Priority needs for improvement of activity data to support MRV in Ethiopia's livestock sector

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LIST OF ABBREVIATIONS

ACIAR	Australian Centre for International Agricultural Research
BUR	Biennial Update Report
CCAFS	Climate Change Agriculture and Food Security program of the CGIAR
CRGE	Climate Resilient Green Economy
CSA	Central Statistical Agency
EFCCC	Environment, Forestry and Climate Change Commission
ECCD	Environment and Climate Change Directorate
GHG	greenhouse gas
GTP	Growth Transformation plan
LMP	Livestock Master Plan
MMS	manure management system
MRV	measurement, reporting and verification
NC	National communication
NDC	Nationally Determined Contribution
SRA	Small Research Activity
UNFCCC	United Nations Framework Convention on Climate Change

SUMMARY

To complement an ongoing CCAFS project 'Enhancing capacities for MRV of sustainable livestock action in East Africa (Kenya and Ethiopia)', implemented by UNIQUE forestry and land use, ACIAR is supporting CCAFS to implement a Small Research Activity (SRA) entitled 'Building capacities for an integrated livestock MRV system in Ethiopia'. The objective of the SRA is to support improvements in methods and procedures used to produce and manage the livestock activity data required for measurement, reporting and verification (MRV) of greenhouse gases (GHG) in Ethiopia. The focus will be on administrative data that is needed for periodic MRV (including both the GHG inventory and mitigation reporting), and data gaps that can be filled through surveys. The SRA will be implemented between June 2019 and the end of December 2020. This report is the first deliverable under the SRA and describes the priority needs for improvement of livestock activity data in Ethiopia's national MRV systems.

Section 1 summarizes the international MRV requirements for GHG inventories and reporting on mitigation actions and outcomes, and describes how these international requirements relate to Ethiopian national policies and MRV systems. In addition to GHG inventory compilation, Ethiopia is pursuing GHG mitigation through its Climate Resilient Green Economy strategy (CRGE). The report highlights the indicators tracked in the CRGE MRV system and methods used for calculations of emission reductions and discusses issues related to data sources and institutional arrangements for data management in MRV of CRGE.

Section 2 summarizes data needs for the GHG inventory and CRGE MRV, and explains why adopting a more advanced (Tier 2) methodology in the GHG inventory will help meet national policy needs and international reporting standards. It also summarizes results of Tier 2 GHG inventory data gap analysis and uncertainty analysis as well as assessment of the current working procedures (data management procedures, institutional arrangements, capacities) for CRGE MRV systems.

Section 3 provides information on the ongoing initiatives related to data improvement for Ethiopia's national MRV system in the livestock sector and potential synergies between these initiatives.

Section 4 outlines priority actions for livestock MRV improvement on short- (< 6 months), medium- (6-18 months) and longer-term (>18 months) time frames. The outline roadmap for livestock MRV improvements can serve as a reference for different stakeholders to orient and coordinate their investments and activities in support of livestock MRV improvements.

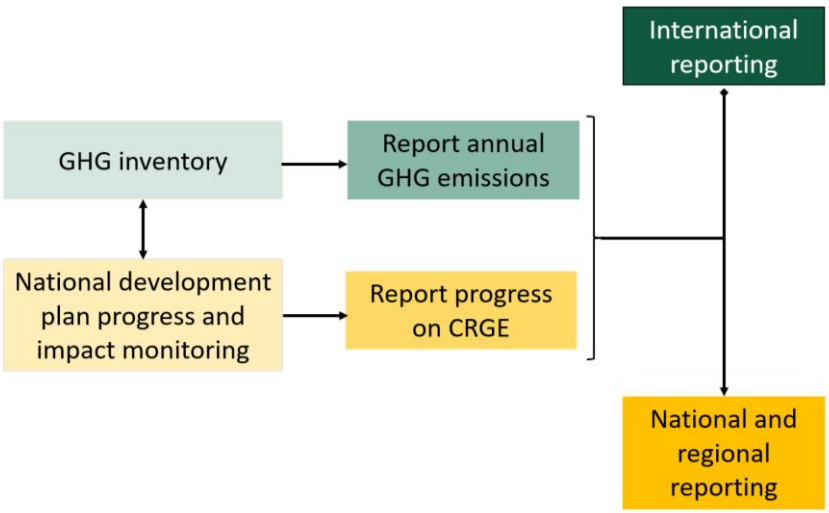
1 MRV SYSTEMS FOR LIVESTOCK GHG EMISSIONS IN ETHIOPIA

1.1 International MRV requirements

Ethiopia is a party to the UN Framework Convention on Climate Change (UNFCCC) and ratified the Paris Agreement in 2017. Parties to the UNFCCC, including Ethiopia, have agreed general requirements for measurement, reporting and verification (MRV) of GHG emissions. Under the currently applicable agreements, developing countries such as Ethiopia are required to submit a National Communication (NC) every 4 years, and a Biennial Update Report (BUR) every 2 years.[1] The NC should include a national GHG inventory,[2] and the BUR should include an update to the national GHG inventory.[3] The latest year reported for GHG emissions in BURs should be no more than 4 years prior to the year of submission. In addition, in the NC parties should report information on policies, programmes or other steps implemented or planned to mitigate climate change. BURs should also report information on mitigation actions and their effects, including associated methodologies and assumptions. Under the Paris Agreement, parties have agreed to shift towards a common reporting system applicable to both developed and developing countries, to be implemented from 2024.[4] The core of this MRV system is a Biennial Transparency Report, which is to be submitted every 2 years by each country, including Ethiopia. This report should include a national GHG inventory and a report of progress made in implementing and achieving the nationally determined contribution (NDC). Thus, in summary, ***countries such as Ethiopia should be able to regularly compile and submit a national GHG inventory and regularly report on the effects of mitigation actions***. Ethiopia's national inventories should be compiled using methods consistent with the IPCC Guidelines. For reporting on the effects of mitigation actions and progress towards NDCs, there is more flexibility for Ethiopia to develop its own methods for accounting for emission reductions. However, it is expected that these methods will be consistent with the IPCC Guidelines[5] and that whatever methodologies and assumptions are used, they should be transparently reported.

[1] https://unfccc.int/files/national_reports/annex_i_natcom_/application/pdf/non-annex_i_mrv_handbook.pdf
[2] https://unfccc.int/resource/docs/cop8/07a02.pdf#page=2
[3] https://unfccc.int/resource/docs/2011/cop17/eng/09a01.pdf#page=39
[4] https://unfccc.int/sites/default/files/resource/CMA2018_03a02E.pdf#page=18
[5] Ethiopia's GHG inventory currently uses the IPCC (2006) Guidelines. The 2019 Refinement to the 2006 Guidelines has not yet been adopted for use by parties to the Paris Agreement, but it is expected that this will be adopted in the coming years.

Figure 1: Schematic overview of Ethiopia's MRV needs



Source: This study.

1.2 Ethiopia's national requirements

Ethiopia is a signatory to the UNFCCC and the Paris Agreement. It is also implementing its own national strategy, the Climate Resilience Green Economy (CRGE) Strategy[6], which has been mainstreamed into the national development plan, the Growth and Transformation Plan (GTP-II, 2016-2020). A new ten year Perspective Development Plan is currently being developed. Therefore, Ethiopia has both national and international needs for MRV (Figure 1).

National GHG inventory: Ethiopia submitted NCs in 2001 and 2016.[7] The 2016 NC included a GHG inventory covering emissions from 1994 to 2013.[8] For livestock GHG emissions, a Tier 1 methodology was used. Ethiopia is currently in the process of compiling its next BUR, including the GHG inventory update, to be completed in 2020. In the GHG inventory for 2013, livestock emissions – including categories 3A1 enteric fermentation, 3A2 manure management N_2O and CH_4, and 3C4 direct N_2O emissions from managed soils, 3C5 indirect N_2O emissions from managed soils which include emissions from dung and urine deposited on pasture – are identified as key source categories. Key source categories are defined as those that "when summed together in descending order of magnitude, add up to 95% of the total level".[9]

Good practice in inventory compilation (IPCC 2006) recommends that key source categories should be estimated using a higher tier methodology. According to the key source category analysis in Ethiopia's last national communication, key source categories are taken as those with a 2013 level over about 2,000 Gg CO_2e. Ethiopia's key source analysis in the 2013 inventory was also conducted only for broad emission categories (e.g. "3A1 enteric fermentation") that include all livestock species. More detailed reporting for the livestock sector estimated

[6] https://www.undp.org/content/dam/ethiopia/docs/Ethiopia%20CRGE.pdf

[7] https://unfccc.int/process-and-meetings/transparency-and-reporting/reporting-and-review-under-the-convention/national-communications-and-biennial-update-reports-non-annex-i-parties/national-communication-submissions-from-non-annex-i-parties

[8] https://unfccc.int/sites/default/files/resource/ethnc2.pdf

[9] https://www.ipcc-nggip.iges.or.jp/public/2006gl/pdf/1_Volume1/V1_4_Ch4_MethodChoice.pdf

enteric fermentation emissions for cattle of 41,850 Gg CO_2e, sheep 3,312.5 Gg CO_2e and goats 3,125 Gg CO_2e using the Tier 1 methodology. Therefore, following IPCC guidance a higher tier (Tier 2) methodology should be applied to cattle, sheep and goats.

Table 1 Livestock sector intervention areas in Ethiopia's Climate Resilient Green Economy (CRGE)

Intervention areas	General description	Likely effects on livestock
Improve cattle value chain efficiency	Increase productivity per head through improved breeding, feeding, health, marketing etc.	▪ Change in breed ▪ Increased live weight ▪ Increased milk yield ▪ Change in feed
Increase share of poultry and other low emitting animals	Increase meat supply from poultry and other low emitting animals	▪ More chickens, sheep and goats ▪ Change in breed ▪ Increased productivity
Promote mechanization	Introduce tractors through small scale mechanization programs	▪ Fewer oxen ▪ Fewer work hours per ox
Improve rangeland management	Increase productivity of pasture and improve rangeland management	▪ Improved feed availability and quality

Source: Compiled for this study based on CRGE Strategy.

Mitigation actions: Ethiopia's strategy for climate change action is the CRGE strategy.[10] The CRGE Strategy was issued in 2011 and has not been updated since. The CRGE Strategy aims to achieve middle-income status by 2025 in a climate-resilient green economy. The CRGE Strategy forms the basis for Ethiopia's NDC.[11] The CRGE Strategy identifies priority sectors and priority interventions in those sectors. Interventions were screened for both mitigation and adaption benefits with the intention that mitigation actions implemented would also strengthen Ethiopia's climate resilience.

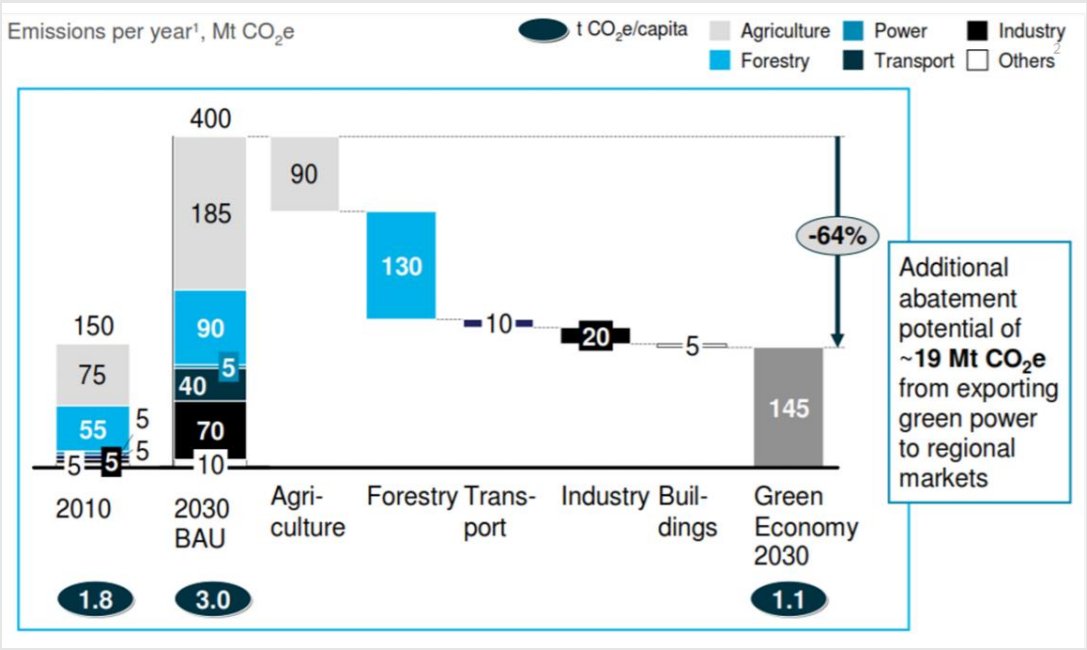
The livestock sector has been identified as one of the priority sectors in the CRGE.[12] Within the livestock sector, four main intervention areas were identified in the CRGE (see Table 1 and Box 1). The CRGE Strategy has been mainstreamed into the national development plan, the Growth and Transformation Plan (2016-2020, [GTP II]) and will most likely be integrated with the upcoming ten-year Perspective Development Plan. Building a climate resilient green economy is one pillar of the GTP II. The monitoring matrix for GTP II includes the indicators to monitor progress in implementing and achieving the CRGE targets.[13] The CRGE indicators related to the intervention areas above are:

[10] https://www.undp.org/content/dam/ethiopia/docs/Ethiopia%20CRGE.pdf
[11] https://www4.unfccc.int/sites/ndcstaging/PublishedDocuments/Ethiopia%20First/INDC-Ethiopia-100615.pdf
[12] The priority sectors are: agriculture, forestry, energy and transport.
[13] https://www.cmpethiopia.org/media/gtp_ii_policy_matrix_english_final_august_2016_2

- Emissions of CO_2e per litre of milk produced
- Estimated annual reduction in CO_2e emissions due to improved productivity of livestock
- Estimated reduction of CO_2e due to shift to rearing of low carbon emitting animal species
- Estimated reduction in CO_2 emissions due to improved grazing (total, communal and private) land management.

Box 1: Ethiopia's CRGE and the livestock sector

BAU projections: Analysis supporting the CRGE strategy suggests that Ethiopia's total GHG emissions would increase from 150 Mt CO_2e in 2010 to 400 Mt CO_2e in 2030, an increase of 167%. Agriculture emissions would increase from 75 Mt CO_2e in 2010 to 185 Mt CO_2e in 2030, which is based on the assumption that the total cattle population doubles over this period. Of the 2010 agricultural emissions, 65 Mt CO_2e (i.e. 87%) are from livestock and BAU projections in 2030 for livestock are 124 Mt CO_2e. Of the livestock emissions, 84% are from cattle. Ethiopia's first NDC is based on the same BAU projections.



Source: Ethiopia's First NDC

Mitigation options and potential: The CRGE Strategy identifies a mitigation potential of 90 Mt CO_2e to 2030, of which 48 Mt CO_2e is due to livestock sector interventions. The livestock sector interventions analysed were:

• Value chain efficiency (40.1 Mt CO_2e): increasing productivity per head of cattle and off-take rate, led by better health and marketing, assuming 19.5 million pastoralist and farmer households are reached through dairy development and feedlot expansion;[14]

[14] Note that although sheep and goat fattening also occurs, they were not included in the CRGE scenario analysis.

• Increased supply and consumption of lower-emitting animal species (17.7 Mt CO_2e), assuming that poultry account for 30% of animal source protein supply in 2030;[15]

• Substituting draft oxen with mechanized ploughing and tillage (11.2 Mt CO_2e), assuming 13.2 million households reached;

• Rangeland carbon sequestration (3 Mt CO_2e), assuming 5 million ha improved.

Source: CRGE Strategy

Specific methodologies describing how progress towards these indicators are to be measured (e.g. GHG sinks and sources included, livestock types included, data sources and calculation methods) have not yet been elaborated.

The livestock sector has also adopted a Livestock Master Plan (LMP).[16] The LMP is aligned with GTP II. The key activities set out in the LMP overlap with the livestock sector intervention areas in the CRGE, but are not identical. Although the LMP document included an estimate of GHG emission levels under the plan implementation scenario, GHG emission reductions were not estimated and no GHG emission reduction targets were set. Therefore, for MRV in the livestock sector, the orienting strategy is the CRGE rather than the LMP. Alignment of the two is a possible area of future work, but is not formally on the policy agenda at present.[17]

In addition to national requirements for MRV, it is important to note that there is also interest in estimating GHG emissions and emission reductions at regional level within Ethiopia. In general, this interest is growing because of the increasing awareness at regional level of their roles in delivering on the national GHG mitigation strategy and because of the potential to leverage climate finance if the effects of mitigation actions can be tracked. In some regions, it is also specifically related to climate investments. For example, the World Bank has been developing the Oromia Forested Landscape Program in Oromia Region.[18] Initially, this focusses on reducing emissions from deforestation and forest degradation, but recently there is interest to include livestock emissions as part of a landscape-wide approach. Reliable GHG inventories and MRV systems for tracking emission reductions due to change in the livestock sector are therefore also relevant at regional level.

1.3 Institutional arrangements for MRV in the livestock sector

Institutional arrangements for MRV are only partially in place. At national level, the Environment, Forest and Climate Change Commission (EFCCC) is responsible for preparation of NCs and BURs, GHG inventories, and for reporting progress on the CRGE. Collation of data for the national inventory and CRGE reporting related to the agriculture sector is the responsibility of the Ministry of Agriculture's Environment and Climate Change Directorate (ECCD), as defined in an MoU between the two agencies. Data collection and reporting on the core CRGE indicators that have been integrated into GTP II is also the responsibility of the Ministry of Agriculture. Figure 2 shows how institutional arrangements for livestock MRV are currently conceived. In theory, this would

[15] Note that although sheep and goats are also sometimes referred to as lower emitting species, they were not included in the CRGE scenario analysis.

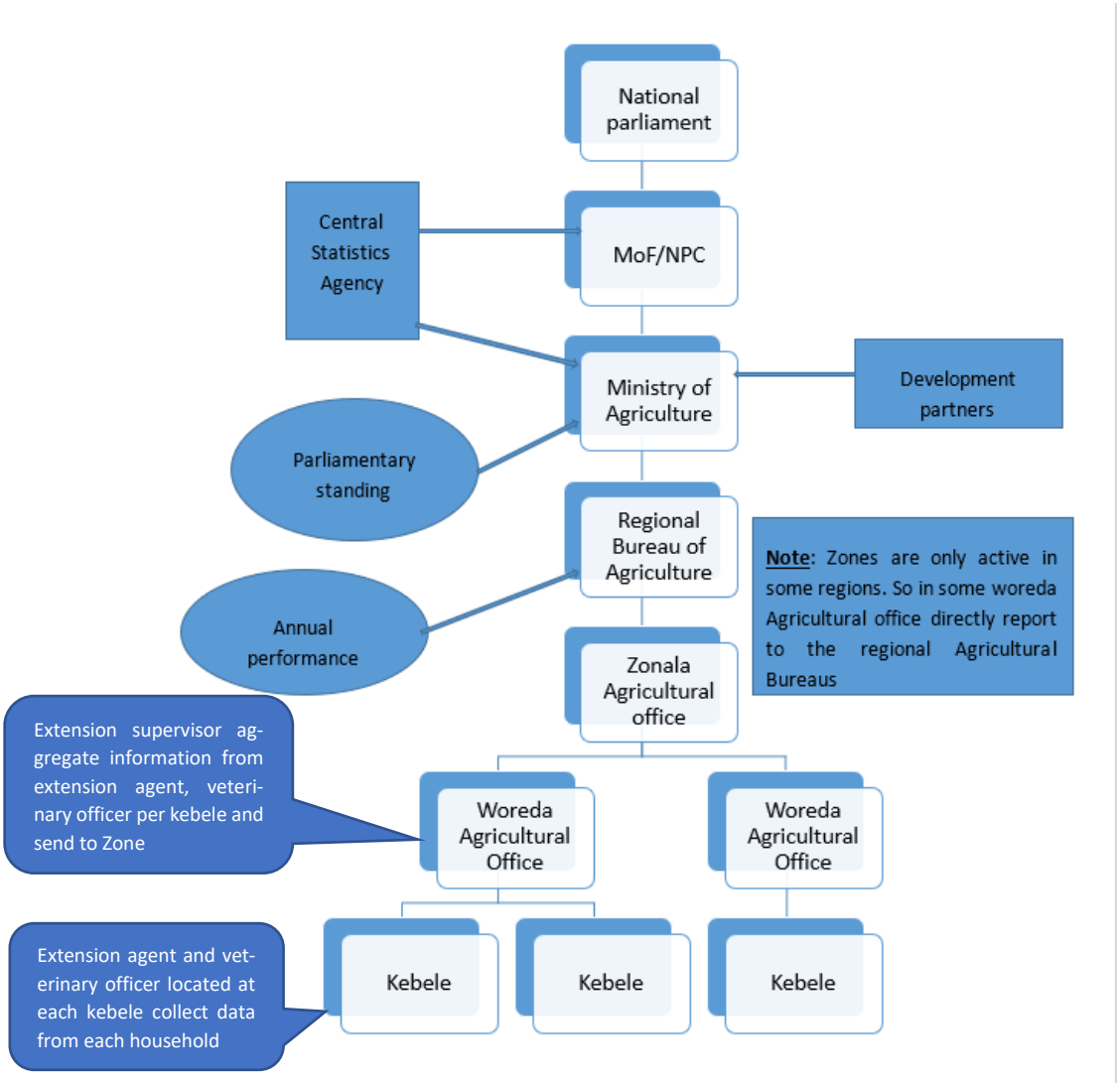
[16] https://cgspace.cgiar.org/bitstream/handle/10568/68037/lmp_roadmaps.pdf?sequence=1&isAllowed=y

[17] See Section 4 below.

[18] https://www.biocarbonfund-isfl.org/ethiopia-program

mean that at national level, the ECCD would compile data reported by each directorate, which would in turn request the data from livestock bureaus at the regional level. The regional level would obtain the data required through the administrative data collection system which provides data from kebele to woreda to zone and region level. In practice, there are a number of barriers to implementing MRV through this system.

Figure 2 Institutional arrangements for Ethiopia's livestock MRV



Source: Compiled for this study

- First, there is insufficient guidance on what data is required in order to report on livestock sector CRGE indicators. Specific methodology briefs summarizing how each indicator is to be calculated have not yet been prepared, and a draft list of the data required has been prepared but is incomplete and not yet implemented at regional level.
- Second, there are multiple practical barriers to collection and management of good quality administrative data, including barriers to sharing data from the regional to the national level. Some of these challenges are summarized in Box 2.

- Third, there are disparities between the official national livestock population data and the data reported in the administrative data system. Official national livestock population data are collected through an annual sample survey by the Central Statistics Agency (CSA). The CSA survey includes data on livestock population, breed type and livestock product yields, and is available for most of the period since 1994. Administrative data, by contrast, is rarely available for the whole time series in all regions, and CSA data rather than administrative data is referred to by some regional governments. Regional governments often remark, however, that there is a disparity between CSA data and their own data. Furthermore, the CSA data does not include animals on commercial farms, urban or peri-urban livestock, and due to security concerns livestock population surveys have not been conducted in 5 out of 16 zones in pastoral zones of Afar Region and Somali Region.

With the proposed shift from a Tier 1 to Tier 2 GHG inventory to better reflect Ethiopia's national circumstances and improve the accuracy of the inventory, more country- and region-specific data is required. Data sources will change based on the needs of the Tier 2 inventory, and institutional arrangements should be adjusted accordingly to support data collection, management and reporting from the sources required for a Tier 2 inventory. Therefore, within the existing national institutional framework, there will be a need to revise the specific institutional arrangements for inventory and CRGE report compilation in order to maintain consistency between data sources used in the GHG inventory and MRV of CRGE.

Box 2: Challenges affecting collection, management and reporting of administrative data on livestock in Ethiopia

According to the GTP-II monitoring matrix, CRGE livestock interventions are supposed to be monitored using administrative data collected and reported by each region to the Ministry of Agriculture. However, disparity between the methods employed by different regions, lack of standardize data collection methodology and manuals to guide data collection and management mean that there is no standardized understanding of the data parameters, data collection tools and methods to be used.

Additional challenges include:

- Capacities (skills, time, resources) for data collection at the lowest administration level are limited;
- Skills of livestock experts to translate raw data into information for input into templates for submission to the planning directorate is a common challenge;
- No computer facilities at lower levels so data management is highly dependent on paper-based formats, leading to high risks of errors during data entry as well as limited traceability of errors in the data;
- Although the monitoring and evaluation unit at zonal and regional level expected to regularly conduct monitoring practice, the unit perform infrequently due to lack of expertise and budget (costs like transportation of field officers);
- There is no continuous system for data sharing between regional and national levels, and data is often not shared even when requested.

Data source: regional assessments conducted for this study.

Given the constraints on administrative data processes, regional governments are not always able to provide a consistent time series of complete data for many key parameters. For livestock populations and some other key parameters (e.g. milk yields, feed sources), data collected by Ethiopian Central Statistics Agency (CSA) is often used instead of administrative data. CSA conducts an annual livestock sample survey, collecting data on animal populations and key management and animal performance parameters. CSA has 25 branch offices and recruits local enumerators each year, with a supervisor for every 3 enumerators. Supervisors are supervised by statisticians. Data are collected on tablets, transmitted to other devices by Bluetooth and then onwards to CSA central office by a specialized private SIM to the CSA server. While CSA procedures are standardized, and CSA is able to provide a consistent time series for the data collected, there are some data gaps (e.g. no sampling is conducted in commercial farms or urban / peri-urban areas, and no data is collected on some animal performance parameters critical for the GHG inventory such as animal live weights) and local governments often contest the accuracy of CSA data.

Overall, this assessment suggests that in the further development of Ethiopia's GHG inventory and CRGE MRV, choices of data sources based on principles for good practice in inventory compilation[19] may require reconsideration of data sources and thus roles and mandates and institutional arrangements. Once data sources, roles and mandates are agreed, irrespective of which organization takes on which roles in data collection and management, needs assessments and capacity building support may be needed to support continuous improvement of data quality.

2 DATA NEEDS AND DATA GAPS FOR ETHIOPIA'S LIVESTOCK MRV

This section describes the key results from analysis of a draft GHG inventory for cattle (Section 2.1) and results of assessments of data needs and institutional procedures for MRV of CRGE (Sections 2.2 and 2.3).

2.1 GHG inventory data needs

Based on the analysis of national MRV needs, it follows that Ethiopia has policy needs to apply the IPCC Tier 2 methodology to emissions from cattle, sheep and goats, and to produce both national and regional GHG inventories at least every two years. Because of the specific interventions proposed in the CRGE, it would be ideal if the national GHG inventory could reflect the GHG effects of the intended changes due to the CRGE interventions. These include:

- Change in numbers of animals of each species;
- Change in numbers of animals in different production systems (e.g. production in commercial dairy farms and beef feedlots)
- Change in breed;

[19] These are transparency, accuracy, completeness, comparability and consistency (IPCC 2006).

- Change in feed composition & quality;
- Change in productivity per animal;
- Change in reproductive performance;
- Change in oxen numbers and work hours.

By March 2020, draft GHG inventories for cattle, sheep and goats had been prepared. These draft inventories indicate where data is unavailable and thus missing data that needs to be filled. Some parameters were estimated using limited available data, so while the situation cannot be described as 'missing data', there may be data gaps because of poor quality data. Furthermore, uncertainty analysis was applied to these draft inventories to indicate which parameters are most important for improving the accuracy of the inventory. Improving data quality for these key parameters is important even if the existing data has been deemed sufficient for an initial Tier 2 inventory, because improved data quality can reduce the uncertainty of the inventory estimates.

Based on the draft inventories, the data gaps (i.e. missing data) listed in Table 2 were identified, and the parameters listed in Table 3 were identified as being based on very limited or poor-quality data. In the short-term, an inventory can be completed using proxy data (e.g. live animal and meat export data as a proxy for commercial feedlot cattle populations), or the best available national data or international default values can be where national data quality is limited. Future improvements in data availability would then provide new, improved data and the GHG inventory can be revised accordingly, as stipulated in the IPCC (2006) Guidelines.[20]

Table 2 Parameters with missing data in the draft GHG inventory for Ethiopia

Population data: ▪ Cattle, sheep and goats in pastoral zones of Afar and Somali regions ▪ Dairy cattle population in commercial, urban and peri-urban systems ▪ Commercial feedlot cattle population data
Animal performance data ▪ Commercial dairy cattle milk yield annual time series

Table 3 Parameters with poor quality data in the draft GHG inventory

Animal performance data: ▪ Available data on diet composition is not specific to livestock species or cattle sub-category ▪ Cattle live weight, weight gain, mature weight are estimated based on available small-scale studies ▪ Data on manure management practices is very limited

Uncertainty analysis was also applied to the draft inventories and identified the parameters that contributed most significantly to uncertainty in emissions from cattle enteric fermentation and

[20] See IPCC (2006) Vol 1 Chapter 5 on recalculations due to methodological revisions or refinements.

manure management methane emissions.[21] The key parameters to reduce uncertainty of cattle enteric fermentation and manure management methane emissions are shown in Tables 4 and 5. The interpretation of the correlation coefficients is: a regression coefficient of 0 indicates no relationship between an input variable and output variable, while a value of 1 or -1 indicates that a 1 or -1 standard deviation change in the input variable will lead to a 1 or -1 standard deviation change in the output variable. It is notable that for both enteric fermentation and manure management, the majority of the most influential variables can be improved with better activity data, especially on feed digestibility and live weight of different cattle sub-categories. It should be remembered that these results were derived from analysis of a draft inventory that does not include full enumeration of cattle in pastoral zones and in the commercial or urban/peri-urban systems. The total proportions of cattle in the commercial or urban/peri-urban systems are likely to be small, but it is possible that the missing population in the pastoral areas is large. If so, animal performance parameters in the pastoral / agro-pastoral system would most likely be important. It is also notable that there is an overlap in some of the influential variables (e.g. digestibility, live weight) on enteric fermentation and manure management emissions, indicating that better data on these parameters would reduce the uncertainty of both emission sources.

Table 4 Parameters with strongest influence on uncertainty of cattle enteric fermentation emissions

Parameter	Regression coefficient
Digestibility, cow, mixed crop-livestock system	-0.50
Live weight, cow, mixed crop-livestock system	0.38
Digestibility, oxen, mixed crop-livestock system	-0.34
Live weight, oxen, mixed crop-livestock system	0.30
Ym, cow, mixed crop-livestock system	0.29
Cf, cow, mixed crop-livestock system	0.28
Cf, oxen, mixed crop-livestock system	0.22
Ym, oxen, mixed crop-livestock system	0.20
Number of cows, mixed crop-livestock system	0.10
Digestibility, cow, pastoral / agro-pastoral system	-0.10
Weight gain, growing female, mixed crop-livestock system	0.09
Digestibility, growing female, mixed crop-livestock system	-0.09
Digestibility, growing male, mixed crop-livestock system	-0.08
Live weight, cow, pastoral / agro-pastoral system	0.07
Number of oxen, mixed crop-livestock system	0.07
Hours of work per day, oxen, mixed crop-livestock system	0.07

Note: Ym = methane conversion factor; Cf = coefficient for maintenance

[21] The method used was Monte Carlo simulation, implemented in Palisade @Risk software. Once uncertainty for total cattle enteric fermentation and manure management methane emissions had been estimated, regression analysis was used to identify those parameters that had the strongest correlation with uncertainty.

Table 5 Parameters with strongest influence on uncertainty of cattle manure management methane emissions

Parameter	Regression coefficient
Methane conversion factor, solid storage	0.52
MMS% solid storage, mixed crop-livestock system	0.52
Digestibility, cow, mixed crop-livestock system	-0.26
Bo	0.24
Methane conversion factor, liquid storage, 12 months, dairy system	0.19
MMS%, liquid / pit storage, dairy system	0.18
Digestibility, oxen, mixed crop-livestock system	-0.18
Digestibility, cow, dairy system	-0.16
Live weight, cow, mixed crop-livestock system	0.13
MMS% solid storage, pastoral / agro-pastoral system	0.12
Live weight, oxen, mixed crop-livestock system	0.10
Cf, cow, mixed crop-livestock system	0.09
Cf, oxen, mixed crop-livestock system	0.08
Digestibility, cow, pastoral / agro-pastoral system	-0.07

Note: MMS = manure management system; Bo = maximum methane producing capacity; Cf = coefficient for maintenance.

2.2 Ethiopia's CRGE MRV data needs

Based on the analysis of national MRV needs, it follows that Ethiopia has policy needs to monitor progress in implementing the CRGE strategy in the livestock sector and to account for the resulting emission reductions. The data sources and methodologies used for MRV of CRGE should as far as possible be consistent and comparable with those used in the national GHG inventory, and the GHG inventory should to the greatest extent possible be capable of reflecting the changes targeted by CRGE interventions.

The CRGE strategy set out a business-as-usual (BAU) scenario, which was based on historical livestock population growth rates, adjusted using other assumptions, using emission factors estimated based on further assumptions. These assumptions could be reviewed in the light of revised Tier 2 emission factors and other activity data, and in the light of subsequent trends in livestock numbers. For each CRGE intervention assessed in the strategy document, with-intervention scenarios were developed that estimated emission reductions on the assumption that increased productivity would result in reductions in herd size. While this may have been a practical method for ex ante analysis, it presents difficulties for monitoring of progress, because reductions in livestock numbers are not observable. International good practices are emerging that calculate emission reductions based on changes in emission intensity (unit CO_2e per unit livestock product), where both baseline and with-intervention emission intensity can be calculated using observed data.[22] Therefore, in addition to updating the existing scenarios using Tier 2 emission factors, alternative methodological approaches for scenario setting and GHG accounting should be explored.

[22] See, e.g. http://www.fao.org/in-action/enteric-methane/en/.

Table 6 Key parameters for estimation of CRGE livestock core indicators

Dairy value chain efficiency: ▪ Population of indigenous, hybrid and exotic cattle ▪ Productivity (meat and milk) per animal, indigenous, hybrid and exotic ▪ Emission factors for indigenous, hybrid and exotic animals
Feedlot value chain efficiency: ▪ Population of fattened and non-fattened cattle (dairy and pastoral) ▪ Productivity (meat and milk) per animal, fattened and non-fattened (dairy and pastoral) ▪ Emission factors for fattened and non-fattened animals (dairy and pastoral)
Increased share of poultry meat in meat supply: ▪ Population numbers for poultry and high-emitting species ▪ Average live weight and dressing percentage for poultry and high-emitting species ▪ Manure management emission factors for poultry

Methodologies for calculating the existing livestock related CRGE core indicators have not yet been elaborated. However, analysis of the methodologies used to construct the original CRGE scenarios, suggests likely data needs as shown in Table 6. Almost all of the CRGE data needs shown in Table 6 are also data requirements for the Tier 2 GHG inventory. Depending on how alternative CRGE scenarios are designed, additional parameters, such as dressing percentage, milk and meat protein content, and data on sheep and goats as well as data on poultry meat and egg production, protein content and manure management may also be required.

2.3 Assessment of data management procedures and institutional arrangements

The existing proposals for the operationalization of livestock MRV have not been fully implemented, and a Tier 2 inventory and CRGE monitoring would imply some changes in data sources and thus institutional roles (although the overall national framework would not change). This provides an opportunity to review and streamline institutional arrangements and data management procedures and to develop implementation plans to ensure that capacities are built where they are needed. Specific proposals have yet to be developed, but should take into consideration the following:

- National livestock population data should be expanded from the current rural household coverage to include urban/peri-urban and commercial livestock populations.
- Data sources used in the GHG inventory and for CRGE monitoring should be as consistent as possible. This would support consistency in GHG estimates and also minimize duplication of efforts.
- Irrespective of which institutions are responsible for collecting data on which parameters, there is a need to support data quality by developing standardized data collection protocols and manuals to standardize data management procedures across regions in the country.

- Ensure that roles and mandates for data collection and management are consistent with available human capacities and financial resources.
- Data management procedures such as quality control and quality assurance should be incorporated at higher administration levels (e.g. zone and region).
- Investment in improving data availability and quality may be more forthcoming if initiatives are designed to meet other needs in addition to MRV.
- Technological advances (apps) that are accessible (not expensive) could be used to track the activity data related to livestock performance. For instance, there is a possibility to collect data by means of mobile communications (smart phone or tablet).

3 ONGOING INITIATIVES RELATED TO DATA IMPROVEMENTS FOR MRV IN ETHIOPIA

Ethiopia's national MRV system is still evolving, and there are also several initiatives supporting MRV improvement in the livestock sector. There is general agreement among relevant stakeholders of the necessity to maximize synergies between these initiatives. At national level, several agencies are supporting further development of MRV systems managed by EFCCC and line ministries, including the Global Environment Facility (GEF)/UNDP, World Bank[23] and Global Green Growth Institute.[24] In particular, one project supported by the Capacity Building Initiative for Transparency (CBIT)[25] will include support to the national GHG inventory system, including capacity building in the agriculture sector, and the EU-supported 'Tracking and Strengthening Climate Action' (TASCA) project, intends to also provide support at sector level.[26]

The following initiatives are specifically related to livestock MRV:

Livestock and Fisheries Sector Development Project (2017-2024): LFSDP is a World Bank loan project implemented by the Ministry of Agriculture, Livestock and Fisheries. This project is working in six regions and is focused on increasing efficiency of dairy, beef and poultry value chain, and commercialization of livestock sector, including fisheries. The project results framework requires monitoring of GHG emissions per unit of milk and meat, for which the project will support development of Tier 2 emission factors. There is also a component that will fund the development of an integrated livestock information platform linking with other existing databases in the country.

Enhancing capacities for MRV of sustainable livestock actions in East Africa (2018-2021): Implemented by CCAFS, UNIQUE forestry and land use and the World Agroforestry Centre in partnership with the Ministry of Agriculture, the project is supporting development of a Tier 2 national GHG inventory and improvements in CRGE MRV. Similar support is being provided in Kenya.

[23] A review of CRGE MRV is ongoing
[24] https://gggi.org/country/ethiopia/
[25] GEF project ID 9967 https://www.thegef.org/project/capacity-building-program-comply-paris-agreement-and-implement-its-transparency-requirements
[26] https://www.wri.org/our-work/project/tracking-and-strengthening-climate-action

Building capacities for an integrated livestock MRV system in Ethiopia (2019-2020): Implemented by CCAFS, UNIQUE, the Centre for Agribusiness of the University of New England, the Ministry of Agriculture and the Ethiopian Institute of Agricultural Research, this project provides technical support for improvements in methods and procedures used to produce and manage the livestock activity data required for MRV in Ethiopia. This project focus on piloting and evaluating innovations to address priority data collection and data management needs in the framework of the national livestock MRV system.

Oromia Forested Landscape Program (2016-2026): Implementing partners: World Bank, Environment, Forestry, Climate Change Commission, and Oromia Environment, Forestry and Climate Change Commission. The World Bank Bio-Carbon Fund is working with Oromia Environment, Forestry and Climate Change Commission on a pilot project to reduce deforestation and net GHG emissions from land use in forested areas in Oromia Regional State. So far, the project has worked only on forestry sector but now plans to include the livestock sector. The project plans to develop a baseline of GHG emissions from the livestock sector and to monitor livestock emissions using a regional Tier 2 livestock GHG inventory and other MRV systems in line with ISFL guidelines.[27]

Programme for Climate Smart Livestock Systems (PCSL) (2018-2022): Implemented by ILRI and the World Bank in partnership with the Ministry of Agriculture, this project is working in two regions of Ethiopia (e.g. Amhara and Afar) to identify adaptation options and establish GHG baselines for small ruminant and pastoral systems. The project is working on location-specific research to estimate Tier 2 emission factors and conduct training on GHG measurement and monitoring. The project is also supporting stakeholder dialogue on livestock and MRV issues.

In addition, there are other initiatives related to livestock information systems that may have links to MRV, such as a project supported by ILRI/CIAT that will produce a roadmap for improvement the national livestock information system.

4 AN OUTLINE ROADMAP FOR LIVESTOCK MRV IMPROVEMENTS IN ETHIOPIA

The policy needs, data gaps for MRV and ongoing initiatives in Ethiopia were discussed at a stakeholder workshop in February 2020. The workshop discussions resulted in proposed priority actions for MRV improvement on short- (< 6 months), medium- (6-18 months) and longer-term (>18 months) time frames. The outline roadmap presented in Table 7 can serve as a reference for different stakeholders to orient and coordinate their investments and activities in support of livestock MRV improvements.

The roadmap is organized around two main objectives:

1) Continuous improvement of the national livestock GHG inventory
2) Continuous improvement of livestock MRV in the CRGE strategy.

There are also various needs for improvements in MRV at the program or project level. These are not treated here, except where they are relevant to supporting development of national MRV systems. The activities listed in Table 7 are not linked to specific responsible institutions

[27] https://www.biocarbonfund-isfl.org/methodology

because detailed discussions have not yet taken place. In general, ECCD, which has the mandate for MRV in the livestock sector, should coordinate stakeholders in further discussions to plan and coordinate inventory improvements.

Several of the ongoing initiatives already plan to address some of the short- and medium-term activities proposed. Inventory compilation and planning of inventory improvements (Activity Lines 1.1 and 1.2) are being supported by both CCAFS-UNIQUE and LFSDP and these two projects are actively coordinating. CCAFS-UNIQUE and OFLP plan to support data quality improvements in line with inventory needs (Activity Line 1.3), and PCSL also plans to produce manuals on data collection methods. For Objective 2 (continuous improvement of CRGE MRV), CCAFS-UNIQUE are supporting assessment of alternative methodologies, and this will also link with the development of methodologies and scenarios for the OFLP. Discussions on how to coordinate this work have just been initiated. Formal adoption of any revised methodologies or institutional arrangements may also depend on how CRGE MRV systems evolve at national level. ECCD should ensure coordination between sectoral and national initiatives. One possible mechanism to enable stakeholder coordination would be to convene an annual meeting at which stakeholders share their planned activities related to each objective in the roadmap, with a 6-monthly meeting to update on progress and enable coordination. Both PCSL and CCAFS-UNIQUE could incorporate support for this mechanism in their plans. ECCD may consider facilitating formal stakeholder discussions on adoption of a livestock MRV roadmap based on the outline here.

Table 7 Short-, medium and longer-term options to meet livestock MRV improvement needs

Objective 1: A continuous improvement process is implemented for the livestock GHG inventory	
Short-term (1-6 months)	**1.1 Compile Tier 2 inventory** a) Fill missing data for commercial dairy population and milk yields, feedlot populations, and pastoral/agro-pastoral populations using available data, proxies or assumptions b) Validate feed digestibility estimates c) Analyze inventory uncertainty d) Document inventory data sources and methods e) Implement quality control and verification f) National review of Tier 2 inventory **1.2 Plan inventory improvements** a) Identify inventory improvement priorities b) Discuss mandates, roles and responsibilities for data collection, analysis and coordination of medium-term data improvement activities c) Design, test and evaluate methods for filling data gaps and collecting better quality data, including sampling design, data collection protocols, data management and data analysis procedures. d) Engage stakeholders to agree roles and collaborations in medium-term inventory improvement activities.
Medium term (6-18 months)	**1.3 Improve the availability and quality of data** a) Collect data to fill data gaps and improve data quality focusing on inventory improvement priorities b) Analyze data to identify cost-effective sampling strategies c) Validate accuracy of data collection methods for key parameters d) Produce standardized manuals for data collection and management and inventory compilation **1.4 Review institutional arrangements** a) Based on Tier 2 inventory data sources and ongoing data management initiatives, review and revise institutional arrangements for inventory data management b) Ensure that livestock inventory improvement needs are considered in the plans and budgets of relevant government agencies **1.5 Capacity building**

	a) Assess institutional and staff capacities in relevant institutions involved in GHG inventory data provision, compilation and management b) Train staff of relevant institutions to collect, analyse and manage the data required using standardized manuals
Longer term	**1.6 Institutionalize improved data management** a) Incorporate data collection and management activities, including coordination, in the mandates and working procedures of relevant institutions b) Develop and implement automated data management systems c) Ensure links between inventory data improvement initiatives and national livestock statistics improvement initiatives.
	Objective 2: A continuous improvement process is implemented for high quality MRV of livestock in the CRGE strategy
Short-term (1-6 months)	**2.1 Test CRGE methodology improvements** a) Assess implications of updating existing CRGE calculation methodologies with Tier 2 emission factors and activity data b) Assess implications of alternative emission reduction calculation methodologies, including the scope of species, GHG sources and accounting methodologies used. c) Assess implications for CRGE monitoring roles and mandates of Tier 2 inventory data sources. d) Engage stakeholders to discuss implications of CRGE methodology improvements, ensuring discussions are linked with CRGE improvement initiatives at national level
Medium term (6-18 months)	**2.2 Implement CRGE methodology improvements** a) Develop methodologies for CRGE core indicator measurement based on agreed revisions in 2.1.d above. b) Based on data sources for CRGE MRV, review institutional mandates, roles and responsibilities in CRGE MRV processes c) Develop standard operating procedures for CRGE core indicator measurement, reporting and verification. d) Train staff of relevant institutions to collect, analyse and manage the data required using standardized manuals
Longer term	**2.3 Institutionalize improved CRGE MRV** a) Incorporate data collection and management activities, including coordination, in the mandates and working procedures of relevant institutions b) Develop and implement automated data management systems c) Ensure links between sectoral MRV improvements and national MRV improvements, including possible alignment of LMP and CRGE scenarios, targets and indicators.

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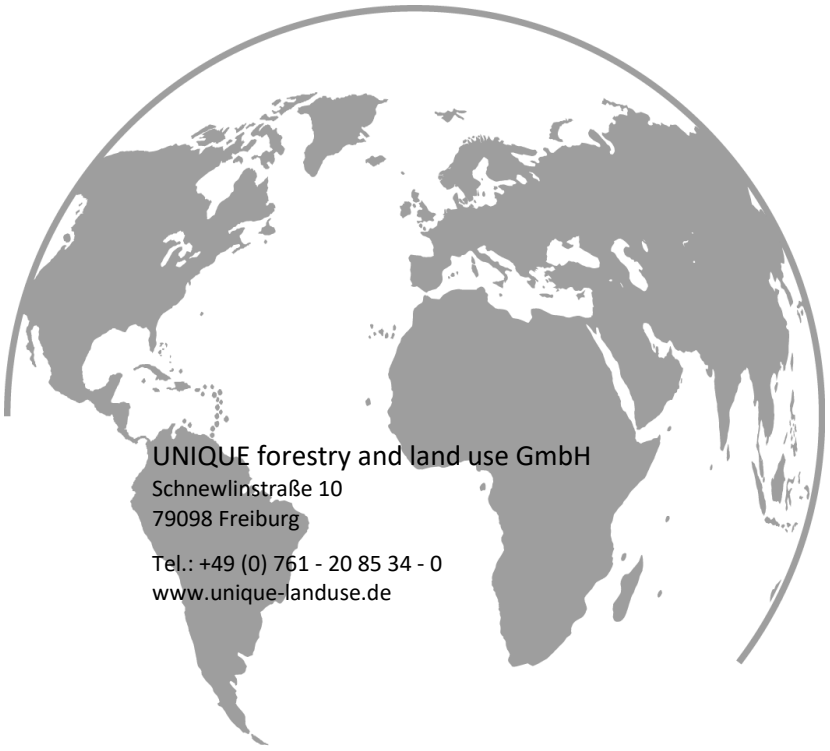

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