WRITTEN TESTIMONY for hearing on *"Title II Conservation Programs: Exploring Climate Smart Practices"*
May 12th 2021 – U.S. House Agricultural Committee, Subcommittee on Conservation and Forestry

Keith Paustian
Department of Soil and Crop Sciences, Colorado State University

Chairwoman Spanberger and Ranking Member LaMalfa, my name is Dr. Keith Paustian; I'm a Professor at Colorado State University, Department of Soil and Crop Sciences. I do research and teaching on soil ecology and biogeochemistry related to agriculture and climate. Thank you for allowing me the opportunity to speak at your hearing today.

Agriculture, both in the US and Globally, is facing several challenges, while being called upon to deliver more and more products and services to an increasing global population. Agriculture is a significant source of GHGs, accounting for about 10% of total US emissions[1] and 14% of global emissions[2]. However, agricultural soils can also be a carbon sink, removing carbon dioxide from the atmosphere and converting it into soil organic matter that improves soil fertility and soil health.

The key determinants for reducing soil GHG emissions, sequestering carbon and improving soil health are the agronomic practices employed by the farmer. Many so-called conventional practices -- including use of continuous annual crops, heavy tillage, extended bare-fallow periods and cultivation of marginal lands -- have, over time, significantly depleted soil carbon stocks. However, we can reverse much of those historic carbon losses by adopting a variety of conservation practices including reduced and no-tillage, cover crops, more diverse crop rotations, field buffers, agroforestry, and other practices[3]. These management practices lead to more carbon dioxide being taken up by plants and converted to organic matter stored in the soil and with less soil disturbance, which also helps to maintain more of that added organic matter.

In addition to sequestering carbon, many of these practices help to "tighten" nutrient cycles, reducing leaching losses that contaminate ground and surface waters and reducing emissions of nitrous oxide – another GHG – from soils. In addition, soils rich in organic matter are also more resilient to both flooding and drought conditions, which reduces yield loss due to extreme climate events.

While these conservation management practices are seeing increasing use in the US, there's massive room for additional adoption – for example, cover crops are still only planted on less than 5% of our annual cropland. USDA conservation programs such as EQIP, the Conservation Stewardship Program (CSP), the Conservation Reserve Program (CRP) and others have been key to introducing appropriate conservation practices to producers across the country and to encourage adoption through cost-sharing, direct payments and technical assistance. Although many conservation practices can pay for themselves in the long run by

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[1] https://www.epa.gov/ghgemissions/sources-greenhouse-gas-emissions
[2] https://www.ipcc.ch/report/ar5/syr/
[3] Paustian, K., J. Lehmann, S. Ogle, D. Reay, G.P. Robertson & P. Smith. 2016. Climate smart soils. *Nature* 532:49-57.

improving soil function and yield stability, there are numerous barriers to adoption. Farming is inherently risky and farmers tend to be risk averse. Thus, the support payments and technical training and outreach from these USDA programs help to mitigate risk while farmers transition to these new practices.

One of the activities that my research team at Colorado State University has been involved in with USDA over the past 12 years has been the development of the COMET-Farm system. COMET-Farm[4] is an on-line tool that farmers, ranchers, crop consultants, NRCS field staff and others can use to do a full carbon and GHG inventory of their operation and explore implementing different conservation management practices to estimate how much they could increase carbon sequestration and reduce other greenhouse gas emissions. The tool is free and available for any one that has an internet connection. The tool implements USDA's Entity Scale Greenhouse Gas Inventory Methods which were developed by top experts from government, academia and industry, overseen by USDA's Office of Energy and Environmental Policy and first published in 2014[5]. We've also developed a related tool called COMET-Planner[6] that gives a quick overview at the regional scale of the impacts of implementing NRCS-prescribed conservation practices on carbon sequestration and GHG reductions. The COMET tools are currently being used by 10s of thousands of users, including federal agencies, state governments, NGOs, companies, consultants, extension personnel, students, as well as individual farmers and ranchers (see attached Appendix A of current COMET users.)

To bring about truly transformative changes on the nation's agricultural lands will require continued support from federal and state governments but also increased participation and investment from the private sector. Over the past couple of years there's been growing interest from major companies towards investing in carbon drawdown approaches, including soil carbon sequestration, to help meet corporate carbon neutrality and sustainability goals. In addition, many agriculturally-related industries are striving to develop low carbon food and fiber products.

To increase the confidence and willingness of the private sector to invest in soil carbon solutions, and to design optimal public policy, we need to improve our abilities to cost-effectively measure and monitor carbon sequestration and greenhouse gas reduction in the agricultural sector and reduce uncertainties in our estimates. While we have many excellent long-term field experiments documenting the performance of conservation practices, as well as highly capable models and tools such as COMET-Farm, there are a number of research and development initiatives that could significantly improve our capabilities. A number of these R&D priorities have been documented in a 2019 study by the National Academy of Sciences[7] on so-called negative emission technologies, including soil carbon sequestration. I will just mention a couple of them here.

One is the need for a national system for on-farm measurements of soil carbon stock changes over time. The National Resources Inventory (NRI) system is managed by USDA and provides a statistical sampling of farms

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[4] https://comet-farm.com/
[5] https://www.usda.gov/sites/default/files/documents/USDATB1939_07072014.pdf
[6] http://comet-planner.com/
[7] https://www.nationalacademies.org/our-work/developing-a-research-agenda-for-carbon-dioxide-removal-and-reliable-sequestration

that tell us what management practices (such as crop rotations, irrigation, fertilizer use, etc.) are being used but there are **no** on-the-ground measurements of, for example, soil carbon stocks. If USDA chose a few thousand NRI points on which to measure soil C stocks every 7-8 years, we would be able to build up a record of soil C stocks changes over time. Our forest inventory system provides this type of information on biomass C changes; we need something similar for our soils.

We also need capabilities for field performance testing of new technologies, such as new crop varieties, new soil amendments and new practices that aren't currently included in long-term field experiments. Typically assessing the impact of new practices or crop types on soil carbon sequestration can take a decade or more; we need systems to assess capabilities of new technologies much more rapidly.

Finally, there's a growing scientific consensus that improved quantification systems can be achieved by more fully integrating multiple data sources, including ground-based measurements and monitoring networks, remote sensing, crowd-sourced data on management activities and dynamic models[8]. Further R & D investments in developing an integrated soils information system can yield major improvements in the next few years.

In summary, USDA Title II programs have been instrumental in promoting the adoption of conservation practices that can yield significant climate benefits along with promoting healthier soils and ecosystems. Good tools exist now to advance and expand policies to promote climate-smart agriculture. Further improvements in quantification technologies can help increase engagement by the private sector to take these improved agricultural conservation practices to scale.

Thank you. I'll be happy to take any questions.

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[8] Paustian, K., et al. 2019. Quantifying carbon for agricultural soil management: from the current status toward a global soil information system. Carbon Management **10**:567-587.

Appendix A. Report to USDA/NRCS, March 2021, Summary of COMET-Farm and COMET-Planner users

COMET-Tools Outreach Report

03/12/2021

COMET-Farm

Year	Total Users	Annual Sessions
2015		3,769
2016	140	4,201
2017	407	2,497
2018	777	3,273
2019	901	2,500
2020	4,181	12,342
2021 (as of 3/12/2021)	1,345	3,111

COMET-Planner

Year	Total Sessions
2016	4,582
2017	7,985
2018	10,029
2019	8,564
2020	5,626
2021 (as of 3/12/2021)	679*
Lifetime	37,460

*Excluding an anomaly of 1,121 users on 2/1/2021

User Support via Help Desk:

Year	Sessions	People	Hours	Solution Article Views
2016	37	54	35.2	-
2017	26	40	21.7	-
2018	38	26	11.5	-
2019	74	104	67.8	-
2020	377	398	321.5	413
2021 (as of (3/12/21)	92	59	16	284

YouTube Training Video Views

Video	Views
Assessing Animal Ag (Dairy)	170
Using Shape Files in COMET-Farm	107
Assessing Agroforestry	123
Assessing Croplands	449
Assessing Croplands (Rice)	89
Assessing Forestry	96
Introduction to COMET-Energy	131
COMET-Planner video (2015)	2250
COMET-Planner video (2017)	1157
New Drag and Drop Feature	46
COMET-Farm & COMET-Planner Introduction *New Channel*	136
Creating a COMET-Farm Account *New Channel*	27
Navigating COMET-Farm *New Channel*	29
Carbon Farm Planning Using COMET-Farm	231
New Animal Ag Accounting (flexible baseline, defining herds, herd copy)	19

Outreach to Date

Federal, State, Regional and Local Government	
USDA Agricultural Research Service	State of Hawaii
USDA Farm Services Agency	San Miguel County, Colorado
California Department of Food and Agriculture	Boulder County, Colorado City of
California Air Resources Board Resource	Boulder, Colorado LaPlata County, Colorado
Conservation Districts throughout California	Summit County, Utah Johnson County, KS
WHATCOM Conservation District, Washington State	Sierra Resource Conservation District
Wilkin Soil and Water Conservation District, Minnesota	NRCS- Annapolis, MD; Walhalla, SC; McMinnville, OR; Washington, D.C.; Connecticut; Madison, WI; Columbia, MO;
Department of Agriculture, Forestry & Fisheries (S. Africa)	Colorado Energy Office
California Air Resources Board	Boulder County (Colorado) Parks and Open Space
New Mexico Department of Agriculture	Alameda County Resource Conservation District

Federal, State, Regional and Local Government (cont.)	
Indiana Department of Agriculture	Tualatin Soil and Water Conservation District
Wisconsin Land + Water	Napa Resource Conservation District

Higher Education	
Colorado State University	University of Northern Colorado
Bard College	University of Wyoming
North Dakota State University	University of Hawaii
University of Maryland	University of Vermont
Western Colorado University	Oklahoma State University
University of Guelph	Yale University
Rutgers University	Northern Arizona University
Georgia Institute of Technology	University of California Composting Education Program
Nueta Hidatsa Sahnish College- North Dakota	

NGO's	
The Marin Carbon Project	Carbon Cycle Institute
Environmental Defense Fund	Chesapeake Bay Foundation
The Nature Conservancy	American Farmland Trust
Climate Action Reserve	American Carbon Registry
Verra (formerly Verified Carbon Standard-VCS)	Innovation Center for U.S. Dairy
Solano Land Trust	Colorado Carbon Fund
The Pinhead Institute	Ducks Unlimited
Sustainable Tompkins	Soil Health Institute
National Corn Growers	Soil Health Partnership
Straus Family Farm	Project Together
Clear Frontier Ag Management	Shelburne Farms
Fish Friendly Farming	Energy District
Carbon 180	California Land Stewardship Institute
Sunflower City	

Agricultural Industry Organizations	
California Farm Bureau	California Almond Growers Rocky
Mountain Farmers Union Hawaii	Agriculture Research Center
Australian Department of Environment and Water	

Businesses	
Ben & Jerry's	Pure Strategies
Fibershed & The North Face	NORI Indigo
Ag Coca Cola	Agrisoma
Unilever	Monsanto
Strauss Dairy	Stemple Creek Ranch
Native Energy	Mad Agriculture
Cargrill	NORI
Sustainable environmental Consultants	Upstream
Watershed Climate	Nutrient
Indigo Agriculture	Microsoft Azure
Logiag	Boston Consulting Group
GD Associates	PIF California
Anthesis Group	SBC Global
Handsome Brook Farms	Post Holdings
Land O' Lakes	Wheat Sheaf Group
Blue Skye	Simplot
First Earth	Jackson Family Wines
Mondelez International	Keystone Pacific/Wild Rose LLC
Lozensky Farms	Active Renewals
Wheat Sheaf Group	Gould Family Farms
Anuvia	Agrocares
FoodTBS	Solution TF
KWS Berlin GmbH	Frontier Farmland
TeamAg Inc.	Stonyfield Organic
Arcor Group	Quivira Coalition
Polytechnique Montreal	Heffernan Consulting, Inc. Home & Farm Consulting
Caterpillar	McKinsey & Company
CiBO Technologies	Casella Waste Systems
SMARTFARM	Pipestone Nutrition
Hudson Carbon	Growell Consulting
Kloberdanz Consulting	Sofies Environmental Consulting
Locus Agriculture Solutions	Florida Crystal Corporation
McKinsey & Company	Philosopher's Farm
Alltech- Quality Animal Nutrition, Health and Feed Supplements	Blockware Technologies (Canada)
Levi's Indigenous Fruit Enterprises	Soletrac Electric Tractors
Treasury Wine Estates	Biome Makers
Team Ag Inc	Royal Dairy
Mountain View Acres Farm & Orchard	Ag Grow Tech
Kytech Consultant	Hem Mills
Smart Farmer (Thailand)	Net Zero Carbon Buildings
Frogs Leap Winery	Pifer's Land Management
Triple Crown Consulting	African Data Technologies

Businesses (cont.)	
Carbon Credits Group	Fresh Del Monte
Pekrul Engineering	LandFund Partners
Sesenta (South Africa)	Farmer's Business Network
Deveron	Cedar Valley Farms
EMBRAPA (Brazil)	Farmer's Edge
North Iowa Agronomy Partners	Dari Gold

Haley Nagle
Outreach and Education Specialist- COMET Tools
Natural Resource Ecology Laboratory
Colorado State University
Haley.nagle@colostate.edu

Committee on Agriculture
U.S. House of Representatives
Information Required From Nongovernmental Witnesses

House rules require nongovernmental witnesses to provide their resume or biographical sketch prior to testifying. If you do not have a resume or biographical sketch available, please complete this form.

1. **Name:_____Keith Paustian_____**

2. **Organization you represent: __Colorado State University_____**

3. **Please list any occupational, employment, or work-related experience you have which add to your qualification to provide testimony before the Committee: ____**
   _____(see attached CV)_____

4. **Please list any special training, education, or professional experience you have which add to your qualifications to provide testimony before the Committee: ____**
   _____(see attached CV) _____

5. **If you are appearing on behalf of an organization, please list the capacity in which you are representing that organization, including any offices or elected positions you hold: _____(see attached CV) _____**

PLEASE ATTACH THIS FORM OR YOUR BIOGRAPHY TO EACH COPY OF TESTIMONY.

CURRICULUM VITAE

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Natural Resource Ecology Laboratory
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EDUCATION:

1987	Ph.D. Systems Ecology/Agroecology, Swedish Univ. of Agric. Sciences, Uppsala
1980	M.Sc. Forest Ecology, Colorado State University, Fort Collins
1977	B.Sc. Forest Biology, Colorado State University, Fort Collins
1976-1977	- Forest Science, Agricultural University of Norway, Ås

PROFESSIONAL EXPERIENCE:

2017-present	University Distinguished Professor, Dept. Soil and Crop Science, Colorado St. Univ.
1996-present	Senior Research Scientist, Natural Resource Ecology Lab, Colorado State University
2001-2016	Professor, Department of Soil and Crop Sciences, Colorado State University
1993-1995	Research Scientist, Natural Resource Ecology Lab, Colorado State University
1991-1993	Research Assoc. Professor, W.K. Kellogg Biological Station, Michigan State University
1989-1990	Research Associate, W.K. Kellogg Biological Station, Michigan State University
1987-1989	Research Scientist, Dept. of Ecology and Environmental Research, Swedish University of Agricultural Sciences
1980-1986	Research Assistant, Swedish Univ. of Agricultural Sciences
1980	Programmer, Natural Resource Ecology Lab, Colorado University
1978-1980	Research Assistant, Dept. of Forest Sciences, Colorado State University
1975-1976	Research Technician, Norwegian Institute of Forest Research, Ås, Norway

BIOGRAPHICAL OVERVIEW:

Keith Paustian is University Distinguished Professor in the Department of Soil and Crop Sciences and Senior Research Scientist at the Natural Resource Ecology Laboratory at Colorado State University. A major focus of his work involves modeling, field and laboratory studies of soil organic matter and nitrogen dynamics in managed ecosystems, and development of inventory methods, policy analyses and assessment tools for soil carbon sequestration and greenhouse gas emissions from soils. He has published over 380 journal articles and book chapters, with more than 47,000 citation and an H-index of 99. Previous and current research activities include development of models and inventory methodology used to estimate US soil C and N_2O emissions that are reported annually by EPA to the UNFCCC; development of a web-based tool (COMET-Farm^{TM}) for estimating on-farm greenhouse gas (GHG) emissions and carbon sequestration used by USDA (http://cometfarm.com/) and project-scale systems for GHG assessment of sustainable land management projects in developing countries (http://www.carbonbenefitsproject.org/). He also served as project director for the Bioenergy Alliance Network of the Rockies (BANR - http://banr.nrel.colostate.edu/) which is a consortium of universities, industry and the US Forest Service, researching the potential for sustainable bioenergy production from beetle-kill trees and forest residues. Professional service activities include Coordinating Lead Author for the IPCC 2006 National Greenhouse Gas Inventory Methods and the IPCC 2003 Good Practice Guidance for Land Use, Land Use Change and Forestry (LULUCF) and two National Academy of Science committees (in 2010-11 and 2018-19) related to land use, greenhouse gases and climate change mitigation. He served as a member of the US Carbon Cycle Science Steering Group, which provides expert input to Federal Agencies involved in climate and carbon cycle research. He also served on the Voluntary Carbon Standard Steering Committee for Agriculture, Forestry and Other Land Use (AFOLU) and on numerous other national and international committees involving climate and carbon cycle

research. He is a Fellow of the Soil Science Society of America, recipient of the Soil Science Society of America's Outstanding Research Award in 2015, and 2019 winner of the Global Foodshot Groundbreaker Award.

GRANTS FUNDED (last 10 years):

2021-24: Co-PI "Leveraging multi-sector partnerships to measure and predict soil health and climate change mitigation outcomes associated with commonly recommended rangeland management practices", FFAR/Point Blue ($205,916)

2020-21: PI "Modeling environmental impacts of synthetic and dairy-manure based fertilizers in US dairy farms", US Dairy Innovation Center ($98,055)

2020-21: PI "Enhancing functionality and use of COMET Greenhouse Gas Assessment and Water Quality tools", USDA/NRCS ($450,000)

2017-21: Co-PI "Decision support to quantify GHG mitigation and ecosystem services from organic production systems", USDA/NIFA ($500,000)

2017-22: Co-PI "Center for Bioenergy Innovation (CBI)", DOE/Oak Ridge National Laboratory ($350,000)

2017-21: Co-PI "Root genetics in the field to understand drought adaptations and carbon sequestration" ARPA-E/DOE ($6,019,238)

2018-23: Co-PI "Emission/removal estimates for the U.S. GHG Inventory's AFOLU Sector and economic analyses and projections", USEPA ($225,000)

2019-22: Co-PI "Development of a Scalable Crowdsourcing Platform for Soil Health Discovery", FFAR ($1,034,444)

2017-22: Co-PI "Reconciling economic and biophysical perspectives on marginal land for sustainable bioenergy crop production", USDA/NIFA ($499,000).

2019-21: PI "COMET-Explorer: A state and regional-scale assessment and planning tool for agricultural soil C sequestration", ClimateWorks Foundation ($230,000).

2019-22: Co-PI "Assessing the Effectiveness of Soil Health Practices in Enhancing Soil Organic Carbon in Maryland", Univ. MD ($161,852)

2016-18: PI "Measurement and Modeling of Soil C Storage and Greenhouse Gas Emissions from Southern Pine Biofuel Feedstocks", Shell Inc. ($622,000)

2016-18: PI "Sustainable Land Management and Climate Change Mitigation Co-benefits", GEF/UNEP ($1,804,800)

2015-16: PI "Addition of Ten Specialty Crops into the COMET-Farm Tool", California Department of Food and Agriculture ($148,000)

2015-18: PI "Maintenance and Enhanced Development of COMET-Farm and Web-Based Tools for Implementation of Agricultural Conservation Practices", USDA/NRCS ($680,000)

2013-18: PI "Biomass Alliance Network of the Rockies (BANR) – Sustainable biofuel feedstocks from beetle-kill wood and other forest biomass", USDA/NIFA CAP program ($10,000,000).

2013-15: PI "Comprehensive carbon metric tools and integrated architecture for environmental product and building declarations", NSF ($800,000).

2014: PI "Analysis of grazing management options using the DayCent model: Support for rangeland GHG mitigation" Marin C Project and Rathmann Family Foundation ($42,000).

2014-16: Co-PI "Greenhouse gas methods development", USDA/OCE-GCPO ($300,000)

2014-17: PI "Whole-farm GHG estimation and environmental diagnostics platform (COMET-Global), FACCE-JPI(EU) & USDA ($150,000).

2013-15: PI "Modeling the soil carbon and GHG flux of sugarcane bioenergy production", Shell Inc. ($177,000)

2012-17: Co-PI "Assessing Water Management Tradeoffs and Targets under Climatic and Land Use Uncertainty", USDA ($1,500,000).

2013-14: PI "Uncertainty, validation and streamlining for COMET-Farm", USDA/NRCS ($328,000)

2013-14: PI "Borlaug Fellow Training Program – Mexico", USAID ($32,000).

2013: PI "Evaluating management opportunities for reducing GHG footprint of corn grain as a feedstock for biofuels: A case study for southwest MN", Huttner Strategies ($16,000)

2013-16: Co-PI "Decision support tools, drought tolerance, and innovative soil and water management strategies to adapt semi-arid irrigated cropping systems to drought", USDA/NRCS-CIG ($882,924)

2012-13: Co-PI "Full accounting of Pyrogenic-C dynamics at the watershed scale: A unique opportunity offered by the High Park Fire", NSF-Rapid program ($197,000)

2011-14: Co-PI " Soils, Land Use and Climate Change: A new Baccalaureate concentration", USDA/Higher Education Challenge ($149,000).

2011: Co-PI "Processor and farm supply specific life cycle assessment of biobutanol in a Minnesota biorefinery: baseline feedstock GHG emissions", GEVO Inc. ($30,000)

2011-16: PI "Decision support tool for integrated biofuel greenhouse gas emission footprints", USDA ($800,000)

2011-16: Co-PI "New tools for soil carbon assessment and greenhouse gas accounting and incentives for mitigation in corn cropping systems", USDA (subcontract from Cornell) ($1,287,000)

2010-14: PI "Developing science-based methods and guidelines for quantifying greenhouse gas sources and sinks in the forest and agriculture sectors", USDA (subcontract from ICF Int'l) ($911,000)

2010-14: Co-PI "Corn Stover Regional Partnership", DOE/SunGrant ($120,000)

2009-13: PI "Carbon Benefits Project: Modelling, Measurement and Monitoring",GEF/UNEP ($2,322,000)

2009-11: Co-PI "Quantifying soil carbon sequestration potential through improved pasture management", EPA ($250,000)

2008-13: Co-PI "IGERT: Integrated Graduate Education in Biorefining and Biofuels", NSF ($2,830,000).

2008-12: PI "Whole farm GHG accounting – COMET-Farm", USDA/NRCS ($1,200,000).

2008-10: PI "Science Support for Greenhouse Gas Mitigation Practices on Colorado Managed Lands", CO Governor's Energy Office ($175,000).

2008-11: Co-PI "Resolving net CO_2 exchange in the mid-continent region of North America", NASA ($1,090,000).

2007:12: Co-PI "US Soil C and N_2O Greenhouse Gas Emission Inventories and Inventory Capacity-Building in Developing Countries", EPA ($1,860,000)

2004-11: Co-PI "CO_2 Fluxes between Agricultural Lands and the Atmosphere: Towards more Complete Accounting by Integrating Remote Sensing with Simulation Modeling", USDA/NASA ($1,100,000)

TEACHING/MENTORING:

Classes as Principal Instructor

Graduate course (SC540) "Soil-Plant-Nutrient Relations", Spring semester (every other year), Dept. of Soil and Crop Sciences.

Graduate course (SC680) "Modeling ecosystem biogeochemical processes", Spring semester (every other year), Dept. of Soil and Crop Sciences.

Graduate course (AGRI/ENGR 680) "Bioenergy Technology" (co-taught with 3 instructors), Fall semester (every year)

Graduate course (AGRI/ENGR 681) "Bioenergy Policy, Economics, and Assessment" (co-taught with 3 instructors), Spring semester (every year)

Graduate student advisor

present Peter Means (PhD) Dept. of Soil and Crop Science, Colorado State University

present Ellie Ellis (PhD) Dept. of Soil and Crop Science, Colorado State University

2018 Trung Nyguyen (PhD) Dept. of Soil and Crop Science, Colorado State University

2018 Preeyarat Chailangka (MSc) Dept. of Soil and Crop Science, Colorado State University

2017 Yao Zhang (PhD) Dept. of Soil and Crop Science, Colorado State University

2017 Jeff Kent (PhD) Graduate Degree Program in Ecology, Colorado State University
2015 Eleanor Campbell (PhD) Graduate Degree Program in Ecology, Colorado State University
2015 John Field – coadvisor (PhD) Dept. of Mechanical Engineering Colorado State University
2014 Kris Nichols (MSc) Dept. of Soil and Crop Science, Colorado State University
2013 Carolyn Hoagland (MSc) Dept. of Soil and Crop Science, Colorado State University
2013 Amy Swan (MSc) Graduate Degree Program in Ecology, Colorado State University
2008 Gabe Olchin (PhD) Dept. of Soil and Crop Science, Colorado State University
2006 Erandi Lokupitiya (PhD) Graduate Degree Program in Ecology, Colorado State University
2006 Cathy Stewart, (PhD) Graduate Degree Program in Ecology, Colorado State University
2004 Karolien Denef (PhD) Univ. of Leuven, Belgium (all research work was done at CSU)
2003 John Brenner, (MSc) Dept. of Soil and Crop Science, Colorado State University
2003 Rudolfo Delgado, (PhD) Dept. of Soil and Crop Science, Colorado State University

Graduate Student Committees

Colorado State University

2016-present, Agustin Nunez,(PhD), Dept. of Soil and Crop Science

2017-2021, Haley Summers (PhD), Dept of Civil and Environmental Engineering
2017-2021, Chenda Deng (PhD), Dept of Civil and Environmental Engineering
2016-2020, Briana Taylor (PhD), Dept of Civil and Environmental Engineering
2016-2020, Samantha Mosier (PhD), Dept. of Soil and Crop Science
2015-2020, Tony Vorster (PhD), Graduate Degree Program in Ecology
2012-2017, Sarah Fulton-Smith (PhD), Graduate Degree Program in Ecology
2012-2020, Ram Gurung (PhD), Graduate Degree Program in Ecology
2012-2014, Jakrapun Suksawat (PhD), Dept of Agriculture and Resource Economics
2013-2014, Jiawei Fan (MSc), Dept. of Construction Management
2012-2013, Biljana Orescanin (MSc), Dept. of Atmospheric Sciences
2010-2013, Grace Lloyd (MSc), Dept. of Soil and Crop Sciences
2010-2014, Barbara Fricks (PhD), Graduate Degree Program in Ecology
2009-2013, Liaw Bata (PhD), Dept. of Mechanical Engineering
2009-2012, Samuel Adams (PhD), Dept. of Agricultural & Resource Economics
2007-2011, Nick Parazoo (PhD), Dept. of Atmospheric Sciences
2007-2010, Rod Simpson (PhD), Graduate Degree Program in Ecology
2006-present, Shannon Spencer (PhD), Graduate Degree Program in Ecology
2005-2008, Michelle Haddix (MSc), Graduate Degree Program in Ecology
2001-2003, Steve Delgrosso (PhD) Dept of Range Ecosystems Science
1995-1998, Johan Six (PhD) Dept. of Soil and Crop Science
1995-1999, Serita Frey (PhD) Graduate Degree Program in Ecology
1996-1999, Romulo Menezes (PhD) Dept. of Soil and Crop Science

Montana State University

2001-2006, Ross Bricklemeyer (MSc) Dept of Soil and Crop Science

Ohio State University

1995-1998, Joann Whalen (PhD) Dept. of Entomology

Michigan State University

1989-1993, Timothy Lynam (PhD) Dept. of Soil and Crop Science
1991-1993, Kurt Patzer (Msc) Dept of Computer Sciences

International

1997 External examiner for PhD dissertation, University of Adelaide.
1998 External examiner for PhD dissertation, Swedish University of Agricultural Sciences.
1998-99 MSc (Thesis project co-advisor) Heleen Bossuyt, Karolien Denef, Steven DeGryze,

Katholieke Universiteit Leuven, Belgium
2003-04 Carlos E. Cerri (PhD), University of Sao Paulo, Brazil
2003-05 Jorge Alvero (PhD), University of Lleida, Spain
2005-06 Marcelo Galdos (PhD), University of Sao Paulo, Brazil
2006 External examiner for PhD dissertation, Royal Technical University, Stockholm, Sweden
2006 External examiner for PhD dissertation, Second University of Naples, Italy
2007-11 Signe Borgen (PhD), Norwegian University of Environmental Sciences, Aas, Norway
2011 Leidivan Almeida Frazão (PhD) University of Sao Paulo, Brazil
2012 External examiner (PhD), University of Wageningen, Netherlands
2012 Carolina Braga Brandani (PhD) University of Sao Paulo, Brazil
2012 Elisa Cocco (PhD) University of Padua, Italy
2013 Daniel Plaza Bonilla (PhD) University of Lleida, Spain
2013-14 Adriana Marcela Silva-Olaya (PhD) University of Sao Paulo, Brazil
2015-16 Zhong Du Chen (PhD) China Agricultural University, Beijing, China
2015-16 Dener Márcio da Silva Oliveira (PhD) University of Sao Paulo, Brazil
2018-19 Junior Damian (PhD) University of Sao Paulo, Brazil

INVITED PRESENTATIONS: 2020

Jan 2020	CO_2 removal through regenerative agricultural soil management, EDF Conf. on "Innovation's Role in Achieving Climate Stabilit"y, San Francisco
Mar 2020	Panel Discussion on Organic Matter/Carbon and Soil Health, Greenleaf conference on "Sensing Technologies and Applications for Soil Health"
Mar 2020	Carbon Farming: Managing soils for CO2 drawdown and agroecosystem sustainability, Webinar for Amer. Resource Conserv. Tech. Initiative on Carbon, Univ. Nebraska
April 2020	COMET-Farm: USA Farm-scale Modeling, CIRCASA EU Webinar
April 2020	Modeling Carbon/Prediction, CSU Industry Consortium
April 2020	Soil Carbon as CDR Strategy, Energy Futures Initiative
May 2020	Thoughts on prospects, barriers and futures for soil carbon solutions, 4 per mille North American Conference
June 2020	Carbon Farming for the Next Millennium, Webinar – Wolf Farming Fast and Slow
June 2020	Unlocking the potential for sustainable land management to promote carbon drawdown, climate resilience and soil health, World Bank Symposium on Innovating Soil 3.0
Aug 2020	Soil Carbon Briefing, Jenna King Foundation
Sept 2020	Carbon Lockdown: Farming Helps Save the Planet, Radically Rural Summit
Sept 2020	Soil Carbon and GHG Accounting Systems: Needs, Challenges and Emerging Opportunities, World Bank Symposium on Carbon Finance
Sept 2020	Why care about soil organic matter?, Society Environmental Journalist Annual Meeting
Oct 2020	Modeling Mitigation and Adaptation Co-Benefits, AgMIP
Nov 2020	Agriculture, soil carbon and climate mitigation – a quick overview, Arrell Food Summit, Guelph Univ., Ontario
Dec 2020	Cutting the Gordian Knot – Reliable, low-cost quantification of CO2 removal and GHG mitigation in agricultural soils, AGU annual meeting
Dec 2020	Soil Solutions for Carbon Drawdown at Colorado State University, NCEC Consortium Annual Meeting

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Total # of citations: 47,405; H index 99, i10-index 255 (Google Scholar, 4/11/2021)

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Keith Paustian (Federally funded research grants during the last 36 months)

2021-24: Co-PI "Leveraging multi-sector partnerships to measure and predict soil health and climate change mitigation outcomes associated with commonly recommended rangeland management practices", Foundation for Food and Agricultural Research/Point Blue ($205,916)

2020-21: PI "Enhancing functionality and use of COMET Greenhouse Gas Assessment and Water Quality tools", USDA/NRCS ($450,000)

2017-21: Co-PI "Decision support to quantify GHG mitigation and ecosystem services from organic production systems", USDA/NIFA ($500,000)

2017-22: Co-PI "Center for Bioenergy Innovation (CBI)", DOE/Oak Ridge National Laboratory ($350,000)

2017-21: Co-PI "Root genetics in the field to understand drought adaptations and carbon sequestration" ARPA-E/DOE ($6,019,238)

2018-23: Co-PI "Emission/removal estimates for the U.S. GHG Inventory's AFOLU Sector and economic analyses and projections", USEPA ($225,000)

2017-22: Co-PI "Reconciling economic and biophysical perspectives on marginal land for sustainable bioenergy crop production", USDA/NIFA ($499,000).

2015-18: PI "Maintenance and Enhanced Development of COMET-Farm and Web-Based Tools for Implementation of Agricultural Conservation Practices", USDA/NRCS ($680,000)

2013-18: PI "Biomass Alliance Network of the Rockies (BANR) – Sustainable biofuel feedstocks from beetle-kill wood and other forest biomass", USDA/NIFA CAP program ($10,000,000).

Truth in Testimony Disclosure Form

In accordance with Rule XI, clause 2(g)(5)* of the *Rules of the House of Representatives*, witnesses are asked to disclose the following information. Please complete this form electronically by filling in the provided blanks.

Committee: Agriculture

Subcommittee: Conservation and Forestry

Hearing Date: 05/12/2021

Hearing Title :

"Title II Conservation Programs: Exploring Climate Smart Practices"

Witness Name: Keith Paustian

Position/Title: University Distinguished Professor

Witness Type: ○ Governmental ● Non-governmental

Are you representing yourself or an organization? ○ Self ● Organization

If you are representing an organization, please list what entity or entities you are representing:

Colorado State University

FOR WITNESSES APPEARING IN A NON-GOVERNMENTAL CAPACITY

Please complete the following fields. If necessary, attach additional sheet(s) to provide more information.

Are you a fiduciary—including, but not limited to, a director, officer, advisor, or resident agent—of any organization or entity that has an interest in the subject matter of the hearing? If so, please list the name of the organization(s) or entities.

Co-founder and co-owner of Soil Metric LLC, a startup company that provides analyses to companies developing low-carbon sustainable supply chains and companies developing carbon market strategies. (However, I am not an employee of the company).

Please list any federal grants or contracts (including subgrants or subcontracts) related to the hearing's subject matter that you, the organization(s) you represent, or entities for which you serve as a fiduciary have received in the past thirty-six months from the date of the hearing. Include the source and amount of each grant or contract.

See separate attachment

Please list any contracts, grants, or payments originating with a foreign government and related to the hearing's subject that you, the organization(s) you represent, or entities for which you serve as a fiduciary have received in the past thirty-six months from the date of the hearing. Include the amount and country of origin of each contract or payment.

NONE

Please complete the following fields. If necessary, attach additional sheet(s) to provide more information.

☐ I have attached a written statement of proposed testimony.

☑ I have attached my curriculum vitae or biography.

* Rule XI, clause 2(g)(5), of the U.S. House of Representatives provides:

(5)(A) Each committee shall, to the greatest extent practicable, require witnesses who appear before it to submit in advance written statements of proposed testimony and to limit their initial presentations to the committee to brief summaries thereof.

(B) In the case of a witness appearing in a non-governmental capacity, a written statement of proposed testimony shall include— (i) a curriculum vitae; (ii) a disclosure of any Federal grants or contracts, or contracts, grants, or payments originating with a foreign government, received during the past 36 months by the witness or by an entity represented by the witness and related to the subject matter of the hearing; and (iii) a disclosure of whether the witness is a fiduciary (including, but not limited to, a director, officer, advisor, or resident agent) of any organization or entity that has an interest in the subject matter of the hearing.

(C) The disclosure referred to in subdivision (B)(iii) shall include— (i) the amount and source of each Federal grant (or subgrant thereof) or contract (or subcontract thereof) related to the subject matter of the hearing; and (ii) the amount and country of origin of any payment or contract related to the subject matter of the hearing originating with a foreign government.

(D) Such statements, with appropriate redactions to protect the privacy or security of the witness, shall be made publicly available in electronic form 24 hours before the witness appears to the extent practicable, but not later than one day after the witness appears.