Info Note

Decision support for agricultural soil carbon sequestration: Multi-lateral development banks' needs and challenges

User perspectives and preliminary observations

Michael Wironen

OCTOBER 2018

Key messages

- Multi-lateral development banks (MDBs) have committed to financing climate change mitigation in agriculture and have adopted a harmonized methodology for attributing and reporting climate finance; however, design (including practice selection) and measurement of project impacts remains ad hoc.
- Decision-support tools such as "practice lists" help users identify and select practices for climate-smart agriculture (CSA) or specific outcomes such as soil organic carbon (SOC) sequestration. However, interviews suggest they are not widely used at MDBs.
- Practice lists fail to provide absolute quantification of the net mitigation or sequestration impact, which is the parameter of primary interest to MDBs. Hence, many MDBs use ex-ante estimation methods such as EX-ACT to determine the net impact of an investment.
- MDBs require better guidance on practice selection, recognizing that barriers such as scientific uncertainty, context-dependence, and adoption-dependence (i.e. persistence) limit the value of lists or ex-ante models. Some measurement, such as adopted in the Australian Emissions Reduction Fund, would significantly reduce uncertainties, at a potential cost tradeoff.
- The potential co-benefits of building SOC have led to interest in developing concessional lending programs and insurance products that factor in SOC levels, provided a means can be found to cost-effectively and reliably estimate and monitor SOC levels.

Multi-lateral development banks (MDBs) generally make agricultural investments to increase productivity, rather than mitigate or cope with climate change. Yet these same institutions have committed to increasing their financing of climate change mitigation and adaptation. Climate change mitigation in agriculture can be complex due to the need to consider site- and practice-specific contexts and possibilities for leakage. These challenges are especially pronounced for projects that aim to sequester soil organic carbon (SOC). Hence, there is a perceived need for decision-support tools to help MDBs and others select practices that can sequester SOC and, in turn, facilitate tracking of their investments in climate change mitigation and adaptation.

This project aims to assess:

- What tools currently exist to help MDBs identify climate smart agriculture (CSA) practices that sequester SOC;
- Which, if any, of these tools are being used to identify and select SOC sequestration practices when investing in agricultural projects and programs, and user perspectives on the tools;
- How MDBs are identifying and tracking the impact of agricultural investments on climate change mitigation; and
- Where there are unmet needs for decision-support and tracking tools to assist with selecting CSA practices that sequester SOC and, in turn, evaluating agricultural investments for their climate change mitigation impacts.

CGIAR RESEARCH PROGRAM ON Climate Change, Agriculture and Food Security CCAFS

This Info Note summarizes insights and conclusions from the preliminary (scoping) stage of the project. The scoping phase involved: a review of existing green/positive lists; interviews with key contacts at the International Finance Corporation (IFC), World Bank (WB), Asian Development Bank (ADB), UNIQUE Forestry and Land Use, and Corporate Carbon (see Appendix 1, Interviewee List); and a review of existing guidance and practices for tracking MDB climate financing in agriculture. Informants at the Inter-American Development Bank (IDB), African Development Bank (AfDB), International Fund for Agriculture and Development (IFAD), and the Green Climate Fund (GCF) were also contacted, but full interviews did not take place.

Existing tools for selecting CSA practices to sequester SOC

There have been multiple attempts to develop decision-support tools to guide the selection of CSA practices for SOC sequestration. Most are list-type tools that provide lists of practices and their typical performance criteria, sometimes with an interface to identify which practices may be suitable to a given context.[1] Not all tools address SOC sequestration as an independent component of CSA or as a greenhouse gas (GHG) mitigation option. In the course of this work, the following tools were reviewed: the Best Bets Compendium; the Climate-Smart Agriculture Country Profiles; KnowSoil; the (now defunct) Carbon Farming Initiative's Positive List; the NRCS Practice Standard GHG and Carbon Sequestration Ranking Tool; and the WOCAT SLM Database.

A few clear findings emerged from the review of existing tools:

- None of the lists attempts to associate a given practice with an absolute magnitude of SOC sequestration or GHG mitigation. Most use a qualitative scale or assess the magnitude of change relative to a baseline. It is often difficult to know how tradeoffs (e.g. effects on methane or nitrous oxide) have been addressed.
- Some lists are curated (e.g. by scientists), whereas others (such as WOCAT SLM) allow anyone to upload practices or cases, although they must be reviewed and approved by a site administrator.
- The Best Bets Compendium, the CSA Country Profiles, and the WOCAT SLM database cover geographical regions in developing countries, whereas the others do not.
- The only list that features a decision-support infrastructure that allows users to enter contextual conditions and then recommends a practice or set of practices is KnowSoil, which features a limited set of practices calibrated for Western Europe.[2]
- While the lists help identify potential practices for consideration, they do not generally provide substantial guidance regarding field implementation. The exception is the NRCS tool, which is linked to specific practice standards that prescribe implementation steps and requirements, albeit tailored to the United States context.

In the case of the Positive List, it is notable that no cropping or pasture management practices made the list; per an executive at Corporate Carbon, this was due to challenges in generating scientific consensus around the link between specific practices and SOC sequestration that worked in most or all Australian contexts. The only agricultural practices that made the list were associated with livestock emissions, manure management, and dry season savannah burning. The Positive List approach has since been abandoned in Australia, replaced by a measurement-based approach.

Use of existing tools by MDBs in designing agricultural projects to sequester SOC

A list of potential interviewees was compiled based on existing knowledge and relationships with MDBs. Interviewees were directly involved in climate change mitigation activities and in some cases specifically focused on agriculture (see Appendix 1, Interviewee List).

Interviewees generally expressed some level of awareness that list-type decision support tools existed, but none indicated that they routinely consulted a list in their work. Nor did most interviewees indicate knowledge of routine use of lists by their project partners. One respondent noted that he is aware of some use of the CSA Country Profiles in identifying potential projects to implement. There appears to be a divide, as well, between direct financing of large projects and programs by MDBs versus lending to national banks, which may subsequently be disbursed to tens of thousands (or more) clients. In the former, MDBs frequently have more

[1] Calculators such as the Ex-Ante Carbon-Balance Tool (EX-ACT) and the Cool Farm Tool can be used to compare different management approaches or project designs (at a low level of detail), but do not directly prescribe practices and so are treated separately. The SmartSoil tool was designed to assess the impact of changing farm management practices on SOC sequestration, calibrated for the climate and agricultural systems of central and southern Europe. It is no longer accessible and available for use and hence was not evaluated.

[2] While not specifically designed for SOC sequestration, an inspiration for simplicity of use and user interface is Cornell's Cover Crop Decision Tool, which combines a simple interface with useful agronomic advice regarding implementation, albeit for a specific geography (New York) and practice type (cover cropping).

involvement in project design and development than in the latter.

Identifying and tracking MDB agricultural investments to achieve climate change mitigation

Since 2011, MDBs have committed to tracking finance of climate mitigation and adaptation using a joint methodology, including in the agricultural sector. This is part of a broader goal, per Article 2.1c of the Paris Agreement, to make "finance flows consistent with a pathway towards low greenhouse gas emissions and climate-resilient development."

In this context, tools that can support identification and selection of CSA practices (including SOC sequestration) can help MBDs design and implement agricultural projects that contribute to SOC (Level 3 in Figure 1). In turn, these projects can be flagged and subsequently tracked as part of a portfolio of investments that deliver SOC sequestration, something that is already ongoing (Level 2, Figure 1). Tracking of climate financing at the project- and portfolio-level could feed into MDB-wide joint reporting (Level 1, Figure 1).

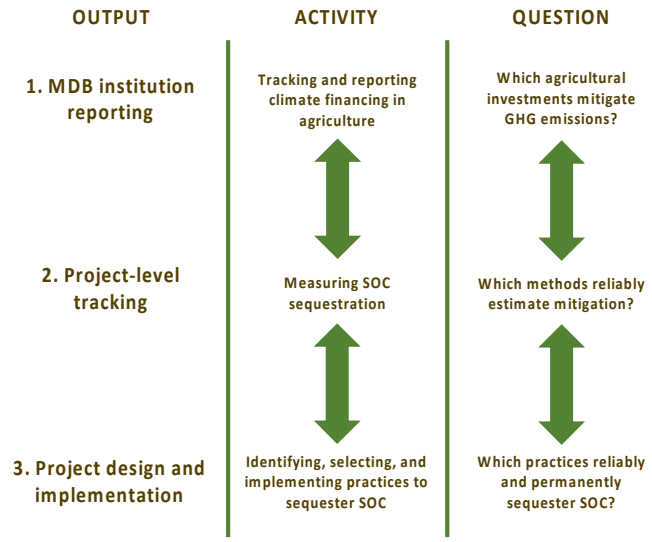

Figure 1. Linking Practice Selection, Climate Mitigation

Investment tracking, and MDB climate finance reporting

Based on the interviews conducted for this study, it appears that efforts at each level are operating semi-independently. At the **MDB institution-level**, reporting and tracking of adaptation and mitigation financing is intended to follow Common Principles developed by the International Development Finance Club (IDFC). Challenges include identifying which project components count as climate financing (attribution), whether climate benefits are additional, and how to adequately track co-financing to avoid double-counting.

For **project-level** tracking, ex-ante estimates must be used to determine if a project can be expected to have a climate benefit. It is left to the project team to select appropriate methods for estimation; none are prescribed. Project activities with mitigation benefits are supposed to be disaggregated from project activities without a mitigation benefit. It does not appear that the magnitude or duration of the benefit matters; as long as project-level ex-ante analysis indicates a net positive mitigation benefit, the activity can be counted as climate financing. Selection of the ex-ante method or tool is generally decided on an *ad hoc* basis, with the exception of the World Bank's Global Agricultural Practice, which has mandated the use of the Ex-Ante Carbon Balance Tool (EX-ACT) for all projects worldwide, even those that are not designed explicitly with climate change mitigation in mind. While there is a mandate to use EX-ACT prior to project implementation, there is no requirement to update estimates to reflect the actual level of practice adoption and implementation. For some projects with carbon sequestration as a focus (e.g. those of the BioCarbon Fund), specific project-level systems (e.g. Results Framework) are developed to monitor mitigation benefits throughout project implementation.

At ADB, teams have begun using EX-ACT, but have noted considerable limitations to its use (e.g. poor emission factors, failure to capture lifecycle-related emissions) and its use has not been mandated. Some bilateral development banks (e.g. l'Agence Française de Développement) are also evaluating the use of EX-ACT.

The IFC has not adopted a standardized approach, although they report some hope for the use of farm management models and tools (e.g. Granular, AgriEdge, Agrible[3]) to track SOC sequestration, with the caveat that these are only really appropriate for larger commercial farms using precision agriculture. In many cases, IFC lends to national banks that then may lend to thousands of individual customers, making it very difficult to understand the climate impact of their lending. Of particular concern is the fact that SOC sequestration is often dependent on the continued adoption of a practice, something that is difficult (or at least not cost-effective) to monitor, especially for smallholders.

In terms of other tools and approaches, a staff member of the World Bank expressed an interest in using GLEAM for livestock projects. Use of the DNDC model for SOC under grassland management is currently being evaluated in Brazil. In Australia, an alternative approach has been taken at the national level, where, instead of ex-ante modeling, their Emissions Reduction Fund requires direct

[3] Note that Agrible's system already incorporates the Cool Farm Tool, a Tier 2 level GHG calculator.

field measurement of SOC sequestration. This approach superseded an earlier, practice-based approach that was built around the "Positive List," previously discussed in this report. According to an executive at Corporate Carbon, the measurement-based approach was instrumental in getting SOC sequestration projects off the ground. The lack of strong consensus about the SOC benefits of many agricultural practices, as well as their context-dependence, had made it hard to get SOC practices onto a positive list. Because SOC sequestration is largely a "no regrets" practice due to its considerable co-benefits and minimal trade-offs (mostly competition for organic matter inputs), the ability to participate in carbon markets has helped incentivize farmers to adopt practices they were often considering already.

For **project design and implementation**, interviews with MDB staff and others indicate that most decisions about practice selection are made on an ad hoc basis by project development teams or, in the case of the IFC, by farmers prior to approaching a bank for financing. One respondent indicated that some project teams are using the CSA Country Profiles developed by CCAFS. While the EX-ACT tool is used by the World Bank during project design and development, it is not typically used as a decision-support tool for selecting practices, in part due to its Tier 1 functionality where the "carbon stock change factors" largely determine the results.

At ADB, there is awareness that their agricultural investment portfolios may have missed opportunities for SOC sequestration and climate change mitigation. They have begun inviting experts to review their project portfolios to identify missed opportunities and have identified commodity chain interventions, including food waste and loss, as a high priority for investment in climate change mitigation, due in part to ongoing partnerships with agribusiness. The lessons learned from the expert reviews will inform future projects, helping mainstream the incorporation of CSA practices. However, the absence of agronomists on staff limits their capacity. Credible list-type tools could potentially facilitate the integration of CSA practices into their project portfolio, especially if practices can be identified that are not "context-dependent." Commodity- or crop system-specific lists could help address the desire for context-independent practice recommendations.

In Australia, the measurements-based approach means that many different practices are being pursued; practices are usually identified by a farmer in tandem with an agronomist or other consultant. Farmers commit to implementing a project for 25 years or longer (permanence), during which monitoring and reporting must occur at five-year (or fewer) intervals to generate marketable credits. There is hope that the results of long-term monitoring and reporting will be useful in developing a list of "best" SOC sequestration practices, but this remains to be seen. They may share (or offload) the costs of monitoring to a third-party, such as a carbon credit originator.

Unmet needs

There is considerable interest, especially at the IFC, in using **SOC sequestration as the basis for concessional lending programs**, e.g. factoring it in to credit risk assessment. Because increased soil organic matter can be associated with a variety of important co-benefits (increased yields, drought tolerance, pest management, etc.), the goal would be to offer favorable loans or insurance products to farmers that can demonstrate successful efforts to build and maintain SOC stocks. However, there are barriers to doing this: in particular is the perception that, because SOC sequestration is dependent on ongoing, long-term practice adoption, it can be **prohibitively expensive and difficult to monitor**, **especially for smallholders**. This contrasts with biomass sequestration, for example, which emerging satellite technologies have made easier to monitor at large scales. The problem was summed up by a member of the IFC, who noted "as a financial institution developing instruments in 20 countries, each of which services 20-30,000 farmers, how can we be sure farmers are doing what they say they are doing?" Given this, there was general interest in learning about the **barriers banks face in financing SOC sequestration**. At ADB, there was a perception that if credible tools to document SOC sequestration could be developed, they would be better able to engage the social impact investment community in project finance.

In terms of tools for identifying projects that contribute to climate change mitigation, while there was wide use of **EX-ACT**, it **was not perceived as a credible tool for quantifying SOC sequestration** because it is based on Tier-1 emission factors. Other weaknesses include difficulty connecting input data with project design; inability to capture lifecycle impacts, especially transportation; and its ex-ante nature. Most MDB projects are driven by borrower countries, who need to estimate adoption as a basis for their loans but are not necessarily required to verify and report on adoption rates. These factors combine to increase the uncertainty of ex-ante estimates. At the World Bank, which requires use of EX-ACT, the formal guidelines do not require any estimate of uncertainty.

Time and cost requirements were perceived as a major barrier to improving estimation of SOC sequestration through field sampling and lab analysis (i.e. measurement). In the medium term, emerging methods such as the use of infrared spectroscopy may be able to lower measurement costs. Hybrid models that combine ex-ante estimation with field measurement could represent a cost-effective yet robust alternative.

Conclusions and recommendations

The preliminary work documented in this Info Note points to several important conclusions:

- Efforts to track MDB investments in agricultural climate mitigation are somewhat disconnected from efforts to select CSA practices and estimate project-level GHG mitigation and SOC sequestration.
- Practice selection for SOC sequestration remains *ad hoc* at the MDBs, although there is interest in having access to better decision-support tools.
- In designing decision-support tools, important priorities for MDB interviewees include: adequately addressing context dependence; estimating the absolute magnitude of SOC sequestration; verifying estimates to address concerns about extent of implementation and permanence of sequestration.
- New technologies (e.g. infrared spectroscopy) and methodologies may help lower the cost of measurement-based approaches to quantifying SOC sequestration.

To advance this work further, the following actions are recommended:

- Undertake additional interviews with MDB personnel responsible for project design and development. This may include partner organizations, extension agents, and other non-MDB staff. Additional MDBs, especially IFAD and AfDB, should also be engaged.
- Investigate the feasibility of developing commodity- or crop system-specific practice lists. The IFC expressed a willingness to connect CCAFS team members with their agronomists and project specialists to discuss this potential.
- Engage with national development banks, commercial banks, and insurers to better understand the ways in which SOC stocks can be incorporated into farm lending and insurance products.

Further Reading

- Alexander P, Paustian K, Smith P, Moran D. 2015. The economics of soil C sequestration and agricultural emissions abatement. *SOIL* 1, 331-339,.
- European Bank for Reconstruction and Development. 2018. Joint report on multilateral development banks' climate finance. London, United Kingdom.
- Li M, Wu J, Deng X. 2016. Land use change and soil carbon sequestration in China: Where does it pay to conserve? Regional Environmental Change 16(8):2429–2441.
- Soussana J-F, Lutfalla S, Ehrhardt F, Rosenstock TS, Lamanna C, Havlík P, Richards M, Wollenberg E, Chotte J-L, Torquebiau E, Ciais P, Smith P, Lal R. 2017. Matching policy and science: Rationale for the '4 per 1000 - soils for food security and climate' initiative. Soil & Tillage Research.
- World Bank. 2012. Carbon Sequestration in Agricultural Soils. Washington, DC.

Thank you *to respondents from:*
Asia Development Bank
African Development Bank
Corporate Carbon
Unique Forestry and Land Use
International Finance Corporation
World Bank

Michael Wironen *(michael.wironen@tnc.org) is a Senior Scientist for Agriculture & Food Systems at The Nature Conservancy, where his work focuses on engaging corporate actors in the agri-food sector to support sustainable intensification and conservation initiatives in agricultural landscapes. His PhD is from the University of Vermont Gund Institute for Environment.*

For more information about this research*, please contact Julianna White, Program Manager for CCAFS Low Emissions Development, via julianna.m.white@uvm.edu*

About CCAFS Info Notes

The CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS) is led by the International Center for Tropical Agriculture (CIAT). CCAFS brings together some of the world's best researchers in agricultural science, development research, climate science and Earth System science, to identify and address the most important interactions, synergies and tradeoffs between climate change, agriculture and food security. Visit us online at **https://ccafs.cgiar.org**.

CCAFS Info Notes are brief reports on interim research results. They are not necessarily peer reviewed. Please contact the author for additional information on their research.

CCAFS is supported by: