

Coordination of International Research Cooperation on soil CArbon Sequestration in Agriculture



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Why Soil Carbon? Co-benefits for adaptation, land degradation and food security

• Half of the agricultural soils are estimated to be degraded [FAO, 2006, 2011].

The annual cost of fertilizer to replace nutrients lost to erosion is US \$110 – US \$ 200 billion [ITPS FAO, 2016].

- Annual losses of 0.3–1.0 billions tons C through erosion of agricultural land [Chappell et al., 2015, NCC].
- 24-40 million metric tons additional grains can be produced in developing countries per additional ton C per hectare stored in soils organic matter [Lal, 2006]
- Reduced yield variability after soil restoration
 leading to increased soil organic matter [Pan et al., 2009]



With soil carbon sequestration, food security is not threatened, even for a 1.5°C global warming target



Ag N2O ■ Ag CH4 ■ Ag SOC ■ FOLU ▲ CALO SOC— soil organic C sequestration

[Frank et al., Env. Res. Lett., 2017]

SOC+— including its benefits for yields

Ag N2O $-N_2O$ mitigation from agriculture; Ag CH4 $-CH_4$ mitigation from agriculture;

Ag SOC $-CO_2$ sequestration from agriculture, FOLU $-CO_2$ mitigation from forestry and other land use

Research trends

• Research on soil organic carbon sequestration in agriculture is rapidly increasing, interdisciplinary and international.



Exponential growth in annual number of scientific papers on soil carbon sequestration in agriculture over 1991-2015 (Left) and distribution by scientific discipline (Right).

(CIRCASA Project, Soussana et al.)



Research trends (cont.)



Main international research networks on agricultural soil carbon sequestration (2016)

(CIRCASA Project, Soussana et al.)



Research trends (cont.)



Main research topics (key-words) concerning soil organic carbon sequestration in agriculture (2016)

(CIRCASA Project, Soussana et al.)



Research trends (cont.)

SMARTSOU **PeatRestore** OLIVE-CLIMA **EIP_Agriculture AGMIP** Future-Earth UNCCD-SPI **ITPSCIRCASA Black Soil** UNFCCC GSBI R GLD IG GSTN CCAFS FAO IFWOCA **IPBES UNEP 4ner1000 ClimateKIC UN-REDD GCP Global peatland FACCE-JPI Belmont-Forum Climate-JPI** AnimalChange **ERA-NET-CSA**

Many ongoing initiatives and research projects dealing (in part) with soils, agriculture and climate change





CIRCASA consortium



UNIVERSITY OF

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WAGENINGEN

UNIVERSITY & RESEARCH



AARHUS UNIVERSITY









eco

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Centro Internacional de Agricultura Tropical International Center for Tropical Agriculture Consultative Group on International Agricultural Research



ARC • LNR Exellence in Agricultural Research and Development













Institut de Recherche pour le Développement F R A N C E







NEW ZEALAND AGRICULTURAL GREENHOUSE GAS Research Centre



International Institute for Applied Systems Analysis













Countries partners of CIRCASA, 4p1000, GRA, FACCE-JPI and CCAFS

- CIRCASA has 22 partners including the research secretariats of 4p1000, GRA and FACCE-JPI
- Together with these initiatives and with CCAFS-CGIAR, it has direct outreach to a total of 82 countries accounting for 85% of the world's total research on soil C sequestration in agriculture



Develop **international synergies concerning research and knowledge transfer** on agricultural soil C sequestration at European Union (EU) and global levels.

- 1. Strengthen the international research community
- 2. Improve our understanding
- 3. Co-design a strategic research agenda with stakeholders
- 4. Create an International Research Consortium



Work plan







Structuring knowledge (WP1)

=> An open data repository with geospatial and modelling data



Spatial distribution of exposure to selected multiple land challenges. A. Un-degraded land exposed to rapid climate change; B, Degraded land exposed to rapid climate change; C, Degraded land exposed to food insecurity; D, Degraded land exposed to rapid climate change and food insecurity



Stakeholder Engagement (WP2)



Agenda will outline priorities for the alignment of international research.

Online Survey – 7 languages

Workshops on 5 continents



Stakeholder Advisory Board

=> Strategic Research Agenda



Create an International Research Consortium on SOC (WP3)

- Belmont forum pre-program on 'Soil Health'
- European Joint Program, Agricultural Soils, with International calls
- EC Horizon Europe Mission planned on Land degradation and Soil Health

=> CIRCASA Research Policy Committee: Explore activities, resources and governance for an International Research Consortium (IRC) on agricultural soil carbon and draft a work plan.

The Global Soil Partnership (GSP), the GRA, FACCE-JPI and the 4 per 1000 initiative will greatly facilitate this task, allowing the CIRCASA IRC to be embedded into a broader soil and agricultural research context.











Communication and Outreach (WP4)





CIRCASA Online Survey – Preliminary Results Perspectives on SOC management

Berlin, 16 January 2019

Survey – 939 respondents globally

+ 1757 Danish farmers Which stakeholder group describes you best?









SOC management options

Residue management (crop residue left in the field)

Reduced/minimum tillage

Zero tillage

Manure and composting (applying livestock manure and/or compost on fields)

Grass in rotation

Use of cover crops

Use of grain legumes

Use of forage legumes



grazing)

Buffer strips and set-aside areas

Crop-livestock systems

Agro-forestry in cropland

Agro-forestry in grazing lands

Agro-forestry in mixed crop-livestock systems

Biochar

Rewetting of organic soils

Preventing erosion (e.g., contour farming,

terracing, windbreaks)



Which management options do you apply or consider applying? - Farmers



Not relevant

■ Don't know

Already applying

Consider applying



Which management options do you apply or consider applying? - Farmers



Consider applying

Not relevant

■ Don't know

Which options do you think farmers are using for SOC management in your region at present? (Global)





Which options do you think farmers are using for SOC management in Europe at present?





Farmers' views on effectiveness of SOC management options





Farmers' views on effectiveness of SOC management options



Residue management Reduced/minimum tillage Zero tillage Manure and composting Grass in rotation Use of cover crops Use of grain legumes Use of forage legumes Permanent grassland management Buffer strips and set-aside areas **Crop-livestock systems** Agro-forestry in cropland Agro-forestry in grazing lands Agro-forestry in mixed crop-livestock. Biochar Rewetting of organic soils Preventing erosion



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Barriers to uptake of management options

- Lack of funds to access inputs (e.g. fertilizer)
- Additional costs are too high
- The right machinery is not available (e.g. suppliers or contractors do not have equipment)
- Not convinced by productivity and economic benefits (e.g. concern about yields)
- SOC sequestration is not rewarded financially (e.g. no subsidies or carbon credits)
- Technical solutions are not mature (additional research is required)
- Information and knowledge support is not available
- Farm extension services do not have knowledge and capacity to train farmers on technical solutions
- Biophysical (unsuitable climate or soil)
- SOC management is not a political priority
- Other



Views on barriers to uptake – Global

SOC sequestration is not rewarded financially (e.g. no... SOC management is not a political priority Not convinced by productivity and economic benefits... Farm extension services do not have knowledge and... Lack of incentive for medium/long-term investment due... Information and knowledge support is not available Lack of funds to access technology or machinery Technical solutions are not mature (additional research is... Additional costs are too high Land is leased Lack of funds to access inputs (e.g. fertilizer) The right machinery is not available (e.g. suppliers or... Biophysical (unsuitable climate or soil) Other 0%

Most important

Important





Farmers' views on barriers to uptake



■ Most important ■ Important ■ Minor Importance ■ Not Important ■ Don't know 28

Farmers' views on barriers to uptake



Lack of funds to access technology or machinery Lack of funds to access inputs (e.g. fertilizer) Additional costs are too high The right machinery is not available Lack of incentive for medium/long-term investment Land is leased Not convinced by productivity and economic benefits SOC sequestration is not rewarded financially Technical solutions are not mature Information and knowledge support is not available Farm extension services do not have knowledge and capacity Biophysical (unsuitable climate or soil) SOC management is not a political priority

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Solutions for increasing uptake

- Tailored guidance and advice for farmers
- Payments for ecosystem services (usually public subsidies) or other financial support to transition to SOC practices (e.g. loans or grants for investments)
- Carbon certification schemes (product labels)
- Compulsory standards set by food companies
- Development of carbon credit schemes
- Include SOC in emission trading schemes
- Improve infrastructures to access inputs and technologies
- Set mandatory targets and regulatory requirements for SOC sequestration
- Information to policy makers on where and how to target SOC sequestration policy
- Indicators and tools for farmers and policy makers to measure progress in improving carbon storage in soils
- Improved awareness among the public
- Other



Views on solutions to increase adoption – Global

Tailored guidance and advice for farmers on how to... Strengthen farm advisory services and knowledge... Improved awareness among the public Indicators and tools for farmers and policy makers to... Information to policy makers on where and how to target... Payments for ecosystem services (usually public subsidies) Other financial support to transition to SOC practices (e.g.... Set mandatory targets and regulatory requirements for... Include SOC in emission trading schemes Development of carbon credit schemes Carbon certification schemes (product labels) Improve infrastructures to access inputs and technologies Compulsory standards set by food companies

Most important

Important





Farmers' views on solutions to increase adoption

Tailored guidance and advice for farmers on how to increase... Strengthen farm advisory services and knowledge exchange... Improved awareness among the public Information to policy makers on where and how to target... Indicators and tools for farmers and policy makers to ... Payments for ecosystem services (usually public subsidies) Other financial support to transition to SOC practices (e.g.... Carbon certification schemes (product labels) Set mandatory targets and regulatory requirements for SOC... Include SOC in emission trading schemes Development of carbon credit schemes Compulsory standards set by food companies Improve infrastructures to access inputs and technologies



Global





Farmers' views on solutions to increase uptake

Improved awareness among the publ Indicators/tools for farmers/policy makers to measur Information to policy makers on where/how to target SC Set mandatory targets and regulatory requirements for SC Improve infrastructures to access inputs and technologie Development of carbon credit scheme Compulsory standards set by food companie Carbon certification schemes (product label Other financial support to transition to SOC practice Payments for ecosystem services (usually public subsidie Strengthen farm advisory services and knowledge exchange Tailored guidance and advice for farmers on how to increas





Effectiveness of SOC management options – Global





Contribution of SOC management – Production & Ecosystem Service (Global)



Improve soil quality Improve soil water holding capacity Enhance the yield stability Improve biodiversity Improve water infiltration and drainage Enhance the yield potential Improve soil workability, e.g. for seedbed preparation Prevent soil erosion Prevent nutrient leakage Reduce demand for fertiliser Improve product quality (e.g. higher value) Reduce irrigation demand Reduce crop protection needs (pest and diseases) To a large extent To some extent



Contribution of SOC management – climate and sustainable development (Global)

SOC management is relevant to climate change adaptation											
SOC management is relevant to food security											
SOC management affects GHG emissions from soils											
Higher SOC would protect against soil degradation under climate change											
Reducing GHG should be a concern for SOC management											
SOC management compensates other agricultural GHG emissions (nitrous oxide and methane)											
SOC management compensates emissions from fossil fuels (energy and transport in society)											
C)% 10)% 2	.0%	30%	40%	50%	60%	6 70	% 80)% 9(0% 10



■ Strongly agree ■ Agree ■ Disagree

■ Strongly disagree ■ Don't know

Thank you for your attention!

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Visit our website www.circasa-project.eu

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CIRCASA StAB Meeting Berlin

Lunch



CIRCASA StAB Meeting Berlin

Thank You!