

# **An Overview of the “Crop Residues for Advanced Biofuels: Exploring Soil Carbon Effects” Workshop**

Presented at:

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# Crop Residues for Advanced Biofuels Workshop—

Exploring Soil Carbon Effects

August 15-17, 2017 | Sacramento, CA

Sheraton Grand Sacramento Hotel



## PROGRAM

## Acknowledgements

Ms. Jeanne Pluemer and the entire  
ACESSS staff for their assistance  
in developing the workshop

Alan Chute for coordinating data  
collection using ThinkTank™

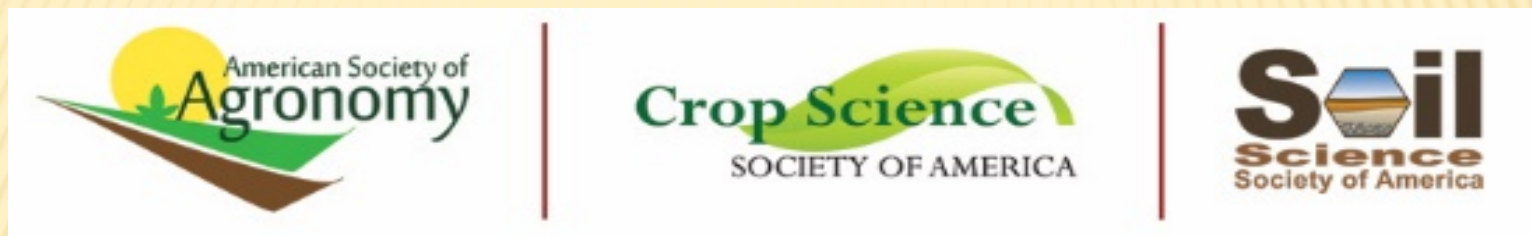
The ASA-CSSA-SSSA Boards for  
their commitment to using our  
agricultural science to improve  
policy decisions

The farmers and ethanol plants  
that brought this important issue  
to our attention and the help they  
are providing in obtaining correct  
answers for everyone.



@ASA\_CSSA\_SSSA

# The “Tri-Societies” – Who Are We?



The American Society of Agronomy (ASA), Crop Science Society of America (CSSA), and Soil Science Society of America (SSSA) are three Professional Societies that collectively represent scientists (research, extension, and education) as well as practitioners (e.g. Certified Crop Advisors, Certified Professional Soil Scientists) striving to balance agricultural productivity, environmental quality, and protection of our soil, water and air resources

Members specialize in agronomic (production systems), crop science (genetics, development, & management) and soil science (biology, chemistry, and physics) perspectives

# Background

- The Workshop evolved in response to a producer/grain ethanol investor who sought ASA support for a request to the California Air Resources Board (CARB) asking them if cellulosic derived ethanol should have greater financial incentives and acceptance than grain ethanol with regard to the low carbon fuel standard (LCFS)
- The stakeholder's rationale was that although corn stover and other crop residues have been identified as potential biofuel feedstocks, they also have other important roles – specifically:
  - Preventing wind and water induced soil erosion
  - Maintaining or building soil organic carbon (SOC)
  - Sustaining or improving soil health

# The Challenge

Recognizing the question did not have a simple answer, an ASA Task Force was appointed and asked to provide the Board a recommendation on how to respond since:

- Increased corn yields can create “residue management” problems for producers
- Plant breeding can significantly change the distribution of carbon between grain and vegetative components
- Crop residue degradation and transformation to soil organic carbon (SOC) is affected by many factors including crop rotation, tillage intensity, rainfall, temperature, and soil type
- Fields are not uniform with regard to slope, aspect, drainage, soil type, and many other factors

# The Response

A “white paper” which concluded that:

Applied agricultural science is an ASA-CSSA-SSSA mission strength, so the translation of science into regional best management practices, measurement and certification protocols with regard to stover removal on SOC should be addressed through an interdisciplinary workshop

The workshop should be designed to ensure a wide range of viewpoints were represented, to benefit the regulatory agencies tasked with ensuring that stover-derived biofuels help reduce atmospheric GHG emissions, and to ensure decisions and guidelines do not negatively impact soil, water, air and other environmental resources

# Workshop Structure

An ASA-CSSA-SSSA planning team strived to assemble the most important and knowledgeable people representing technical and policy areas associated with using crop residues as cellulosic feedstock for advanced biofuels

Personal invitations were sent to more than 100 potential participants who were identified as being leaders for each of the critical areas in order to stimulate cross-fertilization, complimentary perspectives, and fertile discussions

Our goal was to see if science-based consensus regarding sustainability of crop residue harvest and soil organic carbon (SOC) stocks was possible and could be developed.

# Workshop Participants



# Workshop Structure

Presentations were made by multiple presenters in six sessions to address each of the themes

After each plenary session participants broke into small groups to discuss questions such as:

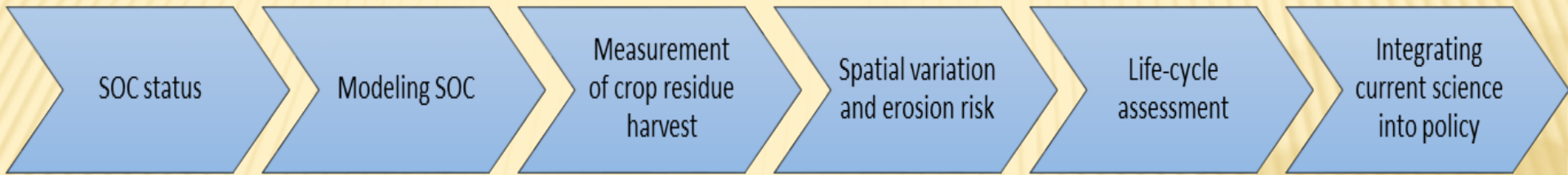
*What do we know and what don't we understand about the conversion of crop residue to soil organic carbon (SOC)?*

*What do we know and what don't we understand about modeling processes and rates of plant biomass conversion to SOC?*

# Themes and Presenters

- **Soil Carbon Status and Trends in the U.S. Corn Belt Region**
  - Chuck Rice, Jane Johnson, and David Clay
- **Modeling Soil Organic Carbon Changes**
  - Adam Liska, Steven DelGrosso, and John Field
- **Measurement and Verification of Stover Harvest/Removal Rates for Regulatory and GHG Accounting Purposes**
  - B. John Pieper, Alan Keller, and Allison Thomson
- **Geospatial Variation and Measurement Changes in SOC and Erosion Risk at the Field and Landscape Scale**
  - David Muth, Jeff Novak, and Richard Cruse
- **Life-Cycle Analysis (LCA): How is Carbon Intensity Determined from Crop Residues?**
  - M. Wang/Z. Qin/C. Canter, Jennifer Pont for (S. Unnasch & T. Darlington)
- **Life-Cycle Analysis of Biofuels: Integrating Current Science into Policy**
  - Anil Prabhu and Aaron Sobel

# Workshop Structure and Data Collection



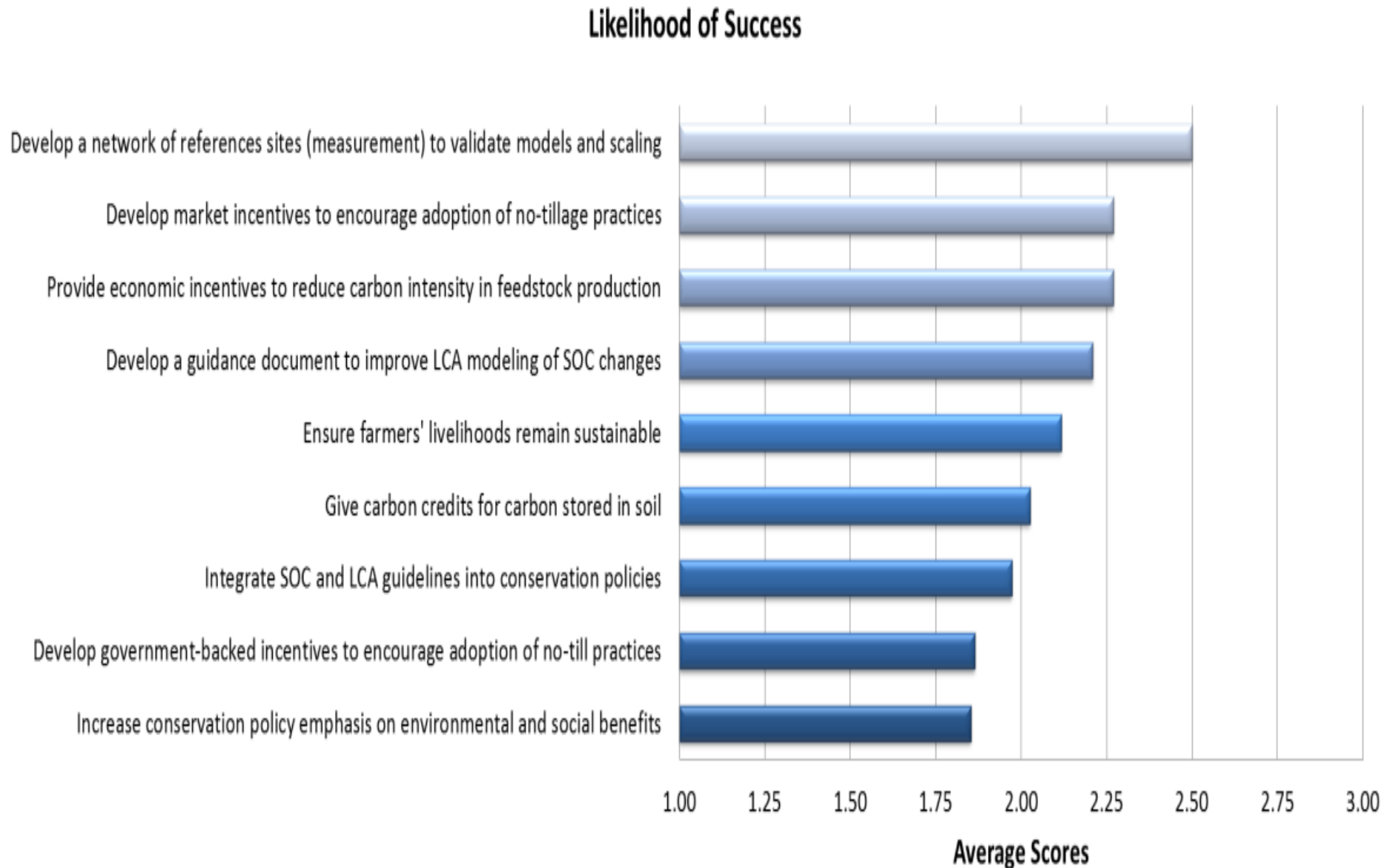
Topics were structured to be provide a common understanding of SOC and crop management, and then focus on increasingly larger scales, and technical issues associated with measurement and verification, finally concluding with the relationship of these topics to LCA methods and policy.

Participant input during and after the workshop was collected using **ThinkTank™** software to record their ideas and to assess the level of agreement on the relevant topics illustrated. During the workshop, UC-Davis graduate students assisted participants with data entry and then summarized the responses.

# Key Issues Identified During the Workshop

- Residue cannot always be removed without affecting SOC levels
  - However, for areas with very high corn yields and limited erosion risk, some residue could be removed without negatively impacting SOC or a soil carbon penalty in LCA calculations.
- Continuous corn generates more residue corn-soybean rotations.
- SOC maintenance requires more residue than erosion protection
- Site-specific and variable rate management methods can be used to adequately control variable removal rates at the field scale
- Rates and exact processes for conversion of crop residues to SOM are complex and influenced by many factors
- Soil carbon data exists but is not adequately compiled or summarized to generate practical guidelines for residue removal
- Current fertilizer adjustments in LCA models compensating for nutrient removal in harvested stover may be an over estimate

# Critical Needs to Manage SOC Risk/Uncertainty



# Preliminary Recommendations

- The amount of stover that can be sustainably harvested =  $f(\text{climate, soil type, slope, drainage, yield, ...})$
- SOC stocks and soil erosion must both be considered when making crop residue management decisions. SOC maintenance requires larger amounts of residues than erosion protection
- SOC databases should be compiled and evaluated to determine trends, compare different soil C models, and determine allowable removal rates
- The purpose of the database and assessment studies is to improve guidelines for harvest of corn stover and other crop residues

# Next Steps

- Presentation of preliminary Workshop outcomes here and at the ASA-CSSA-SSSA annual meetings in Tampa
- Agronomy Journal Special Issue on topic areas
- Initial Workshop report will be posted on an ASA-CSSA-SSSA website
- Identification and compilation of existing soil carbon datasets and crop residue removal data
- Meta-analysis of soil carbon datasets
- Comparative soil carbon model evaluation and validation from compiled soil carbon datasets
- Create robust guidelines for sustainable residue use

# For Further Information

- Regarding submission of original research, perspectives, or information needs to the Agronomy Journal Special Issue on crop residue management and SOC, please contact:
  - David Clay ([david.clay@sdstate.edu](mailto:david.clay@sdstate.edu))
- Regarding the ASA-CSSA-SSSA Task Force or the soil carbon dataset compilation project, please contact:
  - Doug Karlen ([doug.karlen@ars.usda.gov](mailto:doug.karlen@ars.usda.gov))

# The Ultimate Goal: Healthy Soils → Healthy Landscapes → Vibrant Bio-Economies

