



Soil Organic Matter

Working Metric Version 1.0 | Adopted July 31, 2013

Soil Organic Matter (SOM) is the organic fraction of soil excluding non-decomposed plant and animal residues.¹ SOM is usually measured by the amount of Total Organic Carbon (TOC) present in the soil. Increasing amounts of SOM, and hence organic carbon, provide significant agronomic and environmental benefits including improved nutrient delivery to plants, water retention, drainage, and resistance to disease and erosion. A soil’s ability to store SOM varies greatly depending on climate, soil texture and soil type. To normalize against this variability, SOM is compared with a site-specific estimate of the soil’s potential to hold SOM.

The **Soil Organic Matter** metric is the measured TOC of the soil divided by that soil’s potential to store organic carbon, as modeled using USDA’s Soil Management Assessment Framework (SMAF).

Metric:

Soil Organic Matter	$\frac{\text{Soil Organic Matter}}{\text{Soil Organic Matter Potential}}$
<p>Notes:</p> <ul style="list-style-type: none"> - <i>Soil organic matter requires lab test. Soil organic matter potential is calculated using the USDA Soil Management Assessment Framework</i> - <i>Multiple samples are combined by first calculating the score for each sample, then averaging scores. However, in this situation, attention should be paid to range as well as average.</i> - <i>Lab results for TOC should be obtained at least every five years, but may be done more frequently.</i> 	

¹ USDA Fact Sheet, “Soil Quality Indicators” http://soils.usda.gov/sqi/assessment/files/toc_sq_biological_indicator_sheet.pdf

Recommended Issues to Consider in Future:

Through working group discussions, academic technical review, and Metric Technical Advisory Committee discussions, the following items have been identified as issues to be considered in future iterations of this metric:

- Establishing a version of the metric that is usable internationally
- Compaction/bulk density, collected and measured in a way to minimize the impacts of variation in levels as a function of the point in the production season
- Soil pH and mineral levels/balances
- Cation exchange capacity
- Using measures of soil health such as rooting depth, percolation rate, erosion, water holding capacity, and/or aggregate stability
- Presence/absence of any potentially toxic element (e.g. inorganic arsenic levels in soils producing juices or rice),
- A measure of microbial community diversity and activity
- Use of the Cornell soil health index, or a similar integrated measure of soil health driven off soil test results
- Guidance on timing of sampling relative to crop rotation

Technical Notes:

The SISC soil metric is the measured total organic carbon of the soil divided by that soil's potential to store organic carbon, as modeled using USDA's Soil Management Assessment Framework (SMAF). A score approaching 1 (or 100%) indicates that the soil has realized its full potential to hold soil organic matter.

While SMAF provides a suite of quantitative indicators for measuring different aspects of soil quality, the SISC metric and calculator use only the TOC indicator contained in SMAF.² SMAF adjusts a soil's TOC holding potential based on climate, soil series and soil texture. USDA has developed a national dataset for using SMAF, coding specific regions, soil types and textures into classes for use with SMAF. These data were also provided to SISC by USDA and are included in the SISC calculator.³ More information about SMAF can be found in: Andrews, S., Karlen, D., Cambardella, C., Soil Management Assessment Framework: A Quantitative Soil Quality Evaluation Method, Soil Sci. Soc. Am. J. 68:1945–1962 (2004) (see <http://ddr.nal.usda.gov/bitstream/10113/9094/1/IND43661863.pdf>).

The SISC calculator requires the user to identify the soil series, soil texture and climactic region from drop down menus. Climactic regions are defined in the USDA data set for SMAF. The SISC calculator identifies the possible climactic regions for a given SISC Management Area depending on the county it resides in and includes them on a drop-down menu for selection by the user. The user is directed to

² An Excel version of SMAF was provided to SISC by Doug Karlen at USDA's Agriculture Research Services on March 23, 2011. An online version of SMAF is also hosted at http://soilquality.org/tools/smaf_intro.html, although this site was not functioning at the time of publication. More information about SMAF can be found in: Andrews, S., Karlen, D., Cambardella, C., Soil Management Assessment Framework: A Quantitative Soil Quality Evaluation Method, Soil Sci. Soc. Am. J. 68:1945–1962 (2004) (see <http://ddr.nal.usda.gov/bitstream/10113/9094/1/IND43661863.pdf>).

³ Data provided on April 5, 2011 by Susan Andrews, National Leader of the Soil Ecology Branch, National Soil Survey Center, Natural Resource Conservation Service, USDA.

USDA's Web Soil Survey to find the soil series and texture for the sampled soil if these are not already known.

For Management Areas that require multiple samples: the Management Area score is an average of the scores for each sample. First, calculate an individual score for each sample, then average those scores. We note this may obscure important information about high or low quality soils, and encourage that attention is also paid to the range of scores as well as the average.

NOTE:

For detailed guidance on collecting samples, see: "SISC Guidelines: Soil Sampling" at www.stewardshipindex.org.