



ADVANCING ON CAPACITY DEVELOPMENT FOR  
**NATIONAL GHG INVENTORY SYSTEMS**

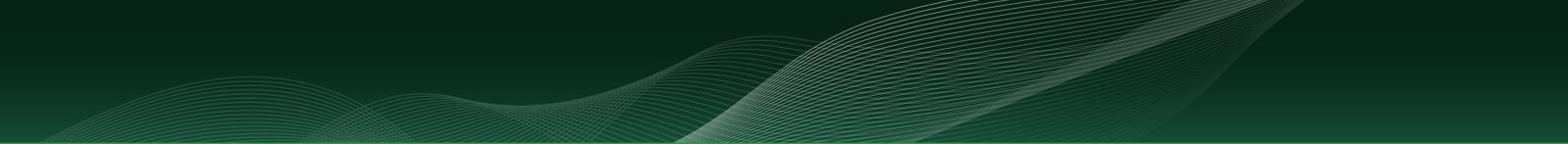
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Coalition for Rainforest Nations

**giz** Deutsche Gesellschaft  
für Internationale  
Zusammenarbeit (GIZ) GmbH

**vTI**  
Julius Hönigk  
und Thünen-Institut



# ADVANCING ON CAPACITY DEVELOPMENT FOR **NATIONAL GHG INVENTORY SYSTEMS**

## **First Lessons on Capacity Development for Reducing Emissions from Deforestation and Forest Degradation**

With contributions from

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CD-REDD is financed by the German Federal Ministry for Environment, Nature Conservation and Nuclear Safety (BMU) as part of its International Climate Initiative (ICI).

The Coalition for Rainforest Nations (CfRN) conceived of and designed CD-REDD in response to calls from developing and developed countries to initiate and develop GHG inventory practices in rainforest nations. The Coalition leads the project with the assistance of partners, the Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) and the Johann Heinrich von Thünen-Institute (vTI).

The project's first phase began in early 2008 and moved to a second phase in 2009. Through the generous support of BMU and the cooperation of GIZ and vTI, the Coalition oversees project activities in eight countries in West Africa and Latin America. The vTI is responsible for project activities in six countries in Southern and East Africa. The CfRN leads common activities for all project countries and on a global level.

### **The CD-REDD project partners**

Rome, November 2012

[www.cdredd.org](http://www.cdredd.org)

Graphic designer: Ivan Grifi

**On behalf of**



Federal Ministry for the  
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and Nuclear Safety

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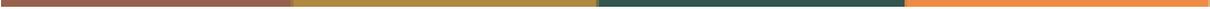
## Summary

Developing countries' GHG inventory systems need to do much more than produce GHG estimates at irregular intervals in reports to the UNFCCC: most notably they need to provide input for national mitigation and development planning and it is also necessary to set up national approaches for monitoring, reporting and verification (MRV) to participate in results-based climate change funding and REDD+.

Currently, in many developing countries the quality of GHG inventory systems is limited. This is because compiling a national GHG inventory is a complex task, while in many developing countries basic input data may be either unavailable or unreliable and the necessary institutional setup for dealing with such a technical challenge is often in early stages of development. Things are just changing for developing countries with a REDD+ mechanism under the UNFCCC being set up that will provide positive incentives for carbon reduction – and for improving national GHG inventory systems to track its results.

The CD-REDD project supports 14 countries (Argentina, Botswana, Dominican Republic, Ecuador, Ghana, Guyana, Liberia, Malawi, Namibia, Nigeria, South Africa, Suriname, Tanzania, and Zambia) to build capacities for greenhouse-gas (GHG) inventories from the land use, land use change and forestry as well as the agriculture sectors. The approach focuses on the inventory teams in countries and coaches them in working with the data already available, providing technical advice, analytical tools and also identifying ways of placing the GHG inventories high on the team's priority lists.

The project helps countries develop capacity for GHG inventory systems. To track this, we developed a score card to rate the quality of GHG inventory systems on a scale of 0-100%: first according to the UNFCCC's and IPCC's five standard criteria of technical quality, i.e. transparency, consistency, accuracy, comparability and completeness, and second according to a further two criteria relating to institutional and management aspects. Using these criteria we locate countries' inventories on a capacity development trajectory towards high-quality GHG inventory systems. The data indicate that the project is targeting an inventory quality of 34% for the project countries, which is up from 13% for the last GHG inventories that these countries had compiled before starting to work with us.



The significant increase of inventory quality for the countries is a direct result of our project's approach of coaching the inventory teams and may serve to facilitate other complementary steps that are also necessary and address the lack of forest inventories and detailed spatial databases on land use and land use change.

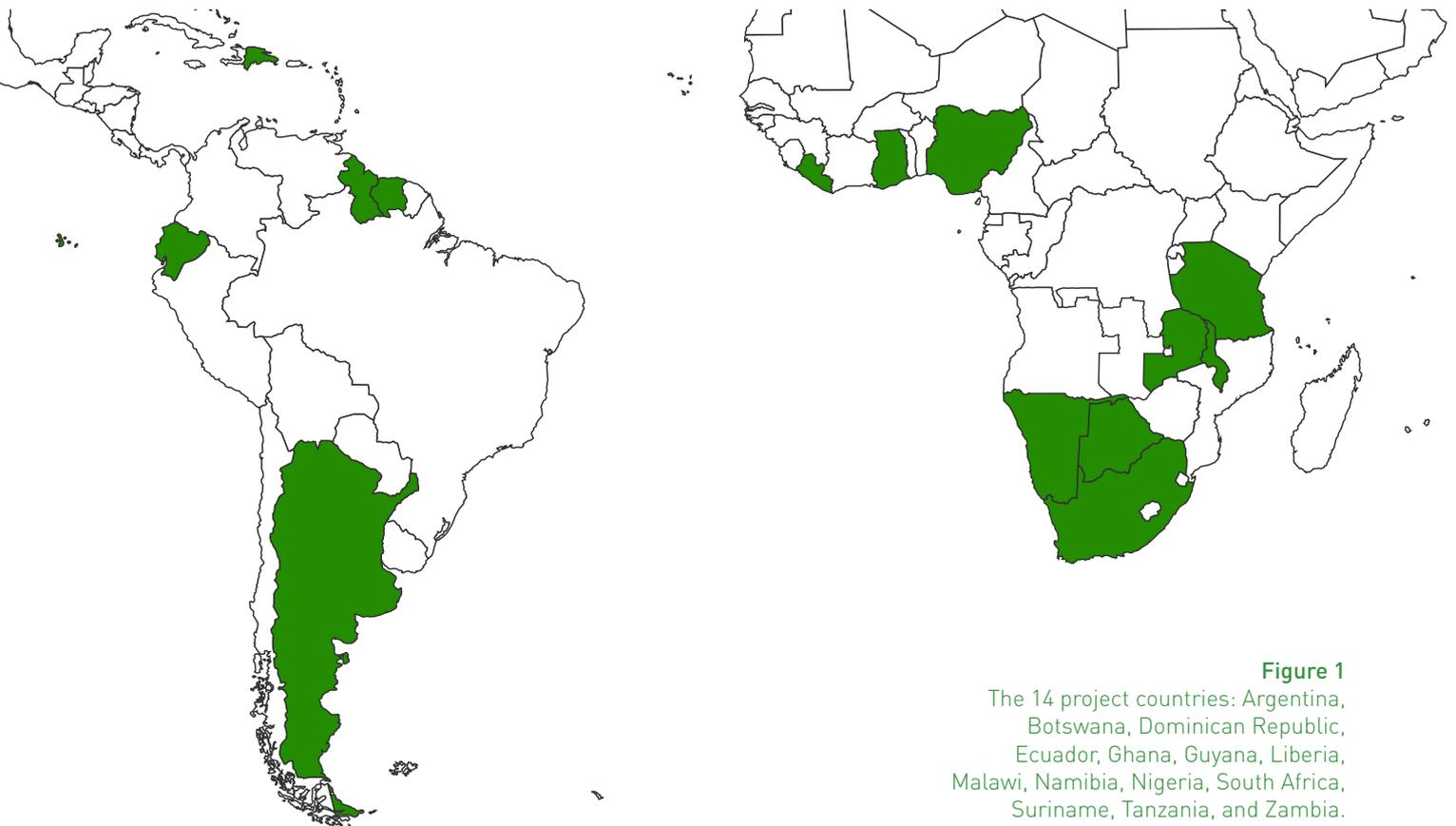
- High-quality national GHG inventory systems in developing countries are essential for an appropriate response to climate change, comprehensive national development planning and access to international mitigation funding – and their absence is a development barrier
  - Many developing countries are on the way to being able to accurately account for GHG emissions in the forestry and agricultural sectors and their changes as results of mitigation actions
  - Putting in place and running high-quality national GHG inventory systems is highly demanding and affects many levels of administration in developing countries, capacity development therefore needs to focus on institutional arrangements and management aspects
  - Capacity building work delivers tangible results and can significantly develop countries' capacities for national GHG inventory systems
  - To assist countries to effectively advance on the capacity development trajectory towards high-quality national GHG inventory systems, different kinds of support need to go hand-in-hand, such as coaching the inventory teams and providing resources for building databases and providing an appropriate institutional setup
  - The design of systems for results-based mitigation funding such as REDD+ needs to recognize just how difficult it is to establish GHG inventory systems and needs to allow for differentiated conditions in countries with very different levels of capacities
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**The CD-REDD project supports countries for transparent, accurate, consistent, comparable and complete greenhouse-gas inventories for the agriculture and forestry sectors**

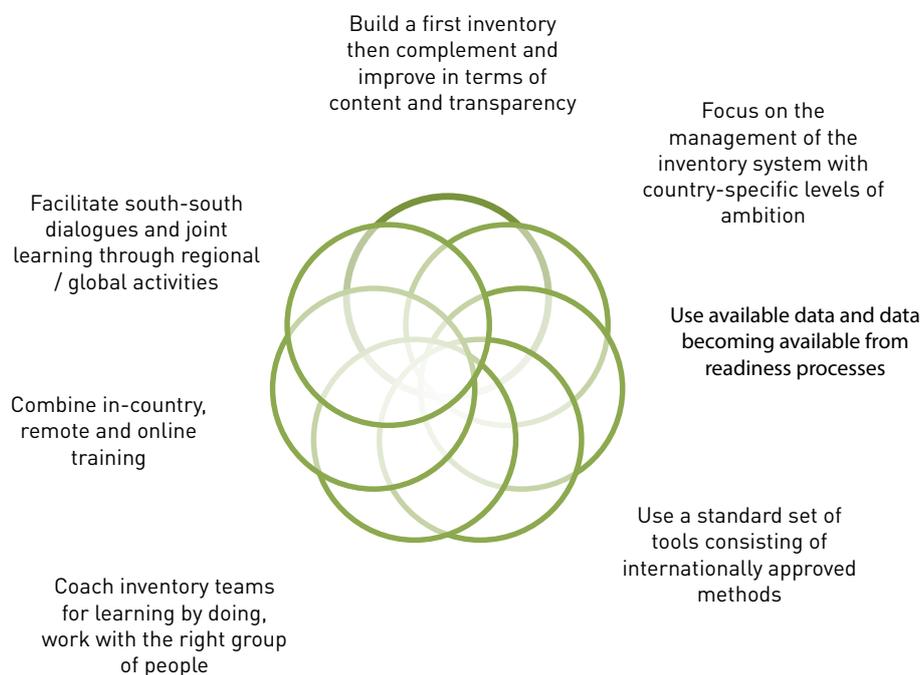
“CD-REDD” stands for **Capacity Development for Reducing Emissions from Deforestation and Forest Degradation**. The project works together with 14 countries in Latin America, Western Africa and Southern Africa (**Figure 1**). It aims to increase capacities for greenhouse gas reporting for the agriculture and forestry sectors. The range of countries covers a spectrum of technical capacity for GHG inventories, beginning with least-developed countries that have little capacity for monitoring GHG emissions and

removals and ranges to countries that are among the advanced developing countries whose technical capacities are closer to those of developed nations. This provides a representation of the diversity of developing countries that strive to reduce emissions and attract international mitigation funding.

The project approach to building capacities for greenhouse-gas (GHG) inventories from the forestry and agriculture sectors is focused on **coaching the countries on a development path towards high-quality GHG inventory systems** that will deliver GHG information that is transparent, accurate, consistent, comparable and complete, in line with the UNFCCC and IPCC reporting guidelines and structured for a



**Figure 1**  
The 14 project countries: Argentina, Botswana, Dominican Republic, Ecuador, Ghana, Guyana, Liberia, Malawi, Namibia, Nigeria, South Africa, Suriname, Tanzania, and Zambia.



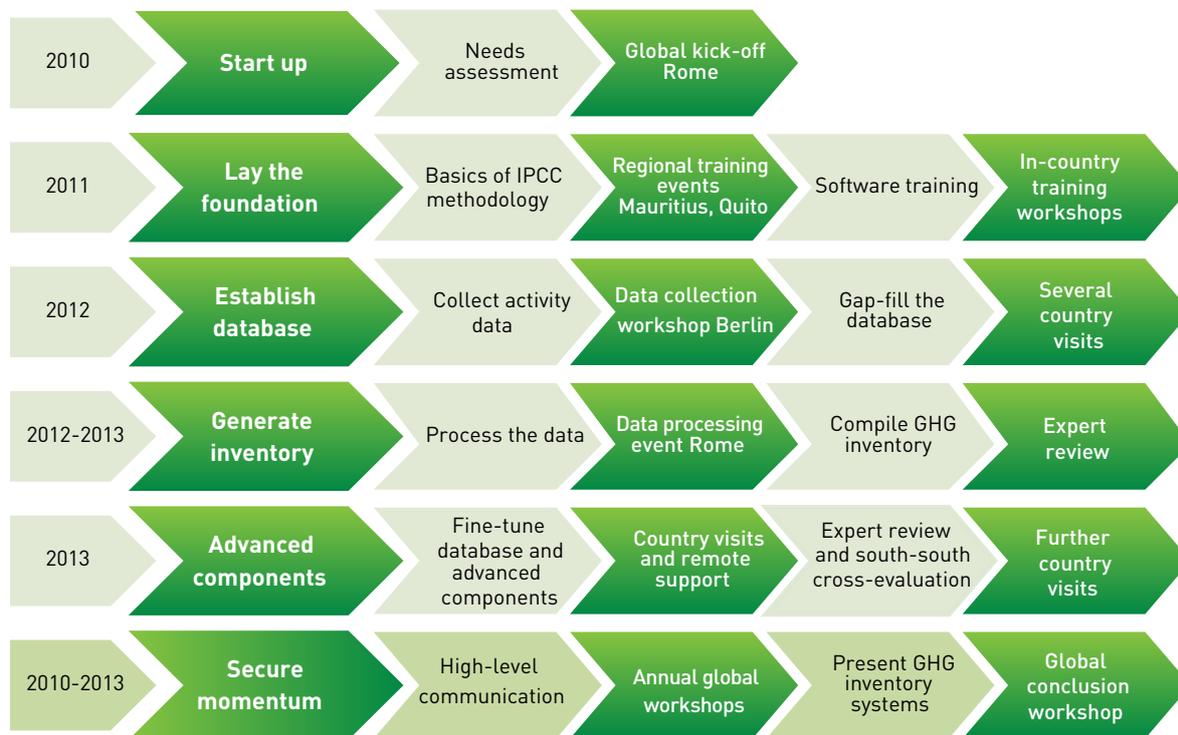
**Figure 2**  
The elements of our approach to coaching inventory teams and building capacity for GHG inventory systems.

range of uses in the countries and internationally. To help the countries advance on their capacity development trajectory, the project approach to building capacities includes several elements (Figure 2) that aim at using available data and resources while gradually building capacities in several fronts..

Our project focuses on the inventory teams in the countries and it is crucial to identify the right people for such a team. They are technically skilled representatives from the lead institutions on climate change, forestry, agriculture and GHG inventories. Much of our work involves coaching the inventory teams and providing them with an environment where they can learn by

doing on how to compile the GHG inventory and run the national GHG inventory system. We therefore use a mixture of complementary measures (in-country visits, remote support, and online training) to provide this support.

Two key determinants set the environment for capacity building: the appropriate level of ambition and the set of tools to be used for the GHG inventory. The pace of work is set by the inventory teams and there are different levels of ambition among the countries according to their capacities and data availability. Despite the different levels of targeted inventory quality in most countries we use *inter alia* a standardized set of tools for all countries, which was



**Figure 3**  
The project's training sequence in 5 phases shown together with our effort to constantly secure momentum through a close relationship with inventory teams and through securing high-level buy-in.

originally developed within the US-EPA's National GHG Inventory Capacity Building Program<sup>1</sup>, including the ALU GHG inventory software for GHG data calculations and a set of national system templates that address important aspects of the GHG inventory system. This enables teams to build a first draft GHG inventory, which functions as a point of departure for further elaboration on the country's process to improve GHG inventory system. This leads to a process of continuous stepwise improvement of the data and methodologies used within each

iteration of the process – including after conclusion of the project.

The project works with the governments to improve the national GHG inventory systems using already available data and staff resources from national or international sources. The project does not support collection of primary data, neither does it provide countries with resources for staff or primary data collection, it is different in that regard from other initiatives that work on similar issues, such as the UN-REDD programme's MRV support or the US-EPA's work on GHG inventory systems in developing countries. That is why we coordinate closely with these institutions and offer developing countries a synergistic approach.

<sup>1</sup> US-EPA. (n.d.). The Inventory Project Progress Indicator. [www.epa.gov/climatechange/EPAactivities/internationalpartnerships/capacity-building.html](http://www.epa.gov/climatechange/EPAactivities/internationalpartnerships/capacity-building.html)

## The project follows a prescribed training sequence with the GHG inventory teams

In late 2012 around half of the project was completed and we had completed our workplan by about half as well (Figure 3). Training began in early 2011 by conveying the basics of the IPCC guidelines for establishing national GHG inventory systems through global, regional and several national events. With remote support by project experts, inventory teams started collecting data to establish a basic set of country specific activity data. A highlight of this phase was the 5-days data collection workshop in Berlin in May/June 2012. The remaining gaps in the database were filled by an extensive series of in-country visits.

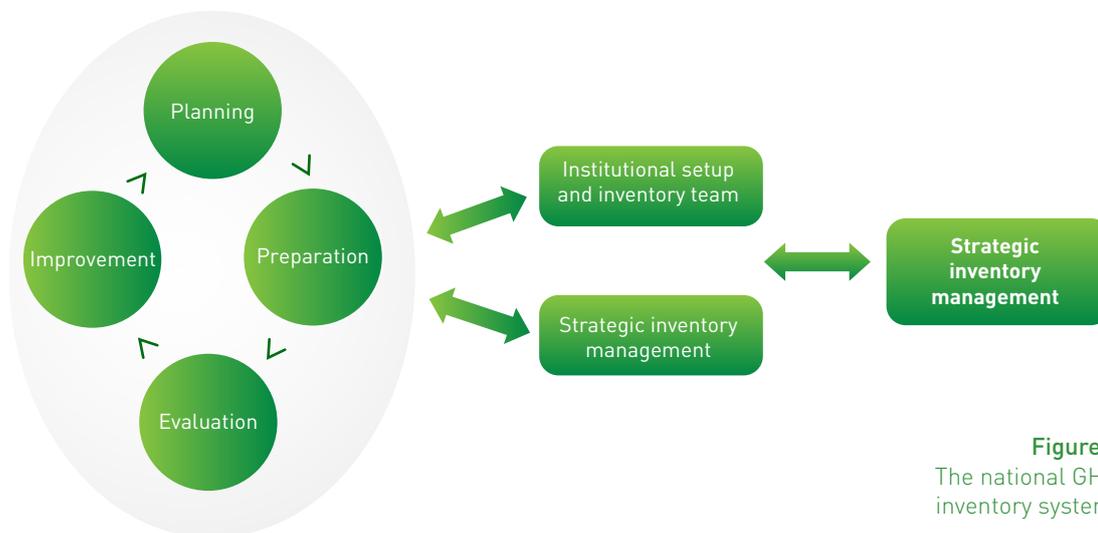
After completing the GHG inventory database (mostly the activity data and emission factors), the inventory teams are then ready to process data and we began with a data-processing workshop held in Rome in late 2012. The inventory teams of several countries come together here to process data, discuss the work carried out and plan out follow-up activities to continue learning based on the first iteration of the inventory cycle.

The project will be finalized throughout the year 2013 with two phases: There will be work on advanced components of GHG inventory system that are more directed towards institutional and management aspects. In some countries, there will also

## The capacity development trajectory for national GHG inventory systems

The project supports countries on a capacity development trajectory towards high-quality GHG inventory systems. The goal of this trajectory is that the countries run a GHG inventory systems that provides reliable input data for national mitigation planning and tracks progress for international financing. In our experience from working with a set of countries this is a highly demanding task - which is why many countries need to invest much effort and resources in the context of the readiness process. We also call this a capacity development trajectory because we believe that capacities for inventories need to be built up through several iterations of the inventory process where the systems improve continuously. Countries with less capacity will start at an earlier stage of the trajectory and their GHG inventory system will not yet meet all quality criteria, but during the iterations of the process, each country will advance. Our project aims at supporting the countries' inventory teams to advance on the GHG inventory systems capacity development trajectory.

be an effort to fine tune the database and improve the calculations. Moreover, effort will be invested in a review through international IPCC experts as well as a cross-evaluation of inventories between countries. This serves to provide the inventory teams with feedback on their work including good practices and possible improvements and to also develop capacity in terms of understanding review processes on an international level and the necessities of build in-country arrangements.



**Figure 4**  
The national GHG inventory system.

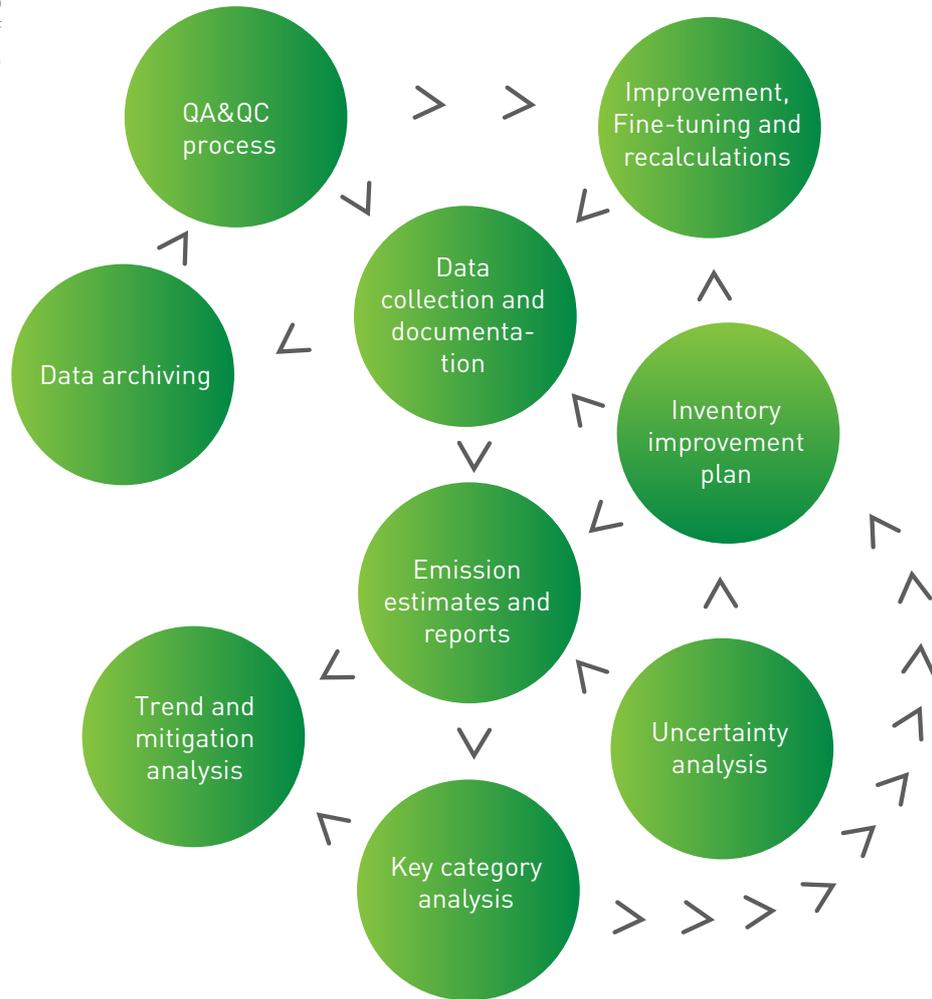
### A national GHG inventory system is much more than the compilation of emission estimates

The national GHG inventory system is a system that the public sector runs to deliver GHG information along a prescribed cycle of planning, preparation, evaluation and continuous improvement (Figure 4). This complex system needs to ensure that the quality of output is high and continuously improves and, to this end, should involve institutions and individuals that collect data and other information, process and archive them. Also key is that the GHG inventory system is managed strategically to integrate the inventories, and share information, with other policy processes that provide inputs to it or use its outputs.

GHG inventories have a set of typical components defined by the IPCC Guidelines<sup>2</sup> and the UNFCCC reporting requirements as well as practical requirements for inventory management. Beyond the GHG estimates themselves, appropriate documentation and archiving of the data and methods used in calculating emission and removal estimates and an effective process for quality assurance and quality control of the data are also integral parts of inventories. The process of inventory compilation should be thought of as a continuous inventory cycle and each iteration as an opportunity for improvement of the inventory. This

<sup>2</sup> IPCC. (2006). 2006 IPCC Guidelines for national greenhouse gas inventories. Intergovernmental Panel on Climate Change.

**Figure 5**  
The components of  
the national GHG  
inventory system.



process must be guided by an inventory improvement plan, i.e. a structured and prioritized list of activities to further develop procedures for estimating emissions and removals. The elaboration of the inventory improvement plan should itself be informed by a key category analysis as well as by an uncertainty analysis of emission estimates to prioritize options for improvement. A high-quality set of inventory estimates over time then provides some basis for the identification of emissions trends that may contribute to a mitigation analysis to underlie policy recommendations (Figure 5).

Some attempts have been undertaken to describe required technical specifications of GHG inventory systems but these are usually written for just one context and therefore remain incomprehensive or too general<sup>345</sup>.

- 3 GOF-C-GOLD. (2010). A sourcebook of methods and procedures for monitoring and reporting anthropogenic greenhouse gas emissions and removals caused by deforestation, gains and losses of carbon stocks in forests remaining forests, and forestation (p. 209).
- 4 OECD. (2011). Towards Green Growth: Monitoring Progress (p. 144). OECD Publishing. doi:10.1787/9789264111356-en
- 5 UNEP. (2012). Measuring Reporting Verifying (p. 32).

General practical guidance is hard to come by and setting up a versatile GHG inventory system therefore remains a matter that national governments need to develop themselves. This is where the project advises developing country governments on setting up these systems.

### Building high-quality GHG inventory systems is as important as it is challenging

The GHG inventory system, in its objectives and its functions, is related to several international and national processes around climate change mitigation and sustainable development policies. In addition, much international discussion is ongoing to define the various scopes of, to name just a few, systems for MRV of REDD+<sup>6</sup>, the need to underpin green growth strategies with appropriate monitoring systems<sup>7</sup>, and further reporting requirements under the UNFCCC beyond the national communications and tracking impacts of mitigation activities<sup>8</sup>. The overlapping and developing policy contexts of GHG inventories make coherence hard to achieve and the coordination efforts of initiatives such as our project are all the more important.

There are three key requirements for running national GHG inventory systems in developing countries and tracking emissions and removals from the land

6 UNFCCC COP 16 (2010).

7 UNEP. (2011). *Towards a green economy*.

8 UNFCCC COP 17 (2011).

use sector along with other parts of the countries' economies. First, there are **reporting commitments in the context of the national communications** to the UNFCCC. Second, high-quality information on where and how the countries' economies generate GHG emissions and where and how much carbon stocks can be protected and emissions can be curbed should be an important **input for national mitigation and development planning**. Lastly, there is also a need to set up national approaches for monitoring, reporting and verification (MRV) to participate in **results-based climate change funding** under the emerging international mechanisms such as those for Nationally Appropriate Mitigation Actions (NAMAs) and Reducing Emissions from Deforestation and Forest Degradation (REDD+). With the several contexts in which information on GHGs is relevant, the national GHG inventory system is a cross-cutting issue (Figure 6).

While high-quality GHG inventories are necessary and useful on several accounts, technical and institutional issues severely constrain many countries' ability to pull together and process the necessary data (Figure 6). For one, inventory requirements and the processes involving greenhouse gases, especially in the agriculture and forestry sectors, are highly complex in themselves. Tasked by the UNFCCC, the IPCC has put together useful guidance for GHG inventories and the resulting **IPCC guidance on national GHG inventories is complex** and contains hundreds of pages



### National GHG inventories are central to policy making

- They underlie the international community's policy response to climate change
- GHG data are a key input to national development and mitigation planning
- High quality inventories are a precondition for international results-based mitigation funding



### Delivering national GHG inventories is challenging

- Inventory requirements and AFOLU emission/removal systems are highly complex
- Data availability and reliability are limited
- The institutional setup for inventory teams is often inappropriate

of highly technical material that is accessible to dedicated technical experts only. Although the technical standard by the IPCC accommodates different levels of methodological complexity and data quality in a three-tier approach, in many developing countries basic **input data for national GHG inventories are either unavailable or unreliable** because appropriate data collecting and data handling procedures are not in place, and **the necessary institutional setup for dealing with the above technical challenge is unavailable**. Establishing such an institutional setup represents an important step to developing capacities. Moreover, there are limited resources for building the necessary technical capacities, data providing arrangements are often missing, inventory teams are often put together ad hoc and are temporary, or are comprised of external consultants, which precludes continuous institutional learning. This makes our efforts at developing an appropriate national system especially important.

**Figure 6:**  
Importance of and challenges for national GHG inventory systems.

The technical issues around the complexity of inventory requirements, data availability and reliability as well as the shortcomings of institutional setups for inventories put at risk the objectives and uses of national GHG inventories. First, the limited quality of the GHG inventories contained in the national communications damages the reputation of the international community's response to climate change. Second, without reliable and timely information on GHG emissions and removal trends, national policy makers lack an important input to development and mitigation planning and are forced to take sub-optimal decisions based on questionable assumptions that replace factual evidence. Lastly, with a view towards REDD+ or NAMA arrangements, limited technical quality of GHG inventories could constrain the ability of countries to attract results-based mitigation funding.

## Key quality criteria for national GHG inventory systems

**Institutional setup:** The GHG inventory system is embedded in institutional arrangements providing the setting in terms of organization and resources.

**Strategic inventory management:** The management provides for a continuous improvement with each iteration of the inventory cycle and connects work to other uses of GHG data beyond the national communications.

**Transparency:** There is sufficient and clear documentation that individuals or groups other than the inventory compilers can understand how the inventory was compiled and can vouch for good practice requirements for national greenhouse gas emissions inventories.

**Accuracy:** The national greenhouse gas inventory neither overestimates nor underestimates GHGs as far as practicable and in so far as can be judged.

**Completeness:** Estimates are reported for all relevant categories of sources and sinks, and gases. Where elements of the greenhouse gas budget are missing their absence should be clearly documented together with a justification for exclusion and a plan to include it in the inventory in the future.

**Consistency:** Estimates for different inventory years, gases and categories are made in such a way that differences in the results between years and categories reflect real differences in emissions.

**Comparability:** The national greenhouse gas inventory is reported in a way that allows it to be compared with national greenhouse gas inventories for other countries.

## High-quality GHG inventory systems meet 7 key criteria which pose challenges for project countries

The IPCC has defined criteria to guide countries in developing GHG inventory systems, which are also required in reporting under the UNFCCC: **the national systems are to be set up to deliver GHG inventories that are transparent, consistent, accurate, comparable and complete.** International mitigation funding clearly requires that these criteria are met. However, **we believe that two further criteria need to be considered to comprehensively address inventory quality: the institutional setup and the approach to strategic inventory management.** These two additional elements are suggested to comprehensively develop national GHG inventory systems, which, according to the experiences gained in the project, also require special attention in the REDD+ process.

The **institutional setup** needs to be built to allow for continuity of activities and capacities, and continuous improvement of GHG inventories. Only a few of the project countries had well-defined institutional roles and responsibilities when the project began and it was therefore challenging to build on work carried out in previous iterations of the inventory cycle. This situation was exacerbated by high turn-over of staff in the institutions and ample short-term outsourcing of technical inventory work to consultants, which made it difficult to find staff who had been involved in previous inventories. For

significant improvements to the GHG inventory system's institutional setup high-level political involvement is required.

Similarly, **strategic inventory management** should provide for a continuous improvement with each iteration of the inventory cycle and connect work to other uses of GHG data beyond the national communications. In several of the project countries there were no inventory improvement plans available and the ad-hoc approach to compiling GHG inventories did not allow for building on previous inventories. Moreover, there was little communication in some cases between the teams working on data collection for other relevant initiatives, for instance regarding readiness for mitigation funding and REDD+ leading to a risk of carrying out the work twice. Part of our efforts focused on encouraging the multitude of initiatives around data collection, MRV systems and readiness that are ongoing in some countries to connect to each other.

Concerning the standard inventory criteria by the IPCC, it is important that countries strive for high-levels of **transparency** in their GHG inventory systems; among other things this is essential to verify estimates in the context of results-based mitigation funding. Before the project, the transparency of inventory systems was relatively limited. For instance, there were several cases where methods for deriving land use maps (a key data source for the inventory) had not been properly described and where even the

primary data could not be recovered (the inventory teams had to rely on hardcopies with the original, digital data unavailable). The lack of documentation and archiving of data stems from the weakness of institutional setups for GHG inventories in the countries.

The GHG inventory systems need to be built to achieve a high level of **accuracy** for GHG emission and removal estimates. Among other things this includes that a key category analysis and a qualitative and quantitative uncertainty analysis needs to be carried out. Regarding these two, accuracy has been fairly limited in many of the countries; not one country had carried out both a key category analysis and an uncertainty analysis before the project began.

National data collection events need to aim for **consistency** of approaches, particularly regarding issues as basic as land use mapping but also regarding many other aspects of data collection included in GHG inventories. Before the project, there was one country that had a land use map (one of the key components of a GHG inventory) from **two** time points available that were collected according to a consistent approach. In roughly half of the other countries there was either no land use map available or only one from a single time point. In the other half of countries, there were several maps available from different time points but with inconsistent land use categories and data sources.

<p><b>Institutional setup and inventory teams</b></p> <ul style="list-style-type: none"> <li>• Lead and support institution(s) clearly defined</li> <li>• Effective support from academia and other external institutions</li> <li>• Inventory team with clearly defined roles</li> <li>• Inventory team works full time on inventory issues</li> <li>• Inventory team permanently employed not outsourced</li> </ul>	
<p><b>Strategic inventory management</b></p> <ul style="list-style-type: none"> <li>• Inventory improvement plan available</li> <li>• Inventory improvement plan linked to KCA / QA&amp;QC</li> <li>• Dedicated inventory budget other than donor funding</li> <li>• Key category analysis carried out</li> <li>• Mitigation analysis carried out</li> <li>• Trend analysis carried out</li> </ul>	
<p><b>Transparency</b></p> <ul style="list-style-type: none"> <li>• QA&amp;QC procedures in place</li> <li>• Quality control carried out</li> <li>• Quality assurance carried out</li> <li>• Data, assumptions, methodology and calculation documented</li> <li>• National inventory report available</li> <li>• Effective archiving process in place</li> </ul>	
<p><b>Accuracy</b></p> <ul style="list-style-type: none"> <li>• Quality of census and economic data</li> <li>• Tier levels and emission factor data</li> <li>• Level of detail on biomass inventory data</li> <li>• Level of detail on spatial land representation</li> <li>• Level of detail of soil and climate stratification</li> <li>• Uncertainty analysis done</li> </ul>	
<p><b>Completeness</b></p> <ul style="list-style-type: none"> <li>• Level of detail on sectors and activities</li> <li>• Level of detail on land use categories and subcategories</li> <li>• Level of detail on livestock</li> <li>• Level of detail on soil organic carbon</li> <li>• Level of detail on disturbances</li> </ul>	
<p><b>Consistency</b></p> <ul style="list-style-type: none"> <li>• Consistent time series for spatial data</li> <li>• Consistent database for several inventory time points available</li> <li>• Cross-checking between several data sources</li> <li>• Recalculation of past inventories when changing methods or data</li> </ul>	
<p><b>Comparability</b></p> <ul style="list-style-type: none"> <li>• Based on IPCC guidelines</li> <li>• Based on 2006-IPCC guidelines already</li> <li>• Distinguish managed and unmanaged lands</li> </ul>	

**Figure 7**  
The 7 criteria and their indicators used in the GHG inventory system score card.

To discuss policy options in a government's development planning, including options for mitigation, **completeness** of the emissions sources and removals in the GHG inventory is important to make sure that planning accounts for a comprehensive picture of options and for the most effective ways to reduce overall emissions. When the project countries began working with us, there were many cases where completeness of inventory data needed to improve in terms of spatial disaggregation, land use classes, detail of time series, etc. because with coarse data consistency is easier to achieve. Also, in some cases the inventory teams did not have a complete overview of existing national datasets. In order to improve the completeness of GHG inventories, we supported countries in retrieving information from international databases (including those provided by the FAO) to supplement national data sources and expert knowledge.

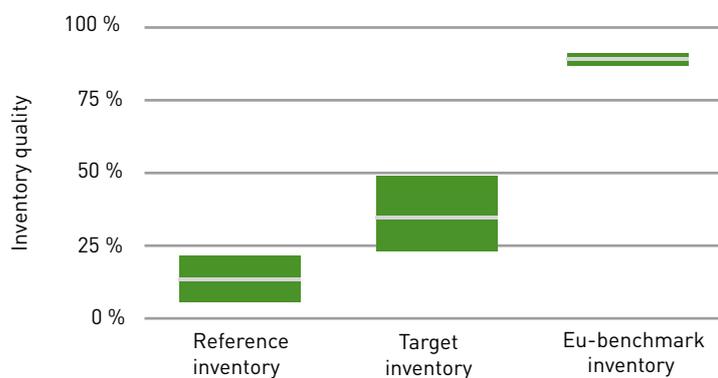
Finally, to ensure **comparability** between inventories, it is important that countries continue applying a rigorous methodological approach, following the development of the reporting guidelines, particularly if they aim to access international mitigation funding and REDD+. We work with inventory teams to apply the latest methodological guidance and best practices of data collection and processing.

## **We position countries' inventories on the capacity development trajectory towards building high-quality GHG inventory systems**

In order to measure the progress towards implementation of high-quality national GHG inventory systems, we developed a score card for describing countries' stage at the capacity development trajectory. The same basic idea of rating the quality of GHG inventories underlies the US-EPA's Inventory Project Progress Indicator and work carried out by Wageningen University and CIFOR<sup>9</sup>, both of which informed our approach.

The score card rates GHG inventory systems according to the IPCC's five criteria of technical quality (transparent, consistent, accurate, comparable and complete) and our two additional criteria (relating to institutional and management aspects). For each criterion we apply several indicators (**Figure 7**) and the project team of GHG inventory experts assesses these indicators using a "yes/no" binary scoring on whether or not they were fulfilled. With a set of fixed indicators for each criterion it is then possible to calculate a score of 0-100% reflecting to what extent the GHG inventory addresses the criterion at hand. The overall score for a national GHG inventory system is then the average of the scores of the seven criteria.

9 Romijn, E., Herold, M., Kooistra, L., Murdiyarto, D., & Verchot, L. (2012). Assessing capacities of non-Annex I countries for national forest monitoring in the context of REDD+. *Environmental Science & Policy*, 19-20, 33-48. doi:10.1016/j.envsci.2012.01.005



**Figure 8**  
Targeted inventory ratings in 10 countries by the end of the project compared against the reference inventories (from last national communications before the project) and rating of European countries' inventories. Bars represent minimum, average and maximum ratings.

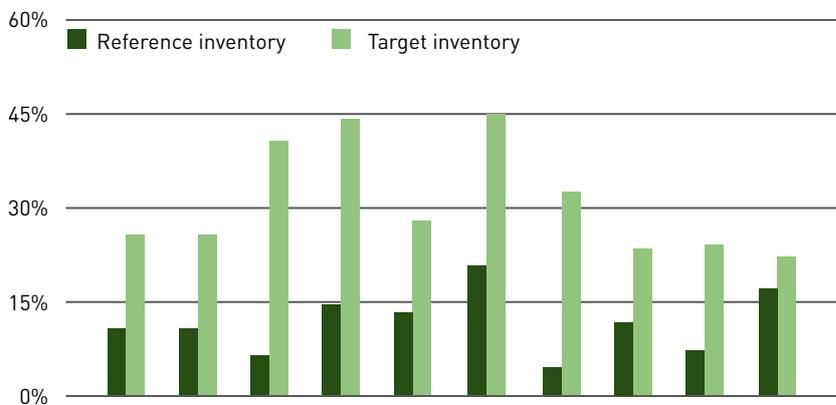
To track the progress of work in the countries, we calculated the score for the GHG inventories that our project work is targeting, i.e., the expected project outcome. Also and as a reference, we calculated the score for the GHG inventory from last national communications before the project started. We intend to repeat the scoring at the end of the project to measure the actual advancement of the countries' inventories (rather than the target). The score card will then also provide us with an evaluation of the project's contribution towards national capacity building.

It is clear that our approach to rating inventories needs to evolve and provides only general guidance from an expert's point of view. Issues to address include: full participation of inventory teams in assessment; more precise selection of indicators; prioritization of criteria based on their relative importance or the number of indicators; and finally, we apply approximate numbers to qualitative information.

When using the scorecard we need to be

aware that while any difference between reference and target rating **can** be due to our project, it may equally well also be due to an unrelated improvement of a country's capacities and not be attributable to our work. Also, while we certainly target sustainable improvements to GHG inventory systems, the scorecard detects a snapshot at a certain time point only and the long-time prospects of the GHG inventory systems that we help building are all but certain.

Beyond such technical aspects, the most important limitation of our approach is that we arrive at the scoring figures from the outside rather than developing them together with the countries' inventory teams. For a more comprehensive and useful assessment of inventories we consider working together with teams for a self-assessment of their inventories under the guidance of external experts. In such an assessment, the mere consideration even without scoring of our criteria might contribute to countries' efforts to develop their own national inventory system. In any case, the system clearly has the advantage to easily



**Figure 9**  
Scoring of 10 countries' project inventories and reference inventories (from last national communications before the project).

and quickly provide useful information on tracking progress against targets to allow for directing future efforts.

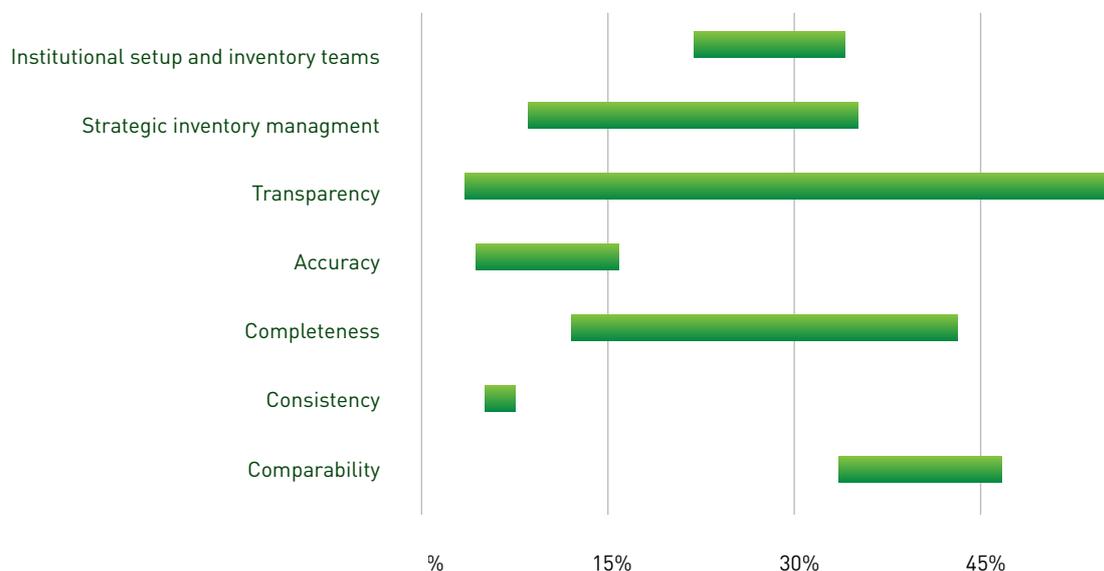
**The project countries have advanced on capacity development for GHG inventory system but much work is still to be done**

The initial assessment using the GHG inventory score card results in an average rating of 34% for the project countries (Figure 8). This is an improvement on the score of 13% for the reference GHG inventories, i.e., the last GHG inventories that these countries had compiled for their national communications before starting to work with us. It is thus clear that the project helps countries advance on capacity development for GHG inventory systems.

The GHG inventories of developed countries (e.g., the inventory of the EU but also other developed countries) could represent an eventual goal that can guide the forest countries in improving their GHG inventories. Rating 3 GHG inventories of EU

countries according to the same system leads to an average score of 89%. It is interesting to observe that even developed European countries by no means achieve a perfect inventory rating and that there still remains significant room for improvement in their inventories, particularly regarding their accuracy and completeness. Nevertheless, for the project countries, our target is still far behind the inventory quality in developed countries (Figure 8).

Disaggregating GHG inventory ratings by countries shows that there is considerable diversity in inventory quality (Figure 9). Some countries start out at a fairly basic level of below 10% while in other countries the last inventories before the project already had a good degree of quality. The project aims at an average improvement between the project inventory and the inventory from the last national communication before the project of around 20%. There is no clear relationship between the degree to which inventories can be improved through our approach and the quality that inventories already had before



**Figure 10**  
Improvements to GHG inventory systems in 10 countries according to the rating criteria between the reference inventory (lower end of the bars) and the project inventory (higher end of the bars).

the project, but our experiences so far suggest that the coaching approach is equally useful and effective under diverse country circumstances.

The time span countries need before being “ready” for participation in results-based REDD+ depends on a range of factors, including the level of national commitment, the availability and quality of support for capacity building, and the point on the capacity development trajectory towards high-quality GHG inventories that countries are currently at relative to acceptable levels. As per the above, countries have had a learning rate of around 20% for a 6-18 months inventory iteration. While it is unclear whether such a rate could at all be sustained, it seems unlikely that it could

be exceeded. If ongoing capacity-building could sustain the rate then forest countries would need around 4 inventory iterations to reach high quality standards of GHG inventories. It is, however, also unclear whether best practices in European countries can at all serve as a reference for results-based REDD+ requirements and will be regarded as acceptable once the mechanism develops turnover.

**For effective and lasting capacity building, coaching inventory teams needs to go hand in hand with providing resources for developing national systems and data collection**

**O**ur approach to building capacity for GHG inventory systems focuses on **coaching the inventory teams** in countries and supports them in working with the data already available, providing technical

advice, analytical tools and also placing the GHG inventories high on the relevant priority lists. With such backstopping inventory teams can, for instance, increase the coverage of data and improve the quality of documentation. The coaching has also led to more structured work within the inventory teams. With all this it has become apparent that the coaching approach can address some of the criteria of inventory quality most effectively: the criteria of transparency and completeness of inventories (Figure 10).

While coaching the inventory teams our project also supports the administrations in the project countries to slowly improve the institutional setting for inventory teams to work in, e.g., through a more ongoing working relationship and thus improved coordination between the various groups and institutions. It also helps to approach the management of inventories strategically. However, for coaching and any support directed towards building databases to be fully effective, it is necessary that the administrations complement these efforts by investing in improving the institutional dimension of GHG inventories and providing the inventory teams with an appropriate institutional setting to work in.

It thus becomes apparent that **other kinds of support beyond coaching** are also needed to comprehensively address the shortcomings of the current GHG inventory systems in the project countries. One of the key shortcomings in some countries is the lack of forest inventories and detailed spatial

databases on land use and land use change, and improvements targeting these shortcomings are also necessary. It is therefore important to provide countries with resources for building missing elements of their national systems, collecting missing data and building consistent databases to improve the accuracy and consistency of GHG inventories.

**Conclusion: capacity building work delivers tangible results but GHG inventory systems are still short of what will be required for results-based REDD+**

**H**igh-quality national GHG inventory systems in developing countries are essential for an appropriate response to climate change, comprehensive national development planning and access to international mitigation funding – and their absence is a development barrier. Not only do countries need inventory systems to fulfill international reporting requirements but an informed national mitigation policy requires these systems, too, particularly if designed to attract international results-based mitigation funding.

**Many developing countries are on the way to being able to accurately account for GHG emissions in the forestry and agricultural sectors and their changes as results of mitigation actions.** Countries would need to advance still much further before achieving a full-fledged accounting for GHG reductions under REDD+ financing arrange-

ments. The project countries represent a set of typical developing countries – typical rather than the most-advanced countries – on which much of the policy debate on results-based mitigation funding focuses. All project countries work only towards a value below 50% on the quality of their GHG inventory systems. To create an inclusive and effective mechanism, the international community needs to recognize that most countries where REDD+ activities could be carried out are far from being able to put in place high-quality GHG monitoring systems.

**Putting in place and running high-quality national GHG inventory systems is highly demanding and affects many levels of administration in developing countries, effective capacity development therefore also focuses on institutional arrangements and management aspects.** How demanding it is to run GHG inventory systems in developing countries on several accounts became clear during the project working alongside the countries' inventory teams. It is therefore unsurprising that even for European countries much room remains for improving their national GHG inventory systems. This is why a score card for the quality of GHG inventory systems included institutional and management aspects together with issues more directly related to data collection, processing and documentation.

**Capacity building work delivers tangible results and can significantly develop countries' capacities for national GHG**

**inventory systems.** The advances of the project countries show that countries can significantly develop their capabilities within a short time frame if they receive the right assistance for doing so.

**To assist countries in effectively advancing on capacity development towards high-quality national GHG inventory systems, different kinds of support need to go hand-in-hand, such as coaching the inventory teams and providing resources for building databases and providing an appropriate institutional setup.** Efforts in countries need to be stepped up and transparent, accurate, consistent, comparable and complete GHG inventories can only be targeted if countries receive support on bolstering the data they have available on land use mapping and vegetation inventories. A more "data-focused" approach should, however, go together with continued coaching of the countries' inventory teams and the building of their institutional capacities as the project is now doing.

**The design of systems for results-based mitigation funding such as REDD+ needs to recognize just how difficult it is to establish GHG inventory systems and needs to allow for differentiated conditions in countries with very different levels of capacities.** The breakdown of REDD+ in several phases with an increasing stringency of commitments and their monitoring and accounting against targets goes a long way in this direction.



**National GHG inventory systems** need to produce high-quality emission estimates for the international community but also input for national mitigation and development planning. They are essential for countries to participate in results-based mitigation funding and **REDD+**. However, the quality of **GHG inventory systems** remains limited in many developing countries because their technical specifications are highly complex and in some countries the necessary capacities are only developing. The **CD-REDD** project aims at mitigating this situation by providing capacity building for the inventory teams of **14 countries in West Africa, East Africa, Southern Africa and Latin America**. We coach the inventory teams to develop transparent, accurate, consistent, comparable and complete **GHG inventory systems** that are strategically managed and embedded in a solid institutional setup.