Using the Mitigation Options Tool (CCAFS-MOT): Case studies

Who are the users of the CCAFS-MOT and what are they using it for?

Diana Feliciano, Kirsten MacSween

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Key messages

- The CCAFS Mitigation Options Tool (CCAFS-MOT) enables quick identification and comparison of mitigation options for agriculture with minimal training or data requirements.
- The tool is appropriate for generating high-level scenarios for discussion by project planners, consultants, extension services, advisors to policy-makers, teachers, and researchers.
- Several users considered CCAFS-MOT easy to use and were interested in continuing use.
- Many users were not familiar with greenhouse gas (GHG) emission accounting tools before experiencing the CCAFS-MOT.

This brief summarises feedback obtained from users of the CCAFS-MOT.

Case Study 1 – Information dissemination

- User: BASE LINE Sustainable Development Goal Initiative
- Land use: Agriculture
- Country/Region: India

In September 2017, the BASE LINE Sustainable Development Goal Initiative organized a conference in New Delhi, India, to discuss the integration of the Sustainable Development Goals (SDG 1 – No poverty) with India targets for poverty alleviation and environmental management. The organizing committee identified the CCAFS-MOT as a potential tool to measure and report positive environmental and social impacts of sustainable agricultural practices and requested to post the CCFAS-MOT website to the conference event.

Case Study 2 – Project reporting

- User: Agri-benchmark Cash Crop team, Thünen Institute of Farm Economics, Germany
- Land use: Upland corn and flooded rice
- Country/Region: China and Vietnam

The CCAFS-MOT was used to calculate emissions from upland continuous corn in China and flooded rice in Vietnam under the project ‘Costs of mitigating greenhouse gas emissions in crop and beef production’. The user mentioned that the tool was easy to use and that the supplementary database provided was important to understand the calculations. The user contacted the CCAFS-MOT team to discuss the results provided by the tool and to make technical suggestions to improve the calculations as for example 1) the amount of residue burnt should be inserted manually instead of an automatic assumption that 50% of the crop residues were burnt; 2) the emissions released from residues transported off-site should be accounted in the overall GHG emissions even if these were not burnt nor incorporated in the soil; 3) the calculation of GHG emissions from residue incorporation should be dependent of the tillage regime chosen by the user; 4) there should be a limit to the increase of soil carbon sequestration as soils reach a soil organic carbon equilibrium. The results obtained from the CCAFS-MOT will be used on a Government report.
Case Study 3 - Research

- **User**: Researcher at West African Science Service Centre on Climate Change and Adapted Land Use, Federal University of Technology, Minna, Nigeria.
- **Land use**: Lowland rice
- **Country/Region**: Niger State, Nigeria

The CCAFS-MOT was used to determine the short-term effects of incorporating urea and pre-wetted straw off-season on soil carbon sequestration of lowland rice fields in Edozhigi, Nigeria. To estimate GHG emissions the researchers input data obtained from the experiments conducted on-site. Regional information included country, climate, and soil type. Management practices included the duration of the experiment, land use, the amount of straw used, and urea input. Soil type was determined by analyzing soil cores in the laboratory; this included information on soil texture, soil pH, organic C (%), nitrogen content N (%), and bulk density (g/cm³). The CCAFS-MOT estimated GHG emissions and SOC balance under different treatments (management options). The study identified three best management options for soil carbon sequestration. The tool helped to identify management practices that could mitigate the negative effects of climate change while supporting productivity and resilience in Northern West Nigeria.

Case Study 4 - Research

- **User**: Senior scientist at CIMMYT-CCAFS (CGIAR), India
- **Land use**: Cropland (cereals)
- **Country/Region**: Indo Gangetic Plains, India

The CCAFS-MOT was used alongside household surveys and statistical models in a study that identified potential high-yield, low-emissions development pathways in two cereal production systems in the Indian Indo-Gangetic Plains. Researchers used available information on a variety of practices including crop residue return, tillage practices, and manure application in the two cereal systems. The CCAFS-MOT was also used to identify how each production system performed in terms of GHG emissions regarding land-use efficiency and efficiency per-unit of product. The CCAFS-MOT also estimated the global warming potential (GWP) of the two production systems by converting all GHG emissions into CO₂-equivalents, and it estimated the GWP of each crop at yield scale by dividing the total GWP by grain yield. The CCAFS-MOT allowed the users to identify management options that could reduce GHG emissions without decreasing production. The main advantage pointed out by the users was the ability of the CCAFS-MOT to recognise context-specific factors at both field and farm level which influence GHG emissions, such as soil characteristics, production inputs and other management practices.

Case Study 5 – Knowledge exchange workshop

- **User**: Researchers, students, technicians and policy makers and advisors
- **Land use**: Agriculture
- **Country/Region**: Ethiopia

The CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS) East Africa Regional Program and Low Emissions Development Flagship, the University of Aberdeen, the United States Department of Agriculture (USDA) Foreign Agricultural Service, the International Livestock Research Institute (ILRI), and the Ethiopian Institute for Agricultural Research (EIAR) co-hosted field activities and a three-day workshop exploring the use of the CCAFS-MOT in Ethiopia. The main objective of the field activities and workshop was to introduce the CCAFS-MOT to a wide range of stakeholders and to use the tool to quantify greenhouse gas (GHG) emissions from different land management practices and to exchange knowledge on the relationship between climate change and land use and management. Workshop participants indicated they would use the CCAFS-MOT in their activities in the future. Even though the appraisal of the CCAFS-MOT was very positive, participants suggested the contextualisation of the tool for Ethiopia.

Case Study 5- Teaching

- **User**: Former student on a MSc in Climate Change, Agriculture, and Food Security (CCAFS) provided by National University of Ireland, Galway (NUI Galway) in 2016
- **Land use**: Cropland (barley)
- **Country/Region**: Ireland

The user downloaded the CCAFS-MOT from the project website after attending a lecture on GHG emissions from agriculture and mitigation practices. The MOT was used to estimate GHG emissions from barley production and land use change from grassland to arable land in Ireland and to identify potential mitigation options. The user contacted the CCAFS-MOT team to discuss the results obtained and to provide feedback which was used to develop the tool. The CCAFS-MOT helped the user to better understand the impact of land use change on the overall GHG emissions and which mitigation options could be implemented to reduce emissions. The user found the tool really useful and very versatile and a very handy tool for CSA practitioners. The user had some doubts regarding the results obtained and contacted the team with suggestions for improvement. These suggestions were incorporated in the following version of the tool.
Conclusions

The CCAFS-MOT has been used in different countries (e.g. India, Ireland, Nigeria, China, Vietnam, Ethiopia – see Figure 1) to quickly assess greenhouse (GHG) emissions related to management options in agriculture and land use change and to identify emission reduction practices with no impact on crop yields (Table 1). These results were used in scientific articles, governmental reports and as tool to raise awareness about the sustainable development goals (especially Sustainable Development Goals 12 and 13) and in knowledge exchange workshops. Users highlighted the user friendliness characteristic of MOT and welcomed leadership from CCAFS, in partnership with an academic institution, in developing a tool that can help to inform policy makers about greenhouse gas emission sources and sinks in the land use sector, on the management options available to reduce those emissions and to enhance carbon sequestration, and on the technical and socio-economic potential of those options. The CCAFS-MOT is not contextualized to any specific country in order to be flexible enough so users in different countries can change it as required. The main advantage of the CCAFS-MOT is to provide free, rapid assessments that are the first step of a more in-depth GHG emission and mitigation options analysis. The CCAFS-MOT is a tool and should be part of a series of steps in the analysis of the contribution of land use management to GHG emissions and possibilities to reduce those emissions. Recommendations provided to policy and practice should always be based on evidence from several sources, of which the CCAFS-MOT is one.

Table 1: Utility of CCAFS-MOT, as described by main users

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<th>Dissemination</th>
<th>Project Reporting</th>
<th>Research</th>
<th>Knowledge Exchange</th>
<th>Teaching</th>
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<tbody>
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<td>Estimating GHG emissions</td>
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<td>Understanding sources of emissions</td>
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<td>Understanding influence of practices on emissions</td>
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<td>Identifying mitigation options</td>
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<td>Identify co-benefits of mitigation</td>
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<td>Country contextualisation</td>
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<td>Enhance learning about the relations between land use and climate change</td>
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Downloads

The CCAFS-MOT has been downloaded from the CGIAR document repository 1,471 times (https://cgspace.cgiar.org/handle/10568/67027). In the past 6 months, most downloads occurred in Ethiopia (262), United States (233), and India (90).

Figure 1 – User locations
The CCAFS-MOT estimates greenhouse gas emissions from multiple crop and livestock management practices in different geographic regions, providing policy-makers across the globe access to reliable information needed to make science-informed decisions about emission reductions from agriculture. CCAFS-MOT joins several empirical models to estimate GHG emissions from different land uses and suggests mitigation options that are compatible with food productions.

Researchers at the University of Aberdeen, in partnership with the CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS) and the University of Vermont’s Gund Institute for Environment, are developing the tool. In addition to support from CCAFS and its donors, research and development of CCAFS-MOT has been supported by the British Research Council’s Natural Environment Research Council (NERC), the United States Agency for International Development (USAID), and the United States Department of Agriculture (USDA).

Diana Feliciano (diana.feliciano@abdn.ac.uk) is a Research Fellow at the University of Aberdeen.

Kirsten MacSween (kirsten.macsween@abdn.ac.uk) is a Research Assistant at the University of Aberdeen.