



National Action Plan for Agriculture GHG Inventory Improvement

St. Kitts and Nevis 2022



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National Action Plan for Agriculture GHG Inventory Improvement

St. Kitts and Nevis 2022

Prepared by:

Greenhouse Gas Management Institute in collaboration with the
Ministry of Agriculture, Lands, Housing, Co-operatives and Fisheries
of the Nevis Island Administration
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Table of Contents

Acronyms.....	iv
1. Introduction	1
2. Context	2
3. Objectives and Methodology	3
4. Assessment of Current Status and Opportunities for Improvement.....	4
4.1 Institutional arrangements	4
4.1.1 <i>Current situation</i>	<i>4</i>
4.1.2 <i>Opportunities for improvement</i>	<i>4</i>
4.2 Data sources and data collection procedures	5
4.2.1 <i>Current situation</i>	<i>5</i>
4.2.2 <i>Opportunities for improvement</i>	<i>6</i>
4.3 Quality control and verification procedures.....	7
4.3.1 <i>Current situation</i>	<i>7</i>
4.3.2 <i>Opportunities for improvement</i>	<i>8</i>
4.4 MRV and archiving	8
4.4.1 <i>Current situation</i>	<i>8</i>
4.4.2 <i>Opportunities for improvement</i>	<i>8</i>
5. Overall action plan for improving St. Kitts and Nevis’ agriculture sector GHG inventory	9
6. References.....	10
Appendix A: Agriculture Inventory Compiler Responsibilities	11
Appendix B: Sample handouts for Data Collection Training	13
Appendix C: Example of Data Collection Template	15

Acronyms

BUR	Biennial Update Report
FAOSTAT	The Food and Agriculture Organization Corporate Statistical Database
GCF	Green Climate Fund
GHG	Greenhouse Gas
GHGI	Greenhouse Gas Inventory
IICA	Inter-American Institute for Cooperation on Agriculture
IPCC	Intergovernmental Panel on Climate Change
LULUCF	Land Use, Land Use Change and Forestry
MMS	Manure Management System
MOC	Memoranda of Cooperation
MRV	Monitoring, Reporting and Verification
NC	National Communication
NIR	National (GHG) Inventory Report
QA/QC	Quality Assurance/ Quality Control
SOW	Scopes of Work
TACCC	Transparency, Accuracy, Completeness, Comparability and Consistency
UNFCCC	United Nations Framework Convention on Climate Change

1. Introduction

The GCF-Readiness Project titled “Strengthening the foundation for a climate responsive agricultural sector in the Caribbean” (GCF CARICOM AgREADY, in short) is funded through a Grant Agreement with the Green Climate Fund (GCF) with The Ministry of Environment and Housing, The Bahamas as the lead National Designated Authority (NDA) and the Inter-American Institute of Cooperation on Agriculture (IICA) as the delivery partner.

The AgREADY project seeks to raise the profile of the agricultural sector in GCF’s climate financing prioritisation processes by positing an evidence-based and inter-sectoral argument that seats Caribbean agriculture as “low-emissions” and part of the solution for addressing climate change. The project logic is premised on a vision of developing “a climate responsive agricultural sector in the Caribbean that supports food security, livelihoods and uses natural resources sustainably” by addressing barriers of ineffective mechanisms and engagement with agricultural experts and stakeholders in GCF climate programming processes, policy gaps, and limited or fragmented data/information to inform climate risks planning, programming, and action in the sector.

The IICA-GCF Readiness Project targets nine countries (The Bahamas, Belize, Dominica, Haiti, St. Kitts and Nevis, Saint Lucia, Saint Vincent and the Grenadines, Suriname, and Trinidad and Tobago) in the CARICOM sub-region, with specific activities related to the following objectives:

- To improve the enabling conditions to design, implement, and evaluate options for enhanced climate action in the agricultural sector by strengthening policies, capacities, frameworks, methods, and institutional arrangements for collecting, monitoring, measuring, reporting, verifying (MRV), and analysing agricultural and associated activity data from the sector.
- To increase the number of projects identified for development and investment in a pipeline of evidenced-based and bankable projects aligned with regional and national priorities as informed by climate risk assessments of the agriculture sector.
- To disseminate best practices for institutional capacity building, coordination, and pipeline development of more robust proposals for building climate-resilience along prioritized agricultural value chains, with a focus on cultivating the innovative capacity of the region’s youth.

2. Context

St. Kitts and Nevis has prepared its most recent GHG inventory, with reference year 2018, for its First Biennial Update Report (BUR) to be submitted in 2022. Its GHG emission estimates were prepared in line with 2006 IPCC guidelines with an approach that allows for reporting of the results both using 2006 IPCC reporting tables or CRF reporting tables as used by Annex I countries, adjusted for the reporting elements which are not applicable for the non-Annex I countries. This approach was done to allow St. Kitts and Nevis a smoother transition to any reporting format required under the Paris agreement.

Total emissions in 2018 without sinks, amounted to 363.5 kt CO₂e, with 81.2% of emissions from the energy sector, 16.2% from the waste sector, and 2.6% from the agriculture sector. Emissions from Industrial Processes are not estimated as they are not occurring in-country.

As the third most important sector, agriculture represents a minor source of methane and a major source of N₂O emissions; specifically, only 9.0% of all methane emissions and as much as 53.8% of all N₂O emissions. In the agricultural sector, the most important sub-sector represents emissions from enteric fermentation, which contributes 55% of all emissions from agriculture, followed by emissions from agriculture soils and manure management, with 24% and 21% respectively; the remaining emissions (less than 1%) are contributed by CO₂ emissions from Urea application¹.

¹Draft St. Kitts and Nevis National Inventory Report, 2021

3. Objectives and Methodology

The objective of this initiative is to develop a National Action Plan to improve the agriculture GHG inventory by:

- a) Assessing the status of the national agriculture GHG inventory
- b) Identifying areas for improvement
- c) Developing actions for taking the improvement plan forward
- d) Prioritising the actions

A review of St. Kitt's & Nevis latest available agriculture GHG inventory was completed to identify current institutional arrangements, data sources, data collection procedures, quality control and verification procedures, and tools utilized for inventory compilation. Any improvement plans suggested in the inventory reports or BURs and NCs were extracted and assessed. This information was used as a basis for discussions with national experts to determine what actions are required to improve the agriculture GHG inventory compilation process in each country and agriculture emission estimates in the future. The synthesis of the results was framed in accordance with current situations of, and opportunities for improving institutional arrangements, data sources, collection, quality control and verification procedures, and MRV and archiving.

4. Assessment of Current Status and Opportunities for Improvement

4.1 Institutional arrangements

4.1.1 Current situation

The Ministry of Environment and Cooperatives, apart from its role as the UNFCCC focal point, coordinates the preparation and presentation of all national reports submitted in adherence to the reporting requirements to the UNFCCC. Their role includes liaising with data providers and identifying national sectoral experts, and coordinating their capacity building. At present, the technical aspects of the planning and preparation of the National Greenhouse Gas Inventory Report are led by regional/international consultants in a collaborative fashion as well as selected national experts with an aim to build national capacity and institutionalise the GHGI reporting process. This includes GHG inventory compilation training and hands-on participation in data collection, GHG inventory calculation training (inclusive of chosen methodologies, activity data and emission factors) and quality assurance activities during the inventory compilation process².

4.1.2 Opportunities for improvement

Generally, increasing the national capacity to collect data, compile, and manage the GHGI reporting process is needed to ensure long term and continuous inventory preparation in future cycles.

The further establishment of sustainable MRV System with appropriate institutional procedural, and legal arrangements with clear reporting and documentation requirements and responsibilities would also ensure continuity of this process. Table 1 shows the identified actions to improve the institutional arrangements for agriculture GHG inventory compilation process.

Table 1: Potential actions to improve the institutional arrangements for the agriculture GHG inventory compilation process

Goal	Actions
Formalised institutional arrangements for National agriculture GHG inventory compiler in the Ministry of Agriculture	Develop a set of roles and responsibilities for the Agriculture GHG Inventory compiler. ³
	Identify a staff member to take on this role.
	Discuss options within the Ministry of Environment to have these roles be formalised as a permanent or continuous position.
Trained inventory team	Identify training opportunities to capacitate the inventory compiler and other experts.
	Provide the inventory compiler with sufficient time to attend these training sessions.
	Implement Train the Trainers programme to continue local capacity.
Formalised institutional arrangements for data collection in the agriculture sector.	Identify key data providers of agricultural GHG inventory data.
	Draft a set of data requirements from the various identified organisations (including details on what, how often, what format, etc).
	Draft MOUs or data agreement, attach the data requirements and formalize the data collection process with each data provider.

² Draft St. Kitts and Nevis National Inventory Report, 2021

³ General guidance provided in Appendix A on Roles and Responsibilities.

4.2 Data sources and data collection procedures

4.2.1 Current situation

Data for the agriculture sector was requested for both the islands of St. Kitts and Nevis, with varying availability. After analysis of the available datasets, livestock population datasets were provided by country experts for St. Kitts for the timeseries 2014-2019 with no available information for Nevis. After comparison with the data sourced from FAOSTAT for the timeseries 2008-2018, the latter was chosen as the input due to its longer timeseries and inclusion of Nevis estimates. Data on Manure Management Systems (MMS) allocations was provided based on the identified species/livestock categories present in-country. MMS systems in St. Kitts and Nevis were inclusive of solid storage, dry lot, liquid slurry, and pasture/range/paddock (included under managed soils). For livestock categories with two MMS allocations, a 50-50 split was assumed. Livestock counts and annual amounts of N applied in synthetic fertilisers were sourced from FAOSTAT and used for GHG emission estimates in the managed soils sub-categories.

For urea utilisation, the department of Agriculture provided purchased urea annual quantities for the timeseries 2015-2020 with 2016 data missing. Comparison to urea import data collected through FAOSTAT showed consistent values for the years 2015 and 2017, with the FAOSTAT dataset applied due to access of data over a longer timeseries⁴.

The priority emission sub-categories, in order, for St Kitt's & Nevis are (a) enteric fermentation, (b) direct N₂O from managed soil and (c) manure management.

Table 2: Data sources for SKN agriculture GHG Inventory activity data

Activity data	Data source
Livestock population numbers	
<i>Cattle</i>	FAOStat
<i>Buffalo</i>	NO
<i>Sheep/goats</i>	FAOStat
<i>Swine</i>	FAOStat
<i>Horses/mules/asses</i>	Horses – NE; Mules and Asses– FAOStat
<i>Poultry</i>	FAOStat
Manure management data	(Manure Management System allocation per livestock category) - Ministry of Agriculture, Fisheries and Marine Resources
Lime consumption	NE
Urea consumption	Ministry of Agriculture, Fisheries and Marine Resources (Sales- TDC)
N fertiliser consumption	FAOStat
Crop residue data	NE
Rice cultivation area and data	NO

⁴ Draft St. Kitts and Nevis National Inventory Report, 2021

Table 3: Categories included in the SKN agriculture GHG inventory and the Tier level approach

Category	E/NE/NO	Tier 1/Tier 2
3A1 Enteric fermentation	E	Tier 1
3A2 Manure management CH ₄	E	Tier 1
3A2 Manure management N ₂ O	E	Tier 1
3C1 Biomass burning	E	Tier 1
3C3 Lime application (CO ₂)	NE	-
3C3 Urea application (CO ₂)	E	Tier 1
3C4 Direct N ₂ O from managed soils	E	Tier 1
3C5 Indirect N ₂ O from managed soils	E	Tier 1
3C6 Indirect N ₂ O from manure management	E	Tier 1
3C7 Rice cultivation	NO	-

E = Estimated; NE = Not estimated; NO = Not occurring

4.2.2 Opportunities for improvement

The main priority for future improvements in the agriculture sector is to prioritise in-country data collection efforts. This includes the set-up of a national MRV system with appropriate administrative capacity and with focus on the Department of Customs as main data source provider.

For agricultural data, in particular livestock count (2000-2018) for both St. Kitts and Nevis, fertiliser imports (2000-2018), and for urea sales from the sole distributor (2000-2018) require improved and consistent data collection efforts.

At present, emission estimates are mainly based on the use of international datasets for the timeseries 2000-2018. Improvement in data collection and country-specific datasets would allow for validation of the input parameters used during the GHG inventory process.

As a suggestion, country experts should begin to collect livestock population counts for Nevis to be integrated with estimates from St. Kitts. Information on collection procedures inclusive of timelines should be submitted to the inventory compilation team for future reporting cycles.

Furthermore, validation of MMS information during the current GHGI cycle by the country team would be necessary to understand and validate manure management practices actually occurring on the ground⁵.

Table 4 shows the identified actions to improve the data and data collection process for the agriculture GHG inventory compilation.

⁵ Draft St. Kitts and Nevis National Inventory Report, 2021.

Table 4: Potential actions to improve the data collection and data collection process for the agriculture GHG inventory compilation process

Goal	Actions
Improved data collection procedures	Hold a stakeholder workshop to identify the best way to collect the data, i.e., what can be collected through extension officers, through the Department of Statistics, Customs and Excise, or via the use of electronic surveys at the farmer registry level.
	Utilise the training material ⁶ from the IICA-GCF project to set up training courses at extension officer training centres to teach farmer/extension officers about climate change and GHG inventory data requirements.
	Prepare short surveys, which can be given out during these training sessions, to determine what would incentivise farmers to collect data.
	Pilot the provided data collection templates ⁷ to understand the issues on the ground and to adapt the templates for local purposes, teaching farmers to collect data (focusing on what key data can be collected such as crop management, livestock, manure management, and fertilizer use).
	Establish “Model Farms” at Government owned farms (e.g., small ruminant farms or poultry farms) to teach farmers to document necessary data, especially in manure management practices.
	Adapt the data collection templates to collect appropriate country specific data and then either produce manual or electronic data collection templates or develop the template into an app.
	Perform scoping study for financing from national activities/projects and/or regional projects to finance data collection efforts, electronic application (or otherwise), and administration.
Improved interisland coordination	Identify focal person in Ministry of Agriculture responsible for data collection in St. Kitts and on Nevis.

4.3 Quality control and verification procedures

4.3.1 Current situation

St. Kitts and Nevis is planning to develop and implement a new Quality Assurance and Quality Control Plan as recommended by the IPCC Guidelines (IPCC 2006) which will identify the specific data quality objectives related to the principles of transparency, accuracy, consistency, completeness and comparability (TACCC) required for the St. Kitts and Nevis national inventory, and will provide specific guidance, documentation forms, and templates for the practical implementation of QA/QC procedures. The QA/QC procedures cover such elements as data selection and acquisition, data processing and reporting. The QA/QC plan will be a part of the Manual of Procedures which is to provide a general overview of the QA/QC system. In addition, the manual provides guidance and templates for appropriate quality checking, documentation, and transparency. The selection of source data, calculation methodologies, peer and expert review of inventory data and the annual requirements for continuous improvement for the inventory are also to be outlined in the manual.

QA, in this case, generally consists of independent third-party review activities to ensure that the inventory represents the best possible estimates of emissions and removals and to support the effectiveness of the QC activities. It is planned that both local and MRV Hub experts coordinate peer reviews at regular intervals and carry out checks to verify the transparency, accuracy, consistency, comparability and completeness of submitted inventories. The review findings will then be addressed by the inventory team as appropriate and based on prioritisation of activities⁸.

⁶ See Appendix B on training material pamphlet from train the trainer training.

⁷ See Appendix C on example data collection template.

⁸ Draft St. Kitts and Nevis National Inventory Report, 2021

4.3.2 Opportunities for improvement

Because quality control procedures are not formally practised, it suggested that the country utilise the QA/QC manual developed and define a responsible party for its implementation at least by the next inventory reporting cycle.

Table 5 shows the identified actions to improve the quality assurance and quality control procedures for the agriculture GHG inventory compilation.

Table 5: Potential actions to improve the quality assurance and quality control for the agriculture GHG inventory compilation process

Goal	Actions
Formalised QA/QC process	Identify agriculture experts to participate in QA/QC training.
	Develop a training plan that falls within the QA/QC plan of procedures in the inventory cycle on a yearly or periodic basis.
	Identify training opportunities to capacitate participants in executing their own QA/QC manual via hands-on work.
Improved QA of agriculture inventory	Develop a bilateral agreement with another Caribbean country so that the agriculture compiler from that country can review St. Kitts and Nevis' agriculture inventory and visa-versa.

4.4 MRV and archiving

4.4.1 Current situation

An MRV system for the country has not yet been established, but there is work underway to understand the data and institutional landscape of climate related data, laws, and policies.

For the case of the GHG Inventory, data providers for the existing emitting sectors have been identified, data collected, and assumptions documented in a country portal hosted by the MRV Hub.

4.4.2 Opportunities for improvement

Work is currently underway by the country to improve data preservation from reports of this nature, however more active work will be required to ensure that all data, assumptions, expert judgement, improvements, QA/QC checks, and report versions are stored by the country, and managed by an entity selected to be its keeper.

Table 6 shows the identified actions to improve the quality assurance and quality control procedures for the agriculture GHG inventory compilation.

Table 6: Potential actions to improve the MRV and archiving for the agriculture GHG inventory compilation process

Goal	Actions
Enhanced transparency in data archiving system	Develop a set of roles and responsibilities for the archiving lead.
	Identify a staff member to take on this role.
	Review options for physical and cloud-based systems for archiving system in both the Ministry of Environment and the Ministry of Agriculture with a focus on agricultural quarterly reports and existing databases.

5. Overall action plan for improving St. Kitts and Nevis' agriculture sector GHG inventory

Goal	Task	Responsibility	Priority (L/M/H) [#]	Timeline (S/M/L) [#]
Improved data collection procedures	Hold a stakeholder workshop to identify the best way to collect the data, i.e., what can be collected through livestock and plant extension officers, through the Department of Statistics, Customs and Excise, or via the use of electronic surveys at the farmer registry level.	Ministry of Agriculture/ Ministry of Environment	H	M-L (2-4 years)
	Utilise the training material ⁹ from the IICA-GCF project to set up training courses at extension officer training centres to teach farmers/extension officers about climate change and GHG inventory data requirements.	Ministry of Agriculture/ Ministry of Environment	M	M-L (2-3 years)
	Prepare short surveys, which can be given out during these training sessions, to determine what would incentivise farmers to collect data.	Ministry of Agriculture/ Ministry of Environment	H	M (2-4 years)
	Pilot the provided data collection templates ¹⁰ to understand the issues on the ground and to adapt the templates for local purposes, teaching farmers to collect data (focusing on what key data can be collected such as crop management, livestock, manure management, and fertilizer use).	Ministry of Agriculture/ Ministry of Environment	H	M (2-4 years)
	Establish "Model Farms" at Government owned farms (e.g., small ruminant farms or poultry farms) to teach farmers to document necessary data, especially in manure management practices.	Ministry of Agriculture/ Ministry of Environment	H	M-L (2 years)
	Adapt the data collection templates to collect appropriate country specific data and then either produce manual or electronic data collection templates or develop the template into an app.	Ministry of Agriculture/ Ministry of Environment	M	L (2 years)
	Perform scoping study for financing from national activities/projects and/or regional projects to finance data collection efforts, electronic application (or otherwise), and administration.	Ministry of Agriculture/ Ministry of Environment	M	L (2 years)
Improved interisland coordination	Identify focal persons in Ministry of Agriculture responsible for data collection in St Kitts and Nevis	Ministry of Agriculture/ Ministry of Environment	H	Ongoing
	Identify persons to validate the data collecting system. Develop a planning unit utilising the relevant data locate on the form. Create a data archiving and retrieval system.	Ministry of Agriculture/ Ministry of Environment	M	1-2 years
Formalised QA/QC process	Identify agriculture experts to participate in QA/QC training	Ministry of Agriculture/ Ministry of Environment	H	M (2 years)
	Develop a training plan that falls within the QA/QC plan of procedures in the inventory cycle on a yearly or periodic basis.	Ministry of Agriculture/ Ministry of Environment	M	S (1-2 years)
	Identify training opportunities to capacitate participants in executing their own QA/QC manual via hands on work.	Ministry of Agriculture/ Ministry of Environment	H	S (1-2 years)
Improved QA of agriculture inventory	Develop a bilateral agreement with another Caribbean country so that the agriculture compiler from that country can review St. Kitts and Nevis' agriculture inventory and visa-versa.	Ministry of Agriculture/ Ministry of Environment	M	L (3-5 years)
Enhanced transparency in data archiving system	Develop a set of roles and responsibilities for the Archiving lead.	Ministry of Agriculture/ Ministry of Environment	M	S (1-2 years)
	Identify a staff member to take on this role.	Ministry of Agriculture/ Ministry of Environment	M-L	S (1 year)
	Review options for physical and cloud-based archiving systems in both the Ministry of Environment and the Ministry of Agriculture with a focus on agricultural quarterly reports and existing databases.	Ministry of Agriculture/ Ministry of Environment	M	M (2 years)

[#]L = Low, M = Medium, H = High *S = Short term (within one year), M = Medium term (completed within two years), L = Long term (completed within four years)

⁹ See Appendix B on training material pamphlet from train the trainer training.

¹⁰ See Appendix C on example data collection template.

6. References

Government of St. Kitts and Nevis. 2021. *Draft St. Kitts and Nevis National Inventory Report*.

Appendix A: Agriculture Inventory Compiler Responsibilities¹¹

1. Review the *2006 IPCC Guidelines for National Greenhouse Gas Inventories* and previous IPCC Guidelines, if applicable, such as *Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories*.
 - a. Understand the GHG categories that are sources in the agriculture sector.
 - b. At minimum, understand the Tier 1 methodologies, data needs, and other requirements for developing GHG estimates for the agriculture sector, and become familiar with those for Tier 2.
2. Collaborate with the Inventory Coordinator to manage the agriculture sector budget and develop an Agriculture sector-specific work plan and schedule that coincides with deliverables acknowledged in the overall National Inventory Schedule.
3. Develop and implement an Agriculture sector-specific plan for archiving all relevant information and materials, in coordination with the archiving coordinator and adhering to any existing archiving guidance materials for your national inventory.
4. Identify the types of agricultural practices in your country that are relevant to production of GHG emissions (e.g., Crop Production, Livestock Management, Burning of Agricultural Residues or Grasslands), contact national, regional, and local experts to determine if the necessary data is readily available, and establish institutional arrangements for collecting activity data.
5. Oversee the establishment of arrangements between agriculture sector data collectors and data suppliers.
 - a. Collaborate with the Inventory Coordinator to record the institutional arrangements for the agriculture sector.
 - b. If required, develop agreements such as Memoranda of Cooperation (MOC) with necessary organizations (e.g., Ministry of Agriculture, universities) to assist with activities required by the Agriculture Sector Lead (e.g., data collection, generating GHG estimates).
 - c. Develop Scopes of Work (SOW) to engage contractors, and/or sector experts. Manage the work being carried out under these contracts to ensure it is meeting the requirements and needs of your GHG inventory sector.
6. Contact federal agencies/ministries or non-governmental organizations to inquire about the existence of satellite imagery data for categories such as Agriculture Residue Burning. Ensure this is done in coordination with the LULUCF sector, which also requires access to imagery.
7. Consider potential improvements identified in the previous inventory for this sector. Assess whether to implement improvements based on the contribution to overall national emissions (by conducting a Key Category Analysis) and availability of resources.
8. Oversee development of GHG estimates from all categories in the agriculture sector.
 - a. Determine the most appropriate IPCC methodology to be used to estimate GHGs for each category in accordance with decision trees.
 - b. Oversee choice and/or development of emission factors.
 - c. Coordinate with the LULUCF Sector Lead to determine emission calculations and activity data adjustments for complex categories such as Agricultural Soil Management and Manure Management.
 - d. Ensure consistency of data between enteric and manure management (e.g., livestock populations and characterization).

¹¹ Adapted from *EPA Toolkit for Building National GHG Inventory Systems*.

- e. Ensure consistency between nitrogen quantities in Manure Management and Agricultural Soil Management.
 - f. Coordinate with the waste sector to ensure assumptions on application of sewage sludge and nitrogen content are consistent.
 - g. Document all data collection arrangements, methodologies, activity data, emission factors, and assumptions, including use of expert judgment, in coordination with contractors and other technical experts that are developing the estimates.
9. In consultation with the QA/QC coordinator, convene Agriculture sector working group to review calculations and perform initial Quality Assurance/Quality Control (QA/QC), consulting QA/QC coordinator.
 - a. QA includes review procedures conducted by personnel not involved in the inventory development process (e.g., experts not involved with estimate development, the public, other relevant agencies, non-governmental organizations, universities, etc.).
 - b. QC includes routine reviews implemented by the inventory development team to measure and control the quality of the inventory as it is prepared (e.g., sector leads and supporting experts involved with estimate development).
 - c. Ensure that QA/QC procedures are consistent with the general and sector-specific procedures, which you should be able to obtain from the Inventory Coordinator.
 10. Coordinate the response to comments received from QA (external) reviews of the agriculture sector GHG estimates and update the inventory if necessary.
 11. Review the final agriculture sector GHG estimates and the narrative describing the assumptions, methodologies, and results.
 12. Oversee the development of the uncertainty analysis for the agriculture sector.
 13. Identify any improvements needed for subsequent inventories, related to activity data, emission factors, methodologies, or other components of developing the estimates. Document these improvements in the relevant tables and discuss them with the Inventory Coordinator for prioritisation in the overall inventory improvement plan.

Appendix B: Sample handouts for Data Collection Training



DATA COLLECTION ON LIVESTOCK FARMS FOR GREENHOUSE GAS EMISSION MONITORING






How do livestock impact greenhouse gas emissions?



Livestock release greenhouse gases into the atmosphere through the digestive process and through manure management.

Why do we need to collect livestock data?

Livestock and manure management data can be used to determine the amount of greenhouse gases produced. Detailed and more frequent data collection means more accurate emission estimates. This information assists farmers and the government to identify relevant actions that can be taken to reduce these emissions. Implementing these actions will in turn reduce the negative impacts of climate change. Frequent monitoring can also be used to determine whether the implemented action is having the desired effect.

$$\text{GHG emissions} = \text{Livestock} \times \text{Emission per head}$$

What type of data is required?



Population data

Livestock categories (gender/type)



Animal weight

Dairy Cows



Feed intake







Manure management by livestock type





What are the benefits to understanding and reducing livestock emissions?

Benefits to farm businesses from improving their emissions performance may include:

- Decreasing costs and increasing productivity. Belched methane represents energy lost from the production system that might otherwise be converted to the milk, meat or fibre that generates income.
- Increasing market opportunities as supply chains and consumers become more aware of increasing demand for food and fibre produced with lower emissions.
- Improved animal health and husbandry.
- Reduction in inorganic fertiliser costs. Reducing nitrogen losses from manure means a higher concentration of nitrogen in manure being applied to soils and therefore a reduction in the requirement for inorganic nitrogen fertilisers.



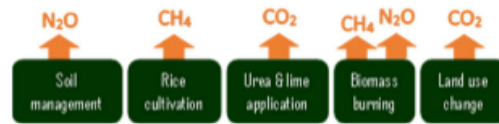



DATA COLLECTION ON CROP FARMS FOR GREENHOUSE GAS EMISSION MONITORING



How does crop farming impact greenhouse gas emissions?

Crop farming leads to the release of greenhouse gases through the application of fertilisers and lime, crop residue burning, tillage and other management practices, saturated soils (such as rice paddies) and the conversion of forest land to cropland.



Croplands can also lead to the removal of CO₂ from the atmosphere (*carbon sequestration*) through woody crop/tree growth, increased crop cover, mulching, no tillage and reduced land conversions.

Why do we need to collect crop data?

Crop areas, harvest areas and crop management data (*activity data*) can be used to determine the amount of greenhouse gases produced. Frequent and detailed data collection means more accurate emission estimates. This information assists farmers and the government to identify relevant actions that can be taken to reduce emissions. Implementing these actions will in turn reduce the negative impacts of climate

$$\text{GHG emissions} = \text{Activity data} \times \text{Emission factor}$$

change. Monitoring can be used to determine whether the implemented action is having the desired effect.

What type of data is required?



What are the benefits to reducing cropland emissions and increasing carbon storage?

Benefits to farm businesses from improving their emissions performance may include:

- Improved soil fertility and sustainability through improved soil management.
- Improved productivity and increased income.
- Increasing market opportunities as supply chains and consumers become more aware of increasing demand for food and fibre produced with lower emissions.
- Reduced time, labour inputs and fuel costs due to more efficient farming.
- Improved nutritional quality of food and food security.
- Increased resilience to climate change for farmers and communities.



Appendix C: Example of Data Collection Template

YEAR	
DATE	

CATEGORY SPECIFIC DEFINITIONS	
High producing cows	Cows in commercial operations that have calved at least once and are used principally for milk production
Low producing cows	Cows managed with traditional methods that have calved at least once and are used principally for milk production
NOTE	Low producing, multi-purpose cows are considered under "Other cattle" as "Mature cows" and not as "Dairy cattle".

NOTES:

Livestock type	Livestock sub-category		Average annual population	Typical average animal mass (TAM)	Daily feed intake	Average milk production	Milk fat content	Manure management						
			(Head)	(kg)	(kg dry matter/head/day)	(kg milk/head/yr)	(%)	(% of total manure produced by each livestock going to each manure management practice)						
Dairy cattle	TOTAL	Avg												
		High												
		Low												
	High producing cows	Avg												
		High												
		Low												
	Low producing cows	Avg												
		High												
		Low												

YEAR	
DATE	

NOTES:

Data collection template for dairy cows

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