AGRICULTURAL WASTE SOLUTIONS,INC.

4607 Lakeview Canyon Drive, # 185 • Westlake Village, CA 91361
805-551-0116 • mccorkle@agwastesolutions.com

May 7, 2020

California Department of Food and Agriculture
Soil Organic Carbon Mapping Project

Subject: Comment letter for CDFA Soil Organic Carbon Mapping

To Whom It May Concern,

Agricultural Waste Solutions, Inc. ("AWS"), headquartered in Westlake Village, California, wishes to express our gratitude to CDFA for the opportunity of commenting on the emerging protocols and standardization in soil carbon mapping. AWS works with California and other farmers and ranchers to produce low carbon transportation fuels and carbon negative co-products such as biochar that reduce GHG emissions and improve water quality while creating new profit centers from manure and other ag resources.

Please see below our comments from the May 6, 2020 CDFA Soil Organic Carbon Mapping Webinar:

- There is a dire need to improve the soil health of California as intensive farming practices have depleted the soil of its total carbon levels. How will researchers and farmers utilize the mapping protocols to track improvements and/or compounded depletions to the soil organic carbon levels?
- The Soil Organic Carbon Mapping provides an excellent tool for baseline understanding of the current state of soil organic carbon levels. In order to actually improve soil carbon levels, however, farmers and researchers must be able to not only use recognized, conventional farming practices such as compost applications and no-till but also atypical farming practices such as compost + biochar applications, or CO2 sequestration biochar applications alone. How will farmers improve the soil carbon levels in their soil with nonconventional techniques like the application of CO2 sequestration biochar and report them within the soil organic carbon mapping protocols?
- Farmers and ranchers will be proactive with adding carbon to their soils and reducing GHG emissions as a result if they know they will be rewarded for their efforts with more nutritious and higher yielding crop production as well as other financial incentives for building carbon levels in their soils. Will the practices for improving soil carbon health in the soil organic carbon mapping protocols be able to be utilized in other state modeling softwares such as CA Greet or COMET Planner that are used to qualify for grants and other valuable carbon credits?

Sincerely,

Stephen McCorkle, CEO
Agricultural Waste Solutions, Inc.

Carbon Cycle Institute

May 20, 2020

Casey Walsh Cady
Biodiversity Initiative Coordinator
California Department of Food Agriculture
1220 N Street
Sacramento, CA 95814

Re: Comments on the establishment of a Soil Carbon Map for California

On behalf of the **Carbon Cycle Institute (CCI)**, we are writing to offer comments and suggestions to the recently proposed development of a Soil Carbon Map as part of the California Biodiversity Initiative. Being able to monitor soil health in California is a worthwhile goal with numerous benefits to a variety of stakeholders and the public at large.

The Carbon Cycle Institute's mission is to stop and reverse climate change by advancing science-verified solutions that remove atmospheric carbon dioxide while promoting environmental stewardship, social equity and economic sustainability. To that end, we support and develop projects that promote climate-beneficial management practices on working lands throughout California, work to build the technical capacity of land managers and producers to plan and implement impactful projects that reduce GHGs and sequester carbon in the land base and are engaged in gathering scientific data on the important role these practices can play in sequestering carbon from the atmosphere. Below are our recommendations for the development of a soil carbon map for the state of California and a soil health data repository system.

1. Leverage the USDA – Natural Resources Conservation Service tools and strategies for assessing soil health. More specifically, the SSURGO database remains one of the most robust and trusted sources of data about the status of soils in the United States. We encourage CDFA staff to coordinate with the NRCS to determine how their efforts will be complementary and result in improvements to the SSURGO database that could be useful.

2. Convene a group of experts to gather feedback on how to make the Soil Carbon Map and the Soil Health Data Repository System most useful. There are a number of experts in Soil Science in the state of California whose input will ensure that the Soil Carbon Map and Data Repository System are constructed in a way that advances our knowledge of soils and the effectiveness of practices to improve soil health. A panel of scientists from research and academic institutions, government agencies and non-profit organizations could provide valuable feedback for these efforts.

245 Kentucky Street, Suite A, Petaluma, CA 94952
testrada@carboncycle.org

3. Work with researchers at Colorado State University and NRCS to ensure that the data collected from the Healthy Soils Program provides the information needed to evaluate practices and refine and improve quantification methodologies (ie COMET tools). CDFA and ARB, working with Colorado State University and others, have adopted the COMET tools as an effective and scientifically sound quantification platform for agriculture, in terms of measurement of soil carbon and GHG impacts. The COMET tools could be enhanced by appropriate field data that would validate model assumptions and increase accuracy of estimation of GHG benefits of conservation practices.

CCI supports investments in applied research programs and activities needed to ensure implementation of the most efficient ways to build and maintain soil carbon at both the farm and the field level while meeting the agronomic needs of growers and ensuring protection of environmental resources. CCI is also supportive of funding for continued research to expand the knowledge base on innovative conservation practices to inform the HSP program and future incentive programs. To advance a soil carbon mapping effort in CA, CDFA should continue to work closely with USDA-NRCS to support and leverage the multi-decadal work represented by SSURGO and the US Soil Survey. CDFA should further support the technical assistance and use of methodologies needed to render Healthy Soils Program soil sampling data scientifically rigorous and able to further enhance the accuracy and utility of both soil carbon maps and the COMET planning tools to support management for climate resilience and biodiversity in CA agriculture.

Sincerely,

Torri Estrada, Executive Director and Policy Director
Jeffrey Creque, Ph.D., Director of Rangeland and Agroecosystem Management
Pelayo Alvarez, Ph.D., Director of Outreach and Partnerships

From: Francis Hourigan
To: CDFA OEFI@CDFA
Cc: Geoff Scott
Subject: CDFA Soil Map of California Public Comment Questions
Date: Tuesday, May 19, 2020 2:23:44 PM
Attachments: image001.png

Hello,

I thought the webinar was very helpful and the soil map would be a great addition to the GIS data that our organization already uses for assessing and implementing our regenerative farming and carbon sequestration goals. Below are some general answers to the questions posed by cdfa.

1. Which existing maps/data sets can be used as baseline for soil organic carbon?
    a. SSURGO/Web Soil Survey online
2. USDA NRCS has developed several maps that may serve the purpose above; stakeholder feedback on the use of these is encouraged.
    a. SSURGO and the ArcGIS Online Living Atlas layer of "USA Soils" are used most frequently for our in-house soil data baseline information.
3. What scale is needed for the map to meet its objective of serving as an indicator of soil health?
    a. 5-10 ft spatial resolution would be nice, so we could determine soil type within vine rows. I'm not sure what the general resolution for SSURGO is our how they determine the distinct soil type areas.
4. Should CDFA develop a statewide map or focus on agricultural production areas?
    a. Statewide would be best for Land Management and our regenerative farming goals AGREED
5. What components and layers should the map includes?
    a. All of the SSURGO attributes plus maybe groundwater/aquifer information and carbon sequestration potential.
6. What is appropriate soil depth for the map (ex: 30 cm)?
    a. 30 cm is fine for standard information but for carbon and groundwater information the depth may need to be larger.
7. What are other issues and concerns?
    a. It would be nice if there was an ArcGIS REST server endpoint so that the layer could be accessed in ArcGIS Online and Portal.
8. What would stakeholders like to use this map for?
    a. Looking at our different properties' soil diversity and also potential for carbon sequestration and groundwater recharge potential. Also, site selection for healthy

soils grant projects.

9. What are the needs for this tool beyond its use by governmental agencies?
    a. Private party Land Use Planning and Regenerative Farming
10. What can stakeholders contribute?
    a. Using ArcGIS Open Data or Hub, users could contribute data in a standardized format that has been collected with specific protocols and could be verified by cdfa.

Thank you,

Francis Hourigan
Senior GIS Analyst
Jackson Family Investments
Francis.hourigan@jfwmail.com
O: 707-522-6460 M: 707-291-6712

From: Walsh Cady, Casey@CDFA
To: Walsh Cady, Casey@CDFA
Subject: FW: CA Soil Carbon Mapping - leveraging satellite mapping of conservation practices
Date: Thursday, May 7, 2020 8:38:20 AM
Attachments: OpTIS_Factsheet_FINAL_1Nov18.pdf

From: wsalas@appliedgeosolutions.com <wsalas@appliedgeosolutions.com>
Sent: Wednesday, May 6, 2020 2:41 PM
To: Rolfes, Tony - NRCS, Davis, CA <tony.rolfes@ca.usda.gov>; Walsh Cady, Casey@CDFA <casey.cady@cdfa.ca.gov>
Cc: Cook, Carolyn@CDFA <carolyn.cook@cdfa.ca.gov>; Joshi, Geetika@CDFA <Geetika.Joshi@cdfa.ca.gov>; Nicholson, Benjamin@ARB <Benjamin.Nicholson@arb.ca.gov>; Wolff, Michael@CDFA <Michael.Wolff@cdfa.ca.gov>; Guo, Lei@ARB <lei.guo@arb.ca.gov>; Gunasekara, Amrith@CDFA <amrith.gunasekara@cdfa.ca.gov>
Subject: CA Soil Carbon Mapping - leveraging satellite mapping of conservation practices

Hi Tony and Casey,

I enjoyed your presentation today on plans to develop a Soil Organic Carbon Map for California. Great work. During the Q&A period you highlighted a plan to extrapolate field measurements (HSP and NRCS, etc) using the soil survey. We have developed an operational satellite mapping system called OpTIS (or Operational Tillage Information System). OpTIS provides subfield scale mapping of crop residue, tillage systems (derived from residue fraction dynamics based on NRCS and other definitions), cover crops (date of emergence and date of termination), days of green cover and days of senescent cover. We have applied OpTIS across the corn belt to map adoption of conservation practices from 2005 to 2019. We are working on a national implementation of OpTIS. Attached is a short summary of the OpTIS work. In the summary you will see that we linked the OpTIS products with DNDC to directly map trends in soil carbon.

I think the OpTIS data may be useful for helping build the state level soil carbon map as well as help mapping trends in adoption of conservation tillage, cover cropping and soil health practices (e.g. days of green cover) under HSP and understand how the HSP investments have influenced overall adoption of practices beyond the individual HSP fields.

If you have the time I would like to set up a time where we can provide a presentation on this work and see if it would be a good source of data to support your program.

Thank you for your time,

Bill

William A Salas, Ph.D.
Applied GeoSolutions, LLC
Dagan, Inc
DNDC Applications, Research and Training
15 Newmarket Road
Durham, NH 03824
Ph: 603-292-1191
Fax: 413-714-1051
Cage Code: 34QP7
DUNS #091440904

Operational Tillage Information System

USING REMOTE SENSING DATA TO MAP CONSERVATION AGRICULTURE PRACTICES

This no-till soybean crop is off to a great start with high organic matter from last year's corn. © Paige Buck, USDA-NRCS Illinois

Agriculture's footprint in the U.S. spans all 50 states and accounts for more than half of the U.S. land base—1.2 billion acres, including more than 200 million acres of row crops like corn, soybeans, wheat, cotton and rice. Tillage practices and winter cover crops on these row crops have a significant impact on productivity and environmental outcomes, including soil erosion, water quality, carbon sequestration and soil health.

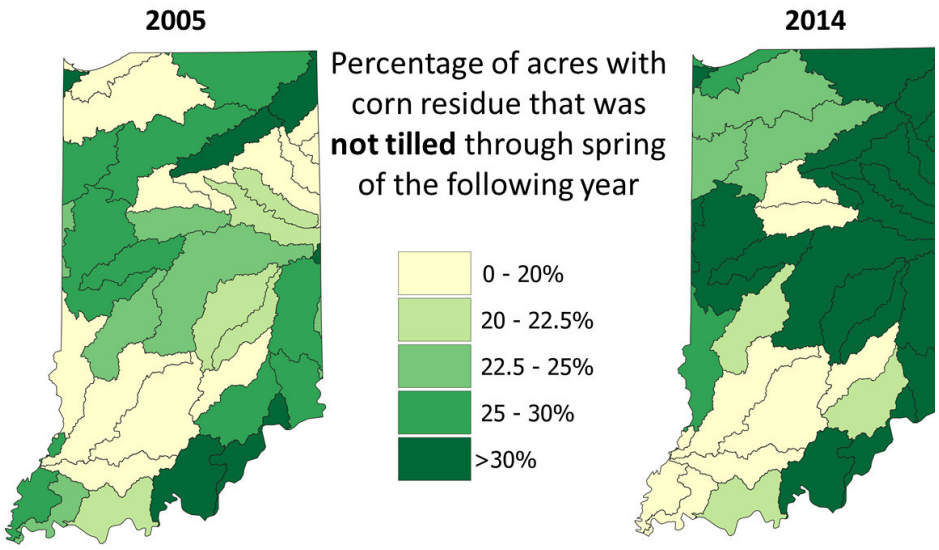
Applied GeoSolutions (AGS) has developed an **automated system to monitor the usage trends of tillage and cover crop practices over large agricultural areas.** Called the Operational Tillage Informational System (OpTIS), this system produces accurate, timely and spatially comprehensive maps of crop emergence, crop residue cover and winter cover crops annually using information from multiple earth-observing satellites. Taken together, this will lead to an accurate estimate of the area being farmed to promote soil health.

In collaboration with the Conservation Technology Information Center (CTIC) and The Nature Conservancy, AGS is applying OpTIS technology and the DeNitrification-DeComposition (DNDC) model—a computer simulation model of carbon and nitrogen biogeochemistry in agroecosystems—to map trends in soil health management practice adoption and to estimate the associated nitrous oxide emissions, nitrate loss, soil organic carbon, and water holding capacity benefits associated with these trends.

While OpTIS calculations are performed and validated at the farm-field scale using publicly available remotely sensed data, the privacy of individual producers is fully protected by reporting only spatially-aggregated results at much larger scales (i.e., HUC 8 watershed and USDA Crop Reporting District).

Multiple cover crop species help to improve soil health and overall production capacity. © Ron Nichols, USDA-NRCS

An aerial-applied rye grass cover crop grows between harvested corn rows in southwest Iowa. © Jason Johnson, USDA-NRCS Iowa



Remote sensing technology, combined with computer analytics, has proven to be a cost-effective, accurate method to gain valuable insight into the adoption of conservation practices across America's croplands, including those practices related to improved water quality and soil health. © CTIC

OpTIS Benefits Conservation and Business Stakeholders

Maps produced by OpTIS and DNDC will fill critical gaps in understanding recent trends in conservation practices and soil health, as well as set a baseline of adoption against which future progress can be tracked. The application of this information is vitally important to multiple private and public stakeholders.

For instance, OpTIS can help:

- **Soil and Water Conservation Districts** establish program priorities and evaluate progress in achieving county or statewide goals.
- The **U.S. Environmental Protection Agency** and state governments to track progress and better focus efforts to meet the Gulf of Mexico Hypoxia Task Force goals.
- Stakeholders throughout the **agri-food system supply chain** better understand market trends that impact environmental sustainability.
- **Conservation organizations** better focus efforts to improve soil health and water quality.
- **Regional and national agriculture agency offices** evaluate and compare the effectiveness of conservation programs across large regions.
- **Academic researchers** model water quality and the carbon cycle.

Historical Perspective and Next Steps

Starting in the late 1980s, CTIC compiled and distributed Crop Residue Management survey data collected by federal, state, county and conservation district personnel in extensive transect programs across the row-cropping regions of the U.S. While the data from this effort was integral to the nation's understanding of conservation tillage trends, data collection efforts at the federal level ended in 2004.

During the intervening years, CTIC has championed efforts to re-start the collection and dissemination of data, leading to the collaboration with AGS and the Conservancy on OpTIS. Given the scale and importance of these data to stakeholders in government, industry, and academia, it is clear that even greater levels of public and private collaboration will be required to operationalize and sustain this effort at the national scale. AGS, CTIC, and the Conservancy are committed to making this vision a reality.

This project is supported by the Foundation for Food and Agricultural Research, United States Department of Agriculture, Bayer Crop Science, DuPont Pioneer, Enterprise Rent-A-Car, Monsanto, Mosaic, J.R. Simplot Company, Syngenta, the Walmart Foundation and The Nature Conservancy.

Field measurements help to validate remote sensing data. © AGS

Documenting OpTIS Success

Applied GeoSolutions (AGS), in collaboration with Conservation Technology Information Center (CTIC), conducted a pilot project to test, ground-truth and document the capability of the Operational Tillage Information System (OpTIS) to consistently map tillage practices and cover crops in Indiana from 2006 to 2015.

Funded as a collaborative public-private partnership, the pilot project produced county and watershed level maps of conservation tillage and cover cropping at an annual time step, as well as a comprehensive report outlining the performance of the system.

Building on the success of the Indiana pilot project, **AGS and CTIC are now collaborating with The Nature Conservancy and other partners to apply OpTIS across the U.S. Corn Belt** for the years 2005-2017, with plans to expand the application to all U.S. agricultural regions.

For more information or to explore collaborative opportunities, contact:

Steve Hagen
shagen@appliedgeosolutions.com
603-292-1189

Dave Gustafson
ctic@ctic.org
314-409-7123

Pipa Elias
pipa.elias@tnc.org
571-354-9654

The Nature Conservancy

CTIC

Applied · Geosolutions

California Department of Food and Agriculture
1220 N Street
Sacramento, California, U.S.A. 95814

Re: Establishment of a soil carbon map for California

To Whom It May Concern:

Thank you for the opportunity to comment on the CDFA's initiative to establish a soil carbon map for California. Kiss the Ground is a 501(c)3 environmental nonprofit based in Los Angeles, CA with the mission to inspire participation in soil regeneration.

We would like to specifically respond to the question regarding potential further uses of this tool. Kiss the Ground works alongside farmers to understand their needs in transitioning to more healthy and regenerative farm practices. Over the past seven years, it has become evident that regenerative agriculture is an unprecedented way to address droughts, floods, climate change, and biodiversity loss, all while increasing regional resiliency. Additionally, it is a significant economic driver that helps empower rural communities. However, the farmers we work with have stated time and time again that their biggest constraint to fully transitioning is due to limited access to capital. At the same time, impact investors are ready to finance projects that will contribute to carbon sequestration but require soil carbon data that can show the impact of their investments.

There is an information gap that Kiss the Ground believes the CDFA soil mapping project could help fill, which could help paint the current investment landscape around regenerative agriculture in California. We recommend that CDFA work with California universities and extension services to identify how this data—and what complementary data—would help respond to this. We strongly suggest combining the carbon accounting data with additional information from satellite technology, such as changes in water-holding capacity, biomass, groundwater recovery, groundcover and biodiversity, which together would create a more comprehensive picture of the carbon dynamics in Californian agriculture. We would like to emphasize, however, that measurement should not fall on the shoulders of farmers, but rather on California's robust and capable agricultural extension system to develop models from which farmers stand to gain.

CDFA can help unlock private sector investment in agriculture that would simultaneously draw down carbon, improve livelihoods and fight against climate change. Kiss the Ground would be ready to help disseminate this data, as well as connect private sector actors interested in using it.

Sincerely,

Kiss the Ground

From: Jim Wilson
To: CDFA OEFI@CDFA
Subject: Healthy soils
Date: Wednesday, May 6, 2020 2:40:43 PM

Can the project help prioritize implementation of climate-safe practices for working and natural lands? Increasingly, aggressive carbon sequestration practices are needed to achieve net negative carbon emissions.

Jim

From: Chuck Bell
To: CDFA OEFI@CDFA
Subject: RE: Webinar to Receive Public Input on Development of a Soil Organic Carbon Map Confirmation
Date: Monday, May 4, 2020 8:37:28 PM

Native desert soils sequester carbon. Disturbance – especially from industrial solar projects, illegal grading and de-brushing, etc release said carbon. Even though it isn't a direct agricultural issue – it is important to maintain 'healthy soils'.

Thanks,

Chuck Bell, Pres. - Mojave Desert Resource Conservation District - 760 964 3118

From: CDFA OEFI [mailto:customercare@gotowebinar.com]
Sent: Monday, May 04, 2020 6:01 PM
To: chuckb@sisp.net
Subject: Webinar to Receive Public Input on Development of a Soil Organic Carbon Map Confirmation

Thank you for registering for "Webinar to Receive Public Input on Development of a Soil Organic Carbon Map".

Please send your questions, comments and feedback to: cdfa.oefi@cdfa.ca.gov

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Comments on the Establishment of a Soil Organic Carbon Map for California

Loma Prieta Soils Committee

The Soils Committee is a citizens' group aiming to raise awareness of soil's importance for environmental and human health and advocate for policy supporting healthy soils in California and beyond.

In order to fulfill the objectives of 1) development of a soil organic carbon map, and 2) a soils data repository system, CDFA invites stakeholders to participate in a webinar to provide input and help define the scope of work needed to fulfill the objectives. CDFA requests feedback on the following questions:

1. Which existing maps/data sets can be used as a baseline for soil organic carbon? USDA NRCS has developed several maps that may serve the purpose above; stakeholder feedback on the use of these is encouraged.

We recommend that the following maps and data, although they may not address or include SOC specifically, be considered and potentially used as a basis for this project. The goal of using one or more of these resources as a basis for the SOC map is to help make sure that the SOC map is compatible with existing key tools for farmers, policymakers, and citizens.

- NRCS SSURGO datasets and basemaps
- NRCS Soil Surveys
- CA bioregions map from UCDavis

Additionally, existing data from the healthy soils program (baseline and ongoing measurements from farmers) could be used as an input. Existing soil testing services (public and private) may have geographically-linked data which it may be possible to seek out and include in the map.

2. What scale is needed for the map to meet its objective of serving as an indicator of soil health?

Ultimately, the map's scale should enable analysis of how different practices (such as use of cover crops, animal grazing practices) intersect with landscape features (such as bioregions, local and regional soil types) to affect the principles of soil health such as SOC.

The appropriate scale for the map should be based on the decisions the map will be used to make and evaluate. There are two main scales at which this will occur:

- Policymakers, activist organizations, and others will need to make decisions at the county/sub-county level about priority areas for funding, awareness campaigns, etc.
- Land managers will need to make decisions about their individual practices. The scale to support this should be aligned with how these land managers make decisions. For example, riparian buffers are typically 250 ft from a stream or creek. Farming practices decisions are typically made at the level of a farm field or an acre. The resolution of the map should be fine enough to both enable decisions at these scales and allow evaluation.

3. Should CDFA develop a statewide map or focus on agricultural production areas?

We recommend that the map eventually cover the entire state, and that this intent be included from the beginning of planning efforts. This would ensure that the result of mapping efforts is holistic rather than siloed, more robust and flexible rather than rigid. Developing a statewide map that includes land managed by many different sectors will establish a framework to accommodate contributions from agriculture, forests, fire risk management, and water resource management. This could help different interests see their connections and interdependencies and foster more collaborations.

Statewide coverage will also help to demonstrate the importance of other sectors, such as forest management, for soil health, and help to prioritize efforts among different sectors. Including other sectors would also bring in more stakeholders to support the development of the map, and including these sectors from the beginning will help create a flexible map framework that others will be able to enter into and expand.

That being said, while we recommend that the framing of the map be statewide from the beginning, this effort will likely be long-term, and it makes sense to begin mapping in areas that are most critical to policy/funding/other decision-making. These priority areas may include:

- Farms and rangelands.
- Agricultural and non-agricultural areas that are at risk of land-use change (to identify priority areas for conservation through SALCP or other programs).
- Other areas subject to carbon management, for example managed forests.

4. What components and layers should the map include?

Aside from soil organic carbon levels, we recommend the map include information about:

- The potential of soil to take up carbon, in other words the “attainable OC” as discussed by Tony Rolfes during the public comment webinar. This could be based to some extent on existing soil type maps, since soil type is a major factor in attainable OC, and should also take into account typical local temperatures, precipitation, etc.
- The water holding capacity (WHC) of the soil.

5. What is appropriate soil depth for the map (ex: 30 cm)?

We recommend that 30cm be the minimum depth of the soil survey. However, soil should be measured to a depth of 2m as much as feasible, to assess the OC in deeper soil levels and add to the growing understanding of the importance of these deeper carbon pools.

6. What are other issues and concerns?

Supporting collaboration will be a key role of the completed map. It is therefore important to create the map so that it can be used compatibly with existing tools and datasets (SSURGO, etc.). For the same

reason, it's important that data, map, and file formats adhere to GIS industry standards and other standards.

We recommend that how the map will be presented, and particularly how it will be combined with or presented alongside existing tools, be considered from the very beginning of the planning process, and that it in part inform other decisions such as scale and data structure.

Another consideration when determining how the map will be presented is that it needs to be easily usable for stakeholders. The very large datasets created for high-resolution maps are too unwieldy for many people to access, so the final interface of the map should take this into account. It should also be easily searchable.

7. Are there recommendations on data standards and quality assurance?

We recommend that:

- Measurement methodology for the map should be developed such that it is standardized and can be carried out by many different labs and other entities, so the map can be continually added to and updated, and made more detailed. There should also be ways to note what field measurement methods and sources are used during data entry.
- The map's preferred units of measure should be based on decision makers' needs, but input should offer flexibility for inputting data in other units. Steps should be taken to ensure that these different units are stored separately so as not to mess up any calculations.
- Design should protect the integrity of data.
- Data source and methods should be referenced for all data.

8. What would stakeholders like to use this map for?

We recommend that the map support the following uses:

- Land managers (farmers, ranchers, etc.) use the map to make decisions about land management and to monitor their progress against the baseline.
- Land managers compare their own soil's OC to the potential OC of their soil (based on soil type, climate, etc.).
- Land managers compare their own soil's OC to the SOC of managers with similar soil type and location but different practices.
- Policy makers prioritize SOC climate mitigation efforts (for example allocation of grants through the HSP) and predict their effects by assessing the SOC potential of a given area.
- Monitoring agencies use datasets over time to compare outcomes to baseline measurements, validate predictions, and produce reports that show comparisons and progress.
- The HSP leverages this broad baseline measurement to potentially ease the application process for land managers.

- Advocates use the map to provide education and outreach for urban and rural constituencies to build their understanding of and support for land management practices that affect our land and human health, food quality and security, water quality and security, and climate resilience.
- Citizens and activist groups use the map to understand the health of farms in California and make informed decisions and recommendations around relevant policy.
- All stakeholders use the map to identify potential areas for collaboration.

9. What are the needs for this tool beyond its use by governmental agencies?

See above answer.

10. What can stakeholders contribute?

We recommend that the mapping effort consider ways to involve citizen scientists in mapping and sampling.