



SEQUESTERING CARBON IN SOIL

ADDRESSING THE CLIMATE THREAT



Summary Report from May 3-5, 2017 Conference Chantilly, France

Conference produced by Breakthrough Strategies and Solutions

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ENDORSEMENTS



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Disclaimer: This report and the summaries of conversations held at the Chantilly conference do not imply the particular expression of any opinion whatsoever by any given individual or endorsing institution. The mention of specific individuals, agencies and institutions does not imply their endorsement of any specific recommendations included in this report. The report is simply our best attempt to capture the discussions and suggested actions by a range of participants. The content of this document and any conclusions or recommendations that it contains do not reflect the official policy or the views of the organizing or endorsing institutions. Endorsement does not imply that the endorsing organization supports any particular recommendation or position reflected at the conference or in this report. It reflects broad support for building the field of soil carbon sequestration and healthy soils.



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On May 3-5, 2017, some 206 soil carbon experts, farmers, NGO leaders, government officials, private sector leaders, philanthropists, and advocates from thirty-four countries met to explore how to advance soil carbon sequestration (SCS) through agriculture and ecosystem restoration. Participants explored practices for building healthy soils, including critical pathways for scaling up SCS to enhance global food security, strengthen adaptation to climate impacts, and make rapid progress towards carbon removal from the atmosphere. The conference was organized and convened by Breakthrough Strategies & Solutions, a small consulting firm based in Takoma Park, Maryland in close partnership with the V. Kann Rasmussen Foundation, and other philanthropic partners. A planning committee and advisory council helped shape the agenda, invitation list, and participatory approach to the conference design. It was convened cooperatively with the Global Alliance on the Future of Food which held a two-day international dialogue on climate change and food systems just prior to the SCS conference.

Participants explored the technical potential of SCS and broke into tracks on the science, practices, policies, finance, and vital connections that place healthy soils in a larger context of sustainable and rural economic development. There were important debates and conversations on a range of topics, from how to measure and verify carbon in agricultural soils

to effective policy mechanisms that promote SCS practices while also addressing rising inequality and protection of small farmers from the developing world. The conference surfaced vital discussions about the great potential of agroforestry, the possibility of engaging tens of thousands of citizens in ecosystem restoration, and the need to avoid potential unintended negative consequences of placing SCS in a narrow framework rather than as part of a holistic effort to advance healthy soils and sustainable development.

Outcomes include an informal global network of leaders dedicated to building healthy soils as rapidly as possible. Listservs are in place. In the United States, new efforts were sparked to promote SCS at the state policy level, particularly in the wake of the Trump Administration's decision to withdraw from the Paris Climate Accord. Progress was discussed and scalable proposals were considered about how to rapidly build healthy soils and SCS locally and globally. There are ongoing discussions on a range of initiatives, including how to link field trials and demonstration farms with academics and IPCC models for carbon removal through soils. This short report attempts to capture some of the critical debates, conversations, and recommended actions for building healthy soils and scaling up SCS as rapidly as possible.

“We must kick start an upward spiral of soil rejuvenation and preservation that supports carbon sequestration, the economic needs of farmers and the production of Nutritious food for human health.”

- Jennifer Dungait, Rothamsted Research

CONFERENCE RATIONALE AND OBJECTIVES

The world must successfully implement strategies to draw down carbon pollution from the atmosphere and into our soils to have a reasonable chance of avoiding catastrophic climate change while simultaneously increasing resilience and adaptation. Efforts to protect and rebuild our global soils are essential for food security, rural economic development, water retention, and healthy ecosystems in all nations. All scenarios for keeping global temperature change below 1.5°C or 2°C involve carbon sequestration and there is growing awareness that SCS can actually help lower the Earth’s temperature if taken to scale over the next few decades. Agricultural soils, grasslands, and wetlands are significant sinks for carbon if properly managed. The conference had the following objectives:

- Identify and convene influential experts, scientists, practitioners, public officials, and philanthropists to accelerate progress and build the field of soil-based carbon sequestration.
- Showcase research, pilot projects, policies, financial structures, and incentives for hastening adoption of carbon sequestration best and emerging practices.

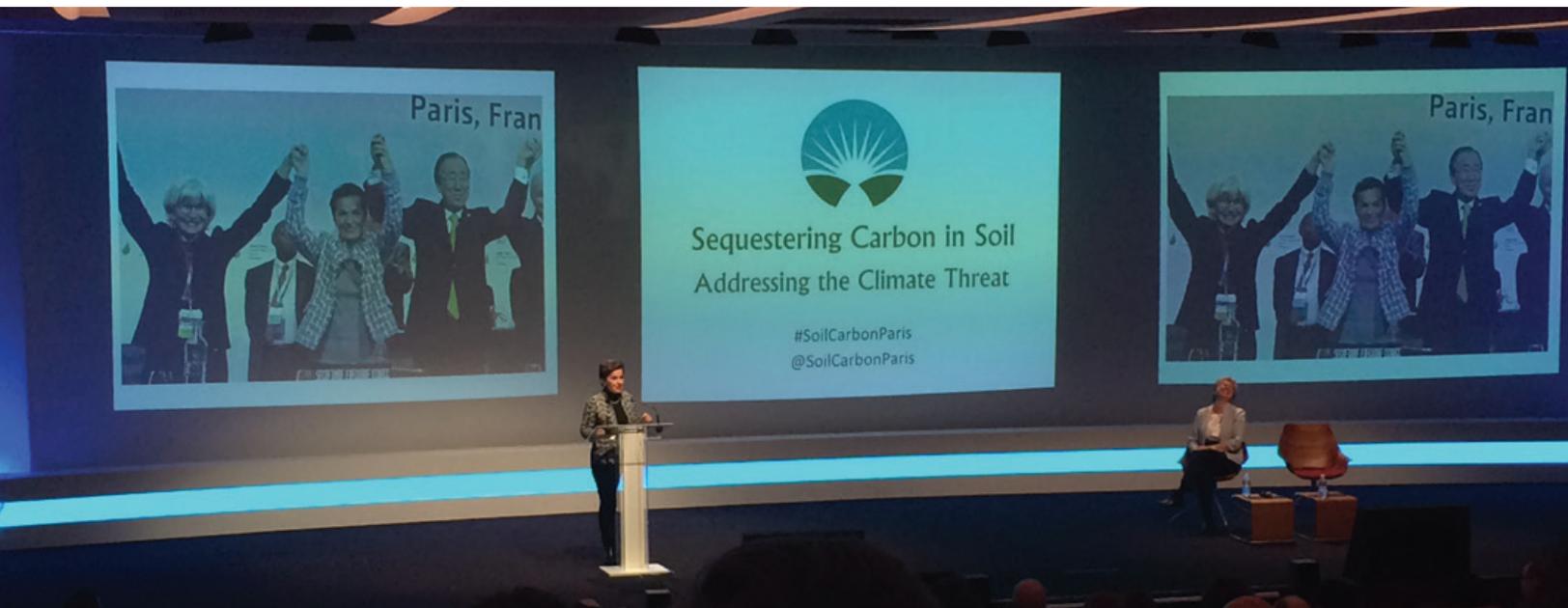
- Explore tangible action plans and initiatives with the potential to help ensure a global carbon budget that keeps global temperature rise to no more than 1.5°C.
- Prioritize systems thinking and a conference agenda that explores the many co-benefits of returning carbon to soil.
- Identify needed next steps for research, policy initiatives, action campaigns and investment opportunities.

SWALLOWING THE ALARM CLOCK

Christiana Figueres, former executive secretary of the UN Framework Convention on Climate Change, under whom the Paris agreement was signed, opened the conference with a call to action. “I invite everyone here to swallow the alarm clock! Avoiding dangerous levels of climate change is still just about possible, but will require unprecedented effort and coordination from governments, businesses, citizens and scientists in the next three years.

“Emissions must peak by 2020. Some say that is impossible but impossible is an attitude, not a fact. Agriculture has a critical role to play, both in dramatically reducing emissions and by providing a sink to draw down carbon from the atmosphere”

-Christiana Figueres, Former Executive Secretary, United Nations Framework Convention on Climate Change (UNFCCC)

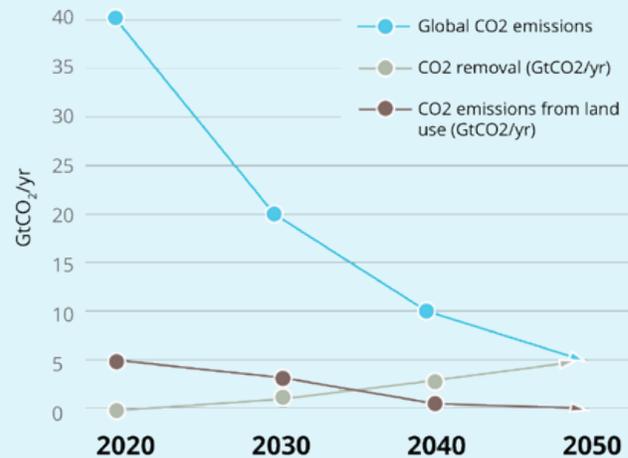


Soil carbon and the Paris Agreement

1. The Paris Agreement requires dramatic reductions in GHG emissions and large scale capture and sequestration of CO₂ from the atmosphere.
2. To achieve such ambitious goals, larger constituencies will need to advocate for climate action around the globe.

Soil carbon projects can help achieve these dual goals.

Global carbon law guiding decadal pathways



From Rockstrom et. al. in Science

Center for Carbon Removal // www.centerforcarbonremoval.org // @carbonremoval

We know enough to get moving. We don't need perfect knowledge; we need to act even as we continue critical scientific research and efforts to measure and verify carbon in the soil." Abdallah Mokssit, Executive Secretary of the IPCC, joined by video and urged the participants to get on with the work of biological sequestration through soils. Kathy Jetnil-Kijiner, Marshall Islands poet, spoke by video and urged participants to recognize the huge difference between 1.5 and 2 degrees of global warming. "At 2 degrees, my islands will be under water."

"We can support this informal global network on SCS while also creating regional networks as part of the bigger network, e.g., Africa, Americas, Europe, Asia, etc."

-Zwide Jere, Total Landcare of Malawi

CRITICAL QUESTIONS

All participants were invited to submit a question in advance of the conference that they considered critical to our discussions. The questions came from nearly 200 participants. The following seven questions were asked most frequently and rose to the top of the group's shared concerns. These questions guided many of the small breakout sessions held on our final day of strategy development.

1. What are best SCS farming practices and how do we help farmers adopt and maintain them?
2. What policies are needed to provide financing and incentives for the adoption of SCS?
3. What are the best approaches to measuring and verifying carbon in soil?
4. How can we scale up SCS while also addressing issues of equity, land access, and sustainable economic development?
5. What scientific research is needed to advance SCS practices and how do we share research and knowledge back and forth between farmers and academics?
6. How do we take SCS to scale as fast as possible?
7. What is the global technical potential of SCS for addressing the climate threat?

FROM ANALYSIS TO ACTION

The conference had five simultaneous tracks as well as breakout sessions on numerous critical topics from pasture and herd management to the importance of addressing food waste and composting. Here are some of the highlights from our conversations along with recommendations for action.

FINANCE

This session explored financial models for accelerating SCS practices, building new markets, and finding the economic drivers to take SCS to scale. There are many ways of financing soil carbon sequestration and a range of financial opportunities and policies were discussed, including private investment, conservation funding, ecosystem service payments, direct loans and grants through development banks and agencies, tax incentives, carbon market offset payments, philanthropy, and partnership with key retail chains dedicated to carbon neutrality. A focus on soil fertility and increased yield were also considered essential – increasing revenue for farmers.

Financial needs and approaches will vary according to local contexts. Some argue strongly that the only way to scale SCS is by building demand through public mandates and policies and private stakeholders such as carbon market traders or retail chains dedicated to emissions reductions. Finance is needed to scale up quickly to cover the cost of new equipment, labor, and early economic risks that some farmers and ranchers may face when transitioning their practices. Engaging climate friendly companies is one step that several are pursuing – urging these companies and corporate networks to provide support to farmers and programs helping farmers sequester carbon in soil. Many contend that farmers should and must be compensated for carbon accumulation in soil, at least during a period of transition in practices. Others suggest that some farmers and ranchers will voluntarily shift practices once the co-benefits are evident; they claim that increased yield and improved water retention are motivation enough. Some ranchers in drought ridden parts of the United States and Australia and small farmers in Ghana, for example, have adopted practices without significant financial incentives. Still, financing is needed, at a minimum, for demonstration farms, extension service support, and farmer to farmer training in SCS practices.

“Farmers will change their practices if there is a support system to ensure they will not go broke in the process”

-Graham Christensen, GCRsolve

There is strong interest in looking at existing subsidies and payment programs to see if they might be adjusted to reward carbon sequestration practices. The entry points for these shifts might be through a focus on water, biodiversity, or improving soil fertility rather than overtly on carbon mitigation. In the United States, there was discussion of taking current land easement financial structures and tweaking them to support ecosystem services more broadly, including SCS. Others are focused on opening up the power of private equity, building new kinds of value and quantifying the carbon benefit of certain farming practices. Quantification of carbon benefits combined with verification of carbon in soil over time could help build private investment in long-term soil restoration. In this context, pro-climate companies might pay for ecosystem services where farmers and ranchers are paid for performance. This model is moving forward in Canada with support from ALUS.

Margarita Astralaga, Director of IFAD's Environment and Climate Change Division, played a critical part in the discussions and spoke to the need for support of small farmer holders in least developed and middle-income countries. IFAD invests 1.2 billion dollars annually in developing countries, reaching about one-fourth of the poorest smallholders around the world through loans and grants. IFAD has the largest climate adaptation program for smallholders in the world focusing on food security and nutrition but often with co-benefits for climate mitigation through building healthy soils.

Many in the finance track argued that we need a robust price on carbon. They maintained that this is the only viable way to scale up SCS quickly. Others were skeptical about offsets. In theory, carbon offsets facilitate low-cost emissions reductions. In practice, many offsets have been unverifiable or over-valued. Carbon markets have been mixed to date with persistently low prices for carbon. Some feel sufficient revenue would be secured more efficiently through a different pricing mechanism such as a carbon tax rather than a trading system.

Much of the conversation on finance focused on demonstrating returns and benefits. If we can demonstrate that SCS practices help with mitigation, adaptation, biodiversity, water management and the improved economic security of farmers and rural communities, we can attract

more public and private investment. This is one of the highest priorities in the coming few years. Philanthropy has a role to play – demonstrating the potential of SCS through demonstration projects, field trials, state and provincial policies, and farmer-to farmer training programs.

Recommended Actions:

- Develop a Soil Carbon Prospectus for climate friendly companies and impact investors, showing how to invest in this field.
- Work with foundations, development banks and IFAD to demonstrate SCS success stories in order to attract additional public and private investment in healthy soils,

especially in less developed nations and in high priority soil carbon landscapes.

- Invest in a powerful pitch or presentation to private sector forums and begin to engage impact investors willing to accept low returns with multiple co-benefits.
- Create a branded program urging companies to compete in their support of drawing carbon out of the atmosphere through support of farmers. Put faces on this campaign, helping the public learn more about the importance of healthy soils.
- Prioritize work with community-based finance with groups like Root Capital, helping small peasant farmers get small loans and grants to transition to climate friendly practices.

SCIENCE

This session reviewed the research and data behind several SCS practices and what the science is telling us. Participants explored important questions about how to build soil health and maximize the potential of SCS over time. There was strong agreement that soil organic matter is a strong overall indicator of soil health and that there is significant potential for soil carbon sequestration through agriculture and ecosystem restoration (as well as afforestation and reforestation though these strategies were not a primary topic of the conference.) Some argued that we need more granular data and higher confidence in the potential for SCS and that we must distinguish carefully between existing C stocks and actual newly sequestered C.

The estimates on the potential of SCS globally varied in part depending on assumptions about what practices would be included, depth of soil measured, and proxies used for measurement or estimates of carbon in soil. There was not uniform agreement on the quantification of global carbon fluxes or the potential of SCS but there was agreement that the potential is measurable and significant and that policy makers should not be paralyzed by the need for perfect measurement. Dr Rattan Lal of Ohio State suggested in opening remarks that it is possible to restore about 66% of the soil carbon depleted through historic land use and management within 25-50 years by adoption of a restorative land use and best management practices (BMPs). Lal reported that global potential for SCS from all soils (through restoration of degraded, salinized, and afforestation of marginal lands, effective erosion control, and adoption of BMPs on agricultural soils) is in the range of 1.2-3.1PgC/yr. (A gigaton of C(1 GtC) is the same as petagram of carbon (1PgC)). Dr. Jean-Francois Soussana of INRA and the 4 pour 1000 Initiative suggested that the global technical potential for SCS through agriculture is 1.8 PgC with an additional technical potential of 2PgC from forested soils and 0.9 from restoration of desertified soils. Others in the group felt that the potential could be higher if global assessments of potential included newer emerging research results on a broader range of practices as well as older methods such as Zai practices using microcatchment systems based on small pot holes around each plant, an ancient practice highlighted at the conference by Pr. Tantely Razafimbelo from Madagascar.



“There are many levers for increasing soil carbon in soil, from cover crops and reduced tillage to agroforestry and careful management of grasslands and use of organic wastes. Soil carbon sequestration is not a silver bullet, but it is essential and we should get moving with timely initiatives.”

-Claire Chenu, AgroParisTech



This track called for both an urgent and holistic approach to soil, looking not just at climate mitigation and adaptation but at the larger issues of food security, water retention, biodiversity support, and rural economic development. This call for moving quickly to draw down carbon in soils using a systems approach was echoed by those in other tracks. There was also strong interest in improving science based communications to make this field more accessible to policy makers and the general public. Perhaps more important, the group discussed the centrality of farmers and ranchers and the need to provide farmer friendly tools and education rooted in science but with practical application for farmers – both for peasant farmers and those engaged in export commodity crops and herd management. In general, there was a strong conviction among most participants that farmers must be supported with education, decision-making tools, and financial payments. The notable scientists in this track recommended some kind of forum or platform for ongoing discussion of the many issues and challenges embedded with the field, from field/academic data sharing to review of emerging data on compost applications, perennial crops, deep-rooted crops, agroforestry, and carbon at greater depths of soil. Time was also spent looking at the essential questions about measurement and durability of sequestration and how to move forward on this as fast as possible with transparency yet also sufficiency – not waiting for perfection. Some also urged a greater focus on developments that might undermine the potential of SCS, such as fires or failure to maintain SCS practices over time. Still others urged a greater prioritization of hotspots, effective mapping of soil stocks to establish acceptable baselines in C measurement and a commitment both to citizen engagement with science yet also to acceptable standards of scientific rigor. The group called for prioritization

of high carbon soils, a uniform proxy or measurement tool that could be used globally, and prioritization of an ongoing research agenda rooted in open and shared data.

Recommended Actions

- Create a uniform measurement method or proxy for soil carbon globally.
- Define a science based set of indicators for farmers to help them know when they are succeeding at building healthy soil and advancing soil carbon sequestration.
- Launch demonstration farms and pilot projects in at least 1/3 of all countries.
- Develop educational tools for policy makers, farmers, investors, and educators.
- Build collaborative research platforms and tools on healthy soils and SCS involving government, private sector stakeholders, farmers and NGOs.
- Protect ecosystems with high organic carbon (peatlands).
- Develop user-friendly tools to help farmers and policy makers with decision making.
- Create a forum for ongoing scientific discussion and collaboration.
- Work with an informal international network of scientists and farmers to establish a set of priorities for the next twelve months and move these recommendations to the IPCC, UNFCCC, and influential decision makers.



POLICY

This track explored strategies that utilize policy as a tool to advance SCS in agricultural systems. The group discussed the political landscape, policy initiatives at the provincial, federal, regional and global level, current challenges, and future opportunities to promote SCS as a key climate solution.

The group felt that progress had been made with programs and policies promoted by the European Union, California, the 4 pour 1000 initiative, Finland, and other regions and countries including parts of Africa and Latin America. The best policy initiatives include built-in efforts to quantify results, engage farmers in meaningful ways, emphasize a suite of benefits beyond just SCS, restore degraded lands, and include tools for education and carbon measurement. To hasten the wide-scale adoption of SCS practices, policies must reward a broader set of outcomes, including tangible yield increases, drought resistance, and improved resilience.

The Healthy Soils Initiative (HIS) in California was discussed extensively and hailed as a promising policy that has the potential to engage agricultural stakeholders in climate policy. Several participants praised the incentive-based design and the focus on farmer to farmer networks. Some raised concerns that the program may not have longevity without a commitment of longer term financing for ranchers and farmers. A significant challenge with the program has been the limited capacity for integrating data collection and research to help demonstrate the value of expansion of the program and replication of SCS practices.

“Carbon sequestration is the solution for sustainable agriculture, food security and mitigation of ghg emissions”

– Tantely Razafimbelo, University of Antananarivo

The group identified several challenges and obstacles including limited financing for soil health, lack of knowledge about SCS and soils, the influence of large agribusiness interests over many governments, existing agricultural subsidies for damaging farm practices in most regions of the world, the lack of policy frameworks designed to protect small farmers and indigenous communities, and insufficient capacity to demonstrate and communicate policy success stories. The growing political and economic tension between urban and rural populations is another challenge. The group explored how best to make climate change and SCS a salient issue for rural communities and policy makers. Some pointed to rural and farmer skepticism in some regions about climate

disruption, and the need often to approach farmers and rural communities not explicitly on carbon sequestration but through the benefits of healthy soil practices for water management and resilience.

Despite these challenges, the group felt a growing momentum in part due to the 4 pour 1000 and the COP 21, the California Healthy Soils Initiative, the FAO Year of the Soils and the linkage between healthy soils and Sustainable Development Goals (SDGs). Non-traditional financing and voluntary initiatives added a sense of forward movement.

All participants seemed to agree that policy tools must include “carrots and sticks” – both penalties and incentives and payments. Agriculture is a source of pollution and must be regulated on this front. But it can also be a source of carbon drawdown and farmers need resources to help them make transitions in practices. There was also strong agreement that we need a detailed and compelling global analysis of taxpayer subsidies that currently reward bad practices and undermine our ability to promote healthy soils.

Recommendations

- Do a comprehensive global analysis of harmful existing subsidies to bad farm practices; communicate these findings in creative and high-impact ways.
- Take a systems and multi-stakeholder approach; promote a policy agenda that will promote economic development, jobs, water protection, soil health, resilience, food security, consumer health, carbon mitigation and other social and environmental benefits.
- Document and elevate successful SCS practices and demonstration farms.
- Create an awards program to promote positive policy initiatives – an “X Prize” for SCS.
- Create short policy papers and briefings for key decision makers to help them understand and promote SCS. Document and elevate farm practices that promote SCS and other co-benefits.
- Advance policies that will help the field get to scale and incorporate acceptable data collection and verification of C in soil.
- Explore how to modify existing rules and policies to promote SCS and healthy soils.
- Promote policies that establish farmer to farmer training and financing programs; support expansion of extension service financing and support programs for farmers.

- Move policy proposals in the context of a larger communications and advocacy campaign to motivate farmers and elected officials to embrace SCS as part of a rural economic development and jobs creation agenda.
- Continue to advance policies directed at stopping deforestation, land conversion, degradation of land and disruption of high carbon lands.

PRACTICE



“We need demonstration farms, farmer to farmer mentoring and training programs, and financial support to build healthy soils and sequester carbon as quickly as possible.”

-Kofi Boa, Center for No-Till Agriculture

This track explored what success on the ground looks like for SCS. The group identified many challenges and opportunities for advancing healthy soils and SCS practices. In general, this group felt that most farmers and ranchers are not focused on healthy soils and that a majority knows nothing about SCS. Reaching these farmers will require an approach rooted in local values, language, concerns, and relationships. At the same time, a growing number of farmers are well aware that building up soil carbon and organic content is one key to achieving high yields without chemical inputs.

Participants in this track felt that markets often promote bad practices and that it can feel like an uphill battle for farmers to do the right thing without any solid support or financing. To achieve broad change will require a change in the way markets and financial subsidies are set up. Farmers in the North and South need financing, scientific support, and social networks for peer-to-peer learning and sharing.

Practices obviously vary depending on climate, soil, markets, and cultural influences. There is no silver bullet or single practice. Instead, many in the group argued for a set of guiding principles that would inform practices across differing landscapes and cultural contexts. How do we establish principles that promote practices with many co-

benefits? Many practices were featured in the track including conservation farming/reduced tillage, cover crops, crop rotation, compost application, silviculture, multi-tiered cropping, integration of trees, animals and crops in a single system, organic farming, avoided conversion of native ecosystems, perennial crops, biochar, pasture management/ holistic grazing, manure application, rice paddy management, improved fallows, and strip intercropping. For an overview of many practices and a graph showing potential impact please visit the resource section of our website and read Eric Toensmeier’s paper titled The Biosequestration Toolkit. (www.breakthroughstrategiesandsolutions.com/resources)

The group placed a major emphasis on the need for farmer-to-farmer sharing and on the need for programs that provide education, rewards, and financial support to farmers. There was concern that much of the conversation and suggested policies and practices have been framed by consultants and academics based in the North with ties mainly to large-scale industrial agriculture. There was a widespread sense that SCS must be framed with relevance and support for medium and large farmers but also for the hundreds of millions of small and peasant farmers who are struggling for food security, resilience in the face of a changing climate and global economy, and whose involvement with SCS could play a pivotal role in mitigating carbon emissions. Some also focused on incorporating practices into urban and rural gardens.

“The community has frequently been hampered by arguments about whose practice is best and whether there’s sufficient evidence for those practices. Focusing on scaling up adoption in the field of several different candidate practices while also being rigorous about measurement and verification is essential. This network can do that and should do that.”

- Dan Kane, Yale University

Recommendations:

- Identify the “lighthouse” farmers from various parts of the world who are outstanding agroecological and SCS farmers. Reward these practitioners and promote their stories.
- Create platforms for sharing knowledge and practices among farmers, locally, regionally and globally. Facilitate mentoring and peer-to-peer learning.
- Make sure policy frameworks and carbon markets are designed to include and protect small farmers/ensure land tenure and land access .
- Work with soil mapping groups to identify degraded lands that could be put into new management to build soil carbon content. Support ranchers and farmers with financing and ecosystem service payments for rebuilding soil.
- Host a summit of agroecological leaders, farmers and NGO groups to promote agroecological approaches to SCS and rural communities.
- Develop a plan to work with enlightened companies that might support and provide ecosystem service payments to farmers.
- Develop a communications campaign that exposes the harmful subsidies and the human health effects of bad farming practices; combine this with a positive campaign about the benefits of healthy soils and soil carbon.
- Build the political influence of farming communities working with religions, cultural, and community based networks of rural stakeholders.
- Get more people back to the land, both in urban and rural settings.
- Create a network of all the farmers who attended the conference and ask each of them to bring in two or three others. Build a strong social and communications network among farmers, including a mentoring program.

VITAL CONNECTIONS

This track identified concerns and strategies to ensure equity, land rights, and social justice within the framework of soil carbon sequestration. Participants in this group represented a breadth of stakeholders, including indigenous pastoralists, peasant leaders, policy advocates, scientific researchers, philanthropists, and compost promoters. The group especially attended to the realities and needs of small and peasant farmers. SCS must take place in a larger context of food security, respect and support for indigenous farmer knowledge, and agroecology versus the dominant development narratives that lock farmers into chemical agriculture.

“The voice of ordinary people and local experts must also be heard, especially often neglected people like indigenous people”

-Phrang Roy, Former Assistant Secretary General of the UN

The discussion ranged across a number of key themes. Prominent amongst these was a concern that soil carbon sequestration will be another corporate-industrial strategy that



benefits big corporate agriculture rather than truly benefiting small producers. Many participants considered ways of resisting this agenda, including through farmer organizations, consumer mobilization, and scientific research. Soil carbon sequestration was questioned as a criterion too narrow on its own, while additional metrics and indices were recommended to ameliorate this. The group felt it was essential to take a more holistic approach to healthy soils including a focus on adaptation to climate impacts, food security, sustainable development, agroecology, and job creation.

In the context of making important connections, the group also explored the circular economy and in particular the fate of urban organic wastes and efforts to divert these from landfills to food-grade compost. This harvesting of waste to build soil was considered vital for all the outcomes stated above. There was also talk of linking healthy soils and SCS to public health and food security. In general, this group was the lead track in making many connections, including those referenced below – both as potential threats and as potential opportunities. The group was especially concerned about carbon markets and the potential for unintended consequences from land grabs and corrupt use of offsets. In many countries, including some of the developed nations, offsets have not worked and in fact led to displacement of indigenous communities through programs like REDD+. There was significant concern about SCS masking a corporate power grab of land, resources, and tax payer subsidies to benefit agribusiness interests while creating more threats to small farmers and land holders. Many called for a statement of principles to guide SCS and others urged a fundamental reframing of SCS to focus more broadly on agroecology and healthy soils to advance adaptation as much as mitigation. (See appendix of this report for a statement issued by several members of this track.) To preclude cooptation by large corporate interests, many in the group called for an open source platform and programs to help farmers share knowledge, practices and support across national boundaries. Others urged inclusion of data collection and research to demonstrate the SCS benefits of agroecological practices (many of which are identical to SCS practices.) Others urged attention to global trade policies that advance harmful subsidies and policies that hurt small farmers and inhibit SCS. There was also a call to strongly oppose any expansion of fossil fuels and to link SCS to a complete transition away from dirty energy. Some worry that SCS could become an excuse for continued burning of oil, coal and gas.

The group looked at the importance of educated and enlightened consumers and investors as drivers of agro ecological farming. How do we link farmers, investors, procurement officials and consumers to build new markets across the world in support of small farmers and rural communities? Can this also promote SCS? Likewise, some looked at the labor implications of SCS as a negative – as causing farmers more costs, but others and most in this group see SCS and a healthy soils agenda as a pathway for job creation and rural economic development.

Recommendations:

- Draft a declaration of principles to guide SCS policies and programs.
- Launch a world-wide consultation with farmers associations about SCS; provide access to knowledge and training for adoption of best practices.
- Create a virtual network and community among small farmers and their associations; develop actions and seek finance together to advance SCS.
- Research the lessons from REDD+, draft a statement of principles, and mobilize movements that cut across issues. Promote alternative financing schemes to provide support for small farmers in less developed countries.
- Build more local markets through farmers' markets and school feeding programs to build demand for food from farms building healthy soils; build public awareness and consumer support for small farmers and agroecological practices that build soil (radio programming, festivals, consumer education).
- Develop positive case studies about small farmers engaged in SCS practices and communicate those stories and studies to policy makers and consumers.
- Capture food waste for compost in all nations.

“The focus of our discourse, debates and actions should be on transforming our food and farming systems away from industrial agriculture and towards community-controlled and locally adapted agroecological approaches - that in the end will lead to carbon being sequestered in the ground and to more resilience.”

- Lili Fuhr, Heinrich Böll Foundation



“Existing land management strategies have the potential to measurably reduce global temperatures by the end of the century, but only with wide spread adoption coupled with aggressive emissions reductions.”

- Whendee Silver, University of California, Berkeley

The 2015 Paris Agreement requires dramatic reductions in GHG emissions and large-scale capture and sequestration of CO₂ from the atmosphere. Afforestation, reforestation, bioenergy with carbon capture and storage, direct air capture, and biochar have received significant attention through the UNFCCC and IPCC processes, but agriculture’s broader role as a potential sink has only recently gained widespread consideration. This may be due to agriculture’s role as a source of emissions as well as ongoing review of best practices, measurement and verification tools, and assumptions about the potential scale and speed of adopted new practices. There are also important debates regarding financial incentives to farmers, measurement of carbon in differing soil depths and types, and legitimate differences in estimates about the global potential for SCS through agriculture based on diverse socioeconomic, cultural, and policy contexts. Estimating potential is also contingent on good mapping of existing stocks and development of accurate baselines. The push for answers is intensifying.

Conference participants explored the technical potential of soil carbon sequestration (SCS) through agriculture in a pre-conference webinar and throughout the conference in numerous plenaries and break-out sessions. What is the science telling us about soil’s ability to pull carbon pollution out of the atmosphere? What estimates should we use to assess the potential of soil carbon sequestration?

Agricultural mitigation must include consideration of four key factors: 1) reducing emissions from agriculture; 2) sequestration of carbon in soils and aboveground biomass; 3) climate change adaptation; 4) avoided deforestation through sustainable intensification of yields. Many conference participants also noted the vital need for reduced beef consumption and reduction of food waste as two essential components of any food system mitigation effort.

The pre-conference webinar featured the following experts on the technical potential of soil carbon sequestration

Jean-François Soussana,

Vice-Chair of the French National Institute for Agronomical Research, Co-Chair of the Integrative Research Group of the Global Research Alliance on Agricultural Greenhouse Gases and a leading scientific adviser with the global 4 per 1000 initiative which was launched by France during COP21.

Keith Paustian,

Professor of Soil Ecology at Colorado State University who previously acted as coordinating lead author of the IPCC program on agriculture and national greenhouse gas inventory

methods. His expertise is in soil organic matter dynamics, carbon and nitrogen cycling, and assessment of agricultural mitigation strategies.

Eric Toensmeier,

Author of *The Carbon Farming Solution: A Global Toolkit of Perennial Crops and Regenerative Agriculture Practices for Climate Change Mitigation and Food Security*. He is an appointed lecturer at Yale University. His area of expertise is agroforestry and perennial crops.

The May 3-5 conference included presentations by numerous scientific experts including Kofi Boa, Deborah Bossio, Claire Chenu, Ping He, Christine Jones, Rattan Lal, Suzanne Lutfalla, Maria Rosa Mosquera Losada, P.K. Nair, Keith Paustian, Tantely Razafimbelo, Whendee Silver, Jean-Francois Soussana, Richard Teague, Ronald Vargas, and others.

Some highlights from the discussions include:

- All participating experts agree that it is possible to remove significant amounts of CO₂ from the atmosphere and store it as organic carbon in soil.
- Existing carbon-friendly management practices applied to large land areas can detectably reduce global warming
- The range of technical potentials that have previously been estimated for agricultural lands (cropland and grassland) have been in the range of 3 to 8 gigatons or petagrams of CO₂ annually. To put this in context, one gigaton or one Pg is equivalent to one billion tons. In order to stay below the globally agreed upon limit of 2 degrees C of average global warming and strive to stay below the more ambitious target of 1.5 degrees C, we must as a global community both reduce emissions from fossil fuels and other greenhouse gas sources and remove carbon dioxide from the atmosphere, through forestry, agriculture, land restoration, and possibly various industrial methods. By 2030, a gap of 12 billion tons CO₂e will prevent the world from reaching the targeted +2 maximum global warming threshold. Soils have a critical role to play in closing this gap. "(See Whendee Silver's presentation in the resource section of our website: <https://www.breakthroughstrategiesandsolutions.com/resources>)
- The 4 per 1000 target of 3.4 GtC/ yr in soil carbon sequestration is the sum of agricultural soils (1.4 Gt C/yr), desertified/salinized soils (0.9 GtC/yr), and forest soils (1.1 GtC/yr). 4 per 1000 is an important platform for engaging governments and major institutions in support of SCS.
- Some experts at the conference argued that the potential for SCS is greater than prevailing current estimates indicate. They focused especially on soil biology, fungi, and on the need to dramatically reduce the use of chemical fertilizers, pesticides, tilling, and practices that damage soil health. They argue that too little attention has been given to the biology rather than chemistry of soil and too many of the global models assume an industrial agricultural model.

- Carbon sequestration in soils is not inherently permanent; if the practices that lead to the increase in soil carbon are not maintained, then the previously stored carbon can be lost again as CO₂. Increases following a management improvement are for limited duration, typically on the order of 20-30 years, as the soil approaches a new equilibrium level. New work on biochar amendments to soil, deeper-rooted crops, perennial crops, green manure, numerous agroforestry practices, and compost applications may add to the possibility of longer term sequestration. But in general, to keep the increase of soil C in the ground, the improved management practices that gave the increases must be maintained over time.
- There are limits on the total amount of sequestration that might be achieved through agricultural soils. Soils can reach a saturation point. Further, adequate N and P supplies are needed to form the stabilized soil organic matter that contains the bulk of soil carbon. We do not yet have adequate data on this but it is important to note this emerging analysis.
- Reimagining organic waste streams, reimagining fertilizers, and focusing on a circular economy may significantly increase the potential for SCS through agriculture.
- The potential for agroforestry for small land holders holds more promise than is currently reflected in some of the Intergovernmental Panel on Climate Change (IPCC) estimates for soil carbon sequestration.
- Preventing SOC losses from carbon-rich soils such as peatlands, permafrost and black soils is a priority.
- The technical potential for soil C sequestration is large enough to be worth pursuing aggressively. We must now focus on developing the tools and infrastructure to help promote actual implementation of soil C sequestering practices and providing the incentives to farmers and ranchers to increase and maintain their soil organic carbon stocks.
- Some experts express strong concerns that those who over-state the potential of SCS are damaging the field with claims and research that have not been peer-reviewed. Others argue that some of the more aggressive claims on SCS have not been published because the field trials are outside current norms for SCS storage data and are rejected for publication for this reason. Investments in replicable field trials are needed to help settle this debate. In the meantime, nearly everyone at the conference agreed that we should move forward to accelerate adoption of SCS practices. Perfect knowledge and precise estimates of potential are not essential. We know we must act with great urgency and with a focused attention to sustainable development needs.



AGROFORESTRY

A presentation by Dr. P.K. Nair and Dr. María Rosa Mosquera Losada provided insight into both the realized and potential ability of agroforestry systems to sequester carbon in soils. Their presentations served as a framework for a discussion that focused on the true potential of this strategy.

There was consensus around the notions that (1) there must be a comprehensive shift from single species systems to multi species systems across the agriculture industry and (2) agroforestry systems (AFS) have significantly higher SC potential than single species systems.

However, several questions/comments were centered around what the group largely agreed was an obvious challenge. Despite these benefits (especially in Africa) and many years of research and investment, why aren't AFS adopted at greater levels? Several members of the group argued that high labor demands limit farmers/producers from implementing AFS and that improving adoption rates would require mitigating these demands. Several others argued that high labor intensity is a good thing as it promotes economic prosperity and much-needed employment and that an effective SC strategy involving AFs would fulfill these labor demands rather than seek to eliminate jobs or push low-wage labor.

There were several challenges and opportunities the group identified in terms of moving AFS forward as a SCS strategy.

Recommendations:

- Convene a webinar or meeting to explore options for meeting the need for farm labor so that AFS can be scaled up (demonstration projects using impact investment, crowd source funding, ecosystem service payments, development financing).
- Prepare a report on how to meet the need for labor, capital, and seedlings that limit farmers working with AFS.

- Create/support markets to sell the products produced in AFS.
- Provide technical and financial support to farmers so that they can actually implement AFS and learn more about multi-species and tiered farming practices that maximize SCS and food security.
- Identify and communicate the many ecosystem services provided by AFS and include a financial calculation of what payments should be considered to benefit the farmers providing these services.

ROTATIONAL GRAZING AND GRASSLAND MANAGEMENT

This session looked at managed grazing to regenerate soil health and sequester carbon. Speakers included Esther Park, Dr. Richard Teague, Dr. Ping He and Max Purnell. This group discussed research demonstrating that multi-paddock grazing improves vegetation, soil health and animal production relative to continuous grazing. Improved grazing management can help increase the amount and quality of rangeland grasses and lower the carbon footprint as well. According to Teague, adaptive multi-paddock grazing is a more effective form of rotational grazing in which one paddock is grazed at a time while other paddocks recover and livestock numbers are adjusted as needed to match available forage as conditions change. This method of grazing has been shown to sequester more soil carbon than the traditional continuous grazing.



Dr. Ping He spoke of grassland restoration efforts in China. There are 400 million hectares of grassland in China in various stages of degradation. China has been working since 2003 to restore its grasslands by limiting grazing, establishing fencing, reseeding areas of the country, and conducting research and pilot projects on rotational grazing. There is growing interest in China in bio-sequestration through agriculture and grassland restoration.

New Zealand has a growing understanding of the need for healthy soils and holistic management of grasslands and grazing. New Zealand has a good history of rotational grazing. Max Purnell spoke of progress with SCS and the need to integrate grazing management with other interventions such as the addition of diversity, e.g. chicory, plantains, and trichoderma to broaden the underground fungal network and speed photosynthesis. Max also challenged the “shallowness” of soils modeling and pointed to the need for scientific modeling that can assess and measure biological processes and carbon storage at greater depths of soil.

More research is needed to fully understand the carbon sequestration potential of multi-paddock rotational grazing and of cows more generally. Ruminants, particularly beef cattle, are perceived by many as a problem since they are a source of greenhouse gas (GHG) due to the methane produced by rumen fermentation. Panelists argued that ruminants such as cows, buffalo and sheep emit methane, but it only becomes a problem when livestock animals are managed industrially and intensively - outside of nature’s inherent ability to absorb these gases.

Project Drawdown lists managed grazing as the 19th out of 100 most important strategies for addressing climate change. This session focused on the carbon gains but also the many other co-benefits of restoring grasslands through careful management of cattle.

PROJECT DRAWDOWN: A FULL SYSTEMS APPROACH

This session focused on the 2017 release of *Drawdown: The Most Comprehensive Plan Ever Proposed To Reverse Global Warming* edited by Paul Hawken. Project Drawdown’s Research Director Chad Frischmann provided an overview of the 100 solutions for reversing global warming and focused primarily on those interventions aimed at: 1) replacing existing energy infrastructure with renewable sources; 2) reducing consumption by technological efficiency and individual choices; and 3) sequestering carbon in plant biomass and soils. Frischmann argued that stabilization at 4, 2, or even 1.5 C is a gamble with uncertain impacts to our ecological and social systems. Rather, a new target was required that set drawdown as the only sensible goal for humanity. Some of the top solutions in a list of 100 came as a surprise: #1 refrigeration management, #2 wind turbines, #3 reduced food waste, #4 plant-rich diet, and #5/6 educating girls and family planning. The food sector as a whole showed more potential for impact than the energy sector, with eight of the top 20 solutions related to food consumption and production. Sequestration of carbon through agriculture and forestry is essential to our success, but it takes the combination of mitigating emissions and sequestration to achieve drawdown.

Recommendation:

Adopt a holistic understanding of solutions to climate disruption and begin rolling out these solutions as fast as possible, to promote sustainable development, food security, resilience, and mitigation of the climate threat.

GLOBAL LAND STRATEGIES

This session provided a global perspective on SCS through agriculture. Deborah Bossio and Justin Adams from the Nature Conservancy, and Lucas Urbano from Danone Brasil provided case studies to demonstrate pathways for enlisting farmer support for SCS.

At the heart of the group discussion was a debate regarding the objectives land management strategies should prioritize. Should ecological services or productivity be the function these systems favor? There was largely agreement on the notion that ecological function is more valuable than productivity but also recognition that economic systems highly favor productivity. The challenge is clear, how do we incentivize/create markets that support farmers and functional ecosystems? And in continuation, how do we sustain these types of farming systems in perpetuity when the amount of carbon sequestered will incrementally slow down and eventually plateau. Some notable challenges inhibiting adoption/effectiveness of SCS practices included (1) staying up to speed with current research, technologies, and measurement systems, (2) harmonizing with carbon accounting methods, (3) defining best practices, and (4) tracking results.

Recommendations:

There is a need to create transitional incentives for farmers to adopt SCS practices. There also needs to be more monitoring once practices are implemented. Lastly, there was a stated need for a global network for knowledge and resource exchange.

Focus on the important questions including these:

1. If we could implement soil carbon enhancing practices on agricultural lands, where can we realize the greatest soil carbon sequestration? What agricultural lands have the greatest SCS potential?
2. How do we create the networks that engage and support enough farmers to achieve sufficient levels of carbon sequestration?
3. With our global analyses are we underestimating the potential for SCS in particular geographies?
4. How do we sustain incentives to sequester carbon in perpetuity (since current estimates are that highest levels are sequestered in the beginning)?
5. How do we foster carbon positive strategies? How do we engage supply chain farmers to adopt those strategies?

DEFINING SOIL SEQUESTRATION AS A FIELD

“Soil Health” versus “Soil Carbon”:

This break-out looked at how to communicate to build the field. Participants explored how best to reach a broad and receptive audience, including in conservative rural communities. Participants suggested that focusing on soil health rather than soil carbon would be more effective as an over-arching frame for this field. In many places, climate change and carbon sequestration have little resonance or worse – they face hostility. “Carbon” lacks a connection to SCS benefits like farmer economic well being, water retention, and crop security. Furthermore, messaging needs to be tailored to specific audiences, to showcase successful practitioners and case studies, and somehow must tie into a virtual network that pools resources and like-minds. Soil health is a term that is both qualitative and quantitative, thereby bridging science to society. By focusing on soil health, we’ll get further.

Soil Health Education:

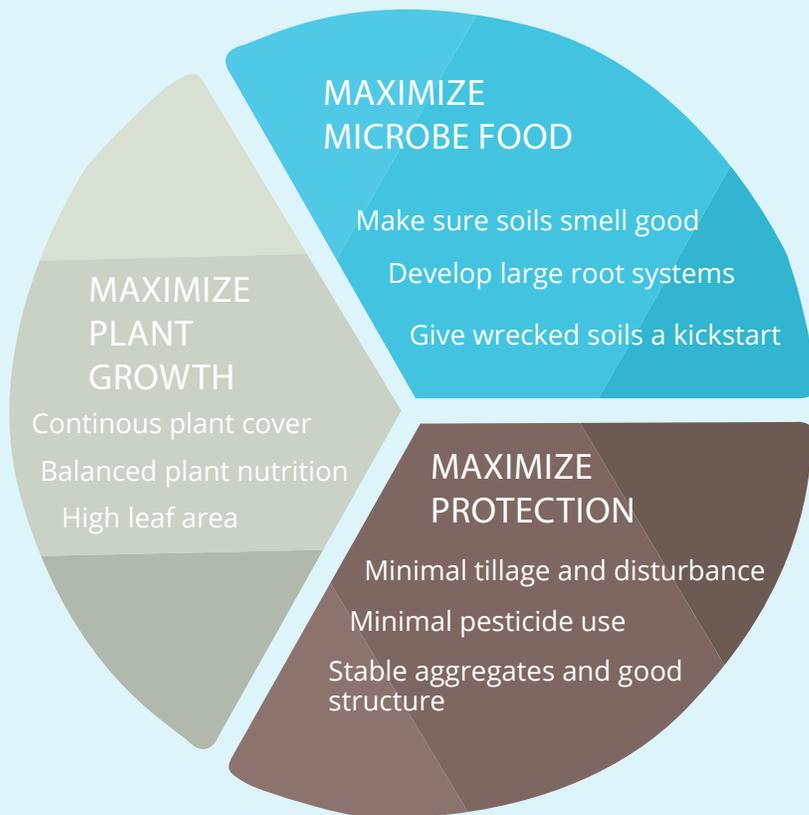
Soil is central to human and environmental health and we need to place a greater priority on educating key stakeholders

on soil’s role. The world has mobilized on water and air but much less on soil. We need to work in partnership with educational institutions and organizations like the FAO to create SCS curriculum and/or a “Certificate of Healthy Soils” to promote a greater awareness of the critical role played by soil. We should focus on all the many benefits and services that healthy soils provide, including carbon sequestration.

A Simple Checklist for SCS:

Simplifying metrics and measurement processes for SCS will improve adoption rates amongst farmers. A list needs to be developed, circulated for comment to the SCS network, and then released for use among practitioners. It needs to be relatively simple. The group took an initial stab at a list but felt it was important to investigate other efforts that might be underway to pull this together. A checklist might include criteria like these: Sunlight to biomass and yield: (1) continuous plant cover, (2) diversity of plants, (3) healthy water cycle, (4) balanced plant nutrition, incremental traces, (5) as much legume as possible. Biomass to microbe food: (1) prime poor soils with compost or inoculants, (2) aim for deep, broad, healthy roots. Microbes to organic matter: (1) preserve and create good crumbs, (2) protect microbe diversity.

A SIMPLE CHECKLIST FOR MAKING SURE YOUR FARM IS INCREASING SOIL ORGANIC CARBON.



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 Tuomas J. Mattila
 2017.

Linking the Waste and Soil Carbon Agenda:

There is an urgent need to reduce food waste and manage animal waste. There is also a need to build healthy soil. These two often separate agendas can be achieved via the prioritization of compost. Compost is currently misunderstood and poorly practiced, which has hindered adoption rates of this high potential GHG mitigation strategy. Research and technical workshops are necessary to ensure “good” compost is produced and procured, which in turn will improve the utilization of this SCS practice. We need to prioritize the integration of compost applications into SCS work while placing it in a larger system analysis and circular zero waste economy.

“We need to engage the public in a very real model which engages them with the problem - turning their organic waste into a commercial asset, for which they are rewarded. Such a model will turn the waste model on its head and provide enormous social and political power to the SCS model!”

- Gerry Gillespie, Returning Organics to Soil

Quality Compost:

We need standards and metrics to ensure good, high quality compost for building soils and sequestering carbon. High quality compost is essential at the field level. We need research to ensure processes are in place to deal with odors, volatile organic compound emissions, and difficult materials like tea bags and compostable tableware. At a practical level, procurement, testing, and application processes must be simple and effective.

Green Manure and Cover Crops:

Green manures and cover crops have high potential to sequester carbon (arguably higher than anything other than agroforestry according to this workshop’s participants). Gm/ccs are plants of any kind that farmers use in order to, among other things, fertilize the soil and/or help control weeds. Intercropped gm/ccs are, in effect, a fallowing system in which both the fallowing function and crop production are occurring simultaneously in the same field. A farmer using gm/ccs can produce over 100 tons of biomass (green weight) on two hectares of land. The only problem here is that finding the right green manure/cover crop (gm/cc) for each situation takes knowledge of scores of different leguminous plants and how to fit them into farmers’ cropping systems. Therefore, discussing

and understanding the different treatments for green manures and cover crops in the context of small farmer holdings, land restoration projects, and effective applications in diverse geographies and climates must be prioritized. We also need to work with demonstration farms and training programs to help farmers understand how particular cover crops can rapidly rebuild their soil.



Cooling the Planet:

We need to think ambitiously about drawing down carbon as fast as possible. This group discussed a range of things. To drawdown 20 billion tons of carbon the “soil carbon sponge” must be utilized, which can be done through an understanding of soil carbon hydrology. This means that the energy cycle, specifically solar radiation and the water cycle, must be central to the SCS discussion. Further research on the exchange of carbon, energy, and water between land and the atmosphere, along with improvements in Earth system models, would help us understand the full potential and limitations of soil carbon sequestration.

Food System Map and Framework:

To effectively manage soil carbon there must be an understanding of the food system and the variables that define it (food waste, GHGs, farmer health and livelihood, soils, management practices, energy use, policies and incentives, R & D, extension services, forest and land use, community health, and nutrition). Everyone needs to have an entry point while seeing who else is part of the system is. What are the feedback loops? Where can we make interventions with multiple co-benefits – for food security, land restoration, mitigation, adaptation, and farmer security? We will achieve more if we help everyone see the larger context and recognize the inter-related dynamics in our global food system.





Principles of Agroecology for SCS:

There is a need to go beyond just a technical explanation of carbon sequestration and ensure that SCS efforts are not co-opted to justify “business as usual” by global corporations that are often undermining soil health in the pursuit of maximizing profits. We have an opportunity to be part of something bigger that helps us to protect water, soil, farmers, and the health of our planet. But it may go the other way – with SCS simply being sold as a carbon market offset opportunity with the North focusing on economics but not on equity or the survival and wellbeing of small farmers. It is essential to advance agroecology and holistic management in the face of skepticism about their potential. We need increased consciousness and a change in values for all types of farmers (from all regions) to be engaged in this effort. SCS should be focused on the livelihoods of people and rural communities. We need a holistic analysis placing SCS in the context of work for sustainable development, equity, human rights, biodiversity, water protection, and vibrant local cultures. No solution is acceptable if it does not address other food and climate issues or if it harms other parts of the world. Don't proliferate new terms, keep it short and simple. Agroecology captures these values.

Bringing Change:

This group looked broadly at strategies for transforming our system of food production to advance justice, food security, mitigation, resilience, and sustainable development. To bring new energy to an old fight both the shared principles and threats that connect the broader movement must be identified. These principles need to be founded in the field of agroecology and can help connect people from all over the world. We need a unifying and inspiring narrative and

programs to connect farmers and farmer organizations from many countries to promote SCS but in the larger context of a just, healthy, and diverse system of food production.

Looking for Leverage:

There are many players (banks, agencies, experts, extension services, farmers, the public) that need to be engaged in the SCS movement and deciphering how and when to engage them is key to promoting soil health as part of the global policy agenda. We need to map the key influencers, policy opportunities, and global conferences. Can we bring SCS and healthy soils into larger agendas including China's five year plan and Belt & Road Initiative, European Common Agriculture reform, the US Farm bill, but also broader agendas where SCS might be a lever for jobs, rural development or water conservation? Where are the leverage points in the next 2-5 years?

Supply Chain Engagement:

This group discussed how supply chains of major companies can help promote SCS, organic agriculture and positive on-farm practices. Many companies are committed to going carbon neutral. Can they move to reward farmers who help mitigate carbon emissions? Can we secure a new label on consumer products to promote regenerative agriculture? What price advantages and financial savings can we secure for farmers for climate friendly products? Do we have enough farmer supply to meet global demand for these carbon farming practices if demand rises quickly?

Engaging Retailers:

We must identify suppliers, consumers, products, and markets and engage the retail industry in SCS efforts. We need an inside and outside approach, working with forward thinking retail companies to take positive steps while simultaneously putting consumer and investor pressure on bad actors who are perpetuating industrial production and factory farming.

PLATFORM AND INFORMATION HUBS

Collaborative Research Platforms for On-farm Research and Networks: Networked research accelerates innovation. This group explored online platforms and tools for advancing research on SCS. There was strong interest in field-based research and data collection by farmers. The group explored how to set up simple yet credible procedures to help farmers observe and collect data and to link that data with academics, government agencies and experts working to better understand the many dimensions of SCS. Academic research agendas and farm-based research agendas need to be merged. Moving this collaborative approach forward will require data quality standards, case studies, utilization of existing academic/field networks, and the pulling of commercial data into open source databases.

A Platform Connecting Stakeholders:

We need to move the field of SCS and healthy soils forward as fast as possible. One key strategy is to provide an online platform to link investors, farmers, government officials, NGO leaders, academics, and UNFCCC leaders. We must map the existing platforms and networks and promote peer to peer exchanges. Content for an online platform should include data, case studies on SCS, stories from farmers, pictures, articles and analysis, and a database of tools for education and research. We must empower people through open source information that is high quality and credible. We need a global online platform for collective problem solving.

The Role of the 4p1000 Initiative:

This breakout group explored the role and potential impact of the 4p1000 Initiative. The 4 Initiative, launched by France, sets out to bring together all willing contributors in the public and private sectors (national governments, local and regional government, companies, trade organizations, NGOs, research facilities, and others) under the framework of the Lima-Paris Action Agenda (LPAA). The aim of the Initiative is to demonstrate that agriculture, and agricultural soils in particular, can play a crucial role in mitigating climate change while increasing food security. This group discussed how to build networks of stakeholders and to advance the field through 4p1000.



Converting Broad Scale Agriculture to SCS:

To convert the industrial agriculture industry to one that sequesters large amounts of carbon, agricultural subsidies must be re-directed to support ecosystem services. Most of the current subsidies are destructive. In addition to taking on subsidies, we need to boost training programs for farmers so they really grasp the benefits of SCS practices. To achieve success, we will need to operate globally and regionally to educate and lobby politicians. We must pilot new systems and demonstrate success. We need a communications and outreach program to reach farmers, consumers and the general public with stories of success. Demonstration farms will be one key to success.

GATHERING AND USING DATA

Soil Carbon Data on Farms:

Creating a stronger and broader connection between smallholder farming and research empowers farmers on the ground and strengthens our scientific understanding of farming and agricultural systems. And improving the rate and efficacy of data collection, storage, and analyses is central to bolstering this connection. For this to occur there are several things that must happen. To start, farmers must have greater access to equipment, like microscopes and other soil testing equipment, and technical training on sampling processes. This is especially true for smallholders who do not use certifications or other expensive methods. Whatever the data collection framework is it must allow for context, customization, and ongoing monitoring. The robust global data set this group discussed has the potential to be used to better understand a wide range of topics that include markets, policy, research and teaching, and management.

Connecting Ground Field with Global Mapping Systems:

Global maps that pinpoint stocks of carbon and the potential for SCS and soil restoration can be greatly enriched by utilizing data from ground scale sampling. The key to doing this successfully is ensuring the data collection and measurement methods are of quality, existing data is identified and merged, and that existing and future data is accessible. This group discussed the inherent challenges that make it difficult to tie localized data into a global data set. This included poorly designed collection and sampling processes, sampling errors, land variability, and inaccessible information. Mitigating these challenges is necessary to unleash the potential of a global mapping system.

FUTURE EVENTS AND INITIATIVES

Raising the First Billion:

Prompted by the urgent need to invest in climate solutions and carbon removal strategies, this group discussed potential mechanisms for financing a Soil Health Investment Fund. Just as there are investment models that support water and

renewable energy, there must be a financial mechanism that supports and bolsters healthy soils. This group talked specifically about the need to focus more broadly on healthy soils and their practical benefits rather than just on soil carbon sequestration. They also discussed the need to align financial strategies with consumer demands. Ultimately, the group proposed Invest Summit 2018, a “high level” event with an international scope that directly prompted investments from consumers, investments funds, and governments.

Ecosystem Camps:

This breakout group explored the role and potential impact of ecosystem restoration camps, an emerging global movement that is attracting people to take up the challenge to restore ecosystems, collectively learning how to protect and monitor water and other soil properties, propagate native plant species, and grow organic soils while they camp. This program currently has a pilot project underway in Spain and requests for camps worldwide.

Creating Ecosystem Restoration Camps allows for extensive ecological and social research, collaborative scientific research, peace building programs and permaculture training for regenerative agriculture. The breakout group discussed the intention to mobilize hundreds of thousands of volunteers to attend ecosystem restoration camps dedicated to restoring critical landscapes and rejuvenating communities. They explored how to connect soil restoration with job development and resettlement of migrants.

The question moving forward is how to take these types of camps to scale, how to get them financed, and promote them and demonstrate their impact.

The Next Generation:

This group discussed what it will take to engage the younger generation in support of SCS and healthy soils. Empowering young people is an essential prerequisite for a powerful global climate movement. The group discussed a range of opportunities and needs, including giving young farmers access to land, establishing and funding teaching, mentorship and leadership programs, and developing SCS curriculum for a range of audiences. Young people can help build and embrace a global call to action and a narrative on climate change and agriculture. The key is for the current leadership to understand who young people are – what are their experiences, values, characteristics, challenges, and opportunities are – and find ways to bring them to the center of the SCS movement immediately. And we can start even with early childhood. We need to place a much greater priority on creating opportunities for children everywhere to connect with nature. These things will allow children to be engaged at a young age and for young adults to see themselves as environmental leaders. Technology has radically changed childhood and we must be proactive in helping children get their hands in the soil.

Accelerating Agroforestry:

Agroforestry was a prominent theme throughout this gathering and was considered by many attendees to have the potential to transform the world's landscapes. So much so that this group proposed there by an international gathering called #Agroforb13 that focused specifically on the field. This event would aim to bolster agroforestry and the farmers who are practicing it. The content would focus on business models and communication strategies that support agroforestry.

How do we build a holistic value chain to connect family farmers to markets in Africa? Farmers in Africa dedicated to healthy soils and local products need stronger connections to markets. This group looked at innovative ways to build a holistic value chain between small farmers and consumers in Africa. Participants called for more cooperation among farmers. They recommended producer/consumer dialogues, farmer training programs, training for young entrepreneurs interested in agroecological methods, and more support to farmers for marketing their goods. The group suggested hosting cultural festivals featuring traditional products and linking farmers cooperatives and local entrepreneurs dedicated to healthy soils and agroecology. Could a focus on climate friendly SCS methods and produce help build markets

for small African farmers? Is financing needed? We need to prioritize these support programs and market development, given the many threats to small farmers in Africa.

FRAMING OUR WORK

Tensions and Questions:

Seventeen participants issued a statement (see Appendix Two) urging others to reframe the conference and future work through the lens of agroecology. The group agreed with the need to sequester carbon and build healthy soils, but expressed deep concerns that SCS might be pursued while further accelerating large scale industrial agriculture at the expense of small peasant farmers, rural communities, and other species that depend on healthy ecosystems. (See Vital Connections where much of this is discussed in greater detail.) The conference did not take any formal action and was not designed to invite convergence on a pathway forward. This tension over our food systems runs deep and embodies many issues with relevance not only to SCS but to sustainable development, food security, small farmer survival in the developing world, and biodiversity. The issues warrant ongoing discussion, debate and engagement from all stakeholders.



CONCLUSION

The conference was an independent initiative organized outside of official governmental or UN channels, seeking to accelerate progress, build a global network on SCS, and promote pathways forward. Addressing the risk of dangerous climate change requires the combined efforts of both greenhouse gas (GHG) emission reductions and sequestration. Some SCS methods have a greater carbon impact than others depending on the rate of carbon absorption and storage and permanence of sequestration practices. Nearly all SCS methods have other co-benefits. Carbon sequestration through agriculture may move forward initially because

farmers and ranchers are motivated to focus on yield and water retention rather than on climate mitigation. A healthy soils agenda can be promoted with no regrets and with the potential for greatly improving our resilience and our ability to mitigate greenhouse gas emissions. We must stay focused on the big picture, on the need to “swallow the alarm clock”, and on programs that rapidly reduce carbon and help farmers and communities manage the impacts of a changing climate.

To participate in a global listserv please email austin@breakthroughstrategiesandsolutions.com to request access

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APPENDIX ONE

Statement from 17 Participants

Presented at Sequestering Carbon in Soil: Addressing the Climate Threat Conference Les Fontaines, Chantilly France
5 May 2017

We, a group of conference participants who believe in the urgency of addressing the threats of climate change through holistic perspectives and systems thinking, recognize the powerful potential of putting carbon in the soil for mitigating GHG emissions. However, we wish to call your attention to the risks of centering the conference on soil carbon sequestration as the main response strategy. We have heard that many other participants and the organizers of this event share our concerns. We hope to contribute to a successful outcome of this conference by making the following statement to clarify our perspective and propose a way forward.

As we already know, analyzing, understanding and dealing with complex social and ecological impacts of climate change on food and farming systems requires a holistic approach. We are deeply concerned that a narrow focus on carbon, however, may lead to unintended negative consequences, such as further fostering a profit-driven economy around the commodification of soil, incentivizing industrial agriculture through carbon markets, promoting land grabbing, increasing corporate control over land and other resources, and repeating failed schemes like REDD+ schemes and carbon markets, which have benefitted carbon traders and large scale agricultural operations at the expense of our communities.

Given the urgency of tackling global climate change, we propose to reframe the emphasis of the conference around the much-needed transformation of conventional food and farming systems and their root causes through the holistic approach of agroecology. This transformation centers the improvement of smallholders' and Indigenous communities livelihoods as a key strategy to achieve food sovereignty, equity and resilience. This approach will in turn lead to healthy soils rich in organic matter and carbon as an added benefit and ultimately contribute to the adaptation to and mitigation of

climate change, a goal we all share.

We believe that this new emphasis not only echoes the concerns of many participants here, but would also elicit a more inclusive, productive and enduring global network for addressing climate change by strengthening resilient rural communities with secure access to soils, water, biodiversity and other resources. We invite our fellow conference participants to join us in reframing our conversations today and going forward, utilizing this more holistic approach to build a truly broad movement for change.

Thank you for listening to us this morning and for this opportunity to share our views and our proposal.

Presented by Shoba Liban, Pastoralist Women for Health and Education, Kenya Signed* by (listed in alphabetical):

Camilla Ables, National Academies of Sciences, Engineering, and Medicine, USA

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APPENDIX TWO

Spoken Word Poem by Tim Merry *Inspired by Christiana Figueres*

Thanks to the magic drink
For making the link
To us here now together
All of us dedicated to the next step
Despite the changing weather
Christiana takes us first into 'where'
Location, location, location
Carbon is enemy and friend
Reverse the direction and send
It back to the soil
Reversing the conveyor belt's toil
Climate and farmer are agreed
Local and global need
Coincide
We must not hide
But rise
To the opportunity
The happy coincidence
We cannot sit on the fence
We have 3 years
Incremental change will only end in tears

2020
To mark the trajectory
Down
To the ground
The descent
Is meant
To lock out
1.5 degrees
Beyond 2 degrees is uninsurable
Systemically
We would never get to eradicate poverty

Yes, Paris came too late
But that is our fate
We must deal with reality
Our current complexity
In three years eco-friendly
Practices must be the choice
Soil and climate live in a two way relationship
Weather causes spikes in prices
We've got to get going, don't be late
We do not put carbon in the soil only for climate

Food, home, water security
This is planetary
Security
A no brainer
That will take all of our hearts and brains

To stay sane
To stay together
And be collectively clever
Through social integrity
Changing subsidies
Scientific sufficiency
Science matters but we do not need perfection
Can we get practical as we go in this direction?
We have enough to go
No need to go slow
We have the tools to make progress
Out of this mess
This is about a survival difference -
Does that make sense?

Swallow the alarm clock
It is high time
It is ours to turn our seeds of intent into seeds in the ground
This is profound
A standing ovation was the sound
The momentum is here
We are clear
Into the future we steer
With future generations calling us on
Like the wind in the sails of a ship in a storm
We are clear
Into the future we steer

***Tim Merry - at Sequestering Carbon in Soil:
Addressing the Climate Threat,
May 3-5, 2017, Chantilly, France***

APPENDIX THREE

Parting Words

This was one of the most thoughtful, pertinent and well conceptualized conferences I've been to. The opening was terrific; probably the best conference opener I can remember.

--*Cynthia Scharf, The Carnegie Climate Geoengineering Governance Initiative (C2G2)*

Thanks a million times for a great conference. We definitely need to move forward with some of the actions agreed upon.

-- *Zwide Jere, Co-founder/Managing Director, Total LandCare, Malawi*

I learned much from the meetings/conversations and am looking forward to next steps.

--*Ping He, President, International Fund for China's Environment*

Thank you so much for putting on such an excellent conference. It is really appreciated. The conference was extremely valuable and enjoyable.

--*Richard Teague, Professor and Director, Texas A&M Agrilife Research & Extension Center*

What I have found in the formal as well as informal conversations since the conference is that my passion has awoken the need for action, on time and broader engagement. How surprising it must be for audiences gathering to talk about art, ethnicity and institutions to instead hear about our Paris conference, frequently summarized as #1.5ToStayAlive. Perhaps part of a next steps strategy is the apparent incongruity of talking about agriculture and climate change in unexpected places. It appears to be impactful and hopefully contributes to the essential role of a more engaged citizenry.

-- *Michael Nicoll Yahgulanaas – Artist/ Officer and Trustee, Christensen Fund, Canada*

Thank you again for the conference. It really gives me strength. It was so wonderful to spend few days with top SCS people in Paris. It charged my battery full!

-- *Saara Kankaanrinta - Soilfood Oy/Co-Founder, Board Member, Finland*

It was wonderful to be part of conference. My time there was very rewarding.

--*Chuck Ross, Director of UVM Extension, Vermont, USA*

For more information about this conference or report, please go to www.breakthroughstrategiesandsolutions.com or contact Austin Badger at: austin@breakthroughstrategiesandsolutions.com



Summary Report from May 3-5, 2017 Conference Chantilly, France

Conference produced by Breakthrough Strategies and Solutions