« 4 pour 1000 Initiative: Soils for food security and climate »

Document Consortium 3-4 – Proposal by STC

3rd Meeting of the Consortium

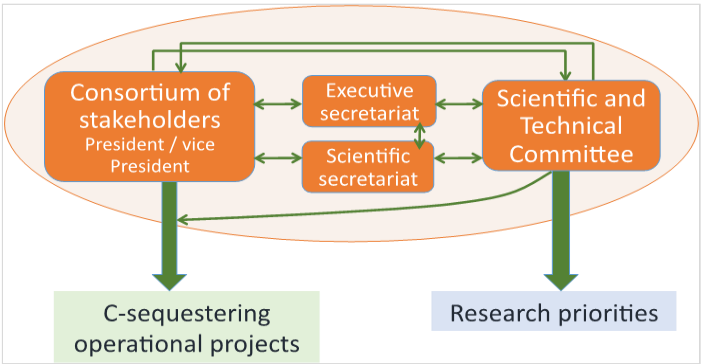
Thursday 16th November 2017
14:30 to 17:30
Stadthalle BAD GODESBERG - Germany

The '4 per 1000' Research Priorities

Introduction

The '4 per 1000' Initiative "Soils for food security and climate" was launched by the French Government at COP 21 in the Paris-Lima Action Plan (now the Global Climate Action Agenda). It aims to avoid loss of organic matter from soils and improve soil carbon sequestration with the ultimate goal of improving food security and reducing climate change. The action will support the use of agricultural and forestry practices that increase or retain soil organic carbon (SOC) and that are adapted to local situations. In addition, the 4 per 1000 Initiative promotes innovation and the development of new SOC sequestration techniques. Implementation of the Initiative requires action plans for better management of SOC by multiple partners i.e. state and non-state participants, capacity building and engagement of local communities and policy makers. In order to address the knowledge gaps to best enhance global SOC stocks, while also ensuring food security, the Scientific and Technical Committee of the Initiative (STC) proposes an international research and scientific cooperative program to provide evidence-based options that can be used in practice by farmers.

Box 1 : *Mission of the Scientific and Technical Committee*



The Scientific and Technical Committee's primary mission is to recommend reference criteria for assessing projects aimed at increasing SOC stocks and to develop research priorities to achieve the aims of the Initiative. It is composed of 14 members with expertise from different countries and scientific disciplines.

4 per 1000 – The science beyond

Soils contain much more organic carbon than in the atmosphere, so small variations of the world soils carbon stocks could have major impacts on the rate of change in atmospheric carbon dioxide concentration. For example, an increase in SOC stocks of ca. 860 Gt across the world's top soil (0-40 cm) by 0.4% per year (i.e. 4 per 1000) would store 3.4 Gt C/yr, and thereby compensate for up to 80% of the current increase in atmospheric CO2 concentration (4.3 Gt CO2/yr). Moreover, SOC storage in agricultural soils could increase food security under climate change, in particular by increasing yields in developing countries and contribute to meeting the joint goal of reducing the impact of agriculture on greenhouse gas emissions and climate change (UN Sustainable Development Goal, SDG 13) and delivering zero hunger (SDG 2). Carbon is the main component of soil organic matter (more than 58%),

which is important to maintain soil fertility and soil quality, and their benefits to the provision of a range of ecosystem services. Increasing soil carbon stocks should be an integral goal of sustainable intensification of agricultural systems, because agricultural soils are generally lower in organic matter than pristine soils, or soils under long-term forest or natural grassland. With appropriate management practices, agricultural soils have the potential to store more carbon, and part of this storage may last for decades or centuries (SOC sequestration). However, it is important to note that the ability of agricultural soils to store carbon depends on many factors in addition to good agricultural practices and farmers' decisions, including climate variables (temperature and humidity) and soil conditions (texture, carbonates, pH, nutrient status etc.). This means that there is no universal management practice or technology that is appropriate for all farming systems.

Why does research feature in the Initiative?

Knowledge is needed to provide evidence-based options for countries' stakeholders and support the development of policies that are specific for each country. While much knowledge is already available, action-oriented research to guide policy is needed. This requires a multidisciplinary and integrated approach, including facilitation by the international scientific community to strengthen complementarities and synergies. Engagement with local communities, stakeholders and policy makers together with enhancement of education and capability building is also needed. The Scientific and Technical Committee of the Initiative will recommend research priorities, promote their adoption among partners of the initiative, and facilitate engagement with existing initiatives and research programs to implement action plans (Box 1). As a first step, the STC defines here a set of research priorities, to provide the framework for implementing the goals of the Initiative.

Research priorities

Research priorities are grouped into four pillars with an initial focus on agricultural land use and land management, because of their frequent low soil organic matter content and crucial role in food security. Work on other ecosystems such as forests and peatlands will be included in the future. Within these priorities, it is important to consider (i) the timescale for the impact of each priority on short-term, medium-term and long-term increases in SOC storage, (ii) the risk of reversibility of practices and negative direct or indirect side effects of practices at different scales and (iii) the alternative uses of existing organic carbon inputs and the competition for this resource.

The four pillars are presented below, and include the key knowledge gaps that have already been identified.

1st Pillar. Estimating the SOC storage potential

Aims

To improve estimates of the potential for SOC storage and sequestration (or loss) in response to management practices at different spatial and temporal scales. This will also consider the implications of increased SOC storage at different scales, including co-benefits for sustainable yield and adaptation to climate change.

Key knowledge gaps

- Mapping of soil organic carbon (SOC) stocks and their rates of change.
- Assessment, projection and mapping of SOC sequestration potential under various management and future climate change scenarios. Estimates of the limits to SOC storage and sequestration.
- Forecasts of the magnitude of the terrestrial SOC sink.
- Biophysical and biochemical constraints on SOC sequestration (N, P, water).

- Vulnerability of SOC stocks and the persistence of SOC in relation to soil type, pedoclimatic conditions and climate change.
- Quantification and prediction of associated non-CO2 greenhouse gas emissions.
- Effects of carbon sequestration on crop and grassland yields, and ecosystem goods and services
- Effects of increased soil carbon on crop and pasture adaptation to climate change.
- Contribution of increasing soil carbon storage to arresting or reversing land degradation.

2nd Pillar. Developing management practices

Aims

To evaluate and improve 4 per 1000 actions for SOC storage in agricultural systems, including their value in terms of climate change, adaptation and mitigation, food security, other relevant SDGs, and their costs and benefits at a range of scales.

Key knowledge gaps

- Review the specific scientific and traditional knowledge of sustainable agricultural practices to identify high potential to avoid SOC loss or increase SOC sequestration at farm and regional scales, including e.g. agro-ecology, agroforestry and landscapes.
- Modelling the impacts of changing management practices and changing climate for SOC sequestration on cropping and grazing systems to identify the drivers of increases and decreases.
- Analyses of the contribution of carbon sequestration practices to the Sustainable Development Goals (SDGs). Monitoring the impacts of management interventions for cropping and grazing systems on the environmental and socio-economic benefits, using case studies at demonstration sites.
- Development and testing of innovative practices to avoid SOC loss and increase SOC.

3rd Pillar. Defining the enabling environment

Aims

To identify, analyze, and draw lessons from case studies that have demonstrated success in effective governance, institutional and organizational arrangements and public policies. To propose options for strengthening the enabling environment for maintaining / increasing SOC in the long term.

Key knowledge gaps

- Identify case studies that have demonstrated scalable, existing or innovative practices, to maintain best agricultural and land use practices and explain the processes supporting this.
- Learn lessons from case studies were specific policies did not succeed to maintain / improve best agricultural and land use practices.
- Assess the social and economic costs and benefits of implementation, disaggregated by social groups.
- Evaluate the impacts of increased SOC on the well-being and resilience of farming communities
- Identify mechanisms leading to society engagement for long-term outcomes.
- Analyze how good practices vary in different geographical, social and soil / climate conditions, including adoption and innovation rates among men and women farmers.
- Examine the impacts of agricultural and environmental policy, including the use of fertilizer, subsidies, irrigation, and of land tenure policies on SOC levels and food security.

- Use scenarios to analyze where and how improvements could be made and innovations could be proposed.

4th Pillar. Monitoring, reporting and verification

Aims

To provide metrics, methodologies and tools for monitoring, reporting and verification (MRV) of actions of increasing SOC sequestration and associated benefits at multiple levels.

Key knowledge gaps

- Develop criteria and indicators to guide implementation of projects in the 4 per 1000 action plan
- Develop and improve direct and indirect methods for monitoring and modelling changes in SOC stock and of GHG emissions, including methodologies combining GIS data, on the impacts of management practices and land use options on SOC stock inventories at farm, project, regional and national scales.
- Develop a practical methodology to certify that changes in SOC stock have met an agreed goal in terms of costs (e.g., amount and value per ton of CO2eq sequestered).

Alignment of 4 per 1000 goals with activities of other organisations

A number of programs worldwide conduct activities related to "4 per 1000" goals (Box 2). Aligning these initiatives can help to better address the priorities listed in the four pillars.

The STC will foster networking for efficient exchange of knowledge, allowing learning from the findings from projects to be shared using a platform made available by the Initiative. Guidance manuals are needed at many levels to strengthen the adoption of practices for managing SOC stocks. Knowledge of the socio-economic benefits and value of increasing SOC stocks needs to be quantified so that this can be used to attract funding from national governments.

Box 2 ***Relevant on-going international programs on soil carbon sequestration aligned with the "4 per 1000" Initiative.***

- **FAO** organized a Global Symposium on Soil Organic Carbon, incorporating a cookbook for measuring changes in SOC stocks, coordinated efforts for a Global Soil Carbon Map and launched a Technical Manual on soil organic carbon management at regional and sub-regional scales.
- **Global Research Alliance** promotes and coordinates research activity on agricultural greenhouse gases and launched a Flagship on Soil Carbon Sequestration.
- **CGIAR** Water, Land and Ecosystems Research Program (WLE-RDL) has a cluster of activities on Soil Restoration and Soil Carbon. Climate Change, Agriculture and Food Security (CCAFS) and the Low Emission Development supports integrated approaches to SOC sequestration. Forest, Trees and Agroforestry supports avoided peat loss.
- **CIRCASA**, EU H2020 Coordination and Support Action, aims strengthening the international research community through an International Research Consortium on agricultural soil carbon sequestration and will a collaborative platform for all relevant stakeholders on soil carbon sequestration.
- **LEAP** (FAO) is developing guidelines for SOC stock assessment and monitoring in livestock systems.
- **CASA**, the Soil Carbon network for Sustainable Agriculture in Africa, involves 12 countries to promote agricultural practices based on an optimal management of organic matter.
- **ALTER** (Asian Agricultural Long-Term ExpeRiment) was established to provide scientific basis and management options for soil C sequestration and agricultural sustainability in Asia and beyond