

# Info Note

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## Measurement, reporting and verification of greenhouse gas emissions from livestock: current practices and opportunities for improvement

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### Key messages

- Despite 92 countries including livestock-related emissions in their Nationally Determined Contributions (NDCs), few countries have adequate means for tracking mitigation.
- As countries begin to implement their NDCs, there is strong interest and need to improve methods for measuring, reporting and verifying (MRV) emission reductions in the livestock sector.
- Adopting an IPCC Tier 2 approach that can reflect changes in the productivity and efficiency of livestock systems will be critical for countries that plan to measure progress in NDCs through the national greenhouse gas (GHG) inventory. Currently, only 5 of 140 developing countries employ methods that can routinely reflect emission reductions arising from changes in management practices and productivity.
- MRV improvement can occur in a step-wise fashion, reflecting countries' capacities and priorities.
- Strategies for inventory improvement vary depending on policy objectives.
- Many countries are also planning to develop intervention-specific MRV systems, but there is lack of experience in setting baselines and using cost-effective monitoring tools.

### Recommendations

- Expand support for analysis and identification of livestock mitigation strategies in countries; recognize that MRV will need to be able to capture impacts across a range of mitigation practices.
- Countries seeking to measure emission reductions through the national GHG inventory should consider developing a Tier 2 approach that can be periodically updated.
- Strengthen synergies among improvements in statistical systems or other livestock data systems and improvements in MRV.

- Support sharing experiences among countries on inventory improvement and MRV system development.
- Support innovation and piloting of MRV systems to increase practical experience and options.
- Provide guidance on cost-effective data collection methods for Tier 2 approaches, uncertainty analysis, and scenario development for NDCs and specific mitigation actions.

### Why focus on MRV of livestock emissions?

Greenhouse gas (GHG) emissions from agriculture now exceed emissions from land use, land use change and forestry, including deforestation, and are growing at a rate of about 1% per year (Tubiello et al. 2015). The main livestock emission sources – enteric fermentation, manure management and manure deposited on pasture – account for 62% of all agriculture emissions (FAOSTAT).

Submitted national inventories show that livestock emissions account for an average of 9% of gross GHG emissions in all developing countries, but exceed 20% of gross emissions in more than a third of developing countries. Future increase in demand for livestock products is expected to drive livestock GHG emissions higher. At the same time, however, the GHG emission intensity (tCO<sub>2</sub>e per tonne of livestock product) has been falling with the enhanced productivity and efficiency of livestock systems (Caro et al. 2014) and is expected to continue to fall. Productivity and efficiency gains are important ways to meet increasing demand for livestock products while limiting impact on the global climate system (Gerber et al. 2013, Havlík et al. 2014).

As part of their contribution to the Paris Agreement, 92 developing countries included livestock-related emissions in the scope of their INDCs, including 48 that explicitly mentioned intentions to reduce emissions from livestock-related sources (enteric fermentation, manure

management and biogas, grasslands and silvopastoral systems). Seventeen countries have proposed livestock mitigation policies and measures such as Nationally Appropriate Mitigation Actions (NAMAs). Associated with these plans is growing interest in improving measurement, reporting and verification (MRV) of livestock emissions (Box 1).

Guidance from the Intergovernmental Panel on Climate Change (IPCC) for compilation and reporting of national GHG inventories provides methodological options for estimating livestock GHG emissions (IPCC 1996, IPCC 2006). Tier 1 methodologies use fixed values for GHG emissions per head of livestock, so this quantification approach can only reflect changes in livestock populations. Tier 2 methodologies – which require more detailed information on different categories of animal and data on livestock weight, weight gain, feed digestibility and other factors – are better able to capture the effects of changes in management on GHG emissions. However, only 5 of 140 developing countries have adopted a Tier 2 approach that can routinely capture changes in productivity and efficiency of livestock systems in reporting to the UNFCCC. Another 16 developing countries are currently using a Tier 2 approach to calculate country- and system-specific emission factors, but their reporting systems are unable to capture ongoing changes in productivity that affect emission factors and emission intensity over time.

Within this context, CCAFS, the Global Research Alliance on Agricultural Greenhouse Gases (GRA) and the Food and Agriculture Organization of the United Nations (FAO), with support from the New Zealand government, the United States Agency for International Development (USAID) and the World Bank, embarked on a study of current MRV practices and opportunities for improvement.

The study focused on three areas:

1. Do current livestock GHG emission MRV practices meet countries' policy needs?
2. What are the common barriers to improving MRV of livestock GHG emissions?
3. How can international organizations support improvements in MRV of livestock GHG emissions?

UNIQUE Forestry and Land Use GmbH conducted a desk study and interviews. At a CCAFS-GRA-FAO-World Bank workshop in Rome in February 2017, 32 experts from developing and developed countries deliberated on a draft discussion paper, providing further insights on countries' priority concerns, constraints and plans. This info note summarizes key findings from the process; full results will be published in a forthcoming report by Wilkes et al. (2017).

## Current state of livestock MRV: Use of national GHG inventories

Reporting through national GHG inventories to the UNFCCC is currently a key approach to MRV for all countries. Many countries are now seeking to link MRV of mitigation actions with national GHG inventories to measure and report on progress in Nationally Determined Contributions (NDCs). How suitable are current inventory compilation practices for these purposes?

Our review assessed the transparency, accuracy, completeness, comparability and consistency of livestock emission reporting in the national inventories of 140 developing countries. While all countries used either the 1996 *IPCC Guidelines* or 2006 *IPCC Guidelines*, which provided comparable reports, the reports varied in transparency, accuracy, completeness, comparability and consistency (Box 2).

### BOX 1: MRV REQUIREMENTS IN THE UNFCCC, IPCC AND PARIS AGREEMENT

Developing countries mostly submit their national GHG inventory reports through National Communications (NCs) or Biennial Update Reports (BURs). NCs are to be submitted every 4 years and BURs every 2 years, with flexibility for countries based on capacities, data availability and resources available for MRV. Inventory reports should be compiled using methods set out in the *Revised 1996 IPCC Guidelines for National GHG Inventories*. Inventory compilation should adhere to five principles: transparency, accuracy, completeness, comparability and consistency. The *IPCC Guidelines* also set out methodological options that provide countries with flexibility. Countries should report on mitigation actions as part of BURs, giving information on methodologies “to the extent possible”, but very little further guidance is provided. Thus, UNFCCC requirements and IPCC guidance on MRV leave considerable flexibility for countries to decide how to meet reporting requirements. This flexibility has strong advantages for countries, but it can also leave them unsure of what quality and detail of reporting is ‘good enough’, especially when they seek to adopt significant updates in their reporting systems.

The Paris Agreement adds the obligation to prepare, communicate and maintain successive NDCs and to pursue mitigation actions aligned with these contributions. Key reporting provisions of the Paris Agreement are that all Parties shall regularly submit national inventory reports and information on implementation and achievement of NDCs, and all Parties shall account for their NDCs. The Paris Agreement also proposes an Enhanced Transparency Framework (ETF) as a system for MRV of climate action and support. The purpose of the ETF is to provide a clear understanding of mitigation actions, track progress towards NDCs and inform a global stocktake to be undertaken every 5 years. The ETF will build on existing transparency mechanisms under the UNFCCC, and specific modalities, procedures and guidelines are being developed for presentation at COP 24 (2018).

The biggest gap between reporting requirements and current practice was due to widespread use of a Tier 1 approach. Tier 1 approaches limit the policy utility of inventory reports, as they are not able to reflect changes in animal productivity and efficiency of farm systems, and thus cannot measure the effects of productivity-based mitigation actions on GHG emissions. Among the few countries that adopted a Tier 2 approach, most undertook a one-time exercise to estimate country-specific emission factors but have not updated emission factors to reflect trends in their livestock sectors. Interviews with inventory compilers in 7 developing countries found that common constraints to improvement included weak linkages between inventory compilation processes and national data providers, and lack of funding for inventory improvement.

## Current state of MRV of livestock mitigation actions

INDCs submitted by 48 developing countries explicitly mentioned the intention to reduce emissions from livestock-related sources; another 44 countries included livestock emissions in the scope of their INDC along with the agriculture sector in general or as part of an economy-wide target. However, few countries identified policies or measures to implement these intentions (Figure 2). Only 11 of the 48 countries explicitly including livestock mitigation mentioned a policy or measure in their INDC, and only 17 countries have proposed NAMAs to address livestock-related emissions. For most countries, therefore, progress in GHG mitigation in the livestock sector still requires development of policies and measures for implementation.

### BOX 2: ASSESSMENT OF LIVESTOCK REPORTING QUALITY IN NATIONAL GHG INVENTORIES

Figure 1: Average score for quality of livestock inventory reporting, compared with maximum scores for 140 developing countries\*



\*The scoring methodology provided scoring options from 0 to 9 for each principle based on specific criteria. Each principle was then weighted based on expert opinion by 32 experts from developing and developed countries.

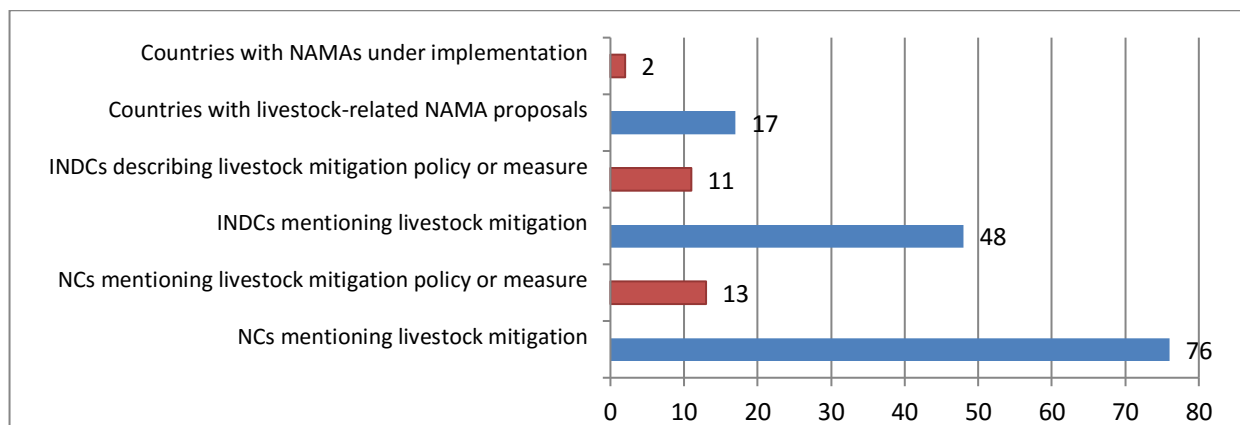
**Completeness:** Almost all countries reported enteric fermentation emissions, but 32 countries omitted either methane or nitrous oxide emissions from manure or nitrous oxide emissions from dung deposition on pasture.

**Consistency:** While most countries reported a consistent time series, 37 did not, most commonly due to a change in the inclusion of manure emissions or deposition of dung on pastures. However, consistency appears to have improved over time as countries compiled more regular inventory reports.

**Accuracy:** Less than half of developing countries reported analysis of key emission sources in their inventory. Of the 65 countries that did, 49 found that one or more livestock emission sources were key source categories. Key source categories can be better described using a Tier 2 approach, but 118 out of 140 developing countries used a Tier 1 approach for all livestock emissions, including 68 countries for which FAO data suggested livestock emissions were likely to be a key source and 73 countries that included livestock in their INDC. Only 21 countries have adopted a Tier 2 approach for some or all livestock emissions, including 14 countries for which livestock emissions were likely to be a key source. Most of these countries have developed Tier 2 emission factors based on a combination of national statistics, surveys or literature reports and expert judgment, and have not updated these country-specific emission factors since. Only 5 developing countries reported using a Tier 2 approach that periodically updated emission estimates on the basis of herd statistics and animal productivity data or that emission factors had been updated between submissions.

**Transparency:** 41 countries neither explained the source of livestock population data nor presented population data; 23 countries did not mention the tier approach used in estimation of enteric fermentation or other emissions; and of the 32 countries omitting one or more livestock emission sources, 20 gave no explanation for this omission.

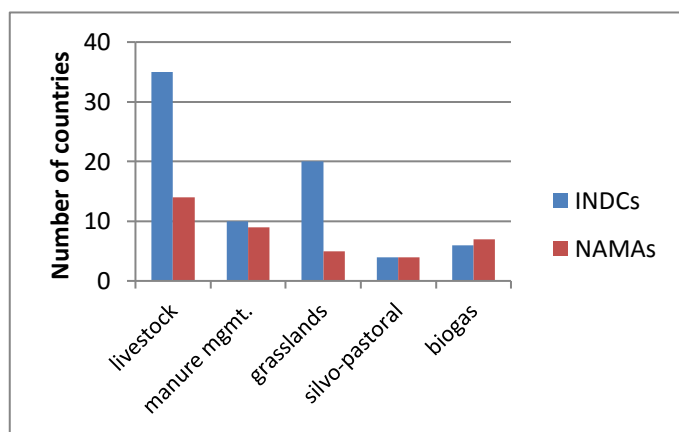
**Figure 2: Number of developing countries expressing intention to or engaging in livestock mitigation actions\***



\*NAMA: Nationally Appropriate Mitigation Action; INDC: Intended Nationally Determined Contribution; NC: National Communication.

More than one third of livestock-related NAMAs and livestock-related mitigation measures mentioned explicitly in INDCs related not only to the main livestock emission sources but also to vegetation and soil carbon pools or energy emissions (Figure 3). These countries will require MRV systems that capture effects of changing practices in livestock production systems, but their MRV systems cannot focus only on changes in particular GHG inventory categories. In many cases, MRV of livestock emissions will need to be addressed within a landscape approach, which will also require MRV systems that link with MRV in other sectors. Because most countries are still developing livestock-related mitigation actions and MRV systems are at an early stage of development, countries have the opportunity to develop MRV systems appropriate to their contexts and objectives.

**Figure 3: Number of countries expressing interest in different livestock-related mitigation measures**



Future trajectories for MRV of livestock emissions and emission reductions in developing countries are likely to be shaped by the current status of national GHG inventories, the types of mitigation action pursued and the mechanisms for implementation and MRV.

**Starting points:** The majority of countries that included livestock-related emissions in their INDCs intend to measure emission reductions compared to a business-as-usual scenario. Not all of these countries have made an

in-depth assessment of baseline and mitigation emission scenarios, and only about a quarter of these countries have identified policies and measures to reduce livestock-related emissions. Many countries, therefore, will need to start with describing baseline scenarios, assessing mitigation potentials, and identifying policies and measures for implementation of mitigation to further advance their MRV systems. In addition, some countries will focus on gathering reliable data on livestock populations, while others will focus on moving from Tier 1 to Tier 2 approaches in their national GHG inventories.

**Types of mitigation actions:** Although mitigation actions may focus on the livestock sector, they are likely to have effects on other sectors as well. For example, improving feed supply may affect cropland management and fertilizer use, and impacts on land use and forestry should also be accounted for where livestock or livestock feed production is a driver of deforestation or land use change.

**Implementation mechanisms:** Among countries that have identified mitigation policies and measures, some are planning project-based mechanisms, while others are planning policy mechanisms (e.g. regulations, subsidies).

**MRV mechanisms:** Some countries have made a policy decision to track progress in INDCs and NAMAs through the national GHG inventory. Other countries will focus on developing intervention-specific MRV systems. Both options face challenges (Box 3, Box 4). The main trajectories for the development of livestock MRV systems in the coming years will involve:

1. GHG inventory improvements, including:
  - a. Improvements in completeness or reliability of livestock population data
  - b. Moving from Tier 1 to Tier 2 approaches
  - c. Adjusting existing Tier 2 approaches to reflect trends in the livestock sector
  - d. Continuous improvement of regularly updated Tier 2 approaches
2. Development of intervention-specific MRV systems
3. Integrating MRV of livestock emissions with MRV of land-based and energy emissions

## Improving national GHG inventories

Inventory improvement will occur in steps and over time, and strategies for improvements may differ depending on the functions the inventory serves. In many countries, national GHG inventories are compiled mainly to meet national reporting obligations. For these countries, improving inventory accuracy is often the main concern. But where livestock GHG mitigation is in line with national livestock development policies – to enhance productivity, for example – and where livestock are included in the scope of NDCs, national inventories also can be a tool to inform policy-making or measure progress against policy goals. In these countries, the *change* in emissions is more relevant to policy goals, so it may be more informative for inventories to show a precise trend in emissions in the livestock sub-sectors targeted by policies. This approach requires that the inventory methods used each year are the same. While many countries will want both accuracy and precision in trends, in practice initial improvements may require choosing one or the other.

In countries that prioritize improvements in the accuracy of inventories, the first step is to identify which livestock types are key source categories. Next, factors influencing total emissions, in order of importance, are likely to be:

- Livestock numbers and population structure
- Distribution of the livestock population by agro-ecological zone or production system
- Characterization of feed intake and digestibility

### BOX 3: CHALLENGES TO ALIGNING MRV SYSTEMS WITH GHG INVENTORIES

Challenges to reporting the effects of mitigation actions through national inventories include:

- Most national inventories do not apply a Tier 2 approach in ways that can track the effects of changes in production practices and productivity on GHG emissions.
- MRV of specific mitigation actions may generate higher resolution data than are used in the national GHG inventory. This could be an opportunity to revise national inventories to incorporate higher resolution activity data or emission factors, but the feasibility and costs of doing so while maintaining consistency would need to be assessed.
- Most INDCs propose to estimate emission reductions in comparison to a business-as-usual (BAU) scenario. BAU scenarios may be created from historical inventory data or developed on the basis of other information (e.g. policies and plans), but are not reflected in national inventories.
- Livestock mitigation actions may affect several GHG sinks and sources (e.g. soils, woody biomass, energy use) in different sectoral scopes in national inventories. Aligning data management processes with existing inventory processes will be needed.

- Tracking change in livestock reproduction and performance parameters over time (Figure 4).

Where inventories are used to track the effects of policies over time, they should reflect change in practices and livestock performance for the livestock types targeted by policies. Here, the priority is to show a precise trend in emissions over time to capture changes driven by the policies. Steps, in order of importance, could be:

- Prioritize livestock sub-sectors or sub-populations based on planned mitigation interventions or expected trends in the sector affecting emissions
- Use available data to estimate emissions using a Tier 2 approach
- Assess data quality and uncertainty to prioritize inventory improvements over time (Figure 5).

Both strategies for initial improvement of the inventory can be implemented in a manner consistent with IPCC guidelines. Both strategies will require institutional cooperation between inventory compilers and providers of livestock statistics, as well as strengthening human resource and technical capacities. Resources for inventory improvement are a common constraint; involving key stakeholders from livestock and other sectors in discussions on inventory improvements may increase awareness of the value of inventory improvements and enable additional allocation of resources to inventory improvements that serve policy goals.

### BOX 4: CHALLENGES TO LINKING PROJECT-BASED MRV WITH NATIONAL MRV SYSTEMS

Some countries are considering establishing intervention-specific MRV systems that are linked with national MRV systems. Challenges include:

- Data from programme monitoring are not always linked to national GHG inventories or MRV systems. In international development agencies and financial institutions, project monitoring largely plays accountability functions, and projects are implemented by dedicated project management units, so even where data relevant to quantifying GHG emission reductions is collected, project monitoring systems may not link with national MRV systems.
- Different international finance institutions and development agencies have their own GHG quantification policies, procedures and guidelines.
- Financial institutions (e.g. state or commercial banks) will often play key roles in supporting NAMA implementation. Few financial institutions have incorporated GHG accounting in their management information systems. They are also subject to privacy legislation.

Figure 4: Stylized strategy for improving the accuracy of livestock emission estimates in national GHG inventories

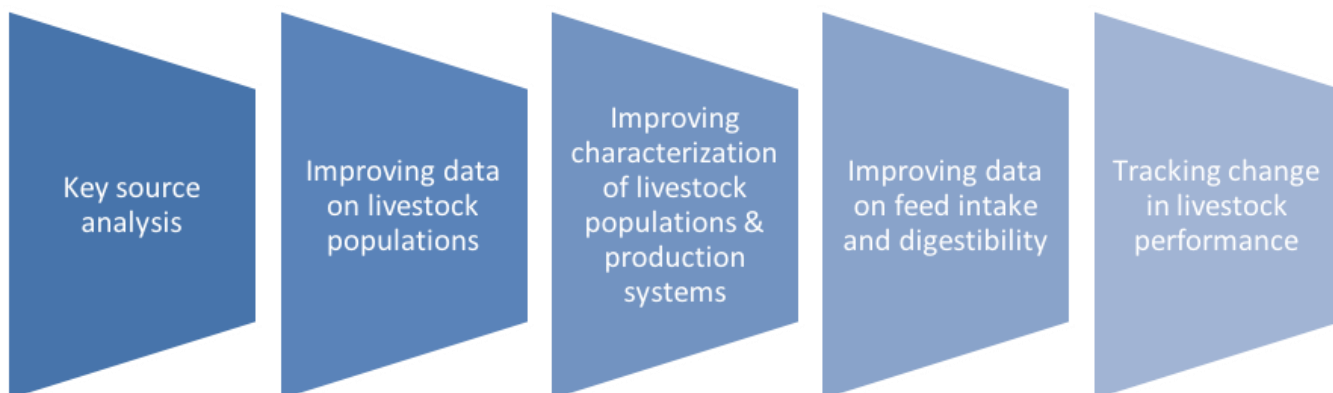
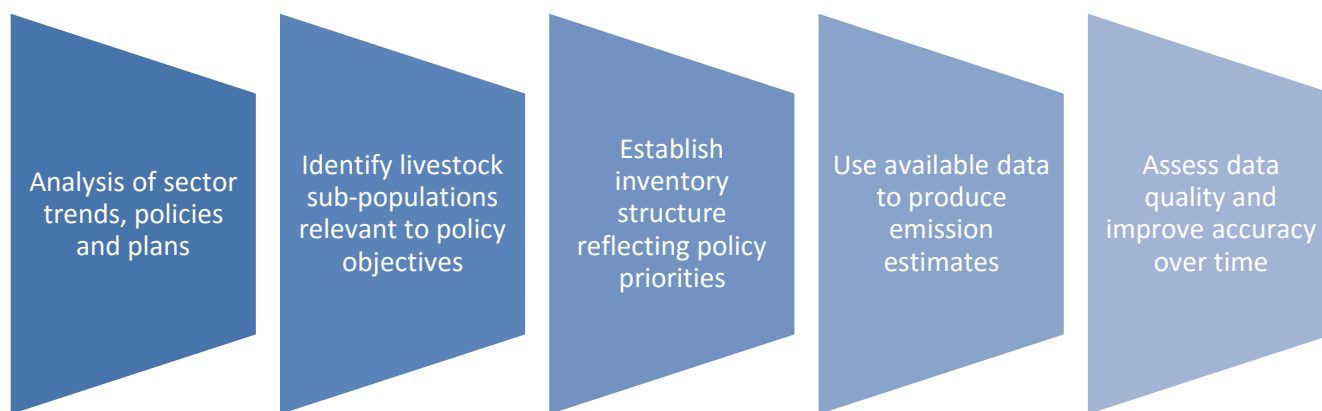


Figure 5: Stylized strategy for improving the precision of reported livestock emission trends in national GHG inventories

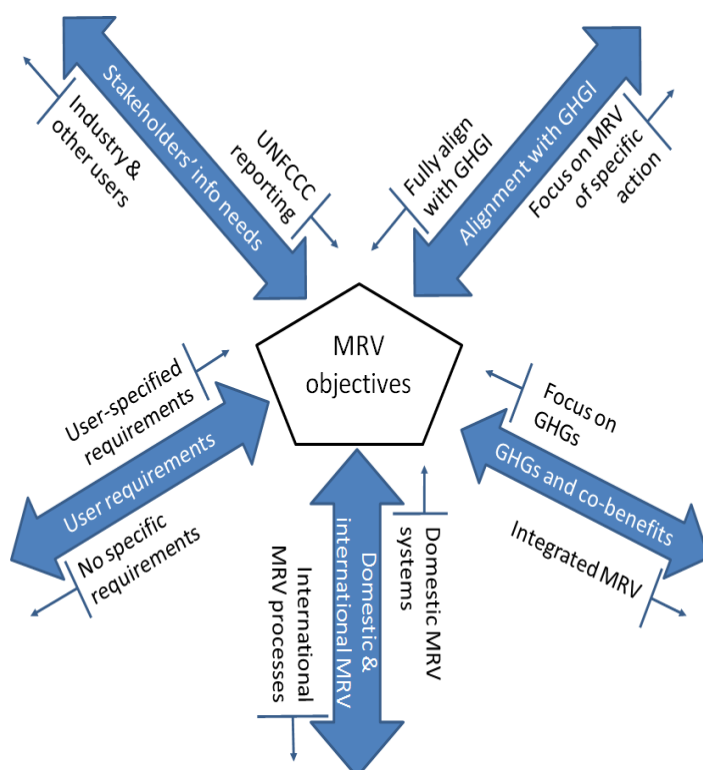


### Improving MRV of mitigation actions

Currently, there are no uniform institutional and technical requirements for MRV systems for mitigation actions. Future agreements on modalities, procedures and guidelines for the ETF may provide additional clarity. In the meantime, each country is considering decisions across a number of dimensions (Figure 6):

- Whether and how to align MRV of mitigation with national GHG inventories
- Whether intended users of MRV systems will have specific pre-set requirements or needs
- To what extent MRV systems should be designed with the objective of only reporting to the UNFCCC, or also meeting other objectives and stakeholders' information needs
- Whether to focus on GHG effects only or to integrate MRV of GHG emissions with MRV of sustainable development benefits
- Whether to develop MRV systems based on domestic requirements or to align MRV with international requirements, such as those of carbon markets, or particular implementation or funding agencies.

Figure 6: Five dimensions framing decisions in MRV system design



## Recommendations to support MRV improvement

Developing countries and their international partners can support improvements in MRV through the following actions:

### ➊ Improving national GHG inventories through:

#### (a) Policies, institutions and supporting conditions

- Analyze how improvements in inventories and other MRV systems can help countries meet their policy goals.
- Share examples of how countries are improving national MRV systems, especially how improved components of MRV systems support overall performance.
- Enable regional sharing of experiences on MRV improvement.

#### (b) Methods

- Review current Tier 2 approaches to clarify how different methodological approaches have evolved and the steps countries have used to improve their methods over time.
- Compare methods for collection of data on livestock populations, herd structure, feed intake, livestock performance and other parameters to guide the choice of more reliable and cost-effective methods, including alternative methods to 'gold standard' methods.
- Assess the potential for countries to use research results from analogous production systems in other countries, so that not all countries need to undertake original research for all parameters in the Tier 2 approach.
- Provide guidance on uncertainty analysis and its relevance for different policy objectives.
- Document and share case studies of the approaches, including institutional arrangements, used by different countries to compile and improve their national GHG inventories.

### ➋ Improving MRV of mitigation actions

- Produce guidance on good practices in baseline and mitigation scenario analysis for NDCs and specific mitigation actions.
- Further develop assessment tools (e.g. GLEAM) to improve software capabilities and transparency for use in national decision-making.
- Support testing of MRV systems and innovations at sub-national levels.
- Provide case studies of methods used in MRV at national, sub-national and project levels.
- Convene regional and cross-regional exchange workshops.

### Further reading

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## CCAFS and Info Notes

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