and innovation.
4. Advance regional carbon farming efforts to support the role of agriculture as a natural solution to climate change.
5. Serve and represent our communities in a way that uplifts and values diverse perspectives, backgrounds, needs, knowledge systems, and visions for the future.

To find out more, visit https://soilhub.org