

**Development of Soil Organic Carbon Map for California**

Questions and Responses from USDA NRCS Soil Scientist, Tony Rolfes

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Question	Response
Is there a standard relationship between soil organic matter (SOM) and 0-30 cm depth that allows extrapolation to 1 m?	Each layer with its own thickness has its soil organic carbon (SOC) data. If two layers, e.g. 0-15 cm and 15-30 cm have different SOC, then the total SOC for 0-30 cm will be based on the weighted average. Database allows users to choose the depth where they want to see the data.
Most studies are focusing on active SOM fraction. Do any studies focus on recalcitrant SOM or is that planned to be included?	Depends on which test is used. SSURGO work measures total SOC which doesn't differentiate between the labile or recalcitrant fractions. The question here is only active fraction should be considered since that's where most of the microbial activity that affects soil health is. One may need to measure both fractions to answer this question; although that's not currently done in NRCS soil surveys.
Please explain baseline soil data again.	Baseline soil data is based on what SOM we have, but it can change based on management which changes every season and year. We don't have a handle on the management component. But the stable part of SOM might be a good candidate for baseline data.
Irrigation increases soil organic carbon (SOC). Are you researching SOC in areas with higher rainfall?	In CA almost all cropland is irrigated and therefore opportunity to increase SOC exists with compost, cover crops etc. Geography affects the baseline carbon, which might have developed under the natural precipitation zones. But now with management there is the opportunity to increase OM. High precipitation zones such as Humboldt County have high SOC, while the arid central valley has lower SOC. The Bay Delta has high OM due to high water tables.
Humboldt has high SOC, is that the redwood forest soils?	Forest soils have high C in the upper 10 cm rather than below the surface because tree roots don't provide that much C to soil as much as grasses and forbs, unless there is a thick understory.
How does baseline soil relate to gSSURGO?	It's the same data. Several NRCS tools and UC Davis tool, they differ in how data is displayed

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	and queried, but the background data comes from the same dataset.
How might a mapping tool measure C-oxidation and subsidence in delta peat soils?	Someone would need to model this. We do know how many feet have decreased since the delta was drained and mechanically disturbed, the main mechanism was C-oxidation rather than subsidence (e.g. tillage). A model would be needed to factor in such variables along with climate, erosion, etc.
How often is the data for California soil carbon maps and NRCS updated?	They are updated at MLRA level whenever soil surveys are conducted. Some regions are updated on a project-basis rather than the whole region or whole county. Not every county is updated every year. NRCS has 120 soil surveys that have some updates each year.
How do you decide the soil map polygon boundaries?	First look at the five soil forming factors evaluation for rough cut delineation. Looking at the actual field site, we see signatures such as geographic features or vegetation. We also look at maps and sometimes dig multiple holes to see what makes sense. E.g. stream and river flood plains are more complicated because flat and variable sediment deposits, in those landforms we dig holes in a grid pattern to map out the soil boundaries.
How are the impact of ag pesticides and fumigants being measured to address soil health, GHG reduction potential and soil C sequestration potential?	Challenge in CA is the crop diversity and specific crops may need specific pesticides or may limit which practices can be implemented; e.g. strawberries. However, if one starts to practice soil health practices, some of the IPM can be minimized, as some practitioners are finding out. This is not instant and can take a few years to get results. NRCS wants to see the needle move on soil health practices in CA.
Can you discuss the ways or options to extrapolate point data to landscape scale?	SSURGO does that. Dr. Toby O’Geen’s model for groupings of soil health can potentially achieve this.
How is 30 cm settled upon as the right depth, given that some research shows 6 feet depth.	30 cm is an example for some of our projects. In Soil Survey data we do up to 2 m. Depending on the project, one can choose whatever depth and layer they think makes sense. For my presentation, 30 cm made sense because a lot of the e soil carbon is in the upper soil layers and is likely to show changes

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	especially because of practices like compost and cover crop.
LIDAR – how significant would it be to improve the quality of mapping units?	The technique today that I discussed is older which we still use. However, we are now using digital techniques, Dylan Beaudette in Sonora soil survey office is has technical expertise and is working on this for NRCS nationwide.
If you are using soil data in GIS and location is at edge of an explicit zone, should an adjacent site be taken?	Sometimes this is quite obvious, e.g. rising slope in change of landform. Otherwise, need to grid out, dig holes and see where changes arise, and then pick soil boundary based accordingly. Changes can be based on vegetation, geographical features etc.
Regional specific C-variation in CA, how will soil carbon be used to determine soil health? Seems like soil C is a continuum.	Yes, point-in-time samples only serve as baselines. The practices, field locations and history, will need to be used on specific field-by-field basis. This is why looking at 3 years data through HSP projects makes sense because that can be modeled and compared with existing tools such as the one at UC Davis/Dr. Toby O’Geen.