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Using the CCAFS Mitigation Options Tool to identify mitigation co-benefits in Ethiopia's land use sector

November 2018

Diana Feliciano

Using the CCAFS Mitigation Options Tool to identify mitigation co-benefits in Ethiopia's land use sector

Field activities and workshop report,

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1. Introduction

From 20-27th March 2018, 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-Mitigation Options Tool (MOT) [1] in Ethiopia.

The primary objective of the field activities and workshop was to introduce the CCAFS-MOT to researchers, students, technical personnel of the agriculture and environment ministries and policy advisors in Ethiopia and use the tool to quantify greenhouse gas (GHG) emissions from different land management practices. The CCAFS-MOT identifies the main sources of agricultural emissions and potential agricultural practices that reduce GHG emissions. The workshop provided an opportunity to discuss the co-benefits of low emissions agricultural practices and the barriers for implementation.

[1] https://ccafs.cgiar.org/mitigation-option-tool-agriculture#.WyJ8j02WyTM

2. Executive summary

CCAFS, the University of Aberdeen, USDA, ILRI and EIAR invited a wide range of stakeholders interested in climate change adaptation and mitigation to field activities and a worshop that would apply CCAFS-MOT to the Ethiopian context. These activities included field work for data collection and a three-day workshop; the workshop was composed of one day to train the trainers, one day to train technicians, and a one-day seminar for policy makers and policy advisors. The workshop took place at the ILRI (International Livestock Research Institute) campus in Addis Ababa, Ethiopia on the 23rd, 26-27th March 2018. Participants included representatives from Ethiopian ministries, universities, research institutes, NGOs, students. Please find the invitation letter in Appendix 1, the full participant list in Appendix 2 and the workshop agenda in Appendix 3.

The aims of the training of technicians and the seminar for policy makers and policy advisors were to introduce the CCAFS-MOT and to understand its capacity to support users to estimate GHG emissions from land management practices, identify sources of GHG emissions in the land use sector (agriculture, forest, grassland), understand the influence of land management practices on GHG emissions, identify mitigation options and their co-benefits and barriers for its implementation, and identify gaps for further analysis and tool refinement.

Participants collected field data in two sub-catchments of Tula catchment in the Lemi district, Ethiopia, used the CCAFS-MOT with local data on climate, soil characteristics and land management practices, estimated GHG emissions from land management activities and ranked the most effective practices that reduce emissions to build resilience in agriculture. Undertaking such analyses can be a specialised and time-consuming task, but the CCAFS-MOT was designed to offer users a shortcut. In Ethiopia, the CCAFS-MOT can serve experts in their efforts to develop policies and implementation actions to achieve Ethiopia's National Determined Contribution (NDC) targets.

3. Background

The Ethiopian government is a leader on incorporating climate considerations into national policies and program. Ethiopia was the first Least Developed Country to submit its Intended Nationally Determined Contribution (INDC). Ethiopia's contribution represents a 64 percent emissions reduction from business as-usual (BAU) emissions by 2030 (from 400 $MtCO_2e$ to 255 $MtCO_2e$). Ethiopia's NDC would lead to a reduction of at least 64% below the Ethiopian BAU scenario by 2030, when emissions including LULUCF are projected to reach 400 $MtCO_2e$. The corresponding GHG emissions reduction target for 2030, excluding LULUCF, is 40% below BAU, or 185 $MtCO_2e$, which is the emissions level used to rate the emissions reduction target. Full implementation of the NDC is conditional on finance, technology transfer and capacity building support under the framework of Ethiopia's Climate Resilient Green Economy (CRGE) Strategy, which is integrated in its national development Second Growth and Transformation Plan (GTP II). If policies are successfully implemented, the NDC target could be achieved in 2030. Uncertainty remains about the effectiveness of current policies and is reflected in a range of current policy projections.

Ethiopia's NDC includes GHG emission reduction targets and mitigation options for all sectors of the economy. The agriculture and land use sector presents unique mitigation opportunities because it is the only sector that is able to reduce GHG emissions and also sequester carbon in trees, vegetation and soils. According to the FAOSTAT data[2], GHG emissions from the agricultural sector have been steadily increasing from 48,084 $MtCO_2e$ in 1993 to 100,584 $MtCO_2e$ in 2017. The agricultural sector is a major contributor to national emission levels (approximately 60%), mainly resulting from livestock-related activities. At the same time, agriculture is the basis of Ethiopia's economy and the primary source of employment for its population. About 90% of total export earnings come from agriculture, especially from coffee, livestock products, and seeds and pulses.

The Ethiopian government already engaged in discussions about the implementation of climate-smart agriculture (CSA) practices which include the reduction and removal of greenhouse gases (GHG) from the atmosphere (mitigation), the increase in resilience to

[2] http://www.fao.org/faostat/en/#home

climate change and variability (adaptation) and the increase in food production and income. Climate Smart Agriculture[3] considers these three pillars at scales from farm to landscape, at levels from local to global, and over short and long time horizons, while taking into account national and local specificities and priorities. There are several tools and methods available to undertake the context-specific analysis needed to make evidence-based decisions on the prioritisation of CSA practices, including practices that reduce GHG emissions and contribute to NDC targets. However, obtaining and applying such analyses can be costly, time-consuming and require specialized skills.

The CCAFS-MOT, developed by the University of Aberdeen and CCAFS with funding from CGIAR Fund Donors, USAID and USDA, can undertake low-cost, rapid analyses about the contribution of land management to climate change and the potential of the land use sector to mitigate climate change. The CCAFS-MOT estimates GHG emissions from multiple crops and livestock management practices using region-specific data by bringing together several empirical models. The CCAFS-MOT includes a variety of soil types and climate zones suitable for general use everywhere in the world. It provides policy-makers access to general information needed to make evidence-based decisions about land management practices that can reduce emissions and sequester carbon, and it can be used as the first step of an in-depth GHG emission assessment. The CCAFS-MOT can also be used in workshops, interviews, focus groups, and discussions to create awareness and facilitate learning about the relation between land use (agriculture, forestry, grassland) and climate change. Although a number of GHG calculators already exist, the CCAFS-MOT is distinct because it:

- Ranks the most effective mitigation options for dozens of different crops according to mitigation potential and in relation to current management practices and climate and soil characteristics
- Has low input data requirements
- Takes approximately 5 minutes to input data
- Runs in Excel
- Is freely downloadable from the CCAFS website

[3] http://www.fao.org/climate-smart-agriculture/en/

The workshop brought together representatives from several Ethiopian institutions (research institutes, universities, NGO's, government ministries, students). Participants used the CCAFS-MOT to estimate GHG emissions from land use management practices, rank the most effective management practices to reduce emissions, and discuss the co-benefits and barriers for the implementation of those practices in the Ethiopian context.

4. Activity overview

Activities included meetings and discussion with field data collectors, field work, and interviews with farmers. At the workshop for technicians, international development partners, experts, policy-makers and policy advisors, activities included presentations on climate change science and policy, a presentation on the CCAFS-MOT, practical exercises applying the CCAFS-MOT to the situation in Ethiopia, discussion of the results, presentation of the results, reflections and suggestions. An outline of the activities according to the days they took place is presented in Table 1. Planning was carried out between October 2017 and March 2018. Information on the preparation stages is collated in Appendix 4.

Table 1 – Overview of the activities undertaken

Day 0 – 20-21st March	Field work in Tula catchment, Lemi district
Day 1 – 23rd March	Training of trainers – Presentation on climate change science and policy, presentation on the CCAFS-MOT, practical exercises, discussion, suggestions
Day 2 – 26th March	Trainer of technicians – Presentations on climate change science and policy, presentation on the CCAFS-MOT, practical exercises, discussion on the results, PowerPoint preparation, reflections, questionnaire
Day 3 – 27th March	Seminar - Presentations on climate change science and policy, presentation on the CCAFS-MOT, presentation of results from previous day to policy-makers and policy advisors, break-out session, final considerations, written feedback

4.1. Day 0 - Field data collection

The field sites for data collection are located in the Tula catchment, Lemi district, about 15 km from Hossana and 265 km from Addis Ababa, along the Addis – Areka road. The altitude of the region varies from 2620 to 2740m. The major farming system of the area is mixed

enset[4]-cereal-livestock production. The major crops grown include enset, wheat, potato and faba-bean. The average yield of wheat and potato is 3 and 29 ton per hectare, respectively. The climate is classified as tepid sub humid mid highlands. According to FAO soil classification, the watershed is classified as Chromic Luvisol (LVcr). The soil is characterised by high clay content in the sub soil and is susceptible to soil erosion on steep slopes. There are 345 households in Tula watershed. According to the local wealth ranking, 21, 50 and 29% of the households are classified as rich, medium and poor, respectively.

Figure 1– Lemi district (Google maps)

Figure 2– Tula catchment - Inter Aide hand sketched map (Credit: Feliciano D.)

[4] Ensete ventricosum

Figure 3: Field site in Tula (Credit: Feliciano D.)

On the 22nd March 2018, PhD students and researchers (9 men, 1 woman) joined Diana Feliciano (University of Aberdeen), John Recha (CCAFS) and translators to collect data on field site characteristics, farmers' current land management practices, perceptions on weather changes and socio-economic characteristics. The participants were briefed the day before on the objectives of field work and the data collection. A structured interview guide prepared by Diana Feliciano and John Recha (see Appendix 5) was presented, discussed and amended with suggestions provided by the participants. The NGO Inter Aide was contacted *a priori* to identify and liaise with farmers willing to be interviewed in two sub-catchments of Tula catchment. Two teams of 6 people plus translators interviewed farmers individually at field sites. In total 28 farmers were interviewed, including 5 women. Each interview lasted an average of 45 minutes. Data collected was typed by each interviewer, compiled by one participant and sent to Diana Feliciano.

Figure 4: Session to discuss field data collection (Credit: Ambaw G.)

Figure 5: Individual farmer interview (Credit: Feliciano D.)

4.2. Day 1 - Training of trainers

The objective of the trainers of trainers (23rd March 2018) was to introduce the CCAFS-MOT to the researchers, PhD students, and MSc students, discuss its functionalities and build capacity to use the tool in future activities. The trainers would have the ability to train other people interested in the contribution of land use and management to climate change, and on the impacts of climate change on land use and management. During the session, Diana

Feliciano presented on climate change science, climate change policy and the CCAFS-MOT (Appendix 6) and led practical exercises with the tool (Appendix 7) using the data collected in the field. The team who collected the data in the field input the data in the tool, estimated the results, ranked the most effective practices to reduce GHG emissions and discussed the co-benefits of these practices and the barriers to implementation. The participants also discussed data quality issues and suggested improvements to the CCAFS-MOT. In addition, they were also briefed on their role, objectives and structure of the session to be carried out on the 26-27th March (Days 2 and 3).

4.3. Day 2 - Training of technicians

Dawit Solomon from CCAFS East Africa Regional Program began the program with a presentation on the role of CCAFS and the importance of agriculture for climate change mitigation and adaptation in Ethiopia. Next, Diana Feliciano presented on climate change science, climate change policy, the CCAFS-MOT (Appendix 8) and led practical exercises with the CCAFS-MOT with the support of the participants trained in Day 1. Trainers were assigned to groups of 4-5 participants and guided the execution of the exercises using the CCAFS-MOT. Groups prepared presentations about the results of exercises undertaken, feedback on the CCAFS-MOT and reflections about the usefulness and suitability of the tool to the Ethiopian context. One representative from each group presented the results the following day. Participants were also asked to fill a questionnaire about their current work and its relation to climate change, their sources of information, and their experience with GHG emission accounting tools (Appendix 9).

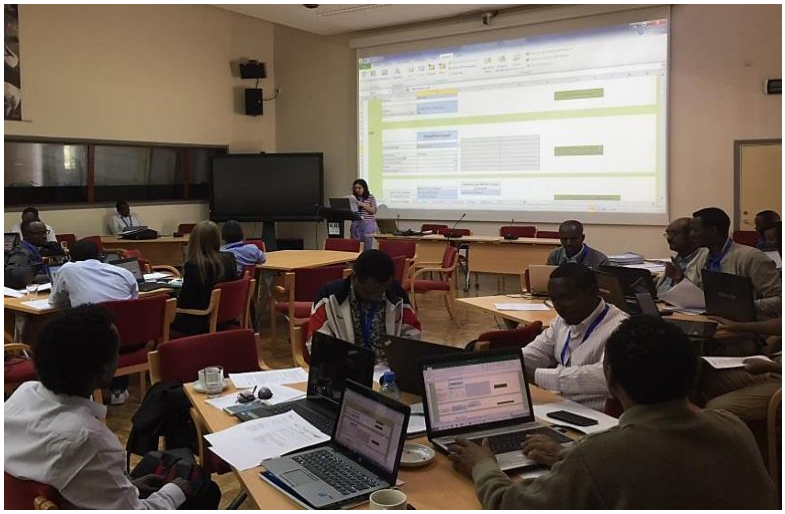

Figure 6: Training of technicians (Credit: Muchaba T.)

Figure 7: Group exercises (Credit: Muchaba T.)

Figure 8: Catch-up with trainers (Credit: Muchaba T.)

4.4. Day 3- Seminar for policy-makers and policy advisors

Dawit Solomon started with a presentation on the Carbon Benefits Project. Next, Diana Feliciano presented on climate change science, climate change policy, and the CCAFS-MOT (Appendix 10). Trainers presented the results from the previous day's exercises, feedback on the CCAFS-MOT and reflections (Appendix 11). Next, three groups including different types of stakeholders (researchers, policy-makers, policy-advisors, and students) were formed in order to discuss and answer three main questions:

- How could a project be designed to collect and use the CCAFS-MOT to estimate GHG emissions at Ethiopian level?
- How do you suggest individual databases with data, GHG emissions, and mitigation options to become linked and available for different users?
- How could you make the CCAFS-MOT more context-specific? Which teams could work on it?

Participants were also asked to provide written feedback (Appendix 12) about their intention to use the CCAFS-MOT in the future, the usefulness of the tool, or any other comments. According to the data provided by the feedback form, participants of Day 3 were:

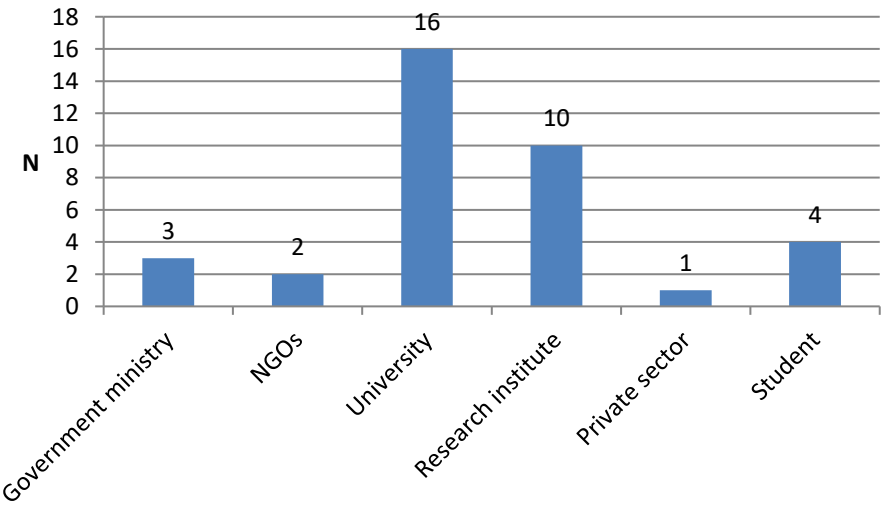

Figure 9: Stakeholder types attending Day 3

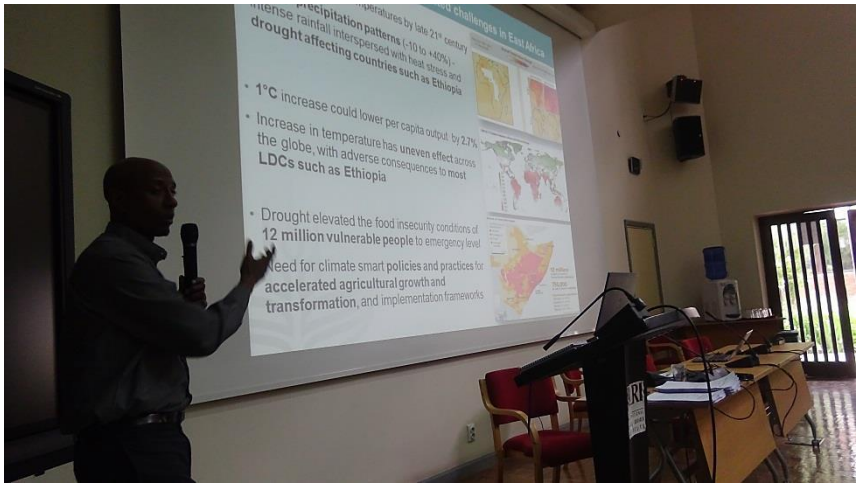

Figure 10: Dawit Solomon presents on the Carbon Benefits Project (Credit: Feliciano D.)

Figure 11: Workshop participants (Credit: Muchaba T.)

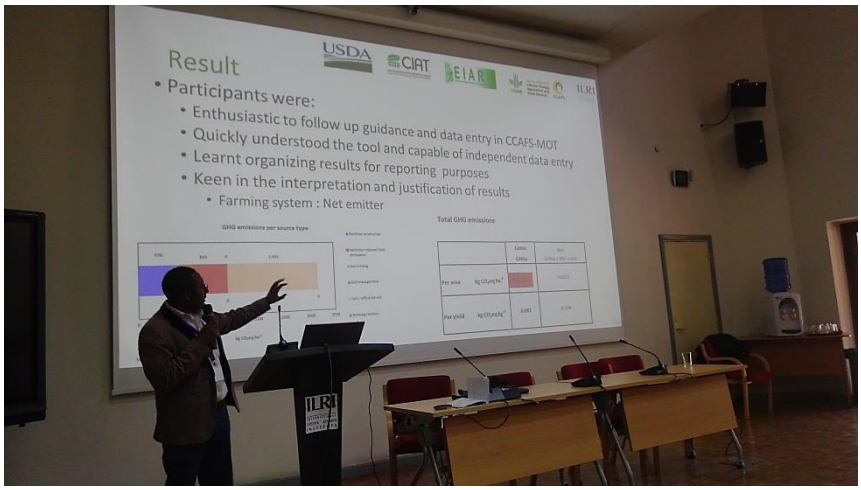

Figure 12: Group representative presenting the results from Day 2- Training of Technicians (Credit: Feliciano D.)

Figure 13: Participants' discussion in the break-out session (Credit: Muchaba T.)

5. Outcomes

5.1. Learning effectiveness

According to Bonwell & Eison (1991)[5] active learning is "a method of learning in which students are actively or experientially involved in the learning process and where there are different levels of active learning, depending on student involvement." The activities and workshop followed the active learning method with technical foci on the relation between land use (agriculture, forestry, grassland) and climate change and the assessment of GHG emissions from land management practices, sources of emissions, identification of management practices that reduce emissions, co-benefits of those practices, and barriers to implementation. According to responses (N=32) to a questionnaire distributed to participants at the end of Day 1 – Training of Trainers, 19 participants expressed no former experience with GHG emission accounting tools, 7 had only limited experience and 6 revealed they had good experience with GHG emission tools. To enhance effective learning, participants were also encouraged to express their views on what they learnt both individually and in groups and to prepare a summary of these reflections for the audience of Day 3. Group representatives presented the list of most important reflections on the learning process. In

[5] Bonwell, C., Eison, J. (1991). Active Learning: Creating Excitement in the Classroom AEHE-ERIC Higher Education Report No. 1. Washington, D.C.: Jossey-Bass.

addition, written feedback to a questionnaire distributed at the end of Day 3 provided further insights on the learning process. The reflections and considerations from participants show that effective learning occurred:

- Presentations were passionate
- The learning process was proactive
- Participants were enthusiastic to follow up on guidance and data entry to the CCAFS-MOT
- Participants quickly understood the tool and were capable of independent data entry
- Participants learnt how to organise results for reporting purposes
- Participants were keen in the interpretation and justification of results
- The activities were attractive enough to get the participants' full attention
- The CCAFS-MOT is an easy way to learn about GHG emission and sequestration
- There was widespread curiosity in using the tool
- The training was useful and attractive with a smart instructor
- Well-thought-out opinions and feedback for further development of the CCAFS-MOT were provided.

5.2. Appraisal of the CCAFS-MOT

Participants' reflections also included an appraisal of the CCAFS-MOT since Day 2 was focused on answering questions about using the CCAFS-MOT. These reflections were presented to the policy-makers and policy advisors on Day 3. In addition to the considerations presented to the audience by the group representatives, written feedback from participants also assessed the value of the CCAFS-MOT. The main considerations from participants about the CCAFS-MOT are listed below:

- The CCAFS-MOT is highly applicable because of low data requirements
- The CCAFS-MOT is simplified and user friendly
- The CCAFS-MOT can be used by different institutions and individuals interested to estimate GHG emission and sequestration at various scales (household level, watershed level)
- This tool is very helpful to come-up with evidence-based results and conclusions in agricultural sector mitigation

- The CCAFS-MOT is important to assess information on this global issue
- The CCAFS-MOT is really useful, easy to work with and equally applied by users from various backgrounds
- The CCAFS-MOT is accessible and valuable
- Participants show interest in using the CCAFS-MOT for teaching, further development, postgraduate study, research.

Participants were also asked to rate the usefulness of the CCAFS-MOT to provide information about GHG emissions and mitigation options in agriculture. The responses are shown below (Figure 14):

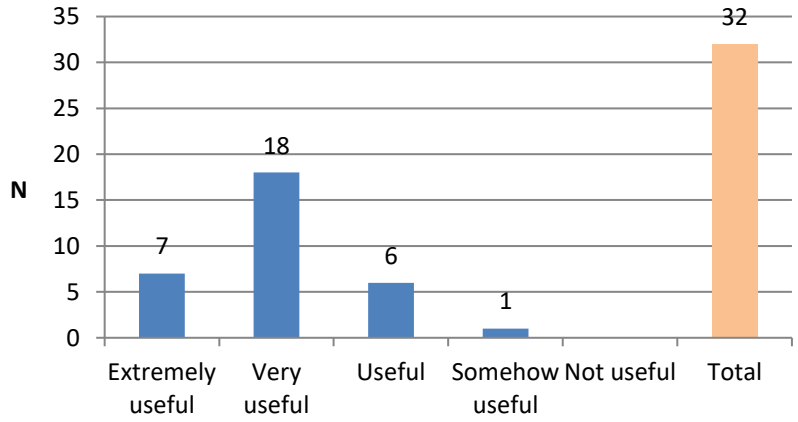

Figure 14: Usefulness of the CCAFS-MOT (participant's responses, N=32)

All participants (N=32) wrote they would use the CCAFS-MOT in their activities in the future. These activities are listed below:

- Research – 22 people
- Teaching – 5 people
- Ongoing research projects – 4 people
- Training – 2 people
- PhD thesis – 2 people
- Prepare scientific articles – 2 people
- Consultancy – 1 person
- Advice – 1 person

- Further development of the CCAFS-MOT – 1 person
- NDC reporting – 1 person

In addition to the discussions undertaken *in loco*, follow-up e-mails sent by participants confirmed that the CCAFS-MOT will be used in the future. Some e-mail excerpts are presented below:

- "I heard lots of good comments from participants. Some are interested to test and even planning to see how to incorporate some parameters that are peculiar to Ethiopia and if possible, make it applicable at 'landscape level' so that it can reflect spatial dynamics. These indicate how relevant the training was and congrats to you, CCAFS and USDA."
- "I'm looking forward to using the tool for my thesis paper and please send me if there is updated version of the tool."

Even though the appraisal of the CCAFS-MOT was very positive, participants suggested the contextualisation of the tool for Ethiopia. Suggestions in presentations and writing are to:

- Add Ethiopian climate classification
- Add Ethiopian agro-ecological classification system
- Include teff (Eragrostis tef) and enset (Ensete ventricosum) as crop types
- Detail information on land use change (e.g. to include change in tree species, extent of the change and spatial setting)
- Include GHG emissions from fermentation of "kocho" (starchy food product obtained from a mixture of the scraped pulp of pseudo stem and pulverized corm of enset plant)
- Include more fertiliser types
- Include agroforestry, intercropping, fallow land as a baseline practices
- Include home garden types
- Include aggregation of several crops at the same time (landscape level)
- Include more livestock types
- Include crop rotations
- Include option for quality of livestock feed
- Include forests, riparian vegetation, field border trees in the carbon sequestration account
- Make practices that sequester carbon more visible
- Expand mitigation options to include soil and water conservation practices

- Include nitrogen fixing crops (e.g. pulses) as mitigation option
- Consider interaction of two or more mitigation options
- Include livelihood strategies (e.g. intensification, diversification)
- Consider specific parameters and default values for Ethiopia or allow its manual input
- Make it specific for small holders
- Include more tillage options (e.g. oxen ploughing)
- Include cost-benefit analysis for management options
- Include socio-economic activities that influence adoption
- Include option to include farming system information
- Make it spatial

5.3. Break-out sessions

Three questions were discussed in the break-out sessions. These questions were:

- How could a project be designed to collect and use the CCAFS-MOT to estimate GHG emissions at Ethiopian level?
- How do you suggest individual databases with data, GHG emissions, mitigation options to become linked and available for different users?
- How could you make the CCAFS-MOT more context-specific? Which teams could work on it?

Participants suggested that implementing a project using the CCAFS-MOT would entail: establish the budget, identify one watershed as unit of assessment, identify the field sites for data collection, and describe the field sites in terms of agroecology and climate. In addition, participants recognised the need to liaise with local stakeholders so farmers could be contacted and data collected. Data collected should be organised and analysed, and a report with recommendations should be written and disseminated to the interested parts.

Participants considered that the Ministry of Agriculture should be responsible to ensure that quality data is collected and should support the creation of a database at the national level. Participants pointed out that even though infrastructure exists with the contribution of the Agriculture Transformation Agency, Agriculture for Ethiopian Research (Agri-NET) and the Ministry of Agriculture and Natural Resources, data transfer is not happening at the moment.

Participants agreed that the Ministry of Agriculture should coordinate but not be in charge of collecting the data.

It was suggested that several organisations, including research institutes, universities, NGOs, CGIAR, and development agents with personnel that are agronomists, soil scientists, climate change experts, greenhouse gas emission experts and environmental experts, should collaborate to develop the CCAFS-MOT further and contextualise it for Ethiopia.

5.4. Observers' notes

Two observers from USDA attended the workshop activities. They mixed with the groups and participated in practical exercises. They also compiled reflections on the CCAFS-MOT (Appendix 13). These considerations have been mostly covered in section 5.2.

6. Discussion

A wide diversity of stakeholders from several Ethiopian regions, including both men and women, attended the event. The structure of activities allowed for continuous exchange of ideas and feedback and continuous adjustment of the workshop structure. This contributed to active effective learning by participants. Most participants mentioned they would use the CCAFS-MOT in the future, and several ensured they will use the tool for teaching. This expands the potential number of users in Ethiopia, and consequently the learning about the relation between land use and management and climate change at larger scale. Several participants contacted the University of Aberdeen after the workshop to express their interest to continue working with the tool and with the team. This confirms that communities of practice were formed during the workshop; through these communities the number of users can be expanded.

The outcomes of the workshop show that the CCAFS-MOT can be used in similar activities with the objective of triggering discussion about the contribution of land management practices to climate change and the potential of the land use sector to mitigate climate change and benefits for climate change adaptation. The capacity of the CCAFS-MOT to influence change in land management at larger scales depends on the effectiveness of capacity building

workshops, discussions, classes, focus groups and whether they create awareness about the sources of emissions, practices to reduce emissions, the co-benefits of those practices, the barriers to implementation, and data gaps. In this case, even though the objectives of the workshop were accomplished, some changes should be introduced, namely, presentation of the CCAFS-MOT to field data collectors before the field work, ensure the trainers are confident enough to be working group leaders, and improve the connection with policy-makers and policy advisors to ensure greater participation of this stakeholder type.

Land management change at larger scale is determined by social, economic, environmental, political, technology factors. While stakeholder types that use the CCAFS-MOT might influence each of these different factors, effective and systematic change requires that several factors be aligned. For example, the CCAFS-MOT may influence policy-makers to suggest the creation of financial incentives to plant trees that sequester carbon, but the uptake of these incentives by farmers may or may not happen. Even if the CCAFS-MOT is used to show farmers and other land managers that planting trees contributes to carbon sequestration in soil and trees, the financial incentives might not be enough to overcome certain beliefs, for example that farmers should produce food rather than planting trees, that land is too scarce to produce both food and trees, or that planting trees is risky because land property rights are not secure. Therefore, policy-makers need to find effective ways of overcoming obstacles and to consider the views of a wide group of stakeholders.

Although participants noticed that the CCAFS-MOT was not contextualised for Ethiopia and requested the CCAFS-MOT to be developed so it suitable for extensive use in the country, the objective of the tool was not to be specific for every different country in the world but 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 can be freely downloaded from the website and the password to unlock the equation, default values and calculation spreadsheets is available for users to change the functionalities of the tool as they wish. 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 (see Figure 15). Recommendations provided to policy and practice should always be based on evidence from several sources, of which the CCAFS-MOT is one.

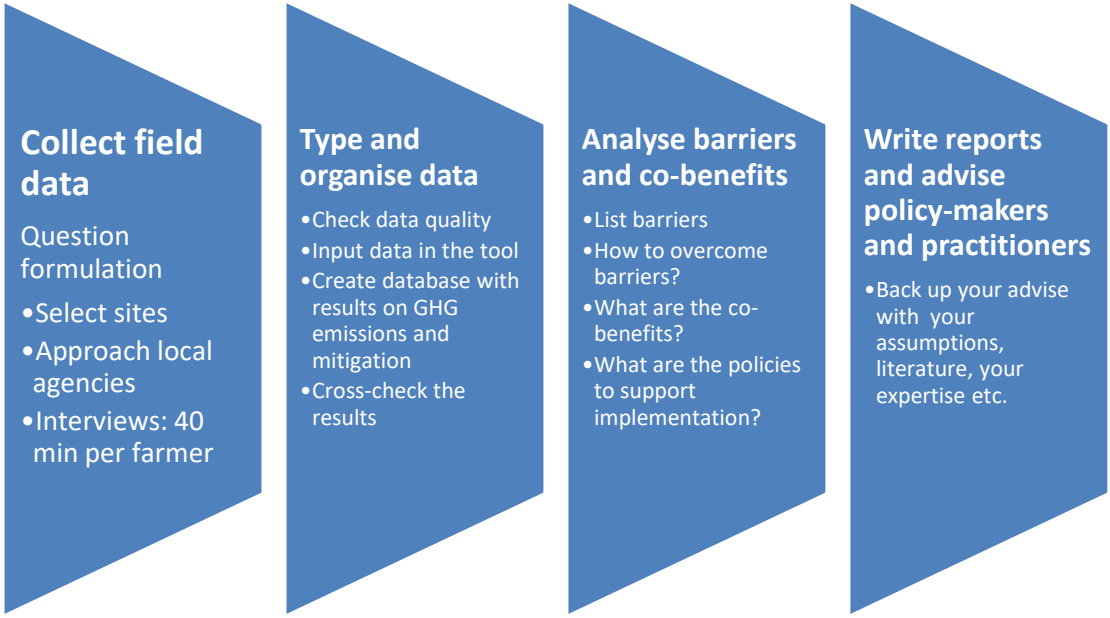

Figure 15: Steps to use the CCAFS-MOT in monitoring and reporting

7. Next steps

After the workshop, the organisers met to discuss further steps. These were:

- Approach interested parts (scientists, students) to write a joint proposal to contextualise the CCAFS-MOT for Ethiopia and identify potential funding sources
- Undertake a preliminary analysis of the data collected during the field work in Lemi district and write a working paper suggesting a following stage for data collection and analysis
- Design a process for systematic data collection in other sites (e.g. Africa Rising project sites) using an improved version of the questionnaire and write working paper with results and recommendations
- Link CCAFS-MOT to a geospatial platform (e.g. using GIS)
- Identify sources of funding to reproduce an improved version of the workshop in other countries.