Lessons learned from the implementation of MRV Systems for REDD+

GFOI Global Forest Observations Initiative

This publication is the result of a work conducted by the World Bank under the umbrella of the Global Forest Observations Initiative (GFOI). The Initiative coordinates international support for improving forest monitoring capacity in developing countries. Through collaborative action, GFOI partners support developing countries to develop forest monitoring systems which inform their national decision making, international commitments, and track progress in climate action.

GFOI is a partnership of countries and international organizations. The Initiative is led by representatives from the Governments of Australia, Germany, Norway, the United Kingdom and the United States; the Committee on Earth Observation Satellites (CEOS), the European Space Agency (ESA), FAO and the World Bank. It coordinates the collaborative activities of these partners and many other organizations and individuals to help developing countries address decisions taken under the United Nations Framework Convention on Climate Change (UNFCCC) in a manner that is consistent with the good practice guidance set out by the Intergovernmental Panel on Climate Change (IPCC). GFOI is also a Flagship of Group on Earth Observation (GEO).

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Acronyms and abbreviations

AFOLU	Agriculture Forestry and Other Land Use
ASPs	(Costa Rica) National System of Protected Wilderness Areas
BioCF	The World Bank BioCarbon Fund
BSP	Benefit Sharing Plans
CF	Carbon Fund of the Forest Carbon Partnership Facility
CNA	Country Needs Assessment
CONAF	Chile National Forest Corporation
DAC	Development Assistance Committee
DINAF	(Mozambique) National Directorate of Forests
ENCCRV	(Chile) National Strategy for Climate Change and Vegetation Resources
ER	Emissions Reductions
ERPA	Emission Reductions Payment Agreement
EU	European Union
FAO	Food and Agriculture Organization
FCPF	Forest Carbon Partnership Facility
FIPS	Forest Information Platform System
FNDS	(Mozambique) National Sustainable Development Fund
FREL/FRL	Forest Reference Emission Level / Forest Reference Level
GCBM	Generic Carbon Budget Model
GCF	Green Climate Fund
GFC	Guyana Forestry Commission
GFOI	Global Forest Observations Initiative
GHG	Greenhouse Gas
Ha	Hectares
INDC	Intended Nationally Determined Contribution
IPCC	Intergovernmental Panel on Climate Change
ISFL	The World Bank Biocarbon Fund Initiative for Sustainable Forest Landscapes
JICA	Japan International Cooperation Agency
LULUCF	Land Use, Land-Use Change and Forestry

MADS	(Colombia) Ministry of Environment and Sustainable Development
ME	Measurement and Estimation
MEF	(Mozambique) Ministry of Economy and Finance
MGD	(GFOI) Methods and Guidance Documentation
Mha	Million Hectares
MRV	Measurement Reporting and Verification
NDC	Nationally Determined Contribution
NFI	National Forest Inventory
NFMS	National Forest Monitoring System
OECD	Organization for Economic Co-operation and Development
PNACC	(Colombia) National Adaptation Plan
RBP	Results-based Payments
REDD+	Reducing Emissions from Deforestation and Forest Degradation, plus enhancement of forest carbon stocks, conservation and sustainable forest management
RENARE	(Colombia) National Registry of CO_2 Emissions Reductions
RF	Readiness Fund
ROC	Republic of Congo
SIMOCUTE	(Costa Rica) National Land Use, Land Cover and Ecosystems Monitoring System
TAC	Technical Advisory Committee
ToR	Terms of Reference
UNFCCC	United Nations Framework Convention on Climate Change
USD	United States Dollar
WB	World Bank

1   Introduction

Globally, forests play a unique role as both a source and sink of greenhouse gases. According to the Intergovernmental Panel on Climate Change (IPCC), the land sector represents roughly 23% of global emissions, the majority of which are from the conversion of forests to other land uses (IPCC, 2019).[1] However, the land sector also acts as a sink, and could contribute up to 30% of the total mitigation necessary to limit warming to 1.5 degrees, with the vast majority of that potential mitigation located in countries with tropical forests (Griscom et al., 2017; Griscom et al., 2020).[2,3] This role as source and potential sink lends a singular urgency to activities that seek to limit global climate change by addressing deforestation and degradation of forests, while also conserving and enhancing carbon stocks. Leveraging the role that forests can play in addressing global climate change, the United Nations Framework Convention on Climate Change (UNFCCC) REDD+ mechanism is designed to create incentives, through a system of results-based payments, for activities that either reduce emissions from deforestation and forest degradation, or enhance the sequestration and storage of carbon by forests.

As per the Cancun Agreements on reducing emissions from deforestation and forest degradation in developing countries, and the role of conservation, sustainable management of forests and enhancement of forest carbon stocks in developing countries (REDD+), countries wishing to engage in REDD+ activities should have four "pillars" in place in order to demonstrate action, and access results-based payments. These are: 1) a national REDD+ strategy or action plan; 2) a national forest monitoring system (NFMS); 3) a forest reference emission level (FREL); and, 4) a system for tracking information on safeguards. While all four pillars are critical to ensuring a credible REDD+ system, the design, operationalization and institutionalization of a functioning National Forest Monitoring System for the Measurement, Reporting and Verification (MRV) of REDD+ is considered fundamental to demonstration of the credibility of REDD+ activities in terms of greenhouse gas (GHG) abatement.

The purpose of this study is to identify lessons learned from the development and implementation of MRV systems for REDD+. The study therefore focuses on the components of NFMS that national governments are using for the purpose of Measurement, Reporting and Verification of REDD+ activities. This can be viewed through the lens of the Global Forest Observations Initiative (GFOI) REDDcompass.[4] This REDDcompass describes key building blocks for REDD+ MRV within an NFMS of: Institutional Arrangements; Policy and Design Decisions; Measurement and Estimation; and, Reporting and Verification. Although broader definitions of NFMS exist, this study focuses on REDD+ MRV, which may constitute the whole of an NFMS or be among a range of functions of an NFMS. Hence, throughout this study we refer to REDD+ MRV 'systems', rather than NFMS, to avoid confusion with any broader definitions.

Similarly, MRV systems are also considered critical for other reporting against UNFCCC commitments, multilateral facilities such as the World Bank's Carbon Fund and Initiative for Sustainable Forest Landscapes (BioCF ISFL), and in decision making for national planning. Important lessons about their design and implementation can be drawn from across these mechanisms.

To operationalize the four pillars of REDD+, various bilateral and multilateral support programs have been created, including the United Nations REDD+ Programme, and the World Bank's Forest Carbon Partnership Facility (FCPF) that have worked with countries to design and implement national REDD+ programs and REDD+ MRV systems. However, achieving operationalized MRV systems has not been a straightforward process. In 2019, a Country Needs Assessment led by the World Bank found that the 34 countries assessed had, on average, completed only 54% of all the actions needed for a fully operational REDD+ MRV system (World Bank, 2019).[5] This left several questions still unanswered. Why was it that countries had been unable—even with substantial direct support and incentives provided—to achieve the operational and institutionalized REDD+ MRV system needed for accessing results-based payments? What were the challenges, barriers, and gaps in support? Conversely, what were the successful modalities of support, and why did they work?

The aim of this study was to help improve the support provided to REDD+ countries for developing operational MRV systems by documenting and analyzing lessons learned from the process of developing REDD+ MRV systems in 10 different countries around the world. Based on lessons learned from these case studies, recommendations were derived that will help to improve the existing support mechanisms in different contexts. These recommendations are primarily intended for the relevant agencies and donors as they help countries to develop and operate their NFMS. However, the broader lessons and recommendations are also relevant for REDD+ countries receiving support as well as the broader stakeholder community, including technical and program staff and consultants.

The objectives of this study as stated in the Terms of Reference (ToR) were:

1) Based on a representative sample of case studies from countries that have proposed emissions reduction (ER) programs under the World Bank's land use climate funds (both FCPF and BioCF ISFL), and considering their national circumstances, identify the key factors of success and the obstacles and challenges for the development of the NFMS.
2) Based on the same country cases as under 1), analyze how the support that these countries received from different partners for developing the NFMS has contributed or responded to those key success factors and obstacles and challenges.
3) Based on the insights from 1) and 2), make appropriate recommendations for the delivery of capacity building by agencies and support from donors, including through the GFOI. The recommendations should go beyond the subset of countries analyzed and apply across REDD+ countries.

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1 IPCC, 2019. Summary for Policymakers. In: Climate Change and Land: an IPCC special report on climate change, desertification, land degradation, sustainable land management, food security, and greenhouse gas fluxes in terrestrial ecosystems. In press.
2 Griscom, B.W. et al., (2017). Natural climate solutions. Proceedings of the National Academy of Science. PNAS October 31, 2017, 114 (44) 11645-11650. https://doi.org/10.1073/pnas.1710465114.
3 Griscom, B. W. et al., (2020) National mitigation potential from natural climate solutions in the tropics. Phil. Trans. R. Soc. B 375, 20190126. http://doi.org/10.1098/rstb.2019.0126.
4 https://www.REDDcompass.org/frontpage

5 World Bank. 2019. Country Needs Assessment of National Forest Monitoring Systems and Its MRV Function: Final Report. World Bank.

2 Approach/methodology

2.1 Case study approach

As required by the ToR, the consultant team applied a case study approach to document ten cases in sufficient detail to generate learning around REDD+ MRV support. This approach allowed an exploration of evidence on the context surrounding each REDD+ MRV system, how that has affected the way in which the given REDD+ MRV system has developed, and how the role of REDD+ MRV support has contributed to achievement of results. Each case study explores the extent of REDD+ MRV development, and the role of REDD+ MRV support in the context of the case study country.

2.1.1 Case study selection

The country case studies were used to identify success factors and challenges encountered in the development of REDD+ MRV systems, and how the modalities of support have contributed to these successes—or otherwise—under a range of circumstances. The selection of countries for analysis was based on purposive sampling criteria.

Countries with proposed Emissions Reduction (ER) programmes under the World Bank's Climate Funds were prioritized as per the ToR, and countries from each of the three FCPF regions were included. With a view to generating broadly applicable recommendations, countries were selected if they showed notable potential to provide important lessons. An additional selection criterion was the existence of relevant information accessible in the given time frame by the assessment team via documents and potential interview partners.

Geographically, the ten selected case study countries are broadly representative, and include one Small Island Developing State (see Table 2.1). They reflect a diverse range of topographic and administrative contexts, all of profound relevance to the development of REDD+ MRV.

Table 2.1 Selected countries for the development of case studies

Region	Country	World Bank Fund
Africa	RO Congo	FCPF Carbon Fund
Africa	Ethiopia	ISFL
Africa	Ghana	FCPF Carbon Fund
Africa	Mozambique	FCPF Carbon Fund
Asia-Pacific	Fiji	FCPF Carbon Fund
Asia-Pacific	Indonesia	FCPF Carbon Fund and ISFL
Latin America	Chile	FCPF Carbon Fund
Latin America	Colombia	ISFL
Latin America	Guyana	FCPF Carbon Fund (PIN submitted (but rejected
Latin America	Costa Rica	FCPF Carbon Fund and ISFL

2.1.2 Case study development

The stepwise methodology applied to the development of the case studies began with the production of an interview protocol that outlined the key questions, supplementary questions and overall purpose (facts and insights sought). This process was guided by the learning questions outlined in Table A1.1 in Appendix A. The protocol was tested and refined though a preparatory series of interviews with staff at World Bank regional focal points, before being finalized for country-specific case study interviews.

The preparatory interviews with the World Bank Regional Focal Point included questions relating to their experience of working across a range of countries and contexts. This provided a valuable set of experiences above and beyond the country-specific experiences of national stakeholders.

The review team then developed each country case study using a standard template, beginning with a literature review focusing on the FCPF documentation and national REDD+ Strategies. Additional information used included the GFOI Country Needs Assessments, in relation to the level of implementation of REDD+ MRV Systems. The literature review enabled the interviewers to supplement their existing knowledge and provided a springboard for the insights and questions in the interviews. For each country case study, interviews were conducted with two to four key individuals. Each interview lasted roughly 1.5 hours. The interviews were then used to develop the country reports, particularly with respect to the country narratives.

Draft country case study reports were widely shared with the interviewees and relevant World Bank focal points for the country programs, and feedback was requested to ensure faithful interpretation of the information recorded. The full case studies are provided in Appendix 3.

2.1.3 Analysis of combined case study findings

As the first step in the analysis, the key points from each interview were compiled in Excel and the combined data of all ten case studies were analyzed using qualitative research methods. Findings were coded as factors that could influence the development of REDD+ MRV systems (such as 'lack of technical capacity'). These factors were then grouped into higher categories (such as 'capacity related obstacles'). Factors and categories were constantly compared and updated to ensure consistency among case studies. This gradually increased the assessment team's understanding of the roles of factors, and the interrelations between them.

For the next step and to assess the role of support in the development of REDD+ MRV systems in relation to the general key influencing factors, a conceptual model was derived to describe the interrelations between support, obstacles/challenges and contextual factors (see Figure A1.1 in the Appendix 1). This model incorporates the finding from the previous analysis step and considers that support modalities can constitute both drivers and obstacles in MRV system development processes. It was used to further deepen insights into the causes and effects of the multifaceted roles of support and contextual factors in the development processes.

2.2   Limitations

The lessons learned and recommendations are based on findings derived from case studies of countries that have (or have proposed) Emissions Reductions programs under the World Bank's Climate Funds. These countries have already made fairly good progress in the development of their MRV systems. This choice was necessary to ensure that processes were sufficiently developed for useful findings to emerge. For this diverse group of countries, findings soon tended to converge on a thematic basis, suggesting very persuasively that they are of global relevance.

Case study interviews were limited to two to four stakeholders per country, and the World Bank regional focal point, in line with project resourcing. The case studies should be considered to be rapid collations of information on REDD+ MRV system development rather than comprehensive reviews. A truly global team with diverse cultures, background, and experiences developed the case studies: inevitably, this has resulted in a degree of inconsistency between them.

The COVID-19 pandemic affected data collection—which had to be wholly remote and desk-based—and scheduling, as the study team and interviewees underwent a series of relatively unpredictable national lockdowns.

Each case study typically involved multiple donors and support partners. This research does not delve into the role or activities of individual donors. Consequently, the terms 'donor' and 'support' refer generally to a broad array of support provided by donor countries, non-governmental organizations, and multilateral organizations.

3 Key factors affecting REDD+ MRV Systems in the selected countries

This section introduces the findings on the current status of development and operationalization of REDD+ MRV Systems in the selected countries. This is followed by an analysis of case studies according to key contextual and design factors affecting progress.

3.1   Progress on REDD+ MRV System development among case study countries

Of the ten selected countries, nine were part of the GFOI Country Needs Assessments that analyzed country progress using the REDDcompass Building Blocks for REDD+ MRV (World Bank analysis spreadsheets, 2019). Table 3.1 shows that at the time of REDDcompass Building Block assessment, case study countries had achieved progress that ranged from 41% (Fiji) to 74% (Colombia). All but two (Fiji and Mozambique) were considered to have achieved "readiness". However, the degree of progress against the REDDcompass Building Blocks did not fully correlate with whether the REDD+ MRV system is now operational and able to monitor and report on REDD+ emissions. For instance, Fiji and Mozambique both scored low on REDDcompass Building Block progress and were not considered to have achieved "readiness", yet both now have operational systems able to report REDD+ emissions (Table 3.1). Conversely, Ethiopia, Ghana and the Republic of Congo all have higher progress

scores against the Building Blocks than Fiji and Mozambique, and were all considered to have achieved "readiness", yet none of these countries have operational systems (Table 3.1). Because of these incongruences, for the purpose of this study countries were categorized based on an assessment of the degree to which the case studies were considered to have operational REDD+ MRV systems. The current state of progress of the case study countries has been divided into three phases of REDD+ MRV system development:

- Readiness Development – REDD+ MRV system components largely in place, but the system is not yet able or proven to generate regular reporting;
- Early Operational – Newly able to generate regular reporting, albeit with the development of components and capacity building still taking place; and,
- Operational Refinement – REDD+ MRV system has been operational for multiple years: efficiencies and wider applications now being built on.

Among the case studies, three were in the Readiness Development phase (Ethiopia, Ghana, Republic of Congo); three were in the Early Operational phase (Indonesia, Fiji and Mozambique); and five were in the Operational Refinement phase (Chile, Colombia, Costa Rica, and Guyana). Note that all the countries in the Operational Refinement phase are Upper-middle Income countries. The countries with less well-established systems are all least-developed countries (LDCs) or lower-middle Income countries (LMIs), according to the Organization for Economic Cooperation and Development criteria on aid eligibility.

It should be noted that in all of the selected countries, even those that have made the most progress, the operation of the REDD+ MRV systems is fragile—as is resourcing—and could be lost. None have a system that is fully secure and sustainable in terms of financing, political support and human capacity to operate. This points decisively to the need for further support, alongside contextual development, to fully embed the systems.

3.2   Key factors linked with REDD+ MRV System progress

As findings were analyzed, no discrete clusters of countries emerged with respect to obstacles and successes, partly because all countries reported similar types of obstacles. However, four key factors appear to correlate with the extent of progress, suggesting the need for slightly different focuses for support (See Figure 3.1):

- **Level of national development**: More developed countries, with higher general capacity and relevant infrastructure (Chile, Colombia, Costa Rica, Indonesia, Guyana, Fiji) can be contrasted with those classed as LDCs and LMIs (Ethiopia, Mozambique, Ghana, Republic of Congo).
- **Degree of political support:** Countries with high-level political support for—and political enabling of—REDD+ MRV system development include Colombia, Costa Rica, Fiji, Guyana, Indonesia, and Mozambique; those with some political support, but conditions that are not sufficiently enabling, include Ethiopia and Ghana; while those with only limited high-level political support are Chile and Republic of Congo.
- **Complexity of REDD+ MRV system**: High complexity systems involved some or all of the following: subnational jurisdictional systems (regional or provincial systems); large and/or heterogeneous forest landscape; and

forest degradation as the main driver (Costa Rica, Chile, Ghana, Ethiopia, Indonesia). Lower complexity involved centralized systems, and small and/or comparatively homogeneous forest landscape (Colombia, Fiji, Guyana, Mozambique, Republic of Congo).

- **Development strategy**: Either: 1) focused on operationality, starting with a strategy or system focus, and building functionality over time (Guyana, Mozambique); or 2) focused on functionality, starting by building the system components or outputs (e.g., FREL) with a view to gradual attainment of operationality (Ethiopia, Ghana, Indonesia). Some countries began in the second of those categories, with a functionality (output) focus, before transitioning to the first, namely operationalization of their system (Fiji, Colombia, Chile).

Countries with lower levels of national development generally had very limited or no pre-existing forest monitoring capacity and had made less progress in the development of their REDD+ MRV systems. A notable exception is Mozambique, which has succeeded in developing an operational system. More developed countries tended to have the general national capacity and infrastructure—frequently including pre-existing forest monitoring capacity— likely to favor more rapid development of their REDD+ MRV systems. Likewise, far greater progress was seen in countries with high levels of political support and political facilitation.

The complexity of the REDD+ MRV system and development strategy affected the speed of development towards operationalization.

An additional factor highlighted in relation to the sustainability of the system, rather than development progress *per se*, is the potential to receive results-based payments for REDD+ emissions reductions. In this respect, some of the selected countries were notable candidates, others less so, driven by a range of factors. Indonesia showed the highest potential, followed by the Latin America Countries. Less potential was generally noted in a country with high forest cover and low historical deforestation rates (Guyana and Republic of Congo) or a comparatively small country, such as Fiji, with low levels of emissions from the forest sector—from a global perspective—even when that sector accounts for a large proportion of national emissions.

The impact of these factors is highlighted throughout the findings and lessons learned.

Figure 3.1 Key factors affecting REDD+ MRV progress in case study countries*.
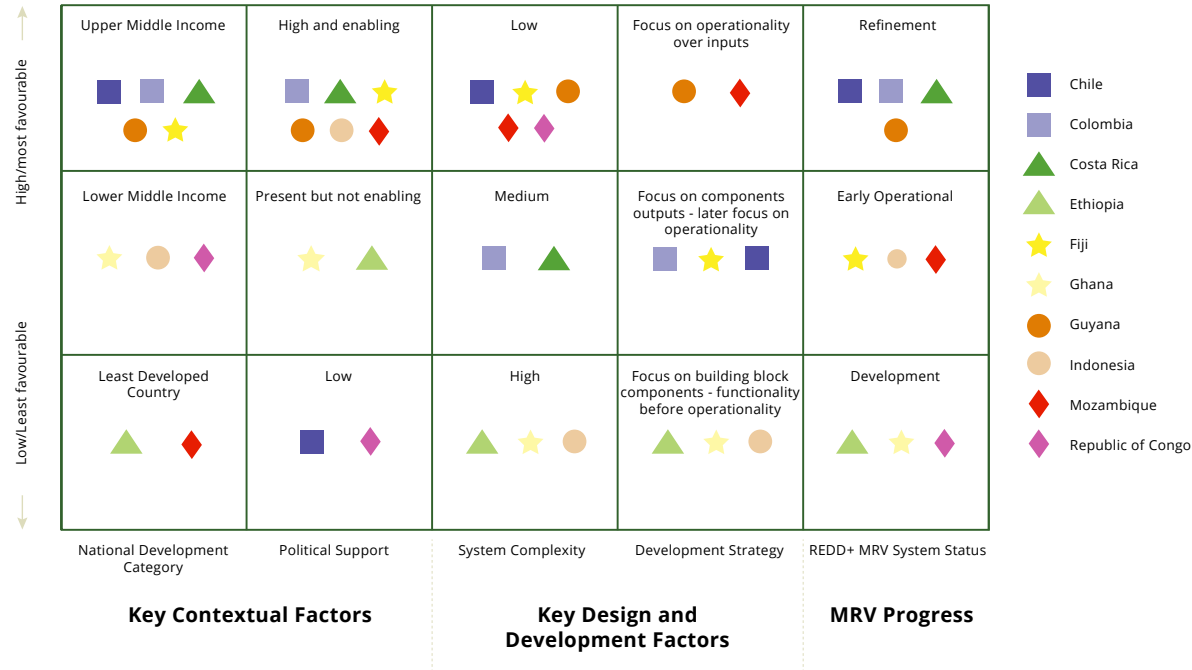
* Note: Costa Rica and Republic of Congo are not included in the Development Strategy column, as this information was not clear for those countries.

Table 3.1 Case study country findings overview

Country	REDDcompass achieved readiness?*	System scope	Stage	Key support success pathways	Key support gaps and challenges identified by national stakeholders (support has not addressed a gap, or support has created an obstruction)
Chile	60	Subnational	Refinement	• Financial support enabled hiring of specialized embedded TA to co-design and operate system. • Provision of guidance material was helpful to the national team. • Facilitated south-south collabora-tions have helped the national team refine their technical ap-proach.	• Support has not yet helped overcome issues of system sustainability (staff-ing, national added value of the sys-tem). • Ongoing support is needed to develop the system as the state of the art evolves. • Improvements needed on forest deg-radation and nested activities meth-odologies.
Colombia	70	National	Refinement	• Investments in capacity and technology enabled the devel-opment of the system.	• Staffing and financial sustainability. • Sustained investment in technical development.
Costa Rica	66	Subnational	Refinement	• Capacity and knowledge-transfer approach built national capacity to operate the system. • Specialist technical assistance (TA) enabled the development of a system appropriate for the context. • Facilitation of access to satellite imagery. • Provision of methodological guid-ance and tools.	• Combining subnational systems at national level. • Short-term aspects of financial sus-tainability • Sustainability of staffing. • Capacity gaps at jurisdictional level. • Some tools presented through support were too general or lacked sufficient guidance to be adaptable for the country context. • Ongoing support is needed to develop the system as the state of the art evolves.
Ethiopia	60	Subnational	Development	• Capacity building through em-bedded support combined with university training program. • Financial support enabled hiring of experts for key roles that could not otherwise have been undertaken. • National ownership of system. • Facilitated south-south collabora-tions have helped the national team refine its technical approach.	• Support has not yet helped overcome issues of system sustainability (staff-ing, financing, fundamental IT infra-structure). • Operationality, particularly at the jurisdictional (subnational) level. • Lack of a workable methodology to monitor forest degradation. • Ongoing support is needed to develop the system as the state of the art evolves.
Fiji	41	National	Operational	• Support that focused on national ownership generated nationally appropriate solutions and built national capacity and confidence. • Support that facilitated holistic oversight enabled progress. • Support that helped define the national added value for the MRV system has been important given low potential for results-based payments (RBP). • Facilitated south-south collabora-tions have helped the national team refine its technical approach.	• Early support involving much out-sourcing did not generate solutions appropriate for the national context. • Support for discrete elements of the system created components that did not readily interconnect. • Ongoing support needed to refine and develop the system as the state of the art evolves.
Ghana	54	Subnational	Development	• Support has been most effective when this has involved working closely with national experts and fully engaging with local stake-holders. • Support providers fully under-stand the national process and have built national capacity ac-cordingly. • Embedded technical support has built national capacity.	• Early support involving much out-sourcing did not generate solutions that were fully accepted nationally, and slowed progress. • Jurisdictional systems developed without an overarching focus on the national system may not be scalable horizontally (between jurisdictions) or vertically (to the national level). • Ongoing support is needed to build sustainable capacity to operate the system.
Guyana	NA	National	Refinement	• Embedded support in develop-ment phase built national capaci-ty. • Financial support now used to drive ongoing refinement and updating of the system. • Support was focused on opera-tionality of system from the out-set. • Long-term support has enabled progress through development, operation and refinement stages, now focusing on building sustain-ability into the system. • Support facilitated national own-ership of system. • Provision of guidance material was helpful to the national team.	• Ongoing support is needed to develop the system as the state of the art evolves.

*Source: World Bank analysis spreadsheets. Country Needs Assessment of National Forest Monitoring Systems and Its MRV Function: Final Report. World Bank, 2019.

Country					Successes	Challenges
Indonesia	65	Y	Subnational	Operational (at national level)	• Financial support enabled hiring of experts for key roles that could not otherwise have been undertaken. • Provision of guidance material was helpful to the national team. • Facilitated south-south collabora-tions have helped the national team refine their technical ap-proach. • Facilitating national	• Support has not yet built capacity in the jurisdictions that are critical to the operation of this system. • Lack of access to sufficient high-resolution satellite imagery or alterna-tives that fit the country context of a large heterogeneous forest area; and poor internet connectivity in the re-gions. • Lack of methodologies for measuring displacement and any reversal of emissions reduction or carbon seques-tration. • Ongoing support is needed to develop the system as the state of the art evolves.
Mozambique	53	N	National	Operational	• Support focused on capacity building and knowledge transfer has hugely built national capaci-ty. • Facilitated south-south collabora-tions have helped the national team refine its technical ap-proach. • TA used for quality assurance (QA) and development, with op-erational work done nationally.	• Ongoing support is needed to refine the system. • Ongoing support is needed to develop the system as the state of the art evolves.
R.O. Congo	59	Y	National	Development	• Embedded support in develop-ment phase did build national capacity (but this is fragile).	• Lack of understanding of low govern-ment capacity for managing multiple support partners. • Lack of coordination among donors. • Lack of focus on country ownership. • Discontinuity of financial support for expected 10-year process. • Financial sustainability. • Working with low internet reliability.

Source: World Bank analysis spreadsheets. Country Needs Assessment of National Forest Monitoring Systems and Its MRV Function: Final Report. World Bank, 2019.

4 Common obstacles, successes and emerging lessons for MRV System development

The key contextual and design factors have enabled specific lessons to be identified in relation to MRV system development phase and a series of contextual factors. These are highlighted in the subsequent discussion of common obstacles, examples of successes in overcoming obstacles, and emerging lessons.

This section is divided into common obstacles, successes and lessons learned related to: (i) enabling conditions for MRV System development; (ii) technical aspects of MRV systems; and, (iii) the modalities of delivering MRV support.

4.1 Enabling conditions for MRV System development

There are different enabling conditions that can affect MRV System Development. The four crucial areas are: (i) Financing issues; (ii) The enabling environment; (iii) National ownership and coordination; and (iv) Clarity of requirements.

Financing issues

4.1.1 Incomplete financing to cover establishment of the REDD+ MRV System

Countries reported challenges related to discontinuity of financial support over the full period needed for MRV system development (Ethiopia, Ghana, ROC); discontinuities in staffing due to key MRV system staff being hired on a finite project basis (Ethiopia); and project-based support focused on discrete system components that did not subsequently interlink functionally to create an integrated operational system (all case study countries, to varying extents). This was a salient issue in LDC and LMI countries without national budget input for MRV system development that had therefore remained almost entirely reliant on donor finance and support.

By contrast, where countries received long-term and stable support (low turnover of support staff and consultants) over the whole development phase (such as Guyana, Mozambique) this obstacle was more likely to be overcome. Here, a secure planning environment was maintained, facilitating holistic, whole system planning, alongside associated local employment opportunities. Trust could be built, and long-term partnerships nurtured.

Lesson 1: There is a need for financial and technical support to be long-term, to the extent possible, and focused on building an integrated operational system rather than generating discrete outputs. This is particularly important for countries with lower levels of development that struggle with expenditure on system development from their national budgets.

4.1.2 The need for ongoing financing to update functionality and refine systems

Given the breadth and extent of work needed to develop a fully functioning REDD+ MRV system, the process was consistently described by stakeholders interviewed—across all the

countries—as a long-term endeavor. In seven of the ten case studies, stakeholders identified as an obstacle the need for ongoing support to update and refine their systems as the state of the art develops and best practices change. Updating guidance and methodologies will also require funding. For countries such as Mozambique and Guyana that focused first on achieving simple operationality, the need to build functionality and refine the system is an implicit need in the medium term. These costs should be much lower than for the readiness phase of MRV system development.

Lesson 2: Some funding will be required beyond the readiness phase to update guidance and methodologies, and to support countries to enhance functionality and refine their REDD+ MRV systems.

4.1.3   National systems in combination with subnational jurisdictional systems require greater investment than centralized systems

Countries that are developing subnational systems in addition to their national system, noted that the necessary capacity at the subnational level to operate the system was still lacking (Costa Rica, Ethiopia, Indonesia). This was because capacity building during the system development (readiness) phase had been wholly focused at the national level. Similarly, a number of countries were concerned that the implementation of their Emissions Reduction Payment Agreements is at a subnational level, whereas capacity development had primarily occurred at the national level, meaning that there was a capacity gap at the subnational level.

Lesson 3: The scale of investment in capacity building and time needed to build capacity in countries with subnational systems may be much larger than for countries with centralized systems: this needs to be factored into the readiness and operational budgeting of the system, commensurate with what is ultimately likely to be sustainable for the country.

Enabling environment

4.1.4   Insufficient political support

A cross-cutting theme across all of the case studies was the degree of political support, and how far this was translated into political facilitation to overcome barriers to the development of a REDD+ MRV system. Examples of the political context serving to impede progress were explicitly mentioned by stakeholders in three of the country case studies. In other countries a lack of political support was implied to have hindered progress. Frequent political shifts were disruptive to MRV system development in two countries. In a third country it was suggested that political influence over the development of the MRV system could detract from the scientific basis of the system. In a fourth country stakeholders reported that REDD+ MRV was not seen as a benefit or priority on the government's agenda, resulting in a lack of interest in maintaining the MRV system and its staff. Some specific constraints on development of MRV systems were also identified, such as legislation relating to ongoing employment of contractors, and slow procurement processes.

By contrast, several factors were cited as reasons for successes: clear leadership, and overall political will, particularly the impulse to keep climate and natural resources high on the political agenda. Notably, countries that enjoyed the greatest political support for the development of their REDD+ MRV systems were generally those that had progressed further, and the political support had enabled contextual obstacles to be overcome. In Costa Rica, the involvement of decision-makers, and a strong alignment with national policy, helped to consolidate progress. In Mozambique, political support empowered local staff with the necessary governmental mandates to operate. An individual in a key position can function as a driver of progress by pushing MRV system development higher up the political agenda, and by functioning as a broker for new institutional arrangements. This relates to the advantages of having clearly delineated legal responsibilities that set out the various roles and mandates of institutions, especially when stable governments with long-term commitments provide consistency within ministries between election years.

In some countries it might also be useful to consider how and when the value of the REDD+ MRV system is communicated to political leaders. In Indonesia, for instance, political support from the then new president was gained by leveraging the value of the system in the national effort to tackle forest fires, among other benefits.

Lesson 4: Alongside the need for technical advisory support in REDD+ MRV system development, there is also a need in some countries for donors to work with the national government to improve the political context for REDD+ MRV.

4.1.5   Contextual barriers to MRV System development

The case studies also illustrate a range of examples where fundamental contextual barriers to REDD+ MRV system development were not addressed. For example, in Chile, Colombia, Costa Rica, Ethiopia, and Ghana the key obstacles to securing sustainability of staffing were mainly contextual. Labor procurement restrictions constrained hiring of the necessary technical experts; meanwhile, government salaries remained too low to attract or retain them. In Ethiopia and Republic of Congo (ROC), the level of IT infrastructure and internet connectivity required to generate activity data is not available to the government institutions charged with operating the MRV system. Staff have therefore been obliged to work—on a provisional basis—from other offices with an internet connection whenever they need to undertake analysis of satellite data. Where these barriers exist, they seem to have been underestimated during readiness planning.

Lesson 5: Fundamental contextual barriers to REDD+ MRV system development and operation need to be identified from the outset, and sustainable solutions identified during the development phase. Enabling activities are likely to be needed in order to address contextual barriers to hiring of staff, procurement, access to fundamental IT infrastructure and internet connectivity.

National ownership and coordination

4.1.6　Insufficient national ownership

Half of the case studies emphasized the importance of support that facilitated national ownership of the REDD+ MRV system. National ownership was broadly described as a vital enabling factor in terms of development of the system. For instance, Ethiopian stakeholders voiced a strong desire to be able to monitor and measure forests nationally rather than to outsource this. In Fiji, support that focused on national ownership generated nationally appropriate solutions and built national capacity and the confidence to develop and operate the REDD+ MRV system. In Indonesia and Guyana, the ability to exercise sovereignty over the system and determine its development have been important factors for success.

There was no single feature of support provision that resulted in this national ownership. Rather, it is the product of multiple facets and approaches to delivering support, with time, engagement, collaboration and the development of national capacity all vital themes. Where support helped to enhance knowledge and capacity within the wider stakeholder community, beyond just the staff directly responsible for REDD+ MRV, a wider pool of national capacity was developed and was more likely to result in broader stakeholder buy-in for REDD+ MRV. In countries where the staff involved had a strong interest in generating and owning the MRV system, several of the obstacles were overcome with more ease. By contrast, in countries where national ownership has not been built initially, this lack has obstructed progress.

Countries that felt they had national ownership of the REDD+ MRV system were better placed to make decisions about the components of their systems, including which of those to develop in-house, and when to use external systems and platforms to meet their needs. Although some of the interviewees identified ownership and direction as a success factor that had been in place from the start of development of a given system, many reflected on negative experiences—when outsourcing design and development to donors and consultants—that had resulted in poor outcomes and significant obstacles.

Lesson 6: MRV support, much like other development, needs to be fully embedded in national needs and priorities with support designed to facilitate national ownership.

4.1.7　The need for programmatic support in some national contexts

The ROC has struggled to manage and coordinate its donors during its REDD+ MRV development processes. This has resulted in the funding of competing products that are often contradictory. The process in Ethiopia by contrast, has included a Steering Committee comprising national government, donors and technical partners, which was highly regarded by the government for its coordination of activities and facilitation of process development. The experience of ROC suggests that a lack of political support may perhaps have been a factor there (and this itself warrants donor action). Meanwhile, a clear inference is that in low capacity contexts donors and support partners may need to play a strong supporting role in programmatic management, while helping the country to gradually build up the resources and capacity needed to take over exclusive control. The pivotal issue here is a country's capacity to manage multiple donors, rather than the total number of donors in and of itself (Indonesia, for instance, had many support partners and donors, but managing the associated complexity was not identified as a challenge).

Lesson 7: In low capacity contexts, donors and support partners may need to attend particularly diligently to coordination in order to prioritize activities, ensure their integration, and to avoid duplication. Support partners may need to lead this coordination role—alongside national government counterparts—if national counterparts do not have the capacity for managing multiple support partners and multiple concurrent activities.

Clarity of requirements

4.1.8　Lack of clarity on technical needs of the system

Several of the case studies identified challenges associated with unclear or changing system requirements from donors. Examples include unclear methodological guidance, and the requirements for information in the Emissions Reduction Program Document (this was specifically noted for Chile but was also identified for other countries). This became an obstacle in a number of ways, including lost time and resources due to delays and uncertainty about how to proceed, and having to rapidly change methods or approaches at the last minute when it became apparent that the donor requirements were not being met. This issue appears to have improved somewhat in recent years.

Lesson 8: Early work on REDD+ MRV system development was hampered by a lack of clarity on the technical needs of the system.

4.2　Technical aspects of MRV Systems

4.2.1　System components versus system operationality

Particularly in the early years of REDD+ MRV development in some of the case study countries, support was focused on the development of discrete components or outputs of the system (such as the FREL, the National Forest Inventory). However, this became an end point in itself, divorced from the overarching functionality of the system, resulting in a lack of operationality. For example, in Fiji discrete components of the system that had been built separately did not work together; in Indonesia, pilot MRV systems in different jurisdictions are not mutually compatible, nor did they easily align at the national level. In Ethiopia, the focus of work has been at the national level, but this is obstructed by the current lack of capacity in the jurisdictions that are required to provide the necessary data.

Countries such as Guyana and Mozambique took a programmatic approach that focused on the end result—an operational REDD+ MRV system that regularly reports REDD+ emissions. This programmatic approach was a key success pathway for those countries. Their systems were up and running sooner, and their capacity building processes may also have made gains in efficiency, for instance in the development of institutional arrangements. It should be pointed out that countries that followed a systems components approach—rather than a programmatic approach—tended to do so in response to gaps in funding, or because project-focused support attended to specific outputs rather than system functionality.

Lesson 9: A programmatic design, which focuses on whole system operationality, is likely to be a more efficient and faster way to build a REDD+ MRV system than an assemblage of individual components.

4.2.2 Step-wise development of functionality over time

Guyana and Mozambique both took an approach focused on developing operational systems that start simply and build functionality with time. Mozambique, for example, followed a step-by-step process, starting small and focusing on the development of a robust and state-of-art MRV system. It intends to expand this on a needs basis. Guyana also focused on rapidly building an operational system, and has steadily increased the precision, scope, sophistication and functionality, to arrive at the current iteration. This approach also seems to have helped to resolve some of the challenges associated with collaboration, and building institutional relationships, by generating tangible, demonstrable outputs from the outset. This also suggests that systems should be designed with a view to being upgraded to keep pace with technological progress.

Lesson 10: Starting with simple operationality, followed by strategic, step-wise building of functionality over time (as was envisaged in the Warsaw Framework) has been a successful design approach.

4.2.3 Providing a strategic pathway for REDD+ MRV System development

Several of the case study countries developed implementation roadmaps or Terms of Reference (ToR) for the development of the REDD+ MRV system at the outset, and have used these to focus and guide system development since then. All countries that did this (Chile, Ethiopia, Ghana, Guyana, Mozambique) found it significantly helped them to strategically manage the development process and to tailor support to national requirements. In some cases, the roadmap was put in place as one of the first actions of readiness (for example, Chile, Ethiopia, Guyana, Mozambique), but elsewhere, developing the roadmap at a later stage was still a beneficial exercise that helped to overcome a range of support and contextual obstacles. This activity involved collaboration between government staff, donors, consultants, institutional partners and other key stakeholders. Regular review, adaptation and agreement of the roadmap was also important for its continued role in directing support in a strategic manner.

The strategic roadmaps were most useful when they incorporated assessment of such elements as: country policy and reporting priorities; institutional structures; resources and budget; data and infrastructure; and capacity needs. These assessments identified capacity gaps, institutional needs, and training needs. In Guyana, where the assessment was described as "crucial support at the time", a specific MRV ToR was generated which was used to systematically guide activities throughout that development phase, with new gap assessments and ToRs developed and followed for subsequent phases of MRV system operation and refinement.

Lesson 11: Whatever the current stage of development or operation of the REDD+ MRV system, having a strategic roadmap in place is an effective mechanism for countries to focus their activities along a pathway to a defined end point, and to help guide the

support that is provided in the most effective way. Where a country is at the earliest stages of development of their system or where capacity is relatively low (such as LDC/LMI countries), more support will be required to help the country to develop the roadmap.

4.2.4 Planning for sustainability

Although the case studies universally identified the sustainability of their REDD+ MRV systems as being of concern, some countries (such as Colombia) have undertaken no planning for sustainability at all. This is particularly obvious where the system has developed as a set of discrete components rather than with the full system in mind. Most of the countries are reaching the point where their systems need to transition from an intensively supported readiness phase to a more independent operational phase, coinciding with a reduction in the support and funding from donors. There is uncertainty about the sustainability of systems at this juncture. The three key areas of concern voiced by case study country stakeholders were: (i) financial sustainability; ii) sustainability of capacity and staffing; and, (iii) uncertainty over ability to operate the systems independently. Standard practice in most development support is to incorporate planning for sustainability or an 'exit strategy', but this has not been a prominent feature of the MRV development support undertaken among the case study countries.

Lesson 12: Standard practice in most development support is to incorporate planning for sustainability or an 'exit strategy'. This needs to be addressed in REDD+ MRV support and should at the very least incorporate planning to ensure ongoing staffing and operating costs. This is not a technical challenge *per se* and requires a relatively conventional programmatic development approach to support provision.

4.2.5 High operational and maintenance costs and lack of financial sustainability

Annual system operational cost estimates ranged from US$ 120,000 (Liberia) and US$ 472,000 (Uganda) for basic operationality, to US$ 1 million for the sophisticated Guyanese system, and probably much more for the complex Indonesian system. Uncertain financial benefits, especially in countries with in the absence of no agreed arrangements for results-based payments, hampered both motivation and the ability to identify an appropriate budget scale. Although financial constraints were noted in most of the case studies, only the Guyanese and Fijian interviewees discussed how they have actively planned to address financial sustainability. In the Guyana case, this has involved a combination of identifying where cost efficiencies can be made in the system, through increasing the cost efficiency of processing, and data use (reduction in the use of expensive high-resolution satellite imagery). Fiji, Chile and Guyana also promoted the added value the system could provide nationally. Guyana has shifted towards low-cost or free satellite data and open-source cloud-based processing, and is exploring other potential funding such as the Architecture for REDD+ Transactions (ART) and the Green Climate Fund. Guyana has also facilitated consultations with other national agencies to identify options for further use of MRV system data, which are now used to support a range of national needs including natural resources management, support for students in the University of Guyana, and national infrastructure planning. Guyana's REDD+ MRV system data and staff expertise are also used for a range of

international reporting needs (UNFCCC Biennial Update Reports and Nationally Determined Contribution reporting; United Nations Convention to Combat Desertification reporting; Sustainable Development Goals reporting) and national reporting needs—for instance against the Guyana Low Carbon Development Strategy.

Lesson 13: Planning for eventual financial sustainability must be built into REDD+ MRV system development. This is general good practice, but is a particular need for countries with less scope for results-based payments for emissions reductions.

Financial sustainability may derive from multiple sources of REDD+ results-based payments; cost efficiencies within the system; and, added national value in the use of the system, its data and resources. Further funding alone is unlikely to be the only or best solution to the financial obstacle. Countries such as Colombia and Guyana that have developed advanced REDD+ MRV systems have semi-automated their systems, which enables them to easily produce data tailored to meet the technical requirements of a range of financial partners.

Lesson 14: Methods to facilitate data production and reporting to a range of partner and other needs should be a system development goal. This is important given that there is no carbon market mechanism, and countries will likely need to seek results-based payments from a range of sources to aid financial sustainability.

4.3   Modalities of delivering of MRV support

4.3.1   Delivery without national ownership

In addition to being a high-level issue requiring donor attention, national ownership is also an area for action by technical support providers. The initial technical support in some circumstances, particularly when countries were in the early system development phase, at times focused on the top-down, outsourced, delivery of outputs such as activity data or the FREL for the country, rather than in close collaboration with the country (see examples in the Fiji and Ghana case studies). These top-down outputs were not well accepted by the countries and had to be redone. This was commonly identified as an obstacle where the donor had engaged their own in-house expertise or an external consultant to develop a report or a data product for the country, without also incorporating support for in-country capacity development. It cannot be said that engaging external expertise was inevitably counterproductive, but rather that the expertise engaged did not always meet the needs of the partner country.

By contrast, the case studies universally show that where collaborative engagement and participatory approaches to support were taken these were highly regarded by case study stakeholders. A collaborative embedded approach involving a close hand-in-hand working relationship. This in time led to purposeful and comfortable communication between local and external experts that was effective in overcoming a number of contextual and support obstacles. In many instances, particularly among the lower capacity countries, this involved a consistent physical presence. However, this was not the only way, or a guaranteed way of building collaboration and engagement. Rather, a willingness to engage and incorporate feedback from local stakeholders was identified as important. Collaboration and engagement occurring at

multiple levels was a success factor, ranging from staff level engagement, to technical working groups, steering committees and executive level engagement. In many of the countries, long-standing, trusted relationships with technical partners have been built over the years, particularly when those partners have been willing to support training of national staff. These long-standing, trusted partnerships are essential to enable good progress through open communication and collaborative learning among different stakeholders and parties (see Chile, Ethiopia, Fiji, Mozambique, Guyana).

In Guyana, which has operated its system independently for a number of years, the role of the trusted technical partners—built in the development phase—has now changed to one of supporting on development areas only, rather than operations. This is only possible given the intimate understanding of the national system and context accumulated by those partners.

A crucial success factor noted by a number of the case study countries was that the local staff had control and ownership over the development of the MRV system, with external experts being consulted for specific work and system reviews, rather than this being prescribed externally. This meant they were able to take a more strategic approach to the support that was on offer, and to ensure that the workshops and training programs—often delivered to already busy staff—were targeted towards their needs and strategic goals. Taking ownership of the design of the system would include considering how existing tools, platforms or processes could be used or adapted. System design does not mean that it is necessary to start from scratch and ignore what has already been developed. This issue seemed to be more common during the early readiness development phase, and may already be a lesson learned that has been incorporated into the way that donors are delivering support.

Lesson 15: Technical support needs to be delivered in a collaborative way that facilitates national ownership to generate buy-in and enable strategic decision-making by the national team. Collaborative, participatory engagement, with support focused on capacity development, has been well received by country stakeholders and has enabled the establishment of trusted technical partnerships based on deep knowledge of the national context.

4.3.2   Tailoring of support to the national context

Certain country-specific conditions were found to support REDD+ MRV development processes, whereas other contextual factors were obstructive. Several countries had already invested in forest monitoring and reporting capacities—and related human resources—prior to receiving support for development of their REDD+ MRV systems. This was more likely when forests were already topical (such as frequent bushfires, or public reforestation commitments). When national policy goals and reporting requirements align with REDD+ MRV, there is a higher chance of finding political support and synergies between institutions.

Various countries reported obstacles originating from the insufficient tailoring of support to the national context. Sometimes external experts lacked sufficient background knowledge of the MRV system or country context in question. This led to misunderstandings and misleading recommendations and was most prevalent among countries with lower national capacities or those with relatively small governments (for example, Ghana, Fiji).

In some situations, there was a feeling that some support providers lacked understanding of national and institutional capacities and needs when they embarked on REDD+ MRV system development (Ghana, Fiji), or that support was needed at an additional level of government than initially targeted (for example, at a regional level in countries with subnational systems) and that country institutional relationships should be clearly understood to avoid competing interests within the country (Mozambique).

Lesson 16: Technical advisory support needs to be provided from a standpoint of good knowledge of the national context, including physical geography, capacity, administration, and institutional dynamics.

4.3.3   Addressing initial capacity gaps

All of the case study countries have made good progress on the development of the in-country capabilities for conducting REDD+ MRV, despite their differing starting capacities. These ranged from very limited pre-existing relevant capacity (Ethiopia, Fiji, Guyana, Ghana, Mozambique, Republic of Congo) through to countries with comparatively extensive relevant capacity (Chile, Colombia, Costa Rica). The level of starting capacity correlated with country development category. Unsurprisingly, this pattern is generally reprised in the current status of REDD+ MRV system development, with higher-income countries generally at later stages of REDD+ MRV system development, having built on pre-existing capacity. The level of technical expertise within the institutions responsible for REDD+ MRV prior to the initiation of support activities clearly influences the amount and nature of capacity building required. This was particularly relevant in countries where the initial level of technical capacity was low, particularly the LDCs.

Notably, the two countries that have arguably made the best progress in the establishment of their REDD+ MRV systems, Guyana and Mozambique, have both had a consistent, well-led national team of dedicated staff driving forward the development and operation of REDD+ MRV, with limited staff turnover. Across all the case study countries, support modalities that focused on the transfer of relevant knowledge to national experts were favored and considered to have been successful in building capacity. Embedded support, including mentoring, was highly valued by countries at various points on the continuum of preparedness for REDD+ MRV (both low and high starting capacity). For Chile and Costa Rica, both of which had high pre-existing capacity relevant to REDD+ MRV, and for Guyana, the support of embedded technical specialists was considered critical for progress in early stages to co-design the REDD+ MRV system and transfer the basic knowledge needed. For countries such as Ethiopia and Republic of Congo with very low national capacity, embedded in-country support, combined with specialized technical mentoring through REDD+ MRV system activities was a well-regarded approach to knowledge transfer and building capacity. As capacity has increased, countries have favored a range of knowledge transfer approaches to support, particularly: provision of technical guidance material (Chile, Guyana, Indonesia); facilitated South-South collaborations focused on enabling countries to refine their approach through understanding lessons from other countries (Chile, Ethiopia, Fiji, Guyana, Indonesia, Mozambique); and knowledge transfer workshops focused on particular technical challenges (Indonesia, Fiji).

The building of local capacity proved to be important for overcoming obstacles in many of the case studies. Hands-on or on-the-job training resulted in deeper learning, and a more long-lasting knowledge transfer. Targeted workshops, particularly those in which national staff are mentored by a technical expert while they conduct an activity themselves, was considered a successful mode for capacity building. Similary targeted workshops involving exchanges between experts from different countries exchange were also found to be successful. Embedded technical support was also successful where capacity was very limited or in early phases of REDD+ MRV system support. It was noted that capacity which was developed with long-term and targeted support had led to technologies and knowledge being retained in the institutions and operating procedures. Furthermore, where capacity building and training was provided strategically to targeted individuals, and in a way that was retained, institutionally, it was noted as providing the most successful outcomes.

Lesson 17: REDD+ countries favour support that is focused strongly on developing national capacity to own and operate the REDD+ MRV system. Embedded or high-input support was necessary universally at the design stage, while countries with low capacity required ongoing, often embedded coaching and mentoring. Countries with higher capacity and those further along the development process favored less intensive capacity-building support focused on the strategic transfer of knowledge relevant to the national system, including advanced technical guidance. Facilitated South-South sharing of knowledge and experience was also a favored modality of technical support provision.

4.3.4   Building subnational capacity

Countries that are developing subnational systems noted a continued absence of the necessary capacity to operate the system at the subnational level (Costa Rica, Ethiopia, Indonesia). This was because capacity building during the readiness phase of system development had been focused at the national level. Similarly, a number of countries were concerned that the implementation of their Emissions Reduction Program Agreements was at a subnational level, whereas capacity development had primarily occurred at the national level, leaving a significant capacity gap at the subnational level.

Lesson 18: In subnational systems which require operational capacity at the subnational level, capacity building at this level has been insufficiently developed and seems to be a gap in readiness planning.

4.3.5   Maintaining a sustainable pool of national expertise

Seven of the ten case study countries reported ongoing challenges in building and maintaining sufficient human capacity in their REDD+ MRV systems. Contextual challenges to building expertise are compounded when a complex approach to measurement and estimation has been taken. LDC and LMI countries tend to have a smaller pool of technical capacity than is available in more developed countries. In these contexts, building and maintaining capacity within the relevant institutions is a significant challenge.

Countries have sought to address these obstacles in a range of ways including: development of clear Standard Operating Procedures and ensuring multiple staff are able to operate each component of the system (as in Ghana, Guyana, Mozambique); strategic planning for staff turnover (Guyana); and transition to highly collaborative, participatory development processes where that was not the initial case (Fiji, Ghana). Ethiopia has developed ongoing training courses on aspects of REDD+ MRV. These have served to sustain national capacity, and the subsequent phase now seeks to target regional staff.

Lesson 19: Examples of ways countries have sought to develop a sustainable pool of trained experts include: specific management planning for staff turnover; development of clear SOPs; working with national research institutions to train a pool of experts; and ensuring multiple staff are able to implement each activity.

4.3.6   Methodological challenges and gaps

In some of the case study countries the process of developing a REDD+ MRV system has become increasingly complex, owing to: (i) a heterogeneous or large forest landscape; (ii) complicated national institutional frameworks; (iii) complex subnational government structures; (iv) security constraints, and (v) difficult terrain.

In countries with a highly heterogeneous forest landscape (such as Indonesia) complex systems for measurement and estimation are required to achieve high-quality data collection, presenting a potential barrier to development of a practical and sustainable REDD+ MRV system. Landscape heterogeneity has also been a challenge in some countries where support for REDD+ MRV development has mainly been at a subnational level. In Costa Rica, Ghana and Indonesia, for example, landscape heterogeneity was mentioned as a challenge to scaling up subnational level MRV systems to the national level. In Ethiopia, the difficulty of accessing certain areas—owing to challenging topography and security concerns—was also mentioned as an obstacle to sampling-based approaches to measurement and estimation. An inability to centrally integrate data from separate regional jurisdictions was an ongoing obstacle for countries with subnational systems. An analogous problem (mentioned by Indonesia, Ghana and Costa Rica) was the difficulty in transferring data horizontally between jurisdictions that had developed REDD+ MRV systems independently of each other or for very different forest landscapes. In some cases, such as Mozambique, there has been investment in the development of systems that address these challenges; while in others, such as Ghana, where there are challenges in distinguishing between forests and tree crops, solutions are yet to be identified. Overarching methodological guidance on how to handle system complexity might aid countries with complex system factors.

Several of the case studies highlighted current methodological gaps. The MRV of forest degradation was a particular technical challenge identified in a number of case studies. Many countries identified the higher technical complexity of estimating emissions from degradation as an obstacle, alongside the availability and sources of data for identifying the occurrence of degradation. Where forest degradation is an important driver of GHG emissions, a lack of practical methodologies for detecting it has required innovation, and a reliance on higher resolution remote sensing data and

more complex analysis—than was anticipated at the start of the readiness process. For countries such as Ethiopia, a methodological approach is needed that can continue to function in a far from ideal context of low capacity and low technological infrastructure where data is incomplete or of poor quality. This is especially pertinent for countries within which degradation is the major source of emissions (such as Ethiopia) as they are reliant on reporting of degradation emissions reductions to secure the results-based payments to finance the system.

Other methodological gaps identified by the country stakeholders were: (i) the lack of methodologies to account for displacement of emissions and any reversal of emission reductions; (ii) improved nested activities methodologies; and (iii) methodologies for combining subnational systems at a national level.

Lesson 20: An overarching lesson on technical obstacles is that there is a current and ongoing need for methodological guidance and tools developed through collaboration between technical partners and countries. This is a key support role as countries develop, operate and refine their REDD+ MRV systems and it will persist as the state of the art evolves and matures. Current thematic areas for development include: methodologies for measuring degradation, displacement and reversal, guidance for complex contexts (heterogeneous landscapes, subnational systems), integration and automation of processes.

The need for technical support to be underpinned by a deep understanding of the national context was underscored in other cases. In some circumstances where REDD+ MRV tools have been developed and promoted, the introduction of these tools has been too hasty with insufficient depth and support to allow the countries to understand how they could test the tools and tailor them for deployment into their systems (see Costa Rica case study).

Lesson 21: While the case studies illustrated a desire and opportunity for donors and technical agencies to develop tools and best practices involving the most advanced technology and methods, for example for monitoring of degradation and distinguishing forest from tree crops, promotion of these tools and approaches needs to be tailored towards meeting the needs of the particular country.

4.3.7   Understanding the technical needs of the system

To a certain extent this is being addressed by the tools and guidance being developed by technical partners. A number of the case study countries noted that the establishment of a technical working group that focuses on elements of forest monitoring, change mapping—as well as other technical aspects such as mapping and monitoring of degradation—has been highly beneficial in terms of clarity. Effective working groups were seen to act as a hub for the MRV activities. Working groups were typically composed of the key stakeholders that had either technical or policy-related responsibilities related to REDD+ MRV. In some instances, the groups included members from stakeholders outside of government, such as research institutes and universities.

Lesson 22: Technical working groups are a helpful modality that helped provide clarity for national experts on the technical needs of the system.

4.3.8 Access to satellite data

Many of the case study stakeholders commented that access to satellite imagery was an ongoing constraint and valued the role that support providers had played in facilitating this access. For countries with complex forest landscapes, this is a serious predicament. Indonesian stakeholders, for instance, noted that they were unable to secure access to sufficient high-resolution satellite imagery to provide coverage of its large and heterogeneous forest area.

Lesson 23: Facilitation of access to satellite imagery is a valued aspect of REDD+ MRV support provision.

5 Recommendations

Lessons from the country case studies provide examples of a broad range of factors that have influenced the process of developing REDD+ MRV systems. These factors relate to the context within which the MRV system was developed, and how the support received interacted with other salient contextual conditions. In all cases, hindsight offers an opportunity to consider how support could have been better tailored to national circumstances to achieve greater efficiency and improve sustainability. Interestingly, it often became apparent that certain lessons had already been learned and applied, as many of the case studies described obstacles that had already been overcome by adopting new approaches to support.

The following recommendations draw on the above lessons learned to identify: i) key considerations and enabling conditions that facilitate succesful MRV support; ii) characteristics of REDD+ MRV systems that are likely to promote efficiency and sustainability; and iii) modalities for delivering support that have proved most effective in relation to the key country factors.

The recommendations aim to provide an overarching view of the lessons. Many of the lessons are broadly applicable, and where relevant, specific contextual factors are highlighted. Although the recommendations are universal, their implementation needs to be shaped in response to each country context. However, despite the wide differences in national context, common themes bind together all the obstacles and successes encountered by the countries reviewed. The recommendations section should be read in conjunction with the lessons identified, with the lessons providing the insights behind the recommendations.

5.1 Key considerations and enabling conditions that facilitate successful MRV support

Recommendation 1: Implement consistent, long-term support

Explanation: Long-term funding and relationships were identified as being important in building trust as well as helping to embed and internalize the system and processes within country teams. The case studies showed that it can take time to build the capacity, processes and arrangements for REDD+ MRV systems. In many instances, support that was embedded in-country helped to build close working relationships. However, that was not always necessary, as there were some examples where remote support served to offer close collaboration and effective engagement.

Issues to consider: Consistent support means much more than the existence of a long-term commitment at the program level (especially as arguably all of the case study countries received long-term funding support). For example, changes (staff turnover) among donor technical and program personnel, as well as consultants, can disrupt support, and lead to significant uncertainty and inefficiencies. To the extent possible, support programs should be designed in a way that precludes or mitigates such effects, and to have appropriate documentation and transition arrangements in place if staff do change. This is particularly important for LDC/LMI countries that are more likely to struggle to supplement system development from their national budgets, and consistency is likely to be required in the form of close, regular program support, with detailed technical support. This is likely to be needed on an ongoing basis, and where feasible embedded coaching and mentoring should be incorporated. This is equally applicable to countries at an early phase of development, or those with low capacity. Current limitations caused by the COVID 19 pandemic may make embedding support a challenging undertaking, thus greater reliance on remote technologies for regular engagement may be necessary.

Countries with higher capacity and those further along the path of REDD+ MRV system development still benefit from consistent long-term support. However, this will typically involve less intensive capacity building support focused on strategic knowledge transfer, on activities or capacities relevant to the national system, and particularly the provision of guidance on state-of-the-art methods and technology.

In countries with subnational administrative systems the scale of investment in capacity building—and the time frame needed—may be much larger than for countries with centralized systems. This needs to be factored into the readiness and operational budgeting of the system, commensurate with what is ultimately likely to be sustainable for the country.

Recommendation 2: Ensure effective donor coordination

Explanation: The lessons learned indicated that a lack of donor coordination could be an obstacle to effective support. Better donor coordination includes coordination among multiple donors providing simultaneous support, as well as coordination between donors providing support at different points in time. This is particularly important for low capacity countries and those that are early in the development phase. Good coordination will have considerable impact for these countries, as they are less likely to be in a situation to strategically direct the support themselves.

Issues to consider: Countries have now received support from a range of donors and programs over many years. Therefore, any new program of support should be developed in the context of the support, work, systems, and processes that have already been put in place by the countries. The design and implementation of support should include strong donor, stakeholder and country coordination. Coordination, however, goes beyond collaboration

and engagement, in the sense that it requires donors to focus on the needs and context of the country, rather than any preconceived priorities or approaches favored by a particular donor. A donor may have developed a particular tool but if it is not compatible with the framework that the country has already developed with the support of other donors, then its introduction would be counterproductive.

The GFOI has a potential role to play in supporting better donor coordination. The GFOI has been providing an effective role in coordinating partners at a higher conceptual level. This recommendation is therefore for the GFOI to support better coordination between donors at the country level. This could involve developing a framework or protocols for donors to follow, and thereby coordinate support at the country level.

Recommendation 3: Foster ongoing political support

Explanation: Political support, such as the support of government ministers or senior executives, was identified as either an obstacle (if lacking or indifferent) or as a driver of success (if present). Political support for REDD+ is a key component of the sustainability of the REDD+ MRV system, and therefore a key challenge for country teams and for donors. Potential avenues for country teams and donors to enhance political support include: communicating to senior executives and ministers the potential benefits of REDD+ for the country (in many instances political support for the system was increased with the signing of ERPAs with the FCPF Carbon Fund, demonstrating a clear financial benefit); broadening the scope of the system so that it has multiple uses and provides greater value for policy development, national planning and other financial opportunities (for example, environmental co-benefits); and high- level bilateral and multilateral partnerships and relationships, at both ministerial and senior executive level.

Issues to consider: Political support for REDD+ MRV is ultimately a sovereign issue for countries. Celebrating milestone successes in the MRV development process can foster the interest of the government and partner institutions. This tends to reinforce the creation of institutional arrangements and long-term support of the system. This was observed in relation to official donor recognition of MRV development achievements and in the process of ERPA negotiations. But smaller opportunities to celebrate success should be identified throughout the development process.

Recommendation 4: Basic infrastructure and satellite data support

Explanation: A number of case studies identified challenges in terms of basic infrastructure, notably when internet access was unreliable. In other circumstances, IT hardware, such as servers, storage and backup, has proven to be problematic. This is not a universal issue across countries, with LDC and LMI countries more likely to lack sufficient infrastructure.

The provision of data—particularly analysis-ready data, data products, and platforms or service providers—was seen as an important form of support for some of the case study countries. This may reflect to some extent a failure to appreciate that free and open access to several remotely sensed data sets is commonplace, and of considerable value to countries. Nonetheless, some specific examples highlighted the value of the provision of data.

Issues to consider: Basic infrastructure such as internet access can be more challenging in certain country contexts. However, its fundamental importance is inescapable, given the importance of the internet for MRV systems (data transfer, access to online guidance and methods, and so forth). With the current COVID situation, increased reliance on teleconferencing is also highlighting the importance of basic infrastructure.

Understanding infrastructure needs can be challenging, and many support programs have delivered IT infrastructure that has not been put to full use. Support for infrastructure should be based on an assessment of IT needs and existing infrastructure, ensuring that any new infrastructure is compatible with current systems. With respect to sustainability, it is also important to make the management and ongoing renewal of IT infrastructure an integral component of the system.

Satellite data should be appropriate for the country's needs, and careful consideration should be given to any long-term implications of introducing a particular data source. Free and open access to data, particularly remote sensing data and products, has improved greatly through the coordination activities of the GFOI and other donors and multilateral partners. This includes access to analysis-ready data and increasingly high-resolution visual imagery. The provisioning of this data should be done in a way that meets each country's system design needs in terms of scale and budgetary limitations. Providing access during a support program to a high-cost data product may ultimately lock that country into use of a product that is too costly and thus jeopardizes the sustainability of the system. Conversely, it may be equally inappropriate to provide access to an ostensibly free product that is costly for the country to turn into a final product.

5.2 Characteristics of REDD+ MRV systems that promote efficiency and sustainability

Recommendation 5: Ensure that collaboration and engagement between donors, national institutions and support partners is designed into the support

Explanation: Collaboration and engagement at the core of the program of support is fundamental to building trust and ownership. A high level of collaboration between the country, donors and consultants is more likely to yield a system that the country will continue to operate. Collaboration allows the country to be the leader in its decision making and design and development process. Ensuring that there is regular engagement between parties also helps to build trust and ensure that issues, questions and developments are being effectively communicated. Infrequent engagement often leads to surprises, incorrect assumptions, confusion and a lack of buy-in.

Issues to consider: Collaboration and engagement need to be designed for each country individually, based on what is appropriate for the staff and institutions responsible for REDD+ MRV and other stakeholders. For countries that are in the development phase, there is likely to be a greater need for support to help drive collaboration across the stakeholders of the system. Working Groups of national government and MRV support providers are one example of a mechanism that has worked well among the countries reviewed. Conversely, countries at the early operational phase and operational refinement phases are more likely to already have mechanisms for collaboration in place, and as such donors and partners should aim to make use of these existing mechanisms. In a similar context, LDC/LMI countries and those with lower levels of political support are more likely to benefit from support that helps to drive collaboration and engagement between stakeholders.

Recommendation 6: Ensure sustainability is at the heart of all support

Explanation: The operational sustainability of systems was a significant obstacle identified through the case studies. Sustainability has several facets and is not simply about the technical aspects of the system. Sustainability includes: focusing on the end goal of holistic system operation from the outset, rather than piecing together separate components; supporting the country to develop budget mechanisms to operate the system; supporting a system design and components that are fit for purpose and are financially commensurate with the value the country can derive from the system; assistance in developing and formalizing institutional arrangements; support to implement the necessary system infrastructure and tools; capacity development for country staff to manage and operate the system; and, maintaining capacity within the system such as through opportunities for career progression. In essence, this means that support needs to simultaneously address technical, institutional, and program management aspects of REDD+ MRV.

Issues to consider: While sustainability is an important concern for all countries, it is particularly relevant to countries with low resources, limited baseline capacity (LDC/LMI countries, small population countries), limited political support and limited scope for results-based payments (RBP). Many countries are likely to relate to several of these challenges, however, and identifying which of these issues are present for a country serves as a starting point for identifying opportunities to support sustainability.

For example, LDC/LMI countries where limited resources are a key constraint may need to have a greater focus on managing the operational cost of the MRV system, with a secondary goal of broadening the value of the system for the country. This may involve reviewing the REDD+ MRV system design, as there may be costly elements that ought to be reconsidered (such as expensive high-resolution imagery).

Upper-middle income countries with a low opportunity for RBP may be more likely to benefit from a system that can provide a greater range of benefits beyond only REDD+ MRV, with cost minimization a secondary issue. Building sustainability through a REDD+ MRV system that is able to provide greater value than only REDD+ MRV could involve working with the country to map out broader policy requirements in terms of reporting and land management, so as to develop the system to meet these multiple objectives. This may help to ensure the system has greater value and therefore sustainability in the longer term.

Designing and building systems that have a broad scope and a large suite of priorities (such as an NFMS with functions broader than REDD+ MRV) can create complexity that needs to be managed. For example, this could be managed through an incremental development process, and by developing manageable components of work under a clear and agreed system design strategy that prioritizes REDD+ MRV requirements. Where having a broader scope was identified as a success by the case studies, there were clear outcomes that were identified or achieved by the broader activities. This suggests that broader development of the system needs to address clearly identifiable needs and gaps for the country.

Sustainability risks arising from staff turnover and loss of capacity are a significant issue, particularly for LDC/LMI and small countries. Approaches that have been taken to try and address staff sustainability include: specific management planning for staff turnover; development of clear SOPs; working with national research institutions to train a pool of experts; and ensuring multiple staff are able to implement each component of the system.

Recommendation 7: Focus on system operationality and build towards semi-automation of processes

Explanation: Starting in a simple way, with a framework that is progressively developed over time, may be a more effective and faster way to develop REDD+ MRV systems. This has many benefits including: the regular and early generation of results; progressive development of knowledge and capacity; and gaining experience in operating MRV as a system rather than as the precursor to a single report. Building complex components—and then trying to piece them together into a system—is more likely to result in unforeseen challenges and obstacles.

Semi-automation of processes can facilitate a more efficient and streamlined reporting process, particularly where there is a range of reporting requirements. This can help to increase the operational speed of the system and is particularly relevant where the scope of the system has been broadened to priorities beyond just REDD+ MRV.

Issues to consider: A key aspect of starting simply is to use the system roadmap to develop a framework for the MRV system that can be progressively—and rationally—enhanced over time. The implementation of semi-automated processes was observed to be occurring in countries with systems that are in the operational refinement phase, suggesting that semi-automation is something that is generally being considered by countries once they have already developed their systems. This suggests that more advanced countries may benefit from support and expertise in the development and operation of semi-automated processes.

As experience accumulates in the REDD+ MRV community in the operation and semi-automation of processes, it will become increasingly important to build these considerations into the earlier development phase of systems.

5.3   Modalities for delivering effective support

Recommendation 8: Ensure support is focused on the development of in-country capacity for system operation

Explanation: The case studies highlighted the importance of focusing on developing capacity. Support that involved outsourcing the development of the system, or parts of the system, was more likely to encounter obstacles. The case studies showed a strong preference for the countries to run and operate their systems. The systems may be composed of a mixture of in-house components and outsourced components, as discussed below. This is becoming more relevant as standardized and specialist tools are being made available. The support for system development therefore needs to take into account that ultimately it is the countries that will be running the systems and using the mix of in-house and externally sourced tools and systems. The design of support can take this into account by ensuring that procurement processes and program design include the need to develop capacity as a component of all support.

Issues to consider: To help ensure that capacity support is strategic and relevant, activities such as the Country Needs Assessment are important, particularly for LDC/LMI countries and those in the early development phase. The assessments must cover the full suite of capacity needs, including project and program management, financial management, and institutional

relationships, rather than focusing exclusively on technical capacity. When new donors or consultants step into the development process, after the assessment is completed, it is important that they understand its outcome and that their engagement is tailored according to the assessment. There should also be a constant review of the assessment (allowing for possible changes) during the development process, to ensure that it remains current.

Countries with REDD+ MRV systems that are subnational in nature, particularly where the subnational governments have responsibilities for MRV, will require capacity development at national and subnational levels.

Ensuring that capacity development is a component of all support does not preclude the outsourcing of particular components of a system. For example, the development of forest cover change activity data is a specialist task and some countries may not wish to develop and create the product in-house. In this instance, supporting capacity development may instead focus on the procurement, project management, and technical requirements for the product. The procurement methods and systems of donors may need to be adapted, with less focus on products or reports, and more focus on strategically targeted knowledge sharing and capacity development for system operation.

The sharing of knowledge involves a two-way exchange. The case studies identified a number of successes from support activities that involved the two-way sharing of knowledge between REDD+ countries and between countries, donors and consultants. Many countries have now developed a strong knowledge and experience base. Enabling the sharing of this knowledge and experience helps the country staff to consolidate their knowledge, to hear other views and share experiences. This helps to build a community of specialists and a common understanding of the approaches that have been taken to overcome obstacles.

At the delivery stage of support, it is important for donor staff and consultants to understand how their work fits within the strategic capacity needs of the country. This understanding could be elicited through a simple line of enquiry: how does the support (a workshop, for example, or a report) fit within the strategic capacity needs of the country, and if it is a good fit, will this entail longer-term benefits?

Recommendation 9: Facilitate country-driven systems and processes

Explanation: A number of the case studies indicated that a system and process that was driven by the country team helped to overcome or avoid obstacles more effectively. In particular this helped to overcome obstacles to support predicated on a lack of coordination among donors, the country team and other stakeholders. This recommendation applies equally to donors and to countries. Donors should be mindful when delivering support of any risk that it might remove the country from its role as owner and operator of the system. The stronger the role the country takes in designing, developing and implementing the system, the better it is able to coordinate and control the outcomes of the support. Countries taking a leading role in driving the system and processes can help to direct support in a strategic manner.

Whatever the current stage of development or operation of the REDD+ MRV system, having a strategic road map in place is an effective mechanism for each country to help guide the provision of support in a manner that best meets its needs. Where a country is at the earliest stages of development of its system, or where capacity is relatively low (such

as LDC/LMI countries), more support will be required to help the country to develop the strategy. This needs to be carefully managed to ensure that the country is responsible for and has ownership of the roadmap, and that the roadmap is actually being used to guide development of the system.

Issues to consider: Depending upon the country context, each country will have a different level of knowledge and expertise to bring to system development. Tailoring support should account for the capacity of each country, seeking to enable it to take charge of all aspects of the system. The strategic roadmap should provide a holistic view of the operational REDD+ MRV system taking shape, rather than focus on discrete outputs or components.

Recommendation 10: Donors, GFOI leads and countries should work together to develop common technologies and state-of-the-art approaches

Explanation: As REDD+ MRV systems have been developed at the country level, there has been some development of ad hoc solutions for each country. As the readiness phase has progressed, a more consistent set of tools has begun to emerge, developed by GFOI leads and others. However, it currently still comprises a complex array of spreadsheets and parallel solutions to similar problems. At the same time there are some key thematic areas for the development of state-of-the-art methods, including: methodologies for measuring degradation, displacement and reversal, guidance for complex contexts (heterogeneous landscapes, subnational systems), and the integration and automation of processes.

The limited implementation of consistent tools, integration systems, and frameworks was identified both by countries (as an obstacle to technical needs at the country level) and by regional focal points (as an obstacle at the program and initiative level). A collaborative approach in developing tools and technically advanced approaches offers a number of benefits over both ad hoc and donor-driven processes. Collaboration will be important as the requirements for REDD+ MRV systems continue to increase, and to support the evolution of systems beyond the current FCPF and ISFL programs. To feed into the development of widely applicable tools and approaches, collaboration should combine input from countries with similar requirements, for example by making use of regional workshops. As new technologies are developed, and reporting requirements expand, there will be the need to constantly update and refine MRV approaches. The systems developed for initial design and implementation of REDD+ MRV systems should therefore be maintained to feed into continuous improvement.

Issues to consider: Many of the methods used by countries have a high degree of overlap. This stems from the use of standard guidance (for example, FCPF Methodological Framework, IPCC Guidance and Guidelines, REDDcompass / GFOI Methods and Guidance Document). There are also several examples of existing technologies and initiatives that could be used as a starting point, and analysis by the GFOI has identified a number of these. The GFOI has a potential role to play to support coordination between partners and countries on the technologies and state-of-the-art approaches that could be developed collaboratively. Collaboration here is a key consideration, as the strong drive for countries to develop capacity internally means that any new tool or method is unlikely to be taken up and owned by countries unless they themselves are involved in helping to adapt or develop it.

Many countries were not able to effectively estimate forest degradation emissions, and relied instead on proxies and expert judgement. To continue to improve estimates and reduce

uncertainty, better methods for the MRV of degradation will be necessary. Degradation is a technical challenge for all countries, and the widespread application of robust methods for the MRV of degradation is not in place. A coordinated approach to developing solutions to degradation—and define the best technical approach to adopt—could be an effective means to support all countries.

Developing tools and state-of-the-art approaches is the beginning of the process. Ensuring that countries are able to bring the tools into their systems on an operational and sustainable basis requires appropriate training and ongoing support for the systems. A number of examples were identified where tools had been introduced, but appropriate ongoing support for them was not provided.

Recommendation 11: Develop workshops so that they target specific outcomes for the country

Explanation: Country staff often have a large array of responsibilities and have limited time. While there were many productive workshops and training activities, there was some expression that valuable staff time was taken up by workshops and training activities that were of little or no value to the staff or the country.

Issues to consider: In general, generic or high-level workshops were considered to be of lower value. By contrast, workshops and activities that targeted specific outcomes, or that contained a mix of theoretical and practical learning and knowledge-sharing opportunities, proved to be of greater value. The sharing of generic or high-level concepts may be necessary, but where possible these concepts should be linked to practical or tangible examples for the staff. The workshops and training activities should target a country's needs and identified strategic requirements (Recommendation 4 – *Ensure support is focused on the development of in-country capacity for system operation*) such as through a package of workshops that aim to deliver capacity of direct relevance to the country's system design. Practically oriented sessions that work through real problems and tasks for the staff are one good way of targeting workshops.

6   Conclusions

The case studies highlight that many lessons have already been learned and applied as countries, donors, consultants and other stakeholders have developed their experience and knowledge in relation to REDD+ MRV. This means that countries and support partners have moved a long way forward in terms of their knowledge and experience, and this now affords them a stronger basis for working towards operational and institutionalized systems.

The ownership of the REDD+ MRV systems by countries is a key overarching theme. An early focus on producing outputs such as Forest Reference Levels often failed to result in strong country ownership of systems, particularly where support was used to develop a result for the country, rather than by the country. The recommendations taken together highlight that the focus should now be on providing support to the countries to develop and improve their systems, rather than providing support to generate an output. This is more likely to result in sustainable, operational and institutionalized systems.

While there are many obstacles, challenges and successes that are common across countries,

each has its unique combination of contextual factors. This means that while broad overarching recommendations can be made, their practical (and differentiated) application requires a detailed understanding of a country's circumstances and specific context. For example, how collaboration and engagement are to be enhanced (a key recommendation) in a given country, will depend on institutional structures, stakeholder relationships and existing procedures.

None of the countries studied were keen to outsource their MRV responsibilities. On the contrary, the indication was that countries want to own and conduct their MRV responsibilities. Having the capacity in-country supports broader program implementation as well as more effective support for policy development and analysis. Opportunities exist to better support countries with consistent methods and tools, but this should be achieved through a collaborative development process, rather than through a centralized MRV approach or as an outsourcing model.

All of the countries indicated that they still needed support to keep developing and improving their systems. Although the countries are transitioning to operational phases, their systems are not fully developed. Work is still needed to expand scope or scale, to improve methods and data, or to help embed processes and institutional relationships. The inexorable overall conclusion is that ongoing support is needed: even for those countries that have already undergone an extensive readiness phase. Depending on the status of a country's system, the support could range from broader assistance to targeted support for specific issues. Support should focus on helping countries to build upon and continuously improve their systems. Ongoing support will remain important, albeit in some instances at a reduced level, in order to operationally embed the systems in a sustainable way.
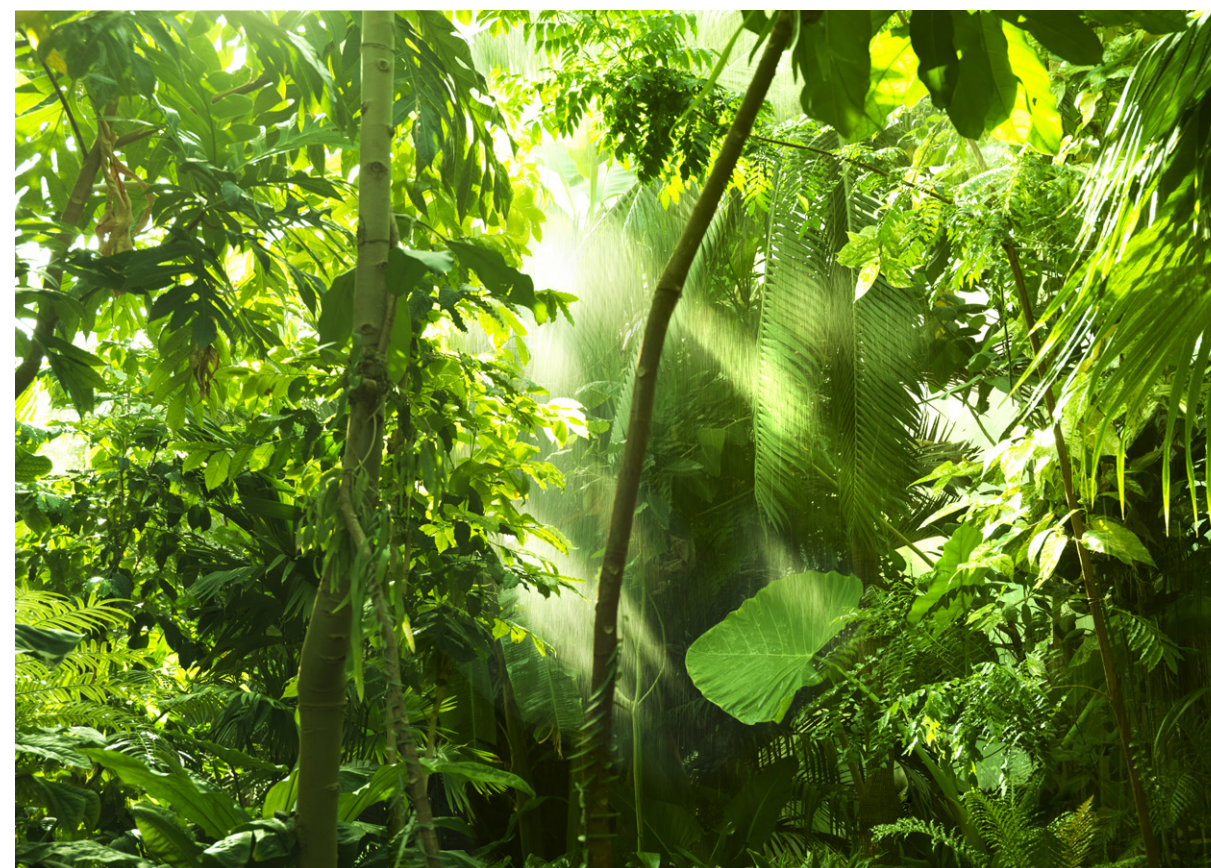
Appendix 1: Analytical approach

Table A1.1 Learning questions and their relationship to the DAC criteria.

No	Learning Questions	Relation to the DAC* Criteria
1	To what extent is there an operational NFMS?	Effectiveness: Is the support provided achieving its objectives?
2	Is there clear governance and oversight of the NFMS development process?	Efficiency: How well have resources been used? Coherence: How well does the interventin fit?
3	Is there a supportive political context surrounding the NFMS?	Sustainability: will the benefits last? Relevance: Is the support provided targeting the right things?
4	Is the NFMS at an appropriate scale?	Coherence: How well does the intervention fit? Sustainability: Will the benefits last?
5	How has country context affected NFMS development?	Cross-cutting
6	How has the type of support affected the NFMS development process?	Cross-cutting

*DAC: Development Assistance Committee of the Organisation for Economic Cooperation and Development (OECD)

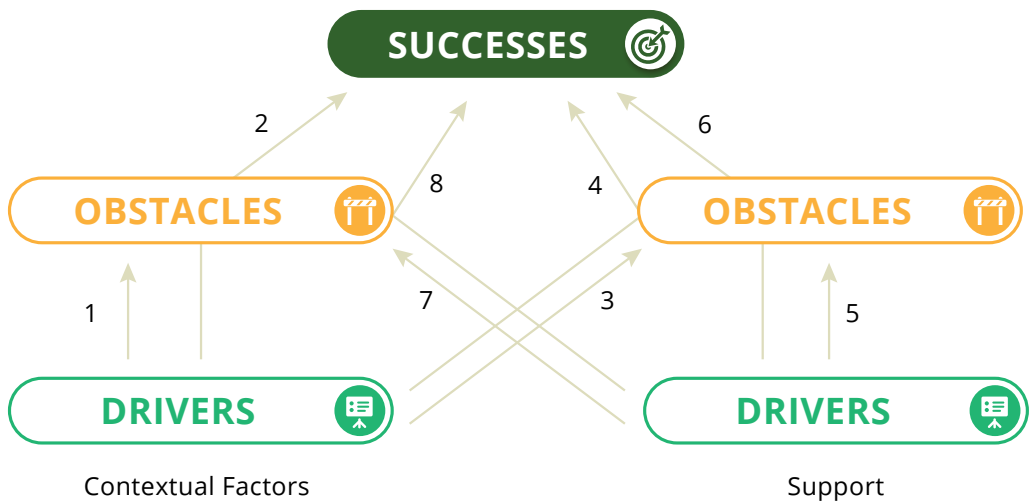*Figure A1.1. High level conceptual interrelations.*

1) A contextual driver is blocked by a contextual obstacle.
2) A contextual driver helps to overcome/avoid a contextual obstacle.
3) A contextual driver is blocked by a support obstacle (obstacle created by the support).
4) A contextual driver helps to overcome/avoid a support obstacle.
5) A support driver is blocked by a support obstacle.
6) A support driver helps to overcome/avoid a support obstacle.
7) A support driver is blocked by a contextual obstacle.
8) A support driver helps to overcome/avoid a contextual obsta-cle.

Appendix 2: Findings emerging from the case studies

Table A2.1 Identified obstacles and challenges

Category	Obstacles / Challenges	Related Countries [1]
Financing	Incomplete funding for development of the whole system, which causes discontinuities and affects speed and quality of progress	ETH, GHA
	Uncertain financial benefits/ no agreement for RBP, which hampers motivation and ability to identify appropriate budget scale	CHL, ETH, FJI, GUY, MOZ
	High establishment and running costs	GUY
	Low opportunity for RBP benefits, particularly for HFLD countries, but also countries where unmeasured degradation is the key source of emissions	ETH, FJI, GUY
Capacity	Insufficient current technical capacity / staffing especially at regional level in subnational systems	CHL, CRI, ETH, FJI, GUY
	Low technical expertise, either national starting point, or of support partner	CHL ETH, FJI, GHA, IDN
	High staff turnover, which makes it difficult to retain built capacity in the system	ETH, CHL, CRI, GHA, IDN, MOZ, COL
	Lack of necessary technological infrastructure nationally, and particularly at regional level in subnational systems	COL, ETH, IDN
Technical	Complexity of system requirements - country forest landscape context / institutional arrangements / subnational systems	CHL, COL, ETH, GHA, IDN
	National data of low quality or unavailable, e.g., due to access, security, consistency reasons	ETH, FJI, IDN, MOZ
	Lack of ability to monitor degradation; especially where this is the key source of emissions, constrains ability to generate RBP	ETH
	Different reporting requirements leads to inefficiency in the system as processing has to be repeated multiple times.	ETH, GUY
	Evolving state of the art requires continued updating of the system	ETH, GUY, IDN
Communication	Unclear requirements	CHL, ETH, FJI, GHA
	Country needs not understood / fully addressed by support partners	CHL, ETH FJI, GHA
	Country capacities not understood by support partners	ETH, FJI, GHA
	Value for the country not understood	FJI
	Results-based Payments distribution not transparent	
	Data not published / shared	CHL, GHA
Institutional Arrangements	Institutional responsibilities unclear	CHL, FJI, GHA, MOZ
	RBP distribution not defined	CHL, FIJ
	Competing institutions	FJI, MOZ

'Fixed?' country context	Heterogeneous landscape	CHL, ETH, GHA, IND
	Large forest area	IND
	Area inaccessibility	ETH
	Jurisdictional administration	CHL, ETH, IND, MOZ
	Inefficient procurement processes	CHL, FJI
'Flexible' country context	Negative experiences with development projects	FJI
	Missing trust	FJI, MOZ, COL
	Missing political support	CHL

[1] Countries have been abbreviated by their Alpha 3 Code.

Table A2.2 Supportive contextual factors observed in the case studies

Category	Condition / Factor	Related Countries[2]
Human Resources	Relevant technical capacity of national experts/ institutions	CHL, COL, CRI, GHA, IDN
	Focus on capacity building and knowledge transfer	ETH, FIJ, GHA, GUY, IDN
Political Support	High level support from individuals	FJI, GUY, IDN, MOZ
	Alignment with national policy goals and reporting requirements	CRI, ETH, FJI, GHA, IDN
National Ownership	Will to develop an MRV system themselves	CRI, FIJ, GUY

[2] Countries have been abbreviated by their Alpha 3 Code.

Table A2.3 Support modalities observed in the case studies

Category	Support Modality	Related Countries[3]
Financial	MRV staff positions, field work expenses	ETH, GUY
	Training curricula on MRV	ETH
	Procurement of equipment	ETH, FJI, GUY, GHA, IDN
	Employment of local contractors / community monitoring staff	ETH, FJI, GUY
	Engagement of consultants	CHL, ETH, FJI, GHA, GUY
Workshops	Scoping workshops	CHL, ETH, FJI, GUY
	Knowledge transfer workshops in country	CHL, CRI, ETH, FJI, GUY, IDN, MOZ
	Knowledge transfer workshops out of country	CHL, FJI, IDN
Technical Assistance	Long term partners based in country	ETH, FJI, COL
	Long term partners remote	CRI, ETH, FJI, GHA, GUY
	Short term/discrete projects	FJI, GHA
Products	Support studies	FJI
	MRV components (e.g. NFI, FREL)	ETH, FJI, GHA
	Guidance and tools	CHL, CRI, ETH, GHA
Data access	Access to imagery	ETH, IDN, GUY, MOZ

[3] Countries have been abbreviated by their Alpha 3 Code.

Table A2.4 Identified successes

Category	Success Identified by Interviewees	Related Countries[4]
Milestones	Establishing institutional arrangements	ETH, FJI, GHA, IDN, MOZ
	Completing a National Forest Inventory	CRI, ETH
	Passing external review	ETH, FJI, IDN
	Operationalization	COL, CRI, FJI, GUY
	Payment / unlocking payments	GUY, IDN
Capacity Increase	Creation of country capacity	COL, CRI, ETH, FJI, GHA, GUY, IDN
	Creation of confidence	COL, ETH, FJI, GUY,
	Team composition	MOZ
Ownership	Creating ownership	CHL, FJI, GHA, GUY, IDN
Co-benefits	Creation of co-benefits	CHL, CRI, FJI, GUY
Competition	Wining inter-country 'competition', being first to achieve a milestone	COL, ETH, FJI, GUY, IDN
Satisfaction (with own work)	Well managed external resources	CHL
	Achieving good MRV system design	CHL
Political	Strong political support/leadership	CRI, GUY, IDN, MOZ

[4] This refers to countries were the specific point was mentioned as success by interviewees. Countries have been abbreviated by their Alpha 3 Code.

Appendix 3: Country case study reports

Chile case study

Basic country information

Continental Chile has an area of 75 M ha, located in southwestern South America. Because of its narrow but extreme length (between latitudinal lines 17°and 56°), the country encompasses a variety of climates, topography, and ecosystems across its territory (MMA, 2018). Chile is considered as an upper middle-income country with a gross national income (GNI) per capita of US\$ 15 010 (WB, 2020). In 2019, Chile´s population reached 18.9 million people, with a Gross Domestic Product (GDP) of US\$ 241 billion (WB, 2020). Although Chile has an extensive and diverse native forest, the forest sector does not contribute significantly to its GDP, representing about 3% of the country's forestry export (CONAF, 2016).

Chile submitted its Readiness Project Idea Note (R-PIN) Template in 2011 and its Readiness Preparation Plan (R-PP) in 2013. In 2018, Chile presented its Readiness Package for the Forest Carbon Partnership Facility (FCPF), and by 2019 Chile became the first Latin American country to sign an Emissions Reduction Payment Agreement (ERPA) under a results-based payment scheme (US\$ 26 million, 2019-2025). Currently, the government of Chile is working on the preparation of an updated Forest Reference Emissions Level (FREL) and their first ERPA report to the FCPF, which will be published by April 2021. The ERPA agreement focuses on 6 administrative regions (Araucanía, Biobío, Los Lago, Los Ríos, Maule, and Ñuble) which are the main contributing regions to the country's forest carbon emissions.

Forest cover

Forest lands in Chile cover a total area of 17.5 Mha which represents 23% of the national surface territory. Forest lands are comprised of 14.32 M ha of native forests (82%), 3 M ha of forest plantations (17%) and 167,600 ha of mixed forests (1%) (CONAF, 2020). Chile´s latitudinal gradient and complex physiography has generated a rich diversity of native forest, which are grouped in six main types: Equatorial Moist Evergreen or Rainforest; Tropical Deciduous Forest; Mediterranean Forests; Temperate Broad-leaved Deciduous and Mixed Forest; Warm Temperate Broad-leaved Deciduous Forest and; Coniferous Forest (YAL, 2020).

Emissions/removals from forest change and forest cover change

In 2016, Chile published its first FREL, which included five out of the six administrative regions considered in the recently signed ERPA. Lands under the FREL represents 22% of the country's total surface area and includes 41% of the total high native forest coverage (CONAF 2016). According to this FREL, annual deforestation between 2001 and 2013 averaged 6,470 ha, while for the same period afforestation/reforestation (AR) was estimated to be on average 17,020 ha per year (CONAF 2016).

Based on Chile's latest GHG inventory (included in its third Biennial Updated Report), the Land Use, Land Use change and Forestry sector (LULUCF), has been the only sector that consistently acted as a net sink since 1990. For example, in year 2016, the LULUCF sector removed – 65M tCO_2e on average, due to increments of biomass in second-growth native forests and forests plantations (MMA, 2018). This amount represents close to 60% of the sum of the CO_2e emissions from all the other sectors for that same year.

In terms of emissions and removals from REDD+ activities, Chile reports in its FREL a net annual emission of 159,826 tCO_2e yr-1 (CONAF, 2016). This amount is the result from losses from deforestation (3.45 $MtCO_2$e yr-1) and forest degradation (9.15 $MtCO_2$e yr-1), as well as gains due to carbon enhancement (-10.01 $MtCO_2$e yr-1) and carbon conservation (-2.43 $MtCO_2$e yr-1). It is important to note that the published FREL and GHG inventories are not exactly comparable considering differences in, for example, areas covered (FREL is still subnational) and periods (2013 is the last reporting year in the FREL's time series, while 2016 is for BUR3).

Key emissions drivers

Chile identifies the main precursors of forest land use/land cover losses to be forest fires, firewood extraction, use of forest for livestock and the substitution of native forests with forest plantations. Other causes that indirectly increases deforestation and forest degradation are related to failures in public policies (regulations, enforcements), unregulated markets of forest commodities (firewood), and lack of opportunities in poor rural areas. The ERPD includes a series of strategic activities to address the drivers of deforestation/ degradation, including forest fires, unsustainable forest management, livestock feeding, expansion of agriculture, farming, and silviculture (FCP, 2020).

Description of NFMS

Chile's REDD+ MRV System (National Forest Monitoring System - NFMS) was created to support the country's assessment of the contribution of its forest sector to climate change. Chile is one of the few countries that accounts for four REDD+ activities using a spatially explicit approach. Although its NFMS started focusing on a subset of administrative regions, Chile aims to transition in the future to a national coverage and to report on all five REDD+ activities (to date, only sustainable forest management has not been included).

Since its inception, the lead implementing agency of Chile's NFMS has been the National Forestry Corporation (CONAF) of the Ministry of Agriculture (MINAGRI). Specifically, it has been under the direct coordination of the Climate Change and Environmental Services Unit (UCCSA). UCCSA acts as the national focal point for REDD+ under the UNFCCC and therefore, it oversees integrating and standardizing the information and generating the corresponding reports to the UNFCCC, as well as to the FCPF. In addition, UCCSA coordinates work with CONAF's Department of Monitoring Forest Ecosystems (DMEF), which is responsible for developing a permanent public forest cadaster, the inventory of biomass and forest carbon and the Territorial Information System (SIT), together with the Forestry Institute (INFOR). INFOR, an institute within MINAGRI but not part of CONAF, is responsible for generating and providing the best possible scientific and technological knowledge on Chile's National Forest Inventory (NFI), which is central to the emissions factors estimates used by the NFMS. Thus,

Chile's NFMS takes advantage of existing tools and systems for data collection associated with land use in Chile (e.g., the NFI, SIT, the Land Registry of Vegetation Resources in Chile, the Continuous Forest Inventory, the Forestry Administration and Control System) (CONAF 2016).

The design and development of the NFMS system is framed within the 2016 National Strategy for Climate Change and Vegetation Resources (ENCCRV in Spanish), which establishes goals and specific actions and measures for REDD+. For example, the definition and implementation of strategic actions of mitigation and adaptation to Climate Change and the development of a carbon accounting and environmental metric services system that includes social and environmental safeguards, consistent with the technical-political requirements of the United Nations Framework Convention on Climate Change (UNFCCC) and the United Nations Convention to Combat Desertification (UNCCD) (CONAF, 2016).

In recent years, Chile has made important progress in the consolidation of its NFMS to evaluate the effectiveness of implemented policies and measures of REDD+ activities to comply with the ENCCRV and with the UNFCCC. In addition to the ENCCRV, the government of Chile has a Forest Policy (2015 – 2035) which aim is to enhance the conservation, integral management and the rational use and exploitation of resources, watersheds, and forest ecosystems. Thus, the two policy instruments are linked through the adoption of their strategic objectives and monitoring systems, which will ultimately contribute to the realization of Chile's Sustainable Development Goals (CONAF, 2020).

The cooperation between CONAF and INFOR in relation to the NFMS, besides the monitoring of REDD+ activities, includes providing information to the National GHG Inventory System (SNICHILE) regarding GHG emissions/removals in the LULUCF sector. However, with the aim to bring together the various institutions that conform MINAGRI and to support the development of Measurement and Monitoring System (MMS) for the LULUCF sector. In addition to the government institutes, the development of some of the key components of the NFMS and the corresponding reports, have benefited from the collaboration with the academia (e.g., Universidad Austral de Chile), foreign organizations (e.g., Winrock International), consultants from donors/supporting organizations (e.g., FAO, the World Bank), as well as consultants (paid with external funds) to support the operation of the NFMS within CONAF.

The NFMS derives activity data for land use and land use change from remote sensing. The country submitted its FREL in 2016, from five administrative regions (Maule, Biobío, La Araucanía, Los Ríos, and Los Lagos) which includes close to 6 million ha of the total national area of native forest (CONAF, 2019). The FREL considers activities or sub-activities related to land use change (REDD+, AR), and activities or sub-activities occurring in forest (fires, secondary growth, conservation). NFMS considers neutral the native forest conversion to forest plantations and carbon in plantations are not included in REDD+ accounting. New forest plantations will be included in future calculations, if these plantations are to maintain permanent coverage and be consistent with the goals set out in the Nationally Determined Contribution (NDC).

REDDcompass Building Block progress scores

It is important to recognise that the displayed scores are potentially outdated and may not represent the status of Chile's MRV system. Particularly, since recent progress has been made on the "measurement and estimation", as well as on "reporting and verification" building blocks. For example, Chile has already submitted its first FREL to the UNFCCC, and it is currently preparing an updated version which will be submitted to the UNFCCC and the FCPF by April of 2021. In addition, work is under way so that these estimates will be generated in a semi-automated system, which will focus on the scripting and archiving of the GHG estimates, as well as on the more detailed and frequent spatial information on forest land cover types. Finally, progress made to date on "non-carbon related reporting", has already allowed Chile to obtain financing to monitor environmental and social co-benefits from the Green Climate Fund. Chile was identified as being Nearly/Fully Finished in relation to the Policy Design Decisions building block, with a mixture of stages across the remaining building blocks. Institutional Arrangements were largely identified as being in the Early stage except for Forest Policy and Governance which is Nearly/Fully Finished. The remaining building blocks of Measurement and Estimation and Reporting and Verification were at a mixture of stages with some components completed (i.e. FREL, REDD+ reporting), while others identified as falling behind. Table 0.1 shows the REDDcompass Building Block Country Needs Assessment (CNA) scores for Chile.
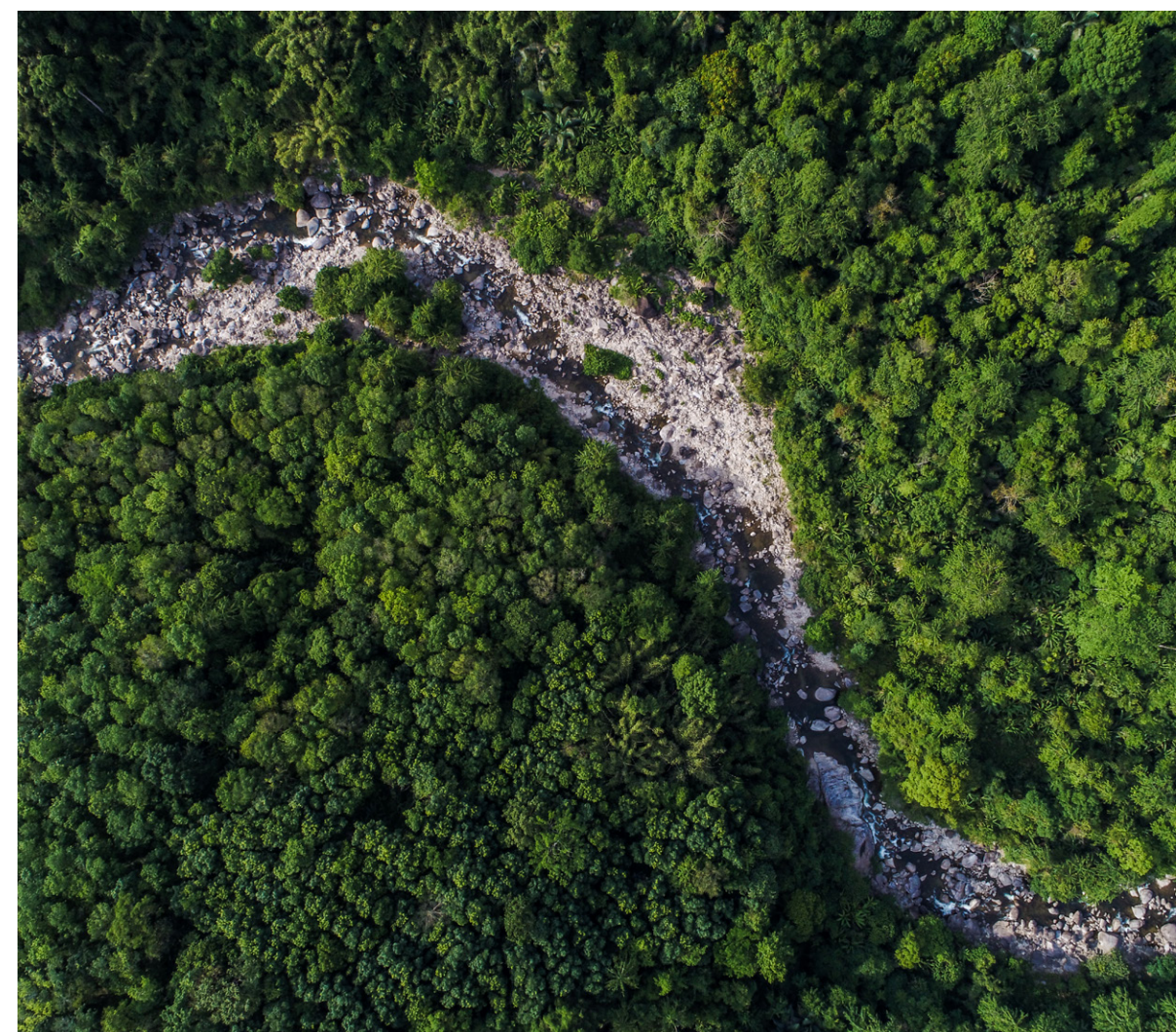
Table 0.1 REDDcompass Building Block scores

REDDcompass Building SBlock	Second Level Building Block Components	Score
Institutional Arrangements	- Forest Policy + Governance - MRV Institutions - Processes -Methods + Tools	Nearly/Fully Finished (90) Early stage (30) Early stage (30) Early stage (30)
Policy and Design Decisions	- Forest Definition - REDD+ Activities - Carbon Pools - LULC Stratification Scheme - Approaches, methods + tiers - Spatial + Temporal Scope	Nearly/Fully Finished (90) Nearly/Fully Finished (90) Nearly/Fully Finished (90) Nearly/Fully Finished (90) Nearly/Fully Finished (90) Nearly/Fully Finished (90)
Measurement and Estimation	- Remote-Sensing Observations - Uncertainty - Ground-Based Observations - Integration + Estimations - Record Keeping	Advanced (60) Fall behind (0) Nearly/Fully Finished (90) Early stage (30) Nearly/Fully Finished (90)
Reporting and Verification	- AFOLU GHG Inventory Reporting - Non-Carbon Related Reporting - Reference Emission Levels - REDD+ Reporting - Internal + External Analysis	Early stage (30) Fall behind (0) Nearly/Fully Finished (90) Nearly/Fully Finished (90) Fall behind (0)

Country needs assessment (CNA) areas identified for further support

The majority of needs were identified in relation to Measurement and Estimation, with a couple of additional needs identified for the "Policy and Design Decisions" and the "Reporting and Verification", and zero for the "Institutional Arrangements", despite that according to the interviewees opinion, the later will play a key role in terms of ensuring the sustainability of the NFMS.

Table 0.2 gives an overview of the support needs identified for Chile through the REDDcompass Country Needs Assessment.

Table 0.2 Further support needed identified in the REDDcompass country needs assessment

REDDcompass Building Block	Second Level Building Block Components	CNA sub-topics	Identified Need
Institutional Arrangements	- Forest Policy + Governance - MRV Institutions - Processes - Methods + Tools - MRV Institutions		
Policy and Design Decisions	- Forest Definition - REDD+ Activities - Carbon Pools - LULC Stratification Scheme - Approaches, methods + tiers - Spatial + Temporal Scope	Other Issues	- Case study for monitoring REDD+/ sustainable forest management
Measurement and Estimation	- Remote-Sensing Observations		- Capacity building radar data processing -Land use land cover change mapping
	- Uncertainty	Uncertainty	- Uncertainty analysis
	- Ground-Based Observations	Land Cover Maps	
	- Integration + Estimations	Integration	- Design and integration of soil carbon to the NFMS - Forest Degradation - methodology
	- Record Keeping (Documentation)	Forest Degradation	- Integration System
Reporting and Verification	- AFOLU GHG Inventory Reporting - Non-Carbon Related Reporting - Reference Emission Levels - REDD+ Reporting - Internal + External Analysis	Other Issues	-Technical support for submission/ update of FREL

REDD+ MRV Support activities and partners

Between 2015 and 2020, the SNMF received international funding aimed at the generation of specific inputs to reduce information gaps, strengthening capacity building, technical assistance, together with national financing destined mainly to the generation of basic inputs such as the Forest Cadastre and the National Forest Inventory, in addition to the management and administration of the Measurement and Monitoring System (MMS). The country has accessed funding up to US$4.4M. Of this amount, something has been provided to support the preparation of the REDD+ MRV system, while the greatest amount (US$64) has been already granted for the monitoring of social and environmental co-benefits, in addition to carbon mitigation. A summary of the financial support provided to the REDD+ MRV is shown in Table 3.

Table 0.3 REDD+ MRV support to Chile

Support Activity	Funding (US$)	Financial Instrument	Donor / financer	Support Provider	Support Mechanism
Readiness Preparation Grant	3.8	Grant	WB FCPF		Technical assistance, capacity building, others
Additional Funding for REDD+ Readiness	5 M	Grant	WB FCPF		Technical assistance, capacity building, others
Support to aligned projects towards the achievement of Chile's objectives	0.25M	Grant	ONU/REDD	FAO	SMM and ENCCRV
	1.55M	Grant	FMAM SIMEF	Government of Chile	Subnational REDD+
	0.8M	Grant	FMAM MST	Government of Chile	NFMS
	0.5M	Grant	DMEF	Government of Chile	National Registry
	0.4M	Grant	INFOR	Government of Chile	NFI
Updating FREL, data management and reporting system	0.9M	Grant	FCPF	FAO?	Technical Assistance, Capacity Building
MRV system of FCPF ER Program (2019-2025)	26 M	Program	WB FCPF		RBP
Integrated Monitoring System of Native Forest Ecosystems (SIMEF) 2015-2019	6.3 M	Grant	GEF		
Monitoring of environmental and social co-benefits	64 M	Grant	GCF	GCF	

Case Study Narrative

The role of national context in REDD+ MRV development in Chile

The NFMS system is framed within the 2016 National Strategy for Climate Change and Vegetation Resources (ENCCRV), which establishes goals and specific actions and measures for REDD+. Since then, Chile has made progress in the consolidation of its NFMS to evaluate the effectiveness of implemented policies and measures of REDD+ activities to comply with the ENCCRV and with the UNFCCC (e.g., BUR, NC, FREL). Furthermore, in 2019, Chile became the first Latin American country to sign an ERPA agreement with the FCPF, under a results-based payment scheme.

Chile's NFMS has been undertaken through existing institutions such as CONAF - National Focal Point for REDD+ under the UNFCCC, as well as INFOR, both with specialized staff on forestry issues, remote sensing, and forest inventories. Despite the various factors that have helped advanced towards the consolidation of the system, such as a strong alignment of

Chile's NFMS with key federal policy instruments, the expected economic benefits, and the progress made in both its infrastructure and specialized staff to operate and improve the system, its long term continuity is still uncertain.

Among the factors that have contributed to this uncertain situation are a mix of institutional and socio-political issues. For example, since its inception, the NFMS has been completely dependent on donor support, with no binding requirement to Chile´s government or a national mandate to develop a long-term strategy for its maintenance. In addition, Chile has a budget law that limits the federal agencies responsible for implementing the NFMS from using internal resources to hire the MRV team as permanent staff, but no efforts have been made to overcome this situation as REDD+MRV issues may not be a top priority at higher government levels.

REDD+ MRV development challenges and obstacles in Chile

Several challenges and obstacles were identified by the interviewees that are all strongly influenced by the national context. These range from institutional memory and staffing through to uncertainty of compliance requirements of the ERPA and including limited operationalization of the system.

Fragile institutional arrangements were identified as an obstacle where roles and responsibilities among the two main institutions supporting the NFMS (CONAF and INFOR) have been defined in practice, but there is no concrete mandate that ensures that the required flow of information and cooperation will be maintained permanently. Two poignant obstacles that are interrelated are insecurity of staffing and weak institutional memory. Chile's system has been developed by embedded consultants which is not an obstacle, rather labour contracts and administrative restrictions make it difficult to continue the engagement of the consultants. This then flows into Chile not having a clear transition plan once the external program funding ends.

The interrelated risk of weak institutional memory compounds the staffing obstacle, as there is currently limited documentation of key inputs, decisions, and processes. This lack of documentation is deepened by changes in key people and managers from both the country and donor sides resulting in changes in direction from previously agreed program scope and activities.

Additional obstacles were identified at the start of the development process as well as now in the ongoing operation of the process. At the outset there was high uncertainty in the design requirements to fully comply with the ERPA/Methodological Guidance, forcing additional resources and time spending to quickly adjust to potentially new methodological guidelines, while the timeline to deliver the expected products was fixed (e.g., Chile's updated FREL will be submitted by June 2021).

In terms of technical barriers to REDD+ MRV system development, the reporting on sustainable forest management has been difficult due to the lack of spatially explicit information and the high risk of double-counting under degradation or carbon enhancement. CONAF is currently exploring different approaches to account for this activity, including the use of carbon budget modelling tools to test the effect of forest management activities.

Finally, limited operationalization of the system is an obstacle as Chile moves forward, for example, the lack of familiarity from IT companies with NFMS requirements has delayed the transition from the use of Excel spreadsheets to a system of databases/scripts.

REDD+ MRV development success in Chile

The interviewees identified several important successes achieved by Chile. They considered that its NFMS design has been clearly defined since the beginning, consistent with the country's needs and available resources. Although in their opinion, this activity took a large amount of time and effort, these aspects have already been compensated as their current design has allowed them to effectively allocate resources obtained from donors to the most strategic components of the system, while easily evolving towards a more robust NFMS system as new tools and data become available.

The need to incorporate a range of data sources to their NFMS has had positive implications beyond improving the quality of the reports. For example, CONAF is organized into technical working groups (gerencias), within them is the department forest monitoring, who produces CONAF's forest cadaster. The department of forest monitoring conducts field work to validate their remote sensing products, however, their forest ecosystems definition not necessarily is consistent with the one used in the National GHG Emissions reports or in the REDD+ reports. Nowadays, there is more understanding among CONAF´s working groups on the type of information and process required to support their MRV system. In other words, the communication among different CONAF´s working groups has greatly improved over time allowing them to transition from being solely data providers towards being part of the analysis and reporting process. This process has facilitated a wider technical staff (not directly responsible for the NFMS) to become more interested on REDD+ issues and enhanced their technical capacities while developing a sense of ownership and team spirit to help consolidate the system in general.

Finally, CONAF's plan is to ensure that the same monitoring system will generate information beyond GHG emissions/removals, that is, a multi-objective monitoring system for the forest sector. In fact, the level of progress made to date has already allowed Chile to obtain financing from the FCPF for the preparation of ERPA, as well as to obtaining additional funds from the Green Climate Fund to monitor environmental and social co-benefits (in addition to forest carbon). Here, Chile already received ($64 million USD), representing more than double the amount from the FCPF.

The role of REDD+ MRV support in Chile

Donor´s support has included technical assistance, capacity building and financial resources for the procurement of infrastructure and equipment. This ongoing financial and technical support received from donors and international agencies since the beginning has also helped them to hire specialized technical staff to develop and operate the system.

The good relationship with external technical teams from the World Bank, FAO, among others, has further strengthened the capacities and experience of the Chilean team to support their NFMS implementation and to conduct continuous improvements (e.g., better data, more complex analysis). In addition, the information published by the GFOI on MRV-

REDD+ systems and the participation in South-South collaboration activities has also been important to enrich the technical discussion within the Chilean team to define the next steps they want to implement as part of a continuous improvement plan of their system.

All the aforementioned support has helped Chile to create and advanced NFMS relative to many other countries in the Latin American region. However, some areas of improvements for future support include more clarity or continuity in the discussion of, and training on, new estimation and operation approaches that are promoted through workshops and courses (e.g., standard operating procedures, integrated modelling approaches). In addition, it would be beneficial to improve the communication with donors about what the training priorities are or about their availability to provide continuous support to countries, when they have staff full of activities. This puts at risk what countries must achieve with the donation received, including many technical issues that cannot be resolved, slowing down the development of the system.

Interviewees' perspectives on future MRV support

Based on the interviewee's opinion, future assistance needs include aspects in three main areas: political support, measurement and estimation, and reporting and verification. Despite the forthcoming financial resources, there is no certainty on how the NFMS will be maintained in the long-term. Thus, it will be crucial that the Chilean technical staff and levels above within CONAF enhance their ability to better communicate the relevance of the NFMS within the government's agenda against climate change. Particularly, since the country is not obligated to reduce emissions from the forest sector nor there is a federal law that could help consolidate the MRV system.

Concerning measurement and estimation, support is needed for reporting on sustainable forest management. This is important given the lack of spatially explicit information which increases the risk of double-counting under degradation or carbon enhancement. Also, support is required to address proper nesting of the REDD+ activities to address the political pressure from private landholders to use the MRV systems to claim mitigation benefits. While the government will have to advance in the political context about the carbon credit ownership rights, the NFMS system will have to be able to provide detailed and transparent information at multiple spatial scales as these national policies and legislation evolve.

Support will continue to be needed towards the use of platforms/database systems, to allow for greater transparency and efficiency through the automatization of the calculation process for carbon and non-carbon indicators (social and environmental co-benefits).

Finally, from the interviewee's perspective, it is essential to clarify, as soon as possible, the guidelines that will be adopted for verification on the emissions reductions under the FCPF.

Conclusions

REDD+ MRV system improvements' needs identified by interviewers include development of cross-cutting institutional technical capacity building at national level, in order to better and effectively integrate it to governmental planning. The MRV system has been undertaken through existing institutions such as CONAF (National Forestry Corporation) - National Focal

Point for REDD+ under the UNFCCC, as well as the entity responsible of Chile's NFMS and INFOR (Forestry Institute).

The good relationship that Chilean staff has with the technical teams of the World Bank, FAO, and others, has further strengthened the capacities and experience of the MRV-REDD+ team. The financial support received from donors has allowed to form a specialized team of technicians to develop and implement Chile's MRV system for REDD+. The country support has allowed CONAF to directly coordinate the hiring and selection of the workgroup (with donors´ approval). CONAF's plan is to ensure that the same monitoring system will generate information on the impact of actions implemented on the land, not only in terms of GHG emissions/removals, but in terms of their impacts considering other environmental and social co-benefits (e.g., decrease in soil loss, regulation of water balance, cultural identity, employment, etc.).

It was stated that support for the development and maintenance of the MRV system to assess the impact of REDD+ activities might be considered by the country as an expense, while reporting of National GHG emissions inventory has more political weight. Thus, personnel appointed from external institutions/donors does not have sufficient prior information on monitoring and reporting REDD + activities, making reporting on sustainable forest management difficult due to the lack of spatially explicit information (high risk of double-counting under degradation or carbon enhancement) and capacity of data analysis. To date, the MRV-REDD+ system focuses on six administrative regions, with high native forest coverage. However, the country aims to transition in the future to a national FREL. Changes in staff, limited documentation of key inputs, decisions, and processes of the MRV system, must be done in a transparent way - not always everything is documented. The lack of permanent technical support may cause the expected results with the MRV system not to be achieved, particularly when some of the guidelines that will be used to assess the results generated with the system are still unknown.

Key lessons

Institutional embeddedness and mandate to perform / system governance (staffing, leadership, direction)

In addition to the lack of institutionalization of the personnel operating the MRV system, a great challenge has been the transfer of information (institutional memory) when managers change on either side, donors or CONAF. This implicates on technical team receives demand to change the course of activities, even when there was prior agreement and progress towards early ones.

Policy and design decisions

Based on our interviews, the most important factor that have allowed the progress that Chile's MRV system has today is a clear system´s design. Being clear about the design and scope of the MRV-REDD + system has allowed Chile to allocate in a more efficient way the financial resources obtained by donors. Direct financing to CONAF by agencies such as the World Bank has been crucial to both, maintaining a specialized technical team within the

institution, and enhancing capacity building (e.g., technical advice, training workshops, etc.). The interviewees recognized that once funds are secured, it is critical to spend sufficient time on the design part of the system. For example, at this moment the team in Chile is working towards the transition of a database system that allows transparent review and publication of data. This process is relatively recent since many of the calculations in the previous reference level were conducted using Excel spreadsheets.

The interest shown by the staff in making continuous improvements to the system has also been key. For example, not limiting the system to a simple representation of the dynamics of one type of native forests but moving towards a better representation of the diversity of forests in Chile, will make the system more robust and useful to national policies (e.g. ENCCRV). Other examples of the relevance of the system's design, that have also favoured obtaining additional funding to support the MRV-REDD+ development, is that the same infrastructure used to generate Chile's FREL for the FCPF, has helped to support the monitoring of social and environmental co-benefits in accordance with the Green Climate Fund ($64 million of USD).

In addition, the good relationship that the Chilean staff has with the technical teams of the World Bank, FAO, and others, has further strengthened the capacities and experience of the MRV-REDD+ team. The willingness to support training of the staff has been key to ensuring that the development of the system improves according to new requirements for monitoring and reporting REDD + activities. It has also been important to have close and clear communication with the donor parties.

Measurement and estimation

The thinking on REDD+ MRV scope and direction has been evolving together with the tools available to improve the system. Today there is more interest in achieving a better representation of the different types of forests that exist in Chile (greater disaggregation of forest cover and forest structure), as well as their dynamics (e.g., more interest in depicting different types of forest degradation), while at the same time the goal is to optimize the integration of the more complex information and the generation of results (e.g., use of platforms).

Reporting and verification

From the interviewees perspective regarding countries participation in programs such as the FCPF, it is not useful to have a date for delivery of the reference level, after which it is not allowed to include any of the advances that are available in the country in terms of methodological or technological approaches. Perhaps it would be convenient to ask the country to carry out an impact analysis of the improvements, to evaluate how best to include the technical updates.

Political support / sustainability of the system (financial and human resourcing / staff capacity)

The interviewees considered that because the country is not obliged to comply with commitments of emissions reductions from the forest sector, results in a lack of interest in maintaining the MRV system (including its staff). It is not seen as a benefit or priority within the government's agenda against climate change, nor there is a federal Law could help consolidate the MRV system as a crucial component to support national policies such as Chile's ENCCRV.

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Colombia case study

Descriptive information

Basic country information

Colombia is an upper-middle income country with per capita GNI $3,956 - $12,235 in 2016 (OECD, 2020[6]), it is noted as being highly vulnerable to climate change with an Intended Nationally Determined Contributions (INDC) that is ambitious and equitable (Gov. of Colombia, 2020). The country signed the Paris Agreement on 22 April 2016 and ratified it in June 2017. In December 2015, Colombia presented an initial Forest Reference Emission Levels (FREL) included in the process for obtaining payment for REDD+ results under the UNFCCC (Gov. of Colombia, 2020).

Forest cover

The country has a land mass area of 1,141,748 km^2 (114 million ha) and forested cover area of 58,501 km^2 (58,5 million ha) (Gov. of Colombia, 2020 [7]). It is currently progressing with new national development plan, with policies to combat deforestation and Green Growth Policy Directive from the National Council on Economic and Social Policy (CONPES). The approach taken is based on a participatory process to incorporate inputs from indigenous peoples, Afro-Colombians and supports the implementation of Colombia's joint declaring of intent (JDI) with Norway, the UK, and Germany (Gov. of Colombia, 2020).

Emissions/removals from forest change and forest cover change

The annual rate of deforestation was just under 220,000 ha / year in 2017, and nearly 197,000 ha / year in 2018 (IDEAM, 2019), with an assessed FREL of 52 million tCO$_2$e/year reported by the Forest and Carbon Monitoring System (SMByC) (IDEAM, 2020). According to the information generated by the Colombian Hydrology, Meteorology and Environmental Studies Institute (IDEAM), deforestation produced estimated GHG emission of 224 MtCO$_2$e / year in 2015. The second Biennial Update Report (BUR) was submitted to UNFCCC, which included the technical annex for assessing the 2015–2016 REDD+ results in Amazon biome (46 million ha – 40% of the territory and 67% of total forest land (FCCC/SBI/ICA/2019/TATR.2/COL). Their National Greenhouse Gas Inventory is prepared according to the IPCC 2006 Guidelines and includes agriculture, forestry and other land use (AFOLU) sector in its economy-wide target. An aggregated analysis was then conducted to estimate the sectorial emissions projection at a national scale (Gov. of Colombia, 2020). The SMByC generated emission factors and activities, used to establish FREL for the Amazon biome, have been based on aerial and sub-terranean biomass calculations with emission factors per forest type using floristic inventories.

Key emissions drivers

In Colombia, at the national level, the main drivers of deforestation are the expansion of the agricultural land and livestock (small-scale and agro-industrial), the expansion of infrastructure (mainly roads) and extractive activities (e.g. extraction of minerals and hydrocarbons, logging), performed both legally and illegally. This also includes coca plantations and alluvial gold mining activities (FCPF, 2017) (IDEAM, 2019).

Description of NFMS

The two public institutions responsible for MRV of REDD+ activities are the Ministry of Environment and Sustainable Development (MADS) and IDEAM, which established the organization of the National Climate Change System [Sistema Nacional de Cambio Climático] (SISCLIMA), framing the formulation of National Climate Change Adaptation Plan (NAP) and REDD+ (FPCF, 2017). SMByC provides processes, methodologies, protocols, and tools for on forest cover and forest-cover change monitoring, estimations of carbon stocks in natural forest, and emissions and removals of GHGs related to deforestation and forest degradation. IDEAM has overall responsibility for the operation of SMByC and the National Forest Inventory NFI, including its administration, coordination, and operation (FCCC, 2020). The EDA component published the localization and dynamics of active nuclei of deforestation at national level covering 25 years of monitoring (1990-2015) of 6 million ha.

The NFMS is based on an approach that includes a national system, covering the subnational Amazon biome, and produces semi-automatically estimates comparing imagery with two-year periods (1 ha). This is designed to adhere to tier 2 from 2006 IPCC Guidelines and the IPCC good practice guidance for LULUCF (FCCC, 2020). It was implemented with support from UN-REDD Programme, which strengthened the technical capacities of the IDEAM and its partner organizations for effective implementation and monitoring. The system operates using four components generating: 1) early deforestation alerts – EDA; 2) annual quantification of the surface area covered by forests and deforestation; 3) characterization of the causes and agents of deforestation; and 4) carbon monitoring. The country has improved characterization and quantification of emissions and removals in AFOLU/LULUCF sector and developed a concept for REDD+ that enables multiple benefits, with tools and information for decision-making, as well as inputs for terrestrial management planning (FCPF, 2017). The BAU scenario is based on deforestation trends under post-conflict scenarios.

Given the significant share of AFOLU emissions in the national emissions profile (about 58% of the total), REDD+ has huge potential to contribute to the stabilization of greenhouse gases in the atmosphere. Colombia FREL is 51,6 M tCO_2e against which REDD+ results have been measured, reported and verified: 13,5 M tCO_2e (2013); 15,4 $MtCO_2$e (2014); 19,4 $MtCO_2$e (2015) and; 12 $MtCO_2$e (2016) (UNFCCC, 2020), which gave access to some USD 391M of approved international funding on Grants and RBPs. Recently, the Green Climate Fund has offered $28 million to help finance the existing REDD+ programme (FAO, 2020). Norway, the UK, and Germany have committed to provide finance conditional on donors delivering results, and USD 360million to Colombia in the framework of two agreements: 1) to support the implementation of the Amazon Vision, and to 2) achieve the goal of zero net deforestation in this region by 2020 (García Arbeláez et al., 2016) In addition to supporting SDG 13 on Climate Action, UN-REDD Programme support in Colombia has contributed to

SDG 5 (Gender equality), and SDG 8 (Decent work and economic growth). Program support for sustainable production models, including capacity development for sustainable cattle ranching as well as environmental and social risk management for the financial sector, also encourages the achievement of SDG 12 (Responsible consumption and production) and SDG 15 (Life on Land) (UNREDD, 2020). Under the provisions contained in decision 12/CP.17, paragraph 9, Colombia adjusted its proposed FREL upwards by 10 per cent compared with the historical average emissions for 2000–2012 in order to take into account national circumstances affecting historical deforestation (FCCC/SBI/ICA/2019/TATR.2/COL, 2020).

IDEAM and MADS identified needs in regards to a continued ability to generate Early Deforestation Alerts (6 month) and rate of deforestation (yearly), develop the NFI, progress towards formalizing the system via a regulatory instrument, integrate the actions of community forestry monitoring on national level, and strengthen the mechanisms for circulating information (FCCC, 2020). Mitigation under the REDD+ Strategy includes providing technical inputs for the REDD+ and, additionally, for the formulation of the National Policy to Combat Deforestation as well as the need for establishing synergies with policy instruments such as the Comprehensive Climate Change Plans (Planes Integrales de Cambio Climático; PICC), the Sector Action Plans (Planes de Acción Sectorial; PAS) of the Colombian Low-Carbon Development Strategy (CLCDS), as well as investments for post-conflict. This strategy also includes producing subnational strategies, such as Amazon Vision, and the related regional and local development instruments. Specific activities in the sectoral context tend to aim at controlling or reduce deforestation and this fall under the authority (partially or totally) of MADS, and is based on the assignment of responsibilities according to the ministerial portfolios worked on for the NDCs and their goals of reducing GHG emissions by 2030. Currently there is a preliminary portfolio with 143 measures grouped into 9 categories, that are coordinated with the strategic options proposed in Colombia's R-PP. The document along with the sectorial and territorial measurement portfolios are being developed by IDEAM with MADS and other stakeholders (NDC CLUSTER, 2020).

REDDcompass Building Block progress scores

Colombia is one of the countries that has been assessed by the FAO, World Bank, and SilvaCarbon MRV experts against each theme of the REDDcompass. Activities against the theme have been appraised and given a score based on achievement to date. The score presented results (0-30% Early Stage; 30-60% Advanced; 60-90% Nearly Implemented; 90-100% Fully Implemented), reflecting where the country is or is expected to be at the end of current readiness phase. The results on Measurement and Estimation and Reporting and Verification are described at the Table 4:

Table 0.1 REDDcompass Building Block scores

REDDcompass Building Block	Second Level Building Block Components	Score
Institutional Arrangements		
Policy and Design Decisions		
	Spatial + Temporal Scope	Nearly / Fully Implemented
Measurement and Estimation	Remote-Sensing Observations	Nearly / Fully Implemented
	Uncertainty	Nearly / Fully Implemented
	Ground-Based Observations	Early Stage
	Integration + Estimations	Advanced
	Record Keeping	Advanced
Reporting and Verification	AFOLU GHG Inventory Reporting	Nearly / Fully Implemented
	Non-Carbon Related Reporting	Advanced
	Reference Emission Levels	Advanced
	REDD+ Reporting	Nearly / Fully Implemented
	Internal + External Analysis	Advanced

At the time of the assessment. The country REDDcompass Building Blocks have been identified in this assessment as all being advanced to nearly fully implemented, with the exception of Ground-Based Observations.

Country needs assessment (CNA) areas identified for further support

To inform the in-country activities, the Country Needs Assessment (CNA) produced an evaluation of the necessary interventions needed to cover gaps—that is, the work packages. A regional workshop specific to tools to support National Greenhouse Gas Inventories in the AFOLU sector was held in 2019 with participation of relevant stakeholders in Colombia This identified the support needed to cover REDD+ interventions, and is outlined in Table 5:

Table 0.2 Further support needed identified in the REDDcompass country needs assessment

REDDcompass Building Block	Second Level Building Block Components	CNA sub-topics	Identified Need (E.g Ethiopia Example)
Institutional Arrangements	- Forest Policy + Governance - MRV Institutions - Processes - Methods + Tools		
Policy and Design Decisions	- Forest Definition - REDD+ Activities - Carbon Pools - LULC Stratification Scheme - Approaches, methods + tiers - Spatial + Temporal Scope		
Measurement and Estimation	- Remote-Sensing Observations - Uncertainty - Ground-Based Observations - Integration + Estimations - Record Keeping (Documentation)	- Land cover maps - Area Estimation - Activity Data - Forest Degradation - Biomass - Other	- Capacity building SEPAL (for land cover maps) - Activity data estimates - Forest Degradation methodology - Forest Biomass gains]
Reporting and Verification	- AFOLU GHG Inventory Reporting - Non-Carbon Related Reporting - Reference Emission Levels - REDD+ Reporting - Internal + External Analysis		

CNA from Colombia identifies further support needed to build capacity on land cover maps and identified: activity data estimating, forest degradation methodology development and forest biomass gains measuring.

REDD+ MRV Support activities and partners

For implementing REDD+ MRV systems, funding has been provided in forms of grants and technical assistance of RBP, following the implementation activities phases. The country has accessed funding up to USD 391M, with the follow focus in Colombia (Table 6).

Table 0.3 REDD+ MRV support to Colombia

Support Activity	Funding (US$)	Financial Instrument	Donor / financer	Support Provider	Support Mechanism
Support to aligned projects towards the achievement of the Colombian objectives	55M	Grant	Germany	REM Program	Amazon Vision
		Grant		National System of Protected Areas	Consolidation
		Grant		PROBOSQUE	Technical Cooperation
		Grant		IKI	Bilateral management of ecosystems
	51M	Grant	Norway	REDD+	Chapter II Joint Declaration
	25M	Grant	UK	Biocarbon Fund and Partnership for Forests	
Achieved emission reductions	260M	RBP	Germany and UK	REDD+	Verified reductions
		RBP	Norway	REDD+	US 10/tCO$_2$e up to NOK 400M/year (2025)

Germany, Norway and the UK Grants reached USD 131M and RBP from achieved emissions reductions funds of US$ 260M.

Case study narrative

Colombian Government progressed on developing a National Forest Inventory (NFI) and designing outreach instruments, with a diagnosis and recommendations for NFMS (regulated and running with a platform),defining and updated their Forestry Monitoring Programme to include community forestry monitoring and deforestation early alerts. Regional PMAs will be defined based on the results of the strategic environmental and social assessment, and programs under development to reduce deforestation, such as Amazon Vision, under the REM pay scheme, and sustainable forest landscapes, being carried out by the BioCarbon Fund (FCPF,2017).

SMByC is a national forest and carbon monitoring system (national FREL), which covers the whole country and is making efforts to create a module to detect displacement of emissions. Improvements on emission estimation include quality assurance and quality control procedures, consistency between the FREL and the GHG inventory, coverage of carbon pools, treatment of non-CO$_2$ emissions, include forest degradation, additional pools and improving estimation of forest carbon stocks adjusted for national circumstances of Amazon biome disaggregated by strata (FCCC, 2020).

Colombia requires the development of enabling measures that facilitate, in accordance with national circumstances, the creation of institutional, technical and operational conditions necessary to facilitate the specific design and support of demonstrative activities that enable the transition towards the implementation of REDD+, as well as an adequate follow-up,

monitoring and reporting. The enabling measures will be necessary in order to implement and evaluate the effectiveness of the different instruments, tools and management schemes developed within the framework of the REDD+, through the development of implementation pilots in active deforestation nuclei in each biogeographic region (Pacific, Andean, Caribbean, Orinoquía and Amazon), emphasizing the measures and actions with the greatest impact on the behaviour of deforestation.

Institutions and REDD+ MRV

FREL/FRL

In 2014 the interinstitutional relationship developed around the FREL/FRL presented by Colombia resulted on a national strategy for forest conservation - Bosques por la vida / Vision Amazonia. The Ministry of environment and sustainable development (MADS) has a major role at REDD+ MRV, with other ministries involved with deforestation vectors or drivers also supporting and engaged. The development of an integrated strategy to control deforestation (Bosques territorios de vida) began in 2018, structured so that each government institution could generate specific activities to begin to participate in activities to control deforestation. IDEAM is responsible to generate the monitoring and early warnings. Three main actors identified:

1. Ministry of Environment and Sustainable Development (MADS): Leads the Integral Strategy for Deforestation Control and Forest Management

2. Ministry of Defence and Attorney General's Office: Several causes of deforestation are due to illicit activities (illicit crops and mining), grassland (illegal land grabbing, land speculation and illegal appropriation). These institutions are in charge of combating the proliferation of these illegal activities

3. Specific work route with ethnic communities: Indigenous and Afro-Colombian population. Establish mechanisms that allow the generation of specific activities in the medium and long term to avoid deforestation

REDD+ MRV development successes in Colombia

REDD+ MRV and vision amazonia

Since 2014 the first FREL/FRL for the Amazon forest has come from Colombia, which has made the country accepted for joining negotiations for RBP for REDD+, with the first big program Vision Amazonia[8]. There is a 2nd level of reference FREL/FRL produced in 2020, evolving from subnational to national REDD+, now looking into integrating other LULUCF/AFOLU within the estimates. This change is being incorporate into REDD+ MRV system monitoring with a landscape or territorial approach.

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8 It is an initiative of the government of Colombia that, with the financial support of the Kingdom of Norway, the United Kingdom of Great Britain and Northern Ireland and the Federal Republic of Germany through the KfW bank, seeks to reduce emissions from deforestation in the Colombian Amazon, through a sustainable development model, which promotes strategies for forest protection and sustainable use of natural resources , while empowering local communities and indigenous peoples by generating developmental and productive alternatives low in deforestation.

Over the years the system has been improved to generate more accurate data, for baseline and monitoring, and improving the speed of reporting. Initially there was a lack of staff and technology to increase scope, so efforts were focused on regions of the Amazon with the largest deforestation rates. Technical developments and methodologies were standardized and got better over the years, the level of imagery processing and algorithms for semiautomatic review and information now available has been improved.

Technical developments

Technical developments generated better conditions for early reporting of deforestation and better monitoring, which allowed the inclusion of further regions, after initially starting with the Amazon. This also supported acquiring better value of deforestation estimation and reducing error (between 7.5% -11%) by quality assurance with semiautomatic data.

REDD+ MRV development challenges and obstacles in Colombia

Sectoral approaches

Other ministries projects and developments affecting degradation and deforestation must be involved so to have a guideline for working with communities within forest ecosystems, including approaching gender and poverty issues with socioeconomic safeguards.

Learning-by-doing process

Nobody really knows how to develop and implement MRV systems with the large complexity on a country level scope, making it a learning-by-doing process. Information is a particularly important factor, so having periodic updates is key to monitor deforestation and GHG emissions associated. The High uncertainty associated to semi-automated methods require field validation work which must be done to verify the information generated and its reliability.

Targeting of investments

Investments need to be directed towards improvement of information to include further carbon pools or reservoirs with lower uncertainty, taking advantage of the National Forest Inventory NFI to be finished in 2021 (COVID-19 delays included). There were some investments made to support law 1447/2018 – RENARE implementing, which does not work properly with the FREL/FRL, hence reducing the usefulness and value of those investments. Since most deforestation is illegal, zoning of regions to have actions directed to priority areas is necessary, which will improve efficiency of money used to fight deforestation according to levels of pressure observed. Some deforestation is legal, involving other ministries development projects with no clear action against deforestation, and their impact needs measuring and compensation.

Overestimation of project level credits under national REDD+ MRV

Estimates from national REDD+ MRV were applied to measure carbon benefits generated from private projects, portraying baseline and quantification resulting on overestimates of total credits volume. The project analyzed has generated a major overestimation of REDD+ credits which does not fit within national FREL/FRL.

Capacity gap

Obstacles involve having technical capacities to generate data and information with high quality and incorporate AFOLU sectors Emissions factors, while other land uses need better imagery and more sensitive equipment to evaluate factors. Field validations require investments to assure indirect methods are accurate and skilled professionals are necessary to perform these tasks. Colombia needs to include more carbon pools, and for that need more skills and capacity building, for completeness of accounting. NFI (2021 to be finished) is being developed to comply with this demand for further pools inclusion, with large investments and time involved. Change in governments and staff has posed some challenges for continuity and rapid response, as well and monitoring of implementation success of on-going REDD+ projects, especially regarding safeguards.

The role of REDD+ MRV Support

Funding makes it real

Bilateral support was responsible for REDD+ MRV up to 2017 (Norway, UK and Germany), and today's payment is based on former FREL/FRL for the Amazon region, currently moving towards a national one. The media influence by advertising data has generated public pressure and resulted in further development of the REDD+ MRV system. With peace process implementation involving the FARC, deforestation rates exploded over the country, with new land open for development – a further evidence of the necessity of having a national system operative and with short term response.

The role of national context in REDD+ MRV development

The country's NDC target aims to reduce GHG emissions by 20% compared to BAU scenario by 2030 or by 30% if international support is provided, with exploration of market instruments envisaged and the LULUCF sector included within an adaptation component builds on National Adaptation Plan (PNACC) (NDC CLUSTER,2020). MADS national policy to combat deforestation contain an action plan aimed at preventing natural forest loss by 2030 and creation of the National Registry on REDD+ for RBP or similar compensation. Sixty local initiatives received technical information thanks to UN-REDD programme support, as part of IDEAM Participating Community Monitoring project. Gender equality is specified as one of the guiding principles and considerations on gender and women's empowerment are integrated into the activities (FPCF, 2017).

The UN-REDD Programme, alongside its partners, supported Colombia National REDD+ Strategy in the Ministry of Environment and Sustainable Development's (MADS) forestry and REDD+ goals. Colombia has developed its system over longer term compared with other countries, since 2010 it has received funds from the Moore foundation[9] and established carbon monitoring system, started focusing on monitoring data and currently is updating to semi-automatic method for analyzing carbon balance from satellite imagery with high resolution, based on a forest classification of strata with a mosaic of forest classes observed every 15 days.

Large programmatic approaches can generate specific frameworks for monitoring which avoid bias from specific areas or sites information on GHG emissions or biomass volume. For example, there are projects that investigate maximizing their results by applying standards which are not develop for their situation – located at low impact regions which does not have any deforestation or degradation pressure. Benefit sharing with large programs also generate conditions to make resources available to reach remote communities in helping to conserve forests traditionally. IDEAM (Institute of Hydrology, Meteorology and Environmental Studies) makes final reports, but in the Amazon vision there is participation of nesting Autonomous Regional Corporations (CARs) with regional institutions.

Interviewees perspectives on future MRV Support

Colombia needs to include its REDD+ MRV system within official government budget, because international dependence makes the work challenging; there is a tax from 2017 on carbon emissions generating money to invest - availability of funds and adequate staff trained to operate the MRV system is a must. With resources available it generates positive impacts and the necessity of strengthening the MRV system by the government, including by the RENARE[10] (National Registry of CO_2 Emissions Reductions) – to validate transactions with carbon and REDD+. Technical investments are also needed on semi-automatic monitoring and reporting, generating accountability regulatory framework for REDD+.

Vison Amazonia, Biocarbon and private projects can be good for long term sustainability, but accounting must be accurate to avoid double counting and assure permanence of market systems. Money is needed to generate information that identify specific responsibilities for each sector on deforestation, to develop specific indicators to measure their impacts and design compensatory payments for REDD+ efforts - RBP. Furthermore, development of Zero-deforestation production chain agreements and certification can be implemented - oil palm, beef, - on a voluntary basis to help strengthening REDD+. Involvement of local communities in monitoring, with a national guideline and framework, would help enforcing barriers against degradation and deforestation. Colombia should keep large programmatic approaches in place (Amazon vision, Savannah), to generate RBP including all AFOLU sectors.

Conclusions

Colombian Government progressed on NFI and developing outreach instruments, with a diagnosis and recommendations for NFMS (regulated and running with a platform) and defined and updated Forestry Monitoring Programme to include community forestry monitoring and deforestation early alerts. The SMByC is a national forest and carbon monitoring system (national FREL), which covers the whole country and is making efforts to create a module to detect displacement of emissions. Over the years the system improved to include more ecosystem and generate more accurate data, for baseline and monitoring, resulting on having reports outputs produced quicker. Initially there was a lack of staff and technology to increase scope, so the efforts were focused on Amazon region, with the largest deforestation rates. Since 2014 the first FREL/FRL for the Amazon come from Colombia, which has made the country acceptable for joining negotiations for RBP for REDD+, with the first big program Vision Amazonia.

Colombia requires the development of enabling measures that facilitate, in accordance with national circumstances, the creation of institutional, technical and operational conditions necessary to develop the specific design and support of demonstrative activities that enable the transition towards the implementation of REDD+, as well as an adequate follow-up, monitoring and reporting.

Nobody really knows how to develop and implement MRV systems with large complexity for a country level scope, is a learning-by-doing process. It is hard to have technical capacities to generate data and information with high quality and incorporate AFOLU sectors Emissions factors, while other land uses need better imagery and more sensitive equipment to evaluate factors.

Colombia needs to include the REDD+ MRV system within official government budget, because international dependence makes the work challengeable and there is room for it, with a Carbon Tax from 2017 on carbon emissions generating money to invest on REDD+. Vison Amazonia, Biocarbon and private projects can be good for long term sustainability, but accounting must be accurate to avoid double counting and assure permanence of market systems and generate information that point specific responsibilities for each sector on deforestation. Bilateral support was responsible for REDD+ MRV system up to 2017 which is currently being updated to generate figures from subnational to national REDD+ scenario. Best investment is the programmatic scheme, when you have a major area and can control data and information better than at local projects.

Key lessons

Investments in capacity building and satellite imagery analysis technologies at IDEAM are making the semi-automatic system for detecting deforestation and forest degradation a reality. Funding to further develop REDD+ MRV skills to implement and operate the system can make the process of monitoring and reporting faster and support decision-making on time to reduce drivers direct and indirect effect on deforestation and forest degradation. Currently the timing between detection and response takes longer than necessary and reporting occurs when the damage is done.

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9   https://www.moore.org/
10 https://www.minambiente.gov.co/index.php/noticias-minambiente/-4497renare-plataforma-para-registrar-reducciones-gases-efecto-invernadero

Funding is needed to support system sustainability, with most of it coming from international sources, with no specific budget from the Colombian government. To further enhance sustainability of the MRV system, the country should work on having dedicated personal on official budget. With official recognition of REDD+ MRV system as part of governmental budget, dedicated staff can be allocated and long-term sustainability established, facilitating the process of semi-automatic detecting, and reporting on deforestation and forest degradation. Currently staff at REDD+ MRV system is coming from other functional areas within the government or are hired consultants.

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Costa Rica case study

Descriptive information

Basic country information

Costa Rica is an upper middle-income country that has experienced steady economic expansion over the past 25 years, based on openness to foreign investment and gradual trade liberalization (WB, 2020). Costa Rica has a population of 5 million people and a land surface area of 5.4 million ha of which 27,4% are forested protected areas. The national FREL/FRL includes the country's continental territory (5,1M ha), but excludes Coco Island (238,500 ha).

Costa Rica submitted its Readiness Plan Idea Note and was accepted into the FCPF in 2008. The Readiness Preparation Plan was submitted in 2011, had its mid-term review in 2015 when its Readiness Package was approved (FCPF, 2020).

Costa Rica's Climate Change National Strategy includes mitigation and adaptation, and a National-level Carbon Neutrality goal, creating a domestic carbon market catalyzing emission reduction, ratified in its Intended Nationally Determined Contribution (INDC) to the UNFCCC. Costa Rica's National REDD+ Strategy includes six new forest policies (Promoting low carbon production systems, prevention and control of land use change and fires, Incentives, landscapes and ecosystems approaches, indigenous and gender) were designed to complement the current National Forestry Development Plan and its 12 forest policies, reflected in Costa Rica's draft Emission Reduction Program (ER-Program) before the FCPF Carbon Fund. All sectors have been proactive in seeking a low-carbon economy and in securing international finance to promote green development. Several Nationally Appropriate Mitigation Actions (NAMA) are being developed and the Coffee NAMA is already operational. Plans and project documents exist for NAMAs in the energy and agriculture sectors, LULUCF and a National REDD+ Strategy (MINAE, 2015).

Forest cover

According to Global Forest Watch, in 2010, Costa Rica had 3.78Mha of natural forest, extending over 76% of its land area. Historically, the country has operated its national system of protected wilderness areas (ASPs) and its environmental services payment program (PSA), which together cover 35% of the country and 70% of forests. As a result, the forestry sector is a net sink for carbon dioxide (MINAE, 2015)

Emissions/removals from forest change and forest cover change

Costa Rica's original FREL/FRL included emission reductions from carbon dioxide (CO_2) emissions and removals associated to changes in carbon stocks in above and below ground biomass, dead wood (DW), litter (L) and Harvested wood products (HWP). The modified submission excludes HWP. From 2001 to 2019, Costa Rica lost 245kha of tree cover,

equivalent to a 6.3% decrease in tree cover since 2000, and 85.6Mt of CO_2 emissions (Global Forest Watch). Net forest area is increasing in Costa Rica due to a combination of decreasing levels of deforestation alongside increasing areas of secondary forest recovery (MINAE 2019).

Key emissions drivers

Numerous drivers of forest change (both deforestation and forest regeneration) are included in the modified FREL submission to the UNFCCC. The two most important being agriculture and tourism.

Description of NFMS

Costa Rica's NFMS includes a measurement function, which includes analysis of activity data and estimation of Emission Factors; a FREL; and National GHG inventory. REDD+ activities in its national strategy are monitored biannually, led by the Ministry of the Environment and Energy (MINAE). The National Meteorological Institute (IMN) is responsible for the National Greenhouse Gas (GHG) Inventory while the National System of Conservation Areas (SINAC) recently completed the first National Forest Inventory (NFI). MINAE assigned the coordination of the development of the NFMS to the National Center for Geo-Environmental Information (CENIGA), which is MINAE's depositary of all official environmental information (MINAE, 2015).

REDDcompass Building Block progress scores

The results from 11 assessed indicators, portray Costa Rica as nearly fully implemented regarding internal and external analysis, with five advanced, four early stage and one falling behind indicator. Overall, Costa Rica is scored as advanced in the development of the REDDcompass Building Blocks (Table 7).

Table 0.1 REDDcompass Building Block scores

REDDcompass Building Block	Second Level Building Block Components	Score
Institutional Arrangements		
Policy and Design Decisions		
Measurement and Estimation	Spatial + Temporal Scope	Advanced
Measurement and Estimation	Remote-Sensing Observations	Advanced
Measurement and Estimation	Uncertainty	Early Stage
Measurement and Estimation	Ground-Based Observations	Advanced
Measurement and Estimation	Integration + Estimations	Early Stage
Measurement and Estimation	Record Keeping	Advanced
Reporting and Verification	AFOLU GHG Inventory Reporting	Advanced
Reporting and Verification	Non-Carbon Related Reporting	Early Stage
Reporting and Verification	Reference Emission Levels	Early Stage
Reporting and Verification	REDD+ Reporting	Fall Behind
Reporting and Verification	Internal + External Analysis	Nearly / Fully Finished

Country needs assessment (CNA) areas identified for further support

Costa Rica participated in a regional workshop to generate its country needs assessment in 2019. Areas identified for further support all fall within the Measurement Building Block and include: Land Use Change Map, Activity Data/estimates, a Platform for NFMS, working on Emissions Factors, forest degradation with satellite imagery, Forest Emissions Tool adjustments, Biomass mapping, Forest Gains accounting, Forest losses and gains annual change monitoring (Table 8).

Table 2 Further support needed identified in the REDDcompass country needs assessment

REDDcompass Building Block	Second Level Building Block Components	CNA sub-topics	Identified Need
Institutional Arrangements	-Forest Policy + Governance		
	- MRV Institutions		
	- Processes		
	- Methods + Tools		
Policy and Design Decisions	- Forest Definition		
	- REDD+ Activities		
	- Carbon Pools		
	- LULC Stratification Scheme		
	- Approaches, methods + tiers		
	- Spatial + Temporal Scope		
Measurement and Estimation	- Remote-Sensing Observations		
	- Uncertainty	Land Cover Map	Land Use Change Map
	- Ground-Based Observations	Area Estimation	Activity Data/estimates
	- Integration + Estimations	Integration	Platform for NFMS
	- Record Keeping (Documentation)	Emissions Factors	Emissions Factors
		Forest Degradation	forest degradation - satellite imagery
			Forest Emissions Tool adjustment
		Biomass	Biomass mapping
			Forest Gains
			Forest losses and gains annual change monitoring
Reporting and Verification	-AFOLU GHG Inventory Reporting		
	-Non-Carbon Related Reporting		
	-Reference Emission Levels		
	-REDD+ Reporting		
	-Internal + External Analysis		

REDD+ MRV support activities and partners

Based on the GFOI inventory of MRV support activities, Costa Rica's key support partners have been USAID, SilvaCarbon and FAO. GIZ has also been involved (Table 9).

Table 0.3 REDD+ MRV Support to Costa Rica

Support Activity	Donor / financer	Support Provider
Development of the data analysis protocol for the land use and land cover inventory subsystem of SIMOCUTE, and training	USAID	International Partner(s): FAO,SilvaCarbon
Engaging Central and South American Participants in other Trainings	USAID	SilvaCarbon
Expert Workshop on NFI Harmonization in Amazonia and Mesoamerica	USAID	SilvaCArbon
Google Earth Engine training	USAID	SilvaCarbon, Boston University
GFOI Regional Workshop on LIDAR in South America	USAID	SilvaCarbon
Improved methodologies for measuring and monitoring degradation using statistical analyses to generate degradation data in Costa Rica and Paraguay	USAID	SilvaCarbon
MRV system of FCPF ER Program	USAID, World Bank	SilvaCarbon, World Bank
National Forest Inventory Technical Assistance	USAID	FAO, SilvaCarbon
Pilot study technical assistance and analysis of results	USAID	FAO, SilvaCarbon
Step-by-step documentation of the analysis of visually interpreted, sample-based Land use and land cover data	USAID	SilvaCarbon
Technical assistance in MRV processes	GIZ	CCAD,GIZ,REDD+ Regional Program
Train the trainer and trainings on the statistical analysis of sample-based, visually interpreted land-use and land-cover data	USAID	SilvaCarbon
Training on Full Lands Integration Tool (FLINT)	USAID, WB, others?	AMEXCID,CONAFOR,Moja Global, SilvaCarbon,USAID,USFS,World Bank FCPF
Training: Advanced land use/land cover (LULC) mapping, LULC change, and forest degradation		FAO, SilvaCarbon

Case study narrative

Costa Rica's proposed mechanism to demonstrate progress in achieving commitments under the UNFCCC holds consistency with REDD+ MRV provisions under the Domestic Carbon Market (MDC) and the upcoming National Climate Change Metric System (SINAMECC). In parallel to this work, the Climate Change Office will conclude work on carbon registries, to

ensure the environmental integrity of emission reductions for all sectors, including AFOLU and REDD+. The National Centre for Geospatial Information (CENIGA) requires technical and administrative personnel to efficiently coordinate all monitoring responsibilities in the environment sector and within the SINIA. The FREL/FRL is consistent with the anthropogenic forest related GHG emissions by sources and removals by sinks reported in Costa Rica's GHG inventory.

Costa Rica carbon neutral goal and REDD+

Costa Rica aims to be Carbon Neutral by 2030 and the national REDD+ MRV system is within this goal. REDD+ MRV is allocated within the framework of monitoring aspects involved at the complete and integrated system – National Land Use, Land Cover and Ecosystems Monitoring System (SIMOCUTE), operating with forest degradation detection at small scale. Today the country has developed basic work, gaining experience to do estimates successfully.

REDD+ and RBP

Monitoring of LULUCF has been ongoing since 1997 and became linked to REDD+ through engagement with the FCPF in 2012. The REDD+ MRV system was developed for the purpose of accessing international funding for REDD+.

REDD+ MRV Development Successes in Costa Rica

REDD+ and carbon neutral

There is an overall national policy guided over the last decades towards having a Green Country, Carbon Neutral which influences positively REDD+ MRV development. Achievements include presentation of Costa Rica's Emission Reduction Program, FREL/FRL to UNFCCC, REDD+ Annex in BUR 2, REDD+ RBP for 2014 and 2015 and Verification of Costa Rica's REDD+ Nested Jurisdiction Program.

The NFI is responsibility of SINAC, and in 2014 the first NFI with emission factors required for MRV was established within the framework of the REDD+ National Strategy. The IMN has produced its own land-use change maps and has so far developed all of Costa Rica's national GHG inventories. In addition, the REDD+ Secretariat has produced a historical series of consistent land-use maps, used for the establishment of the FREL/FRL, submitted to the Convention and the Carbon Fund.

REDD+ and natural capital

REDD+ MRV brought the idea of monitoring ecosystem services and this helps to incorporate natural capital accountability to public and private land. When developing REDD+ MRV system components, it was realised that other land uses could also take advantage of the process and learn how to monitor and integrate territorial analysis. Since 2019 the focus has been on integrating agriculture sectors and measuring short term fluxes.

Integration and accuracy of data is increasingly being required, which demands investments both in staff and technology. Additional capacity is necessary to further develop and make this a sustainable system – finer resolution in terms of area and time for reporting RBP. GIS, IT, AI and data science is becoming more and more needed to produce platforms that run automatically and report on time – increasing demand in terms of money and skills.

Capacity building and the future ahead

Capacity building investments and knowledge sharing produced the REDD+ MRV system. Addressing specific challenges helped align national staff with what was needed and retain them, which is a driver of progress. A combination of context facilitation and technical capacity building worked well, together with a team consistency, formed by national staff and supported by government. Capacity was developed with long-term support and some of the personnel trained are now retained in the institutions and procedures.

From 2025, the country must monitor compliance with the NDCs which include biennial monitoring of forest emissions. At first the data and information produced by the system was too basic to enter REDD+ RBP agreements and produce MRV emissions. With the signing of the WB Carbon Fund ERPA and the commercialization of reduced emissions during the period 2012-2015, the country has committed to conducting biennial monitoring of forest emissions. Over the years techniques have developed and more data and accurate information is available, so the system is becoming more robust and the technical requirements of the system have evolved over the years. Funds are required to consolidate the NFMS MRV equipment and prevent the loss of these staff while the first disbursement of results payments is awaited.

REDD+ MRV development challenges and obstacles in Costa Rica

Political influence

Stakeholders noted that the FREL/FRL and national circumstances definitions are politically guided, and that decisions on the GHG inventory have been based on political considerations. Institutionalization of the MRV REDD+ system is well established in law, and there is strong commitment to the system, but there is still political influence on data and information. Political support is critical for progress, but this is fragile in this context.

MRV System development

MRV systems are set up as pilot projects on subnational levels and further combining the information and data on the national level is a challenge. SIMOCUTE is Currently development maps for types of forests and needs technical support, investment, and capacity to function properly.

Capacity building but no permanent staff

Readiness MRV capacity building focused on national architecture, but implementation of most ERPAs will be at subnational level, so there is a huge capacity gap at subnational level. There is a lot of project related staff turn-over within REDD+ MRV system, resulting in staff lacking exposure, knowledge, or training to understand the methodology or the concepts behind carbon accounting. FONAFIFO do not have expert on carbon accounting and need to consolidate a technical team that adequately handles the protocols for estimating activity data, emission factors and forest emissions.

The role of REDD+ MRV Support

Interviews identified long-term support provided on forest sector monitoring as a major influence on other sectors' engagement and key for REDD+ progress. The relevance of having had good partners in the process was stated as decisive for the development achieved so far. The technical consultancies and universities provided the relevant knowledge basis for development, and GFOI tailor-made specialized technical support recommendations have been critical to the construction of an operational NFMS at an effective cost. Having the national program SIMOCUTE integrating all sectors and ministries helped engaging people and institutions, facilitating REDD+ Annexes drafting, reporting under the FCPF CF.

Simocute

SIMOCUTE is a national program on land monitoring, integrating all sectors and ministries which helped engaging people and institutions, facilitating REDD+ Annexes drafting, reporting under the FCPF CF. Wall to wall mapping was used in the development of the FREL/FRL. More recent improvements include use of simpler data integration tools to estimate forest emissions.

Capacity building

Capacity building and technical support of specialists provided by organizations and projects such as the U.S. Forest Service, Silvacarbon etc. were helpful modalities in early stages to build ownership and institutional cooperation. Tailor-made specialized technical support, such as through the assignment of specialized technical personnel, were key to the development of NFMS. Projects from multiple organizations such as FAO and WB aimed at addressing key topics to fill technical gaps that provide access to high-resolution image licensing and developing tools such as Collect Earth Desktop that facilitate forest monitoring.

Data and information sharing

There has been institutional friction and an institutional resistance to share data and information. There was concern that FAO-SEPAL and Collect Earth Online technical support had promoted tools in a general way, without sufficient depth, sufficiently tested or with the technical accompaniment required to influence the solution for the country.

The role of national context in REDD+ MRV development

National context has had a large impact on REDD+ MRV development. Monitoring of LULUCF is ongoing since 1997 and became linked to REDD+ with FCPF in 2012, an institutional alignment to became eligible for RBP. Costa Rica's Climate Change National Strategy includes mitigation and adaptation, and a National-level Carbon Neutrality goal, creating a domestic carbon market to catalyze emission reductions, ratified in its Intended Nationally Determined Contribution (INDC) to the UNFCCC. All sectors have been proactive in seeking a low-carbon economy and in securing international finance to promote green development. The system was developed due to the perspective of having international funding for REDD+.

Costa Rica is currently developing a grid system for the whole territory using satellite imagery (level 1 - 10,000 points, level 2 - more points). The NFI consists of a Terrestrial Satellite Monitoring System (SMST) run by the National Meteorological Institute and a National Forest Inventory (NFI). National usage change and coverage data are collected through the SMST; emission factors are compiled through the NFI. REDD+ MRV is located within the framework of monitoring aspects involved at the complete and integrated system – National Land Use, Land Cover and Ecosystems Monitoring System (SIMOCUTE), including the bundling of ecosystem services within territories using geographic information data iteration, which might be useful for co-benefits reporting and monitoring.

Interviewees perspectives on future MRV support

Funds with enough flexibility to allow for fast implementation and contracting of demands in an ongoing basis were provided which facilitated the work and should be kept in the future. Capacity building at institutions were successful, and the continuity of the work with World Bank, GFOI, FAO to generate a common platform is particularly foreseen as facilitating all work involved on monitoring and aligning technicians around methodology.

More updated information on best practices needs to be in place and standardization is needed to further develop the system, since this has developed and changed rapidly. The speed of processing information and reporting of the MRV system needs to be increased. Investments both on capacity building and technological development are foreseen as key for that.

The push for having a carbon neutral country has supported development and implementation of REDD+ MRV system for RBP and the REDD+ MRV system has promoted interinstitutional involvement and integration, to improve and consolidate accounting information and data towards the system. All institutions that are involved positively influenced its development. INM (National Meteorological Institute) is highly capacitated, and the REDD+ Secretariat works with universities to have better data and process the information. At SIMOCUTE protocols are being developed to improve data quality and to reduce uncertainties.

Conclusions

Costa Rica aims to be Carbon Neutral by 2030 and development of the REDD+ MRV system falls within this national goal. Monitoring of LULUCF has been ongoing since 1997 and became linked to REDD+ with FCPF in 2012, an institutional alignment to became eligible for RBP. Funds with enough flexibility to allow for fast implementation and contracting of demands in an ongoing basis were provided which facilitated the work. Having good partners in the process has been a critical factor in REDD+ MRV development so far.

Investments are still needed in both human resources and technology to improve integration and accuracy of data. REDD+ MRV is set up as pilot projects on subnational level. Combining the information and data on the national level is a challenge. There is an institutional resistance to share data and information and the political context is not fully supportive. Standardization is needed to further develop the system, sometimes short time to execute tasks makes it hard to deliver with quality and solve all technical issues.

Key lessons

Having decision-makers involved and a national policy going beyond REDD+ MRV system helps to consolidate it. Interviewers stated INDC goal of having the country carbon neutral as pivotal on making REDD+ a national policy and with it allocated within the framework of monitoring aspects involved at SIMOCUTE.

Measures and estimates, together with reporting and verification has evolved over the years, demanding timely and continuous technical knowledge transfer and capacity building as the state of the art develops. Capacity building and technical assistance remain necessary to further progress.

The sustainability of the MRV REDD+ System relies on political, technical, and financial support at national and international level, including by empowering local staff with governmental mandates to operate. Continued funding is an essential requirement of the system according to interviewers; it drives the effort towards building and maintaining it and needs to flow from both national and international sources at this point.

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Ethiopia case study

Descriptive information

Basic country information

According to Ethiopia's REDD+ Strategy, [11] Ethiopia's economy is largely dependent on weather sensitive agriculture and highly vulnerable to climate change impacts. In recognition of its vulnerability to climate change impacts, Ethiopia developed an economy-wide climate policy, the Climate Resilient Green Economy (CRGE) Strategy, which envisions the transition of Ethiopia from a carbon intensive to a carbon neutral and climate resilient development pathway.

The National REDD+ Strategy is intended to contribute in a major way to the achievement of the CRGE strategy and Ethiopia's NDC targets through improving forest resource and land management. According to the Global Forest Watch, in 2010, Ethiopia had 12.4Mha of tree cover, extending over 11% of its land area. From 2001 to 2019, Ethiopia lost 410kha of tree cover, equivalent to a 3.4% decrease in tree cover since 2000, and 129Mt of CO_2 emissions. [12]

According to Ethiopia's historical average FREL, accepted by the UNFCCC, there was 1.1 million hectares of forest loss 2000-2013, equating to emissions of 17.9 million t CO_2 yr-1 during that period. Over the same period, 0.2 million hectares were afforested, sequestering 4.8 million t CO_2 yr-1. [13] Ethiopian forest is currently a net sink for emissions due to sequestration associated with extensive afforestation and reforestation exceeding emissions from deforestation.

Key drivers of forest related emissions listed in the REDD+ Strategy include: Small-scale agricultural conversion; Large-scale agricultural conversion; Unsustainable wood extraction for fuel and construction; Livestock grazing and Forest fire.

Ethiopia has two major REDD+ programmes: The REDD+ Investment Programme, which is funded through the Ethiopia-Norway REDD+ Partnership and The Oromia Forested Landscapes Programme (World Bank BioCarbon Fund Initiative for Sustainable Forested Landscapes, ISFL). Through both of these programmes there is opportunity for Ethiopia to received results-based payments for emissions reduced, as measured and reported through a REDD+ MRV system. Ethiopia has also received readiness funding from the Forest Carbon Partnership Facility, as well as the two REDD+ programmes.

Ethiopia is listed as a Least Developed Country according to the DAC List.

Policy framework

Three key national strategies and Ethiopia's Nationally Determined Contribution (NDC, to emissions reduction under the United Nations Framework Convention on Climate Change)

provide the framework that governs the Ethiopian approach and ambition on REDD+: The Climate Resilient Green Economy (CRGE) Strategy of 2011; The National REDD+ Strategy and The Forest Sector Development Plan, both finalised in 2018. Forest actions form one of the four pillars of the CRGE strategy, with the aim of "Protecting and re-establishing forests for their economic and ecosystem services, including as carbon stocks". Ethiopia's NDC lists the forest sector as expected to contribute more than 50% (132 Mt CO_2e) of the national goal to reduce emissions by 255 $MtCO_2e$ by 2030. The National REDD+ Strategy identifies forests and REDD+ as a central contributor to Ethiopia's potential to reduce emissions and outlines a series of actions for this. The National Forest Sector Development Program (NFSDP) aims to transform the forestry sector in Ethiopia and is the main guiding document for coordinating strategic policy interventions and sector-wide investments for the coming ten-year period. The targets include doubling forest cover to 30% land cover, reducing national emissions by half in 2030, and increasing the GDP contribution of the sector from 4 to 8%.

In summary, a suite of relevant development and emissions reductions targets, strategies and plans form a strong policy framework that are supportive to making progress on REDD+ MRV in Ethiopia, particularly as there is a strong focus on sectoral emissions reductions and also payments for environmental services, both of which require functioning MRV.

Description of the NFMS

Work on REDD+ MRV began in 2013. Ethiopia's MRV system has four components: 1) a FREL (deforestation only); 2) a Satellite Land Monitoring System; 3) National Forest Inventory; and 4), Forest Sector GHG Inventory. The REDD+ MRV function is decentralized at three levels, in alignment with Ethiopia's decentralized system of government.

Institutionally, Ethiopia's MRV function is decentralised at three levels, in alignment with Ethiopia's decentralised system of government organisation. At the Federal Level, the lead institution is the Environment, Forest and Climate Change Commission (EFCCC, formerly MEFCC)). The MRV Unit is housed within the Forest Resource Inventory and Demarcation Directorate located within EFCCC, under the Director General of Forest Resource Inventory and Management Plan Preparation. This federal level institution collaborates with national and international research institutions (e.g. WGCF-NR) and national government institutions including the Ministry of Agriculture, the Ethiopian Central Statistics Agency, the Ethiopian Geospatial Institute and the Ethiopian Mapping Agency.

At the **Regional Level**, REDD+ Regional Coordination Units and Regional Forest and Environment Authorities are the key institutions involved in REDD+ MRV. The Regional institutions are intended to co-ordinate with **Woreda Level Environment and Forest Offices**.

Under this decentralised institutional framework, the Federal Level is responsible for developing the design of methods, systems and processes and the analysis of data that provided by the Regional and Woreda Levels. The Regional and Woreda Levels are focused on forest inventory and activity data collection.

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11 Available at: https://ethiopiareddplus.gov.et/redd-readiness/redd-national-strategy
12 https://www.globalforestwatch.org/
13 https://redd.unfccc.int/submissions.html?country=eth

Key achievements stated by interviewees include:

- Established and implemented first National Forest Inventory 2014, completed inventory in 2016.
- New forest definition developed by MEFCC in 2015.
- First African country to submit its FREL to UNFCCC in 2016. This was reviewed by the UNFCCC TAC, updated and accepted in 2017.
- Federal MRV GIS laboratory established in MRV Directorate of EFCCC.
- Four Regional MRV laboratories in REDD+ pilot regions established (Oromia, Tigray, SNNPR and Amhara).

REDDcompass Building Block progress scores

- Policy and Design Decisions and Measurement and Estimation are the Building blocks that are nearest to completion according to the REDDcompass MRV Gap assessment. Under the Policy and Design Decisions Building Block, four of the six components are classed as Nearly / Fully Finished, and the REDD+ Activities and Carbon Pools components are Advanced. Under Measurement and Estimation, the components of Uncertainty, Ground-Based Observations and Integration + Estimations were scored Nearly / Fully Finished; Remote-Sensing Observations were Advanced, whilst the remining component of Record Keeping was at an Early Stage.
- Institutional Arrangements appear to be progressing more slowly. Whilst the Forest policy and MRV Institutions components are classed as Advanced, Processes and Methods + Tools were both at an Early Stage.
- The Reporting and Verification Building Block was scored as the least developed. Whilst two components were scored as Advanced or Nearly / Fully Finished (AFOLU GHG Inventory and Reference Emission Levels, respectively), the remaining three components were either at an Early Stage or Falling Behind.

Further details outlined in Table 10.

Table 0.1 REDDcompass Building Block scores

REDDcompass Building Block	Second Level Building Block Components	MRV Gap Assessment
Institutional Arrangements	- Forest Policy + Governance	Advanced
	- MRV Institutions	Advanced
	- Processes	Early Stage
	- Methods + Tools	Early Stage
Policy and Design Decisions	- Forest Definition	Nearly / Fully Finished
	- REDD+ Activities	Advanced
	- Carbon Pools	Advanced
	- LULC Stratification Scheme	Nearly / Fully Finished
	- Approaches, methods + tiers	Nearly / Fully Finished
	- Spatial + Temporal Scope	Nearly / Fully Finished
Measurement and Estimation	- Remote-Sensing Observations	Advanced
	- Uncertainty	Nearly/Fully Finished
	- Ground-Based Observations	Nearly/Fully Finished
	- Integration + Estimations	Nearly/Fully FinishedE
	- Record Keeping	Early Stage
Reporting and Verification	- AFOLU GHG Inventory Reporting	Advanced
	- Non-Carbon Related Reporting	Early Stage
	- Reference Emission Levels	Nearly/Fully Finished
	- REDD+ Reporting	Falling Behind
	- Internal + External Analysis	Falling Behind

Country needs assessment (CNA) areas identified for further support

- The topics identified for further support (Table 11) all fall within the Measurement and Estimation Building Block, the second most developed Building Block, according to the REDDcompass scoring in Table 10.
- The areas of "need" don't seem to address the component on Record Keeping, however, which is the only component of Measurement and Estimation that is classed as Early Stage.
- The needs assessment is also contradictory as it does not focus on the Building Blocks of Institutional Arrangements and Reporting and Verification, which are both less developed that Measurement and Estimation, and contains components that are at an Early Stage or Falling Behind.

Table 0.2 Further support needed identified in the REDDcompass country needs assessment

REDDcompass Building Block	Second Level Building Block Components	CNA sub-topics	Identified Need
Institutional Arrangements	- Forest Policy + Governance - MRV Institutions - Processes - Methods + Tools		
Policy and Design Decisions	- Forest Definition - REDD+ Activities - Carbon Pools - LULC Stratification Scheme - Approaches, methods + tiers - Spatial + Temporal Scope		
Measurement and Estimation	- Remote-Sensing Observations - Uncertainty - Ground-Based Observations - Integration + Estimations - Record Keeping (Documentation)	- Land cover maps - Area Estimation - Activity Data - Forest Degradation - Biomass - Other	-Capacity building SEPAL (for land cover maps) - Activity data estimates - Forest Degradation methodology - Forest Biomass gains
Reporting and Verification	- AFOLU GHG Inventory Reporting - Non-Carbon Related Reporting - Reference Emission Levels - REDD+ Reporting - Internal + External Analysis		

REDD+ MRV support activities and partners

The key donors of MRV support to Ethiopia have been the World Bank and Norway, along with German aid, with most programmes of supported implemented in partnership with EFCCC (formerly MEFCC). The FAO has been a key technical support provider, along with the World Bank, Wondo Genet College of Natural Resources, Wageningen University and Silva Carbon. Most funding so far has been enabling or readiness grants, used to provide technical assistance; funding for staffing, research and equipment, monitoring and evaluation; and facilitating learning across countries. FAO provided technical support through two experts embedded in EFCCC and additional staff (from Rome or elsewhere) that provide technical backstopping. An ERPA has been signed with the World Bank Biocarbon Fund for the Oromia Forest Landscape Program and a second phase of the Ethiopia-Norway bilateral REDD+ partnership, which includes payments for emissions reductions achieved through progress on the forest focused pillar of the CRGE. Further details available on REDD+ MRV Support to Ethiopia in Table 12.

Table 0.3 REDD+ MRV Support to Ethiopia, primary Ethiopian partner is EFCCC (formerly MEFCC)

Support Activity	Funding ($)	Financial Instrument	Donor / financer	Support Provider	Support Mechanism	Source
MRV Roadmap, identified data and capacity gaps to be addressed for a functional REDD+ MRV system			Royal Norwegian Embassy	Wageningen University	Consultancy	
Establishment of a Monitoring, Reporting and Verification System and a Reference Emissions Level for REDD+ in Ethiopia	4.4m		WB Biocarbon Fund?	FAO	TA, embedded TA, consultancy	
FCPF Readiness grant (MRV and FREL activities component) to Support establishment of NFI	1.4m*	Grant	WB	FAO	TA, embedded TA, consultancy	*estimate, based on figures in the Mid-Term Progress Report to FCPF
National MRV capacity building project	c. 3.9m	Grant	RNE	Wondo Genet College of Natural Resources	MRV focused Master and PhD training	
Oromia Forested Landscapes Program	4.6m	Grant; ERPA for RBP under development	WB BioCarbon Fund plus (Additional Funding-AF)			Mid-Term Progress Report to FCPF
Support to conducting Forest Inventory				WEForest Oromia Forest and Wildlife Enterprise (OFWE); Amhara Forest Enterprise (AFE)		
MRV system of ISFL ER Program			WB IFSL	FAO, Norway, SilvaCarbon, World Bank IFSL		
Field test forest degradation methodology			GIZ and FAO	GIZ, FAO, Wageningen University		
MRV country Needs Assessment				FAO, World Bank, FCPF		

Case study narrative

The role of national context in REDD+ MRV development

The national contextual factors that have affected REDD+ MRV development in Ethiopia fall broadly into three interlinked groups: factors of socio-political context that affect the ability to make progress; human and other resource capacity related factors that determine the starting point for establishment of the REDD+ MRV system; and factors of the Ethiopian context that relate to decisions on REDD+ MRV system scope. There are several important features of the Ethiopian context that are supportive to the development of REDD+ MRV, whilst others hinder or complicate the process.

Strong alignment with national strategies

REDD+ MRV system development is strongly aligned with key development, sectoral and climate strategies and targets. Forests have a key role of forests in Ethiopia's ambitious Climate Resilient Green Economy Strategy and Ethiopia also has outlined ambitious emission reductions targets in its UNFCCC Nationally Determined Contribution under which forest sector activities form 50% of Ethiopia's national emissions reductions commitments. Forest sector emission reduction targets also form a central component of Ethiopia's Forest Sector Development Strategy.

Long-term donor support

Interlinked with the Ethiopia's ambition on forest related emissions reductions, are two long-term REDD+ partnership agreements: a bilateral agreement with Norway, for which a second phase is currently under negotiation; and long-term support from the World Bank Biocarbon Fund ISFL. Both of these agreements and partnerships involve long-term financing, including payments for emissions reductions achieved that are to be measured through the REDD+ MRV.

Together, the combination of national ambition, the presence of long-term grant funding for REDD+ MRV development through partnerships that ultimately require REDD+ MRV as a basis for payments for emissions reductions, provides a strong mandate for the relevant institutions to develop a REDD+ MRV system.

REDD+ MRV may not be of the highest priority to ministers

In terms of political economy, forests are a relatively minor contributor to the Ethiopian economy, particularly in comparison with the agriculture sector (35% GDP (World Bank undated), compared with 4% for forestry), hence, despite the alignment with key national strategies, REDD+ MRV is likely to be lower on the political agenda and of lower interest for ministerial support than other competing priorities.

Low public sector remuneration affects the ability to retain technical expertise in the Ethiopian government system

A further feature of the Ethiopian context that is a hindrance to the establishment of national MRV capacity is that Ethiopian government remuneration of public sector staff is not commensurate with the level of technical expertise required for REDD+ MRV. Currently some national high-level technical expertise is brought into the Federal level system through the partnership with Norway, which funds the salaries of key national experts at a UN level through a UN administered project. This is a temporary fix, however, and not a sustainable solution.

Low capacity starting point in terms of human technical expertise and IT infrastructure

All interviewees noted that there was no pre-existing technical capacity relevant to REDD+ MRV within MEFCC (now EFCCC) and that this capacity had to be built from scratch. In addition to missing human technical resource capacity, the necessary technical infrastructure was not present. A particular constraint is that REDD+ MRV requires the use of satellite data and GIS analysis, which requires good internet connectivity and speeds, and consistent internet access, which are not available through the state-owned sole internet provider, which has exclusive control of internet access throughout the country. This hampers the ability of national experts to conduct fundamental MRV analysis.

REDD+ MRV approach must be subnational to align with the federal organisation of government in Ethiopia

Ethiopia is a federal republic which is administratively organised between the Federal Government and the Federal States (regions), with legislative and executive powers at both levels of government. This decentralised organisation of government requires that a subnational approach to REDD+ MRV is taken as each region is responsible for providing the data covering that region.

Heterogenous landscape with degradation major contributor to REDD+ emissions

Ethiopia's forested landscapes are large and vary in their structural characteristics, which increases the complexity of measurement required to be able to use national data. In addition, degradation is considered to be the major contributor to REDD+ emissions in Ethiopia, rather than deforestation, and degradation is more challenging to incorporate into the system.

Conflict, security and terrain issues limit the potential for field data collection in key forest areas

Some of Ethiopia's forested regions have ongoing conflict and security challenges that impede or prevent the collection of important field data. Other areas have challenging terrain and are effectively inaccessible.

REDD+ MRV development challenges and obstacles in Ethiopia

The challenges described the interviewees fall within four broad groups: challenges related to capacity; technical challenges; challenges related to operationality of the system and challenges that would likely require an increased power of mandate to overcome. The capacity related challenges are all associated with the Ethiopian context, particularly the low starting point capacity in technical expertise and technical infrastructure, compounded by the government public sector remuneration policy. Challenges with system operationality are also largely related to the national context, particularly the challenges of operating REDD+

MRV within a decentralised Federation, but also affected by issues associated with continuity of financial support. The technical challenges are associated with a combination of national contextual issues and gaps in international support and guidance. The national context related challenges are to do with low expertise and technical infrastructure capacity starting point, landscape heterogeneity and inaccessibility due to terrain and security constraints. The gaps in international support and guidance relate to a lack of workable methodology on degradation, which is the key source of REDD+ emissions in Ethiopia, lack of access to high resolution satellite date and lack of alignment of reporting needs.

Capacity related challenges

Lack of technical expertise generally; currently a complete capacity gap at the Regional and sub-regional levels

All interviewees noted lack of national technical capacity as the fundamental obstacle at the start of the REDD+ MRV development process. Whilst much capacity has now been built at the national level (though capacity for degradation analysis is lacking), there is still no technical capacity at the regional level. The current focus of regional level staff is REDD+ broadly, so they have a wide mandate and they are not MRV experts. This presents an important technical capacity gap for the REDD+ MRV system because the regional staff are critical for technical co-ordination during the National Forest Inventory and other regional data collection. There is also a need to establish additional laboratories and personnel in two more forested regions (Gambela and Benishangul). However, the next phase of training at Wondo Genet College will focus on staff from the regions.

Sustaining technical expertise in the system

High turnover of Federal staff - Interviewees reported that there is a high turnover of employees in the MRV Directorate. An attempt to reduce the number of trained MRV staff moving on has been made by combining the incentive of the opportunity to undertake an MRV focused Master's course at Wondo Genet College with an agreement to return to the government post for six years following graduation. This does not guarantee that staff will stay, according to interviewees, and a mechanism is currently being devised to retain staff as a pre-condition of a second phase of the Norway MRV support.

In addition to high turnover, restructuring of the government the institutions (including MEFCC which became EFCCC) disturbed the staffing and trained MRV technicians trained were assigned somewhere else.

Lack of necessary internet connectivity and equipment

Poor, inconsistent and low speed internet connectivity, combined with occasional shutdowns of the internet by the sole provider in Ethiopia, and frequent disruptions to the power supply, continue to make it very difficult for the MRV team to download satellite data, perform GIS/RS analysis and generate activity data. Up to this point the government MRV technicians have used the Addis FAO office and internet connection for their analysis, but this is not a sustainable solution. Limited connectivity with the regions is also a constraint.

Lack of IT equipment suitable for GIS/RS analysis was also a constraint early on, especially as it took over a year to get this supplied from overseas.

Current technical challenges

IT solutions not yet functional

A web portal has been developed but is not functional and a database is inaccessible. FAO is supporting in fixing issues with IT however that is not a long-lasting solution.

Lack of local data

High quality field data on carbon stocks that across the different forest types present in Ethiopia's heterogeneous forested landscapes, local information on degradation and deforestation and associated carbon stock changes are necessary for accurate calculation of forests sector emissions and emissions reductions. However, there is a lack of local data available and problems with the quality of the data that is available. At the field level, accessibility of the sampling units for the forest inventory was a problem. The sampling was initially designed using Google Earth, without on the ground information, and certain areas selected for sampling were inaccessible due to the difficult terrain. Security issues and conflict also prevent data collection in some of Ethiopia's key forest areas. The result of this lack of local data / poor quality local data is that it is a real challenge for the MRV team to undertake successful analysis and generate activity data because of inaccuracies, lack of data and data quality constraints and related wide confidence levels.

Lack of access to high resolution satellite data

In the absence of access to high resolution satellite data, the MRV technicians have been using OPEN FORIS, which uses low resolution data, to generate activity data. However, the low-resolution data is inadequate for analyzing Ethiopia's heterogeneous landscape and also inadequate for handling degradation which is the major emissions driver from Ethiopia's forest sector.

Lack of degradation methodology

A methodology for assessing forest degradation has been trialled but is not finalised, so Ethiopia doesn't currently have a means of assessing forest degradation, and degradation is not included in the current Forest Reference Emissions Level (FREL). This is a critical gap from both the emissions monitoring perspective, given that degradation is a major source of forest sector emissions, and in relation to the financial sustainability of the system, and ability of Ethiopia to receive payments for the full extent of emissions reductions achieved.

Lack of alignment between reporting needs

A further challenge described by interviewees is a lack of alignment between REDD+ reporting to donors and UNFCCC reporting, which means that data have to be reanalyzed to be compatible with national GHG accounting.

Challenges with REDD+ MRV system operation

Discontinuity of project related / funded Federal Level MRV System oversight roles and Regional Level positions critical for coordination of data collection

During the 4-year period covered by the FCPF Readiness grant, there was an MRV Task Force which reported to a National REDD+ Steering Committee for REDD+. Both functions were discontinued when the readiness funding finished, which means there is currently a gap in system oversight and management as well as a gap in coordination of the Federal level stakeholders, which the Task Force used to undertake. Currently the regional level staff are funded under the REDD+ project which will present a similar challenge when the project funding ends. The Regional staff are critical for co-ordination of local data collection for the NFI and other needs.

Developing systems and linkages between the three levels of government

Interviewees stated that one real challenge is lack of functionality of the MRV system across the different levels of government, creating the link between the pilot regions and the federal system. At the regional level there was no appropriate pre-existing platform for this, so the Federal level REDD+ and MRV units have been communicating with the different bureaux at the regional level, which was not considered an ideal institutional set-up.

Insufficient power of mandate to respond to key constraints

Lack of government enabling action on the key issues of financing, remuneration of technical experts, internet infrastructure

Interviewees pointed out that there needs to be stronger national government action on funding the system to undertake ongoing data collection to update activity date, to redo the NFI periodically and for ongoing analysis. Combined with this is the need for funding to embed the key MRV oversight roles within the government system to reduce the discontinuities of role and position. A further pressing need was for the government to adjust its remuneration policy and provide commensurate remuneration for technical experts to retain them in the system. It was also pointed out that the poor internet connectivity is also an issue that the government could solve, should it choose to, given that the national internet provider is state owned.

The EFCC Commission has lower political visibility than a Ministry which may affect its ability to fulfil its REDD+ MRV mandate

Whilst the REDD+ MRV function within EFCCC has been upgraded from a unit within a Directorate, to a Directorate in its own right, the Commission itself has been downgraded from a Ministry, and as a Commission, it is no longer headed by a State Minister, so it no longer has a minister to support it at the highest political levels and expedite its work.

Cross-cutting

Donor expectations too high

One of the interviewees felt that donor expectation on the pace of development and the feasibility of fulfilling such a stringent scope is too high for a country of Ethiopia's starting point capacity. That developing countries need more space and time to build this capacity and should not be required to achieve the same stringent standards of emissions reporting as developed countries.

REDD+ MRV development successes in Ethiopia

Key successes identified by interviewees divided into three groups: 1) Increases national capacity for MRV and progress on the elements of 2) Measurement and 3) Institutional Arrangements Building Blocks.

Capacity increases identified by interviewees

Necessary MRV technical expertise built at the Federal Level

Most interviewees regarded increase in technical capacity for MRV at the Federal Level to be the key success of the REDD+ MRV development process so far, especially given the low starting capacity. Most of the Federal Level experts have undertaken two-year MRV Master's courses at Wondo Genet College (funded through the Ethiopia-Norway REDD+ Partnership) and returned to office. An interviewee reported that Wondo Genet college has so far produced around 90 trained experts, including 5 PhDs. An interviewee stated that "we can now do 90% of what's needed at Federal Level ourselves" and that "we are now confident in terms of our capacity". Improvements in national capacity identified by interviewees were in relation to forest monitoring, national forest inventory, GIS and RS analysis and statistical analysis, and described as demonstrated by the fact that Forestry MRV is more advanced than MRV of other sectors in Ethiopia.

Established five MRV GIS/RS laboratories

Ethiopia now has five functioning MRV laboratories with all hardware established, the main one at is at the Federal Level at the EFCCC, and there are four regional laboratories set-up in the four REDD+ pilot regions: Oromia, Tigray, Amhara, and SNNPR. These laboratories will provide the decentralised infrastructure needed for data collection and analysis for monitoring against the FREL. An MRV Wiki has been established for sharing data.

Completion of components of the Institutional Arrangements Building Block

Institutional framework is established

An MRV Directorate has been established in the EFCCC; the Regional REDD+ offices have had laboratories established and regional GIS/RS experts have been hired. There is a plan to consolidate this with the hire of regional forest inventory officers too, to cover the regional

data collection and analysis needs of the regional offices. The District Forest Offices will be responsible for collecting Woreda level data. The Federal level will hold the responsibility for compiling the data and analysis, data and analysis checks, and reporting to development partners and financers.

Key successes with completion of components of the Measurement Building Block

First Country in Africa to Submit FREL to the UNFCCC and get this through the Technical Advisory Committee (TAC) review process

Interviewees noted that this was an important success for them and point of national pride, to have prepared and submitted the national FREL to the UNFCCC in 2016, before any other African country. To have this reviewed by the international Technical Advisory Committee experts, updated and approved in 2017 was also considered to be a huge success given the very low capacity starting point of Ethiopia.

Completed first National Forest Inventory

Establishment and completion of Ethiopia's first National Forest Inventory was regarded as a major success by interviewees. The inventory is due to be repeated in 2021 and is considered to be an important step forward towards the ambition for Ethiopia to be able to monitor its own forests.

Success factors identified by interviewees

Strong alignment with national policy goals resulting in strong government support

The interviewees stated that close alignment with the CRGE strategy and Ethiopia's climate change strategy, which are widely supported, meant that there was strong political motivation and government will for establishment of the REDD+ MRV system, and that its establishment was strongly supported by the Commissioner and Deputy Commissioner of the EFCCC.

Use of some readiness funding to increase political level awareness and buy-in

Generate buy-in from critical stakeholders

The use of readiness funding was regarded as having been helpful in generating buy-in from critical stakeholders and producing a lot of support "Our prime minister is now seen as a champion of reducing deforestation", which in turn facilitated progress on development of the REDD+ MRV system.

Ability to use donor support to get the best Ethiopian experts into the system

Through the Norwegian funding it was possible to get very high-profile national experts into the system, which the government does not have the ability to do because of its renumeration policy. The donor funds were used to capture these strategic human resources through having them employed under UN or WB contracts and salaries. This is considered important for both capture and retention of the best national expertise in the absence of government opportunity for this.

Availability of donor finance to fund the government roles

An interviewee made this point: "The finance was available from Norway for us to do our jobs".

The role of REDD+ MRV support

Provision of critical technical advisory support at the beginning to understand the capacity that would be needed and to design a ToR for the development process

Through the Norway partnership, The Norwegian Embassy in Addis contracted Martin Herold from Wageningen University to work with the government right at beginning of REDD+ MRV development process to do a capacity gap analysis, identify institutional needs, training needs, and develop an MRV TOR. This was described as "crucial support at the time", the ToR has been followed ever since, guiding implementation of the REDD+ MRV development process. That TOR was then reassessed just recently to produce a proposal for a new phase of MRV support.

Financing of REDD+ MRV coordination roles

National REDD+ coordinator and national MRV coordinator roles seated in MEFCC (now EFCCC), necessary for oversight and managing progress of development, were paid for using the FCPF readiness grant. However, when the funding ended the roles were no longer active.

Coaching the national team to do the work itself was a highly valued approach

The coaching, 'learning by doing', approach to TA taken by FAO, with ongoing support from staff at the Addis FAO office, combined with periodic two-week visits from a lead expert from FAO Headquarters in Rome to coach the national team to do the MRV work was identified as valuable and effective in addressing the low national technical capacity starting point.

Establishment of MRV training courses at a national university also a useful approach to building capacity and mitigating against capacity leakage

Federal level staff have been trained through a 2-year MRV Master's curriculum that has been established at Wondo Genet College, through the partnership with Norway. The next phase of training will focus on building the capacity of regional level staff.

Working group consisting of government staff and all development and support partners has been important for coordination

A Working Group that includes both government staff and each of the donors / support partners (WB, FAO, Norway) has ensured that the REDD+ MRV development process has been very collaborative, coordinated, worked well together to tackle the capacity gaps and ensure coordination among all the actors.

Long-term provision of experts, that have become trusted partners

The interviewees commented that they had good technical partners that had really helped in planning and implementing the REDD+ MRV development process. The same partners have been involved since the beginning of the process continue to be involved, alongside some additional partners.

Practical support to supplement missing national technical infrastructure capacity

Use of the FAO office internet connection to download satellite data and perform GIS analysis, in the absence of adequate national internet connectivity and infrastructure.

Interviewees perspectives on future MRV Support

Support to consolidate capacity gains towards national operation of the system

Interviewees described the need to consolidate capacity built so far to reach the point where the system could be run using purely national expertise, including through the training of a larger than needed pool of people given the expectation that some people will move on from their jobs. A recently prepared MRV consolidation proposal, developed in consultation with technical support partners from FAO and Wageningen university is being considered by Norway for next phase of support.

Support that is focused on sustaining national capacity rather than workshops

Interviewees described a need to focus on developing sustainability of capacity in the system, rather than holding thematic workshops: support that focuses on linking more universities into the system for training sufficient experts who into the future who will take over these activities. Need to think beyond masters to GIS and RS at PhD level.

Development of the necessary regional level capacity

All interviewees agreed that there is a major capacity gap at the regional level that needs to be closed. This includes the hiring and training of GIS/RS experts and forest inventory staff in all the pilot regions and the establishment of additional MRV laboratories and personnel in Gambela and Benishangul regions

Develop operationality: data connection and systems and linkages between the three levels of government

Interviewees identified the need to build up the operationality of the system by developing and securing data connection and linkages between the subnational to federal institutions involved in the REDD+ MRV system. Interviewees gave the example of the web-based irrigation information system being developed with the Ministry of Agriculture, and that the forest information system needs to replicate the approach taken with this system (local operation and manipulation) in order for monitoring data on deforestation and forest degradation to flow from the ground level to the Federal level.

Technical advisory support on degradation

In Ethiopia forest degradation is a larger issue than deforestation, and likely to be the major emissions source. Monitoring of emissions reductions from reduced degradation are likely to be the major way that Ethiopia could source results-based payments that could help financially sustain the REDD+ MRV system. Whilst a methodology for monitoring degradation has been trialled, there is not yet an agreed, workable, robust system for monitoring emissions. A definition of degradation is not yet agreed and it is not possible to account for emissions from degradation yet. Various partners are working on this, including SilvaCarbon, the World Bank and FAO, but no system that is appropriate to the Ethiopian context has yet been found and this is a major gap.

Updating the technical infrastructure and equipment

A reliable, high speed internet connection is needed for download of satellite data and GIS/RS analysis to generate and update activity data. This is a fundamental requisite to be able to undertake REDD+ MRV and currently the lack of internet connectivity in the EFCCC offices and more generally in Ethiopia, combined with power disruptions mean that the federal MRV team relies on using the FAO Addis office internet connection for their GIS / RS related work. A sustainable solution to this temporary situation urgently needs to be found.

Interviewees also report the need to update servers and hardware and that the FAO support on procuring equipment has been important in this area. High processing capacity computers are needed in the set-up of the regional GIS labs, which can then work on ground truthing.

On-going support as international methods and best practices change over time

Technical advisory support will be needed in an on-going capacity into the future as methodologies and best practices are developed and updated often.

Building sustainability into the system

A range of support needs focussed on sustainability of the system were described: from fully embedding the REDD+ institutions and the national technical support institutions involved in REDD+ MRV; focusing on how to build financial sustainability into the system; focusing on community MRV as a way of generated quality local data.

Conclusions

Ethiopia is an example of a country with a very low capacity starting point for REDD+ MRV in terms of human expertise and technical infrastructure. It has certain contextual features that increase the complexity of the system needed: the decentralised system of government requires a subnational REDD+ MRV design; the heterogeneous landscape increases the field data needed and the complexity of analysis; and degradation is the major contributor to REDD+ emissions, which requires methodological approaches that are less well established and known.

In the seven years since work began on REDD+ MRV in Ethiopia the fundamental four components of the system have been established and federal level capacity built up from scratch. Ethiopia has been supported in this by a range of donors and a combination of short-term funding and long-term bilateral arrangements with agreements for future results-based payments for REDD+ results with Norway and with the World Bank Biocarbon Fund. Notwithstanding the large successes achieved given the starting point, the system at present is fragile. It is reliant on development funding for staffing of senior and regional roles, much capacity remains to be built, particularly at the regional and subregional levels, the system is not yet operational and some critical barriers such as lack of reliable high-speed internet connectivity remain.

The system is not financially sustainable at present. Given that monitoring of emissions reductions from reduced degradation is likely to be the major way that Ethiopia could source results-based payments that could help financially sustain the REDD+ MRV system, a solution for how to monitor degradation effectively in the Ethiopian context is needed.

Key lessons

- The system of government affects the scope of the MRV system – the decentralised government system in Ethiopia required a subnational design of the REDD+ MRV system.
- Working with a technical adviser to identify the steps needed and a Terms of Reference for the development of the REDD+ MRV system at the outset has been a useful approach and that ToR has been used to focus and guide system development since then.
- There is a strong desire to be able to monitor and measure own forests nationally rather than to outsource this, and hence, mentoring support from an external technical specialist to national experts was a preferred capacity building approach.
- The approach of building a cadre of trained national experts by supporting university curricula appears to have worked well, with those experts returned to their government posts.
- Focus on the scale and scope of results-based payments that could be achieved by the country during system design and development could help to align system scope with financial sustainability from the outset.
- Ongoing technical advisory support will be needed as methods and best practices are updated and developed.
- Some fundamental barriers are not technical but political and need to be addressed via different channels or outsourced, for instance the low public sector remittance and lack of internet connectivity in Ethiopia

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Fiji case study

Descriptive information

Basic country information

The Republic of Fiji covers an area of 1.83M ha and includes around 330 islands in the South Pacific of which a third are inhabited (REDD+ Pacific 2019). With reference to the aid eligibility category, Fiji is rated as an upper Middle Income Country with an GNI per capita of US$ 5,360 in 2016 and US$ 5,860 in 2019 (OECD 2020). The contribution of forestry to the GDP is around 3%. Approximately 90% of Fiji's forestland is located on customary land owned by the iTaukei[14] (REDD+ Pacific 2019).

Fiji submitted its Readiness Plan Idea Note and was accepted into the FCPF in 2013. The Readiness Preparation Plan was submitted in 2014 with funding of US$3.8M approved for Readiness activities in 2015. At the mid-term review another US$2M was approved in 2017. Fiji submitted its Emissions Reductions Program Idea Note and Letter of Intent in 2016 and was then in the final cohort of countries to submit their Emissions Reduction Program Document in 2019. Final negotiations of the Emissions Reduction Payment Agreement are taking place at the time of this report.

Forest cover

The information on Fiji's forest cover, is derived from the National Forest Inventory Report (2005-2009) as stated in the Emissions Reduction Program Document (ERPD, MF-RF 2019). This report includes the seven biggest islands[15] of Fiji covering around 94% (1,718,187 ha) of its land area. The forest types include native forests and mangroves, as well as pine and mahogany plantations. Coconut palms are not included as forest.

For 2009, the forest cover was estimated to be 1,105,077 ha. This figure includes 914,868 ha of native forests, 80,272 ha of pine plantations, 59,548 ha of mahogany plantations, and 54,189 ha of mangroves (MF-RF 2019 based on the 2005–2009 National Forest Inventory Report).

Across the three main Islands of Fiji (Viti Levu, Vanua Levu and Taveuni) an annual average of 11,013ha of deforestation occurred between 2006 and 2016. Over the same period afforestation/reforestation (AR) was estimated to be on average 6,180 ha per year (MF-RF 2019).

Emissions/removals from forest change and forest cover change

Here, historic forest sector carbon emissions and removals are reported as stated in Fiji's ERPD (MF-RF 2019) for the period 2006 to 2016. For this period, Fiji's Forest Reference Level (FRL) reports net emissions of 1,636,804 tCO_2e yr $^{-1}$ for the three main islands.

Key emissions drivers

The net emission reported in the FRL include 2,696,831 tCO_2e yr $^{-1}$ emissions from deforestation, 310,442 tCO_2e yr $^{-1}$ emissions from forest degradation and -1,370,469 tCO_2e yr $^{-1}$ removals from the enhancement of carbon stocks (MF-RF 2019). Emissions from deforestation result mainly from the conversion of forests to agriculture, traditional forest use, or the development of infrastructure. Emissions from forest degradation are due to unsustainable forest management. Additional causes of forest degradation are fire in softwood plantations, natural disasters, and invasive species. The enhancement of carbon stocks is the result of Afforestation/Reforestation activities. AR activities are considered as key for enhancing greenhouse gas (GHGs) removals (MF-RF 2019, FCPF 2016).

Description of NFMS

Fiji's National Forest Monitoring System (NFMS) involves the following institutions and key players:

- Ministry of forestry (MoF) Ministry of Economy (MoE)
- Ministry of Agriculture (MoA)
- iTaukei Land Trust Board (TLTB)
- Commercial Forestry Operators (Fiji Hardwood Corporation Limited – FHCL, Fiji Pine Limited – FPL, and private operators)
- External consultants
- REDD+ Steering Committee (RSC)

    Through its REDD+ Unit, the MoF is the lead implementing agency for REDD+ (REDD+ Fiji and Integra 2018). The head of the REDD+ Unit supervises the implementation of the Readiness Fund and the Carbon Fund programs and reports to the Permanent Secretary of the MoF. The unit includes 10 National Forest Inventory (NFI) teams. In addition to the REDD+ Unit, the Forest Assessment Unit of the MoF is also involved in the NFMS.

    The MoE is the national UNFCCC[16] focal point (REDD+ Fiji and Integra 2018) and involved in the NFMS through its Climate Change Unit. Formal agreements between MoF and MoE are in place for data sharing and for ensuring consistency between reports

Both TLTB and MoA are involved in the generation and improvement of land use plans to be used in the NFMS. The connection between MoF and TLTB has been strengthened through the elaboration of the benefit sharing plan which is set up to produce results for individual landowners. The cooperation between MoF, MoA and TLTB in relation to the NFMS is more recent and less formal. The negotiation of the ERPA led to a closer relationship, providing MoA with the impetus for cooperating on REDD+.

Commercial Forestry Operators provide data to the NFMS and collaborate with the MoF to improve the collection of data. Formal agreements with Commercial Forestry Operators are in place and include flexible data delivery specifications.

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14 Main ethnic group indigenous to Fiji
15 Viti Levu, Vanua Levu, Taveuni, Kadavu, Gau, Koro, and Ovalua

16 United Nations Framework Convention on Climate Change

External consultants have been involved in the development of the NFMS on various levels and for varying periods. Relationships between the consultants and the respective ministries are formalized via terms of reference (TORs). At this stage, Fiji continues to rely on external consultants to support it operationalize its NFMS.

Fiji's RSC was formally established in 2011 and includes 19 representatives from multiple sectors and agencies. It is coordinated by the REDD+ Secretary (Fiji REDD+ 2020, REDD+ Fiji and Integra 2018). In relation to the NFMS, the RSC has a passive supervisory role and the members do not have a technical background and are therefore not actively involved in the development of the NFMS.

Fiji's final NFMS is designed to consist of a monitoring component and an MRV component. The monitoring component includes (a) a safeguard information system, (b) a Biodiversity information system, and (c) a national database system. The MRV components include (a) an NFI, and (b) a Greenhous Gas Inventory (GHGI). A Satellite Land Monitoring System (SLMS) supplements both components of the NFMS (Köhl et al. 2018).

At present, FIJI's NFMS covers the three largest islands[17] and includes around 90% of Fiji's land mass (ca. 94% of Fiji's forest area). This area corresponds to the accounting area of the resulting FRL. The reference period for the current UNFCCC and ERPD FRL is 2006–2016 (MF-RF 2019, Köhl et al. 2018, Mundhenk et al. 2019). In 2019 and 2020, the forest cover change data was extended to a total of seven islands for the accounting area. Currently, Fiji is working on including the remaining islands in the FRL. Mangroves are currently not included in the NFMS but work to include mangroves in the future is under way.

The MoF has committed to contributing funding to cover the ongoing running cost of the NFMS but several financial gaps still must be filled.

REDDcompass Building Block progress scores

Table 0.13 shows the REDDcompass Building Block - Country Needs Assessment (CNA) scores for Fiji. It is important to recognise that the scores displayed were already outdated by the time this report was written and do not represent the current status of Fiji's MRV system. At the time of the CNA, Fiji was rated as being in the Early Stage through to Nearly/Fully Finished in the Institutional Arrangements and Policy and Design Decisions building blocks, while the Measurement and Estimation and Reporting and Verification blocks were further behind and rated in the early stage or falling behind.

Fiji has advanced several of the components of the building blocks and is now in a stronger position, and as such the CNA is no longer a good reflection of Fiji's status. In particular, Fiji advanced the development of the Measurement and Estimation and Reporting and Verification building blocks. This advancement reflects some strong successes in Fiji's MRV capacity over the recent short period.

Fiji is now producing national land cover data in house on a continuous basis. They are also running and testing the MRV system for producing their first monitoring report. While the system is working in general, it is not well documented. Ongoing work involves a better alignment with the GHGI which is run by the MoE.

17   Viti Levu, Vanua Levu and Taveuni

Table 0.1 REDDcompass Building Block scores

REDDcompass Building Block	Second Level Building Block Components	%Score MRV Gap Assessment
Institutional Arrangements	- Forest Policy + Governance	Advanced (60)
	- MRV Institutions	Advanced (60)
	- Processes	Early stage (30)
	- Methods + Tools	Early stage (30)
Policy and Design Decisions	- Forest Definition	Nearly/Fully Finished (90)
	- REDD+ Activities	Advanced (60)
	- Carbon Pools	Nearly/Fully Finished (90)
	- LULC Stratification Scheme	Advanced (60)
	- Approaches, methods + tiers	Early stage (30)
	- Spatial + Temporal Scope	Nearly/Fully Finished (90)
Measurement and Estimation	- Remote-Sensing Observations	Early stage (30)
	- Uncertainty	Early stage (30)
	- Ground-Based Observations	Early stage (30)
	- Integration + Estimations	Early stage (30)
	- Record Keeping	Early stage (30)
Reporting and Verification	- AFOLU GHG Inventory Reporting	Early stage (30)
	- Non-Carbon Related Reporting	Early stage (30)
	- Reference Emission Levels	Fall behind (0)
	- REDD+ Reporting	Fall behind (0)
	- Internal + External Analysis	Fall behind (0)

Country needs assessment (CNA)

Table 0.2 gives an overview about the support needs identified for Fiji in the scope of the REDDcompass Country Needs Assessment. All recommendations were linked to the building block 'Measurement and Estimation'. This may not be a full reflection of support needs, as the assessment focused on technical support needs particularly in relation to Measurement and Estimation.

Table 0.2 Further support needed identified in the REDDcompass Country Needs Assessment

REDDcompass Building Block	Second Level Building Block Components	CNA sub-topics	Identified Need
Institutional Arrangements	- Forest Policy + Governance - MRV Institutions - Processes - Methods + Tools		
Policy and Design Decisions	- Forest Definition - REDD+ Activities - Carbon Pools - LULC Stratification Scheme - Approaches, methods + tiers - Spatial + Temporal Scope		
Measurement and Estimation	- Remote-Sensing Observations - Uncertainty - Ground-Based Observations - Integration + Estimations - Record Keeping (Documentation)	-Land cover maps -Area Estimation -Activity Data -Forest Degradation -Biomass -Other	-Uncertainty analysis -Forest degradation - satellite imagery -Documentation QA / QC - Standard Operating Procedures - Fire monitoring + emissions - Technical support for submission/update of FREL
Reporting and Verification	- AFOLU GHG Inventory Reporting - Non-Carbon Related Reporting - Reference Emission Levels - REDD+ Reporting - Internal + External Analysis		

REDD+ MRV support activities and partners

As shown in Table 15, a total of US$5.8M was approved for Fiji under the FCPF Readiness Fund (HBS-NA 2020). Of this amount, US$3.8M was granted as a Readiness Preparation Grant to support the implementation of the R-PP and to develop a REDD+ strategy. An additional US$2M was granted under the Readiness Fund following the mid-term review. This funding was provided for awareness programs and to strengthen the capacity of existing institutions in sectors related to forestry and agriculture (Fiji REDD+ 2020). In addition, the government of Fiji contributed US$687,000 and GIZ US$588,000 (FCPF 2019, MoF 2014).

Major support providers were GIZ, Pacific Community (SPC), University of Hamburg, Australian Commonwealth Scientific and Industrial Research Organisation (CSIRO), Conservation International, University of the South Pacific, and World Bank (WB) consultants. An additional list of involved stakeholders and their roles can be found in the ERPD (MF-RF 2019).

Table 0.3 REDD+ MRV support to Fiji

Support Activity	Funding ($)	Financial Instrument	Donor / financer	Support Provider	Support Mechanism
Readiness Preparation Grant	3.8M	Grant	WB FCPF		Various
Awareness Building/ Capacity building for existing institutions	2M	Grant	WB FCPF		Various
Financial contribution to readiness activities	588,000	Financial contribution	GIZ		Various
Coping with Climate Change in the Pacific Island Region		Project		GIZ, SPC	Embedded support, TA, Capacity Building
Development of Fiji's National Forest Monitoring System (NFI/ MRV/FRL)		Project	WB FCPF	SPC, University of Hamburg, others	TA, Capacity Building
MRV system of FCPF ER Program (2019-2021)		Program	WB FCPF		
Consultancy		Project	WB FCPF	CSIRO	TA, Capacity Building
Consultancy		Project	WB FCPF	Conservation International	
Consultancy		Project	WB FCPF	University of the South Pacific	
Consultancy		Project	WB FCPF	WB Consultants	

GIZ: German Corporation for International Cooperation GmbH; SPC: Pacific Community; CSIRO: Australian Commonwealth Scientific and Industrial Research Organisation; WB: World Bank; TA: Technical Assistance

Case study narrative

"*Unless the world acts decisively to begin addressing the greatest challenge of our age, then the Pacific, as we know it, is doomed,*"

(Frank Bainimarama, President and Fijian Prime Minister, COP23 Fiji)

Facing devastating consequences of climate change already (COP23 Fiji), Fiji has a strong interest in mitigation measures. The country recognises the role of human induced GHG emissions as a driver of climate change and REDD+ as a mitigation opportunity (MPI 2011) Fiji was accepted into the FCPF in 2013. In May 2015, the country became a recipient of FCPF's REDD+ Readiness Fund from which it was granted a total of US$5.8M. In 2019, Fiji was accepted into the Carbon Fund. According to the ERP document, Fiji's combined efforts of emission reduction and removals would result in approximately 2M tonnes of CO_2 equivalent over 5 years (MF-RF 2019, Xinhua 2019). Fiji has put forward its benefit sharing plan and finalized the ERPA. Currently, Fiji has started to write its first monitoring report. The report is likely to be submitted to the Carbon Fund in 2021.

Starting point

From 2009 onwards, Fiji received support from GIZ for structuring and facilitating the process towards implementation of REDD+. This support was oriented towards the creation of clear governance structures, capacity building, developing the National REDD+ Policy and preparing demonstration activities in pilot areas. Directly linked to MRV, the support focused on the creation of a monitoring system, collection of land use data and the creation of a database (RF 2013).

In late 2009, several international consultants carried out a scoping workshop. Agencies consulted in this workshop including among others the MoA, the Department of Forests[18], Department of Environment[19], the Climate Change Unit (part of MoE), the Fijian Land Administration, Landowner groups, and NGOs. In the workshop, potential sources of GHG emissions from the forest sector were identified. Related data, data collection methods, storing and processing capacities as well as capacity gaps and needs were assessed. The workshop report was used as a basis for subsequent work linked to REDD+ (FCPF undated).

A workshop titled 'Fiji National REDD+ Strategy Workshop' took place in November 2010. The workshop was organized by the SPC/GIZ Regional Programme – Coping with Climate Change in the Pacific Island Region and the Fiji Forestry Department. One of the workshop components was to advance the national forest carbon stock assessment (CP Ltd. 2011.)

Several **Institutional Arrangements** relevant to REDD+ MRV had already been initiated before Fiji was accepted by the Readiness Fund. Fiji's REDD+ program was established in 2009. The national REDD+ policy was endorsed by Fiji's cabinet in 2010 and launched by the PS of Fisheries and Forests in 2011. The program is guided by the National REDD+ Steering Committee which was formally established in 2011. With its Climate Change Unit, the MoE had already been established as national UNFCCC focal point (Fiji REDD+ 2020, REDD+ Fiji and Integra 2018).

Regarding **Policy and Design Decisions**, Fiji included a first list of potential REDD+ activities when they expressed their interest in joining FCPF (RF 2013). This included minimizing forest clearance, enforcing the existing Forest Harvesting Code of Practice, improved forest management and the protection of biodiversity hotspots. However, a more in-depth analysis focusing on drivers of deforestation and forest degradation was needed to define REDD+ activities. A first REDD+ pilot site (Emalu forest) had been selected in 2012. The definition of forest was established with Fiji's REDD+ Policy (MPI, 2011) following FAO (2006).

Prior to becoming a Readiness Fund recipient, there was limited products and infrastructure relevant to the **Measurement and Estimation** components of MRV. Fiji had no proper forest monitoring system at that time. Existing products included a carbon stock assessment (2011/2012), and a rudimentary forest area change analysis for the period 1991-2007 (distinguishing forest/non-forest only). Furthermore, a species-specific allometric modelling exercise had been carried out (RF 2013). In 2012, the government of Fiji provided approximately US$141,000[20] for the development of the REDD+ mechanism. Several GIS officers were working for the MoF prior to the reception of the Readiness Grant (RF 2013, FCPF undated).

18 The Department of Forestry is a Department of Fiji's Ministry for Primary Industries
19 The Department of Environment is a Department of the Ministry of Lands, Mineral Resources and Environment
20 FJ300,000$

No recording for Fiji's progress on the building block **Reporting and Verification** prior to the Readiness Grant support could be identified.

The role of national context in REDD+ MRV development

The following Fiji specific factors were found to have impacted the development of Fiji's REDD+ MRV system:

- Small country
- Homogeneity of the landscape
- In country capacities
- Interest of involved people
- Individual as driver
- Tree planting initiative of the government
- Pre-existing infrastructure and products
- Previous experience with external consultants

Fiji is a small country with a comparably homogenous landscape. Consequently, the MRV System is organized on a national scale. Yet, Fiji's land area is scattered across a larger number of islands and the MRV system was first developed for the 3 largest islands before being extended to a total of 7 islands. Not having to deal with a highly heterogeneous landscape supported the extension of the system to additional islands.

The country's size is related to its capacity. Fiji does not have a large pool of people with the necessary capacities. In Fiji, the amount of work related to MRV is relatively high compared to the capacity available in country. The REDD+ Unit has not seen a strong turnover of staff since the development of the MRV was initialized. This contrasts with the relatively high turnover observed in the MoF in general.

In general, the people responsible for MRV in Fiji showed a strong interest in having ownership of the MRV and producing data in-country.

The Permanent Secretary (PS) of the MoF has changed since the development of the MRV has started. He is interested in restoring the landscape and maintains a good relationship with the Prime Minister and the Ministry of Economy. He is also considered as being charismatic and well-recognised. This has helped to establish better relationships between the institutions involved in REDD+ MRV.

At the UN Climate Summit in New York in 2019, Fiji's Prime Minister announced the planting of 30M trees over the next 15 years. The MRV system developed in the context of REDD+ can be used to measure, report, and verify the outcome of this announcement.

It was apparent that some Fijian staff experienced several consultancy projects in the past that did not turn out very well. Consequently, people are cautious about new development projects.

REDD+ MRV support under fcpf funding

Support under the Readiness Fund was delivered in various formats including technical assistance, capacity building and financial means for the procurement of infrastructure and equipment. Different external consultants were engaged for the delivery of the support and a variety of reports were produced.

Financial support

A total of US$5.8M was approved for Fiji under the FCPF Readiness Fund (HBS-NA 2020). In addition, the government of Fiji contributed US$687,000 and GIZ US$588,000 (FCPF 2019, MoF 2014).

Of this amount, US$3.8M was granted as a Readiness Preparation Grant to support the implementation of the R-PP and to develop a REDD+ strategy. The grant aimed to assist with readiness activities over the period 2015–2019 that would enable Fiji to receive carbon funding for its ERP (Fiji REDD+ 2020). According to HBS-NA (2020), only US$740,000 were disbursed up to Feb 2019.

An additional US$2M was granted under the Readiness Fund for awareness programs and to strengthen the capacity of existing institutions in sectors related to forestry and agriculture (Fiji REDD+ 2020). US$1.1M of this grant was disbursed up to Feb 2019 (HBS-NA 2020). The grant anticipated the following modalities (Fiji REDD+ 2020): (a) consultation and participation, (b) institutional strengthening, (c) capacity building, (d) development and finalization of the National REDD+ Strategy, (e) upgrading and further development of the FREL, (f) a system for MRV, (g) establishment of the Safeguards Information System (SIS). Up to date only around 40% of the total money granted under the Readiness Fund has been spent.[21]

Partner organisations

In the scope of the development of its MRV system, Fiji worked with several international partner organisations.[22] Key implementing partners were the University of Hamburg, GIZ, SPC, the University of the South Pacific (USP), Fiji National University, World Bank Consultants, CSIRO, Conservation International and UNIQUE.

The University of Hamburg, the Pacific Community (SPC) and several other institutions were engaged as technical support in a project aimed at developing Fiji's National Forest Monitoring System. Project components were the development of a national forest monitoring system, the development of a FRL (2006-2016), the creation of a functional database housed at the Ministry of Forestry, and the development of standard operating procedures (SOP). Other components were related to NFI and MRV and capacity building including workshops, seminars, and on-the-job training (Universität Hamburg 2020). CSIRO was later engaged to provide TA and training related to the development of Fiji's forest cover change data.

Conservation International provided consultant services for a number of studies in relation to Carbon rights (CI 2019b), and benefit sharing plans (CI 2019b, MF-RF 2019).

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21 According to HBS-NA (2020) US1.84$ had been disbursed by February 2019.
22 A list with stakeholder involved in producing the EFPD can be found in Table 1.3 of the ERPD (MF-RF 2019).

Workshops

Several workshops related to the development of the REDD+ MRV system were undertaken.[23] In 2019, there was a single country workshop in Fiji implemented in collaboration with GFOI and development partners (World Bank 2019). In 2019, there was a workshop on using GIS for the assessment of forest carbon (Buwawa 2019). In the scope of CSIRO's engagement, Fiji's MRV team attended a workshop in Perth (Australia). The workshop was combined with CSIRO providing support in-country for the participants in Fiji.

Support studies

Several studies with components related to REDD+ MRV were conducted. These included (Fiji REDD+ 2020):

- Fiji National REDD+ Programme – Consultation and Participation Plan (MoFF and REDD+ Fiji undated)
- Strategic Environmental and Social Assessment (SESA) study (MoF 2019)
- Environmental Safeguard and Management Framework
- Resettlement Policy Framework
- Process Framework for the Emissions Reduction Program
- Measuring, Reporting and Verification (MRV) study
- Drivers of Deforestation and Forest Degradation (DoDD) study
- Feedback Grievance and Redress Mechanism (FGRM) study
- Benefit Sharing Mechanism and the Carbon Rights Study.

REDD+ MRV development challenges and obstacles in Fiji

Obstacles that complicated the development of Fiji's MRV system were:

- Miscommunication
- Missing holistic oversight
- Lack of capacity
- Slow procurement processes
- Lack of data
- Scepticism
- Institutional competition
- Complex components
- Low financial benefits

The development process of Fiji's MRV system can roughly be divided into two different phases. In an early phase, the MoF was faced with several challenges and obstacles impeding rapid progress. In this phase, much of the work was outsourced to external consultants and institutions. Miscommunication between the parties created challenges and led to outcomes that did not fit Fiji's needs. At the end of this process, the MoF decided to become more involved and develop its own capacities and to use external consultants for assistance and guidance only. Following this approach, progress was relatively fast from this point onwards.

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23 Only a selection of the workshops can be mentioned here.

Lack of clarity and misunderstandings between the parties involved created major challenges in the early phase. The design of the MRV system was not clear enough before the work was outsourced to external consultants. The terms of reference (TOR) used for employing the consultants were not specific enough for Fiji's MRV approach. Consequently, consultants provided individual pieces for an MRV system but not all these pieces fitted together. It was not clear how the components could be integrated into an operational repeatable low-cost system. In addition, data requirements for the individual components and the expectations of the donor were not well understood by the team in Fiji. For example, it was believed that the FRL could be derived from existing data. This was not the case due to gaps, errors, and missing values. It was finally decided to redo the work with in-country capacities. However, this decision was not easy, involved a level of risk, and put a lot of pressure on the people involved.

Slow procurement processes were an additional obstacle and one of the major reasons why only part of the money from the Readiness Fund has been spent to date. The procurement of hardware was slow because the products were not available locally. In addition, the Fijian procurement system only allows purchases up to a limited amount before special procurement processes come into effect. These can take from several weeks up to several months. The Fiji team has now changed to the WB procurement process which is proving to be more efficient for products and consultant engagements.

Many of the essential institutional arrangements were organized relatively late in the process. One explanation for this is that stakeholders in Fiji were rather sceptical about REDD+. The associated undertakings were considered by some stakeholders as just another short-term development project without any long-lasting impacts. In the early stage, this led to a relatively low interest in the program and low political support. Arrangements between MoF and the UNFCCC focal point MoE are of high importance. Earlier cooperation was hindered by more than one institution being interested in becoming the implementing agency for REDD+ MRV which created an atmosphere of competition. In the scope of the ERPA negotiations, subsequent strengthening of the relationships between MoF, MoA, MoE, and TLTB has occurred.

The lack of suitable data has created obstacles in various parts of the MRV development process. Some of the available data did not satisfy the requirements of the FCPF Methodological Guidance due to a low accuracy, data gaps, errors, and missing data. Several components were difficult to be integrated in the MRV due to data issues. This issue was relevant for forest degradation[24], specific forest types (Mangroves), and activity data.

REDD+ MRV development successes in Fiji

As a recipient of the Readiness Fund, Fiji has made good progress in developing its REDD+ MRV system. The system is likely to become operational on a national scale in the near future.

Funding was used to develop an NFI system based on advanced technology, a central database, forest-non-forest spatial products, and related land use change maps. Supported by the grant, the MoF has established a GIS and Land Mapping Team and NFI units. Major successes in the development process of the REDD+ MRV system are:

- Ability to produce national data in-house
- Building of in-country capacities and confidence
- Chang of stakeholder perception
- Achieved institutional arrangements

Several workshops and on-the-job training opportunities were integrated in the support modalities. As a result in-country skills and capacities were established, enhanced, and partially internalized. Staff had a strong interest in producing the system in-house. However, there were uncertainties of whether this could be achieved with the available in-country capacities. Being able to produce the data has increased their confidence and capacity in running the system and communicating the system to others. This also represents a turning point in the thinking of the staff who have now started to explore wider application of the MRV system beyond just REDD+ MRV.

At an early stage, the program was not taken seriously by many stakeholders in the country. This led to a low interest in the program and low political support. The negotiations of the ERPA under the Carbon Fund was perceived as a turning point in the process. The MRV system is now perceived more strongly as an entity with longer-lasting impacts for Fiji.

Institutional arrangements between key institutions and stakeholders are in place. In the scope of the ERPA negotiations, MoF was able to strengthen its relationships with MoA, MoE, and TLTB which was considered an important success. With wider institutional arrangements alternative applications of the MRV system could be explored. This is of particular importance since financial outcomes from REDD+ are comparably low. The MRV system is now increasingly seen as a bigger framework that also supports REDD+ rather than REDD+ supporting the MRV system.

Interviewees perspectives on future MRV support

The remaining funds from the Readiness Fund are likely to be used for NFI data collection and improving the database. Some money will be spent on the development of allometric equations, equipment and infrastructure.

In respect to future support, it was noted that objectives could be tailored better to the capacities and needs of the country. This would help to accelerate processes.

A crucial point for Fiji was that the local staff had control and ownership over the development of the MRV. External experts can then be consulted for specific work and system reviews.

Areas that need future support in Fiji are:

- System documentation
- Training on how to run the system on a continuous basis
- Integration of forest degradation
- Guidance for prioritizing potential improvements of the system (managing continuous improvements at feasible costs)
- Annual events for system review and self-assessment[25]

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24 Currently, an external consultant is working on MRV related to forest degradation (Bullock 2020)

25 Important questions are: What is the future of the system? Where do they want to see change? How do externals evaluate the system? External experts should be invited as consultants to these events.

- Assistance in writing country- and case-specific TORs
- Assistance in developing a financial plan for maintaining the MRV system
- Assistance in writing workplans for justifying budgets to the ministry

For the staff in Fiji, it is important to have an external expert as constant contact person (ideally based in Fiji) who they can trust and to whom they can maintain a close long-lasting relationship.

The interviewees also mentioned the importance of international expert exchanges. These help to exchange experiences between countries (e.g. Fiji and Vietnam) and can foster the motivation of staff. Combining bilateral expert exchanges with follow up work by the participants in the home country has yielded good results in the past.

Conclusions

Fiji is an example of a country with comparably favourable position for developing a national REDD+ MRV system. It is relatively small and has a homogenous forest landscape. Existing institutions are organized on a national level. A disadvantage for Fiji is that future financial benefits from carbon credits are expected to be low.

At the time this case study was written, Fiji had made good process in the development of its REDD+ MRV system. The system was likely to become operational in the near future. It was in the process of becoming national in scale. Missing components were aspects related to forest degradation and the inclusion of mangroves as a forest type. Institutional arrangements between key institutions and stakeholders were in place. The system and related processes had not yet been well documented. Fiji was accepted by the Carbon Fund and was in the process of negotiating its ERPA at the time or writing.

At an early stage of the MRV development process, Fiji faced several problems. Problems were mainly caused by communication issues. The specific requirements of the MRV system and the underlying data were unclear. This led to misunderstanding between Fiji, the donor and engaged external consultants. As a result, products delivered by external consultants were not fit for purpose and had to be redone and reorganized. Another issue was related to national procurement processes preventing or complicating the purchase of equipment and the engagement of external consultants. Important institutional arrangements were achieved relatively late in the process. One reason for this was the creation of inter-institutional competition for funding (more than one ministry was interested in becoming the REDD+ MRV implementing agency). Another reason was scepticism among some local stakeholders who considered projects related to the Readiness Fund as just another development project with low impact.

At present the value of the MRV system for Fiji seems to be better understood. The capacity to be able to produce the data in-country is appreciated by the institutions involved. Since the negotiation of the ERPA and the engagement of a new more active Primary Secretary of the Ministry of Forestry, crucial institutions and stakeholder groups show an increased interest in the MRV system. It is understood that the purpose of the MRV system needs to be extended beyond REDD+ reporting to be of higher value for the country.

Going forward, Fiji will have to finalize the missing components and the documentation of the system. The system is generally run by local staff. External consultants are likely to

be employed for highly specialized tasks and for verifying the system. Securing sufficient ongoing financial support from Fiji's government to ensure the long-term operation and improvement of the system will be a major challenge for the staff. For this it is important that the system can be run and maintained at a low cost. The system must be beneficial for the country and these benefits must be understood and appreciated by the national government. Future support should be tailored to these aspects.

Key lessons

Key lessons that can be learned from the Fiji case study are:

- A good understanding of the requirements and purpose of the MRV system by all stakeholders at the beginning of the process is crucial.
- The specific country capacities and related needs must be clear at the beginning of the process.
- The wider context and potential application of the MRV system beyond REDD+ reporting should be explored at the beginning of the process. Potential implications need to be considered when the MRV system is being planned.
- The creation of competition between institutions of one country should be avoided as far as possible.
- Depending on national circumstance, potential benefits from REDD+ related carbon credits can be marginal. This has implications for the maintenance and sustainability of the MRV system.
- Good and trusted relationships between the local staff and external partners are essential to facilitate good communication.

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Ghana case study

Basic country information

Ghana began its engagement in REDD+ in 2008 through the World Bank's Forest Carbon Partnership Facility (FCPF). In 2016, it submitted a draft Emission Reduction Program Document (ER-PD) for the subnational Ghana Cocoa Forest REDD+ Programme (GCFRP), which is concentrated on the High Forest Zone (HFZ)[26].

National context

Ghana is categorised as a Lower Middle Income country, according to the DAC list of ODA recipients[27]. According the Government of Ghana's 2016 REDD+ Strategy, the country has adopted a nested approach for implementation of REDD+ in a phased programmatic approach with initial focus on the High Forest Zone and scaling out to cover the other distinct major ecological zones of the country such as the Savanna Zone[28]. The proposed measures and interventions will target the drivers of deforestation and forest degradation linked with the production and supply chains of major commodities and defined by clear ecological boundaries. The following, from the FCPF[29] website, provides a general overview of Ghana:

- **Population:** 27.4 million
- **Land Area:** 228,000 sq. km
- **GDP:** US$37.5 billion
- **Terrestrial protected areas:** 15.1% of total land area

Forest status and GHG emissions

The latest FAO Forest Resource Assessment for Ghana[30] identifies 7.9 million hectares of forest 275,000 ha of which is plantations (see Table 16). Due to Ghana's high economic dependence on natural resources, the country now has one of the highest deforestation rates in Africa, at 3.6% per annum[31]. Ghana's deforestation pathway is one of incremental degradation leading to deforestation.

Table 0.1. Forest Cover by Class in Ghana 2017

Class	(Area (1,000 ha
Closed Forest	1,204.37
Open Forest	6,484.24
Plantation Forests	275.43
Total	7,964.04

26 Forestry Commission (2017). Ghana's National Fore Refence Level. National REDD+ Secretariat, Forestry Commission.
27 http://www.oecd.org/dac/financing-sustainable-development/development-finance-standards/DAC-List-of-ODA-Recipients-for-reporting--2020flows.pdf
28 Government of Ghana (2016). Ghana REDD+ Strategy 2035 - 2016
29 Forest Carbon Partnership Facility (2018). Ghana. Accessed on 14th Sep. 2020 - https://www.forestcarbonpartnership.org/country/ghana
30 FAO (2020). Global Forest Resources Assessment 2020 Report - Ghana. http://www.fao.org/3/cb0004en/cb0004en.pdf
31 Ghana's First Summary of Information (SOI) - How safeguards for REDD+ are being addressed and respected in Ghana

Global Forest Watch data[32] suggest that in 2010, Ghana had 7 million ha of natural forest, but that by 2019, it has lost 87,400 ha of natural forest, generating 21.4Mt of CO_2 of emissions.

The principal drivers of deforestation and degradation, in order of relevance, are:

1. Uncontrolled agricultural expansion at the expense of forests;
2. Over-harvesting and illegal harvesting of wood;
3. Population and development pressure;
4. Mining and mineral exploitation; and
5. Wildfires[33].

The **underlying causes** of these drivers are:

- Forest industry over-capacity;
- Policy and market failures;
- Population growth,
- Increasing demand for agriculture and wood products,
- Low-tech farming systems that continue to rely on 'slash and burn' farming methods, and;
- A burgeoning mining and illegal mining sector[34].

Description of NFMS

Institutional Arrangements

The Forestry Commission (FC) has constitutional mandate for monitoring and reporting the status of the forest resources in Ghana. The Climate Change Unit (CCU) of the Forestry Commission hosts the National REDD+ Secretariat and has the direct responsibility of reporting on emissions from the forestry sector to the Environmental Protection Agency (EPA), which is the Designated National Authority (DNA) for reporting Greenhouse gas emissions.

Roles and responsibilities of institutions involved in REDD+ MRV are summarised below:

- **Ministry of Lands and Natural Resources (MLNR)** - The sector ministry to which the Forestry Commission reports. The MLNR will also be responsible for providing financial support for operationalizing the REDD+ MRV System.
- **Resource Management Support Centre (RMSC)** of the FC - Technical lead for collection of field data and analysis of spatial data to generate emissions estimates, in close collaboration with district and regional offices of the FSD.
- **National REDD+ Secretariat (NRS)** hosted by the **Climate Change Unit (CCU)** of the FC - Overall coordination of the REDD+ MRV processes, Reports to the Carbon Fund and EPA.
- **ICT Department** of the FC - Responsible for data storage and backup, advice for procurement of relevant software/hardware for MRV.
- **Forest Services Division (FSD)** of the FC - Districts and Regions provide data on on-reserve CSE activities and legal timber harvest to RMSC; Support RMSC to collect field data for classification and accuracy assessment.

32 Global Forest Watch (2014). World Resources Institute. Accessed on 14th Sep. 2020 - www.globalforestwatch.org.
33 Government of Ghana (2010). Readiness Preparation Proposal Ghana: Revised Ghana R-PP. Accra, Ghana.
34 Forest Carbon Partnership Fund, Emission Reduction Programme Document, Ghana Cocoa REDD+ Programme, April 2017.

- **Forestry Research Institute of Ghana (FORIG)** - Support with collection of data on illegally harvested timber; Develop/ refine allometric equations for carbon stocks estimation in various strata/ forest types.
- **Soil Research Institute (SRI)** - Estimation of forest carbon.
- **Centre for Remote Sensing & Geographic Information Services (CERSGIS)**, University of Ghana - QA/ QC of maps
- **Ghana Energy Commission (GEC)** under MOE - Collection of woodfuel data
- **Ghana Cocoa Board (COCOBOD)** - Provide relevant data on Carbon Stock Enhancement activities being undertaken in cocoa farms.

System components

- **Measurement, Monitoring and Reporting (MMR)**
- *Forest definition* – agreed upon but difficult to distinguish between 'forest' and tree crops with remote sensing
- *National Forest Monitoring System* – Last ground-based National Forest Inventory (NFI) was in 2001. NFMS now redesigned with support of Indufor Oy to incorporate to remote sensing-based approaches combined with ground-based sampling. 12 SOPs for the generation of activity data and emission factors. The design of the NFMS is in line with the latest IPCC/UNFCCC standards. Clear roles and responsibilities have been agreed regarding the operationalization of the NFMS. The NFMS is yet to become fully operational and tested for the first monitoring, and is closely linked to the construction of the FRL.
- *Measurement* – Tier 2 approach using generic algometric equations for tree biomass, and data collected during the NFI, but problems with historical data.
- *Reporting and Verification* - biennial update reports (BUR) to the UNFCCC Secretariat; reports to Carbon Fund for ERPA for the Cocoa Forest Mosaic Landscape; VCM projects outside focal jurisdictions.
- **Forest Reference Level (FRL)** - Draft FRL was established in 2017 and there are structures in place for MRV of deforestation; forest degradation by legal and illegal logging, fire, and fuelwood collection; and enhancement of forest carbon stocks. Issues on accuracy assessment and change detection are being addressed. It is expected that Ghana will fast track the remaining issues with the additional support from Germany being channelled through the World Bank for the ER Program.
- **REDD+ Information Database** - a nationally operated system (compatible with EPA registry) that can monitor and produce outputs from subnational programmes (jurisdictions) as well as the national level.

REDDcompass Building Block progress scores

Starting in 2017, FAO/SilvaCarbon/FCPF conducted an assessment of gaps in terms of MRV implementation[35]. This was done by the technical teams of these capacity building partners who assessed the level of progress in each of the REDDcompass themes. This was done for a number of countries which were defined as high priority by the capacity building partners, including Ghana.

From the study and assessment on Ghana, outlined in Table 17, it is clear that Ghana was noted as being advance in relation Intuitional Arrangements, Policy and Design Decisions, and Measurement and Estimation, with the exception of the capacity to generate uncertainty estimates for the REDD+ estimates. Reporting and Verification was less advanced, with all of the second level building blocks being categorised as early stages or falling behind.

Table 0.2 REDDcompass Building Block scores

REDDcompass Building Block	Second Level Building Block Components	MRV Gap Assessment Score
Institutional Arrangements	- Forest Policy + Governance - MRV Institutions - Processes - Methods + Tools	- Advanced - Advanced - Advanced - Nearly/fully finished
Policy and Design Decisions	- Forest Definition - REDD+ Activities - Carbon Pools - LULC Stratification Scheme -Approaches, methods + tiers -Spatial + Temporal Scope	- Nearly/fully finished - Advanced - Nearly/fully finished - Nearly/fully finished - Advanced - Nearly/fully finished
Measurement and Estimation	- Remote-Sensing Observations - Uncertainty - Ground-Based Observations - Integration + Estimations - Record Keeping	- Advanced - Early stage - Advanced - Advanced - Advanced
Reporting and Verification	- AFOLU GHG Inventory Reporting - Non-Carbon Related Reporting - Reference Emission Levels - REDD+ Reporting - Internal + External Analysis	- Early stage - Fall behind - Early stage - Fall behind - Fall behind

Country needs assessment (CNA) areas for further support

A country needs assessment to identify support needs for Measurement and Estimation and Reporting and Verification, did not identify any further support needs for Ghana, except for general support with Reference Level development, which was outside the scope of the REDDcompass Building Blocks. Details available in Table 18.

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35 World Bank (2019). Country Needs Assessment of National Forest Monitoring Systems and Its MRV Function - Final Report.

Table 0.3 Further support needed identified in the REDDcompass country needs assessment

REDDcompass Building Block	Second Level Building Block Components	CNA sub-topics	Identified Need
Measurement and Estimation	- Remote-Sensing Observations - Uncertainty - Ground-Based Observations - Integration + Estimations - Record Keeping (Documentation)	- Land cover maps - Area Estimation - Activity Data - Forest Degradation - Biomass - Other	None
Reporting and Verification	- AFOLU GHG Inventory Reporting - Non-Carbon Related Reporting - Reference Emission Levels - REDD+ Reporting - Internal + External Analysis		None

REDD+ MRV support activities and partners

The majority of support for REDD+ MRV development has come through grants from the FCPF Readiness Fund that total US$8.8 million[36], although only part of this was for development of the REDD+ MRV system. An overview of some of the support received by Ghana for REDD+ MRV is provided in Table 19.

Table 0.4 REDD+ MRV support to Ghana

Support Activity	Funding ($US	Financial Instrument	Donor / financer	Support Provider	Support Mechanism
Preparation of TOR for REL and MRV System Development		Grant	FCPF Readiness Fund, First Grant Agreement (2015) - Objectives h .and i		Consultancy
Developing SOPs for NFMS				Indufor Oy	Consultancy
Developing a national FRL				Winrock	Consultancy
Establishment of a Measurement, Reporting and Verification (MRV) System	1.911 million	Grant	FCPF Readiness Fund, Third Grant Agreement (2015-2019) - Component 2		Support for addressing gaps in the establishment and operationalization of the Recipient's MRV system, REDD+ registry, and associated information system for multiple benefits and a safeguards information .system
Development of FRL and MRV System				The Coalition for Rainforest (Nations (CfRN	Technical support for Ghana to go through its Technical Assessment .(TA) with the UNFCCC
Forests 2020 -supporting the Forestry Commission to improve its mapping of cocoa agroforestry systems			Global Challenges Research Fund ((UK	Carbomap, Ecometrica, UKSA, University of Edinburgh, University of Leicester	
Training on Full Lands Integration Tool ((FLINT			Silvacarbon	Moja Globa	
Technology Transfer and Support for trend analysis of forest land change, Forest resource map, biomass and CStock estimation and Capacity building	7.8 million		Japanese Funded Forest Preservation Programme ((FPP		
Supporting Ghana in Forest Monitoring based on German Remote Sensing Technology	0.5 million		GIZ		
Biomass map			Gordon and Betty Moore Foundation		

Case study narrative

Redd+ mrv development successes in Ghana

The main successes in the development of operational modalities and institutional arrangements for Ghana's REDD+ MRV system are described below. Factors that have contributed to these successes are described in Section 2.4.1.

Operational modalities

Ghana has made good progress establishing the operational modalities for REDD+ MRV, including developing a set of Standard Operating Procedures (SOP) that were drafted by consultants from Indufor Oy. A draft national Forest Reference Emission Level (FREL) was stablished with support from Winrock Interntional and submitted to the UNFCCC in 2017. Subnational FRELs are currently being developed with support from FAO.

The approaches and systems in place are considered sufficient to meet the monitoring and reporting requirements for FCPF and the national GHG inventory, although ongoing technical support is currently required to implement these.

Intuitional arrangements

There has been good progress in the establishment of institutional arrangements needed to implement the REDD+ MRV system within the Forestry Commission in Ghana, with the national REDD+ Secretariat coordinating input from the FC Resource Management Support Centre (RMSC).

REDD+ MRV development challenges and obstacles in Ghana

Major challenges encountered in the development of Ghana's REDD+ MRV System are described below. Factors that have contributed to these challenges are described in Section 2.4.2.

Operational modalities

Development of the FREL that was used in Ghana's first ERPD submission was led by external consultants, and the methodologies gave results that were not accepted by all national stakeholders.

A web-portal for sharing monitoring data is under development and is seen as an important component of the REDD+ MRV system that is still needed to enable data sharing across institutions in a format that will enable their application in policy formation and decision making.

Support from the FCPF has focused on the Ghana Cocoa Forest landscape. This area is not particularly representative of other regions in the country however, so scaling out the approaches developed for this landscape to the national level may not be straightforward.

Intuitional arrangements

Support for REDD+ MRV development has helped to establish operational modalities, and roles and responsibilities within the Forestry Commission (see Section 2.1), but formal agreements between Ministries are still needed for the system to function effectively. The Forestry Commission, which is overseen by the Ministry of Land and Natural Resources (MLNR), must report emissions from the forestry sector to the Environmental Protection Agency (EPA) within the Ministry of Environment, Science and Technology. There is, therefore, a need to operationalise the REDD+ MRV approaches with clearly defined activities backed up by formal arrangements between the different departments and intuitions involved.

Institutional capacity

Support for the development of Ghana's REDD+ MRV system has been used to build capacity within the Forestry Commission. There is now a perceived risk that this capacity will be lost, unless this capacity is fully embedded at the institutional level, and there is clear career progression for national experts. There is still a reliance on external expertise for the sampling-based approaches with high-resolution remote sensing data being used for the subnational FRELs.

Finance

Additional funding is needed to fully operationalise the REDD+ MRV system as there is little to no national budgetary allocation to support this. Funding is needed to cover the costs of acquiring the high-resolution remote sensing data needed to implement the sampling approaches that were not planned for in the Readiness support, and without this the system may not be sustainable.

The role of REDD+ MRV Support

Most of the funding for development of Ghana's REDD+ MRV system has come through the FCPF Readiness Fund, although prior to this there was support from the Japanese government and others to create forest cover maps and purchase equipment. The Coalition for Rainforest Nations has also provided valuable advice and technical backstopping. More recently support has been received through the Forest2020 programme to address specific technical challenges, such distinguishing between forests and tree crops.

Support from the FCPF has been fundamental to the progress in REDD+ MRV system development, although the subnational focus may mean that scaling out to the national level is not straightforward (see Section 2.2.1). There was also the feeling that further support was needed to ensure the systems in place are sustainable.

The mechanism for delivery of support through the FCPF has played an important role in contributing to the success and challenges described in Sections 2.1 and 2.2. Support from external consultants has been most effective when this has involved working closely with national experts, and fully engaging with local stakeholders. Early consultancy assignments to develop the FREL are perceived as less effective than the more recent support from FAO. A full understanding of the local context, proven experience in delivering similar outputs, and a willingness to fully engage with local stakeholders and build the capacity of local experts were all mentioned as important factors to consider when identifying consultants to support with REDD+ MRV system development. It was also noted that physical presence of the consultants within the country was less important than having an approach that incorporates feedback from local stakeholders – a noted strength of the FAO support.

The role of national context in REDD+ MRV Development

Factors that have contributed to the success and challenges mentioned in Sections 2.1 and 2.2 are summarised below.

Success factors

- **Political support** throughout the REDD+ MRV System development process has been an important contributor to the progress made.
- **Technical support** has been valuable, and has been particularly effective when delivered by teams embedded in the relevant government agencies, and targeted towards addressing specific needs and capacity gaps.
- **Financial support**, particularly through FCPF has been vital for establishing the MRV team and developing their capacity
- **Intuitional capacity** in some areas was strong prior to receiving support for REDD+ MRV System development. A team was already established within the FC RSMC with responsibility for GHG accounting, and there was also relevant expertise in GHG accounting in the EPA.
- **Local ownership** of the MRV System has been important to ensure that the data produced is accepted by local stakeholders and decision makers, and has been developed through an approach to providing technical support that focuses on knowledge transfer.

Challenge factors

- **Technical support** when delivered through top-down approaches without the full engagement of local stakeholders, although noted as a strength in some areas, has meant that progress in establishing the MRV System has been slower than may have been the case with a more collaborative approach.
- As an **early adopter** of the FCPF, Ghana has suffered a little from a lack of examples to follow which has likely resulted in a requirement for additional support. Sharing of lessons learned with other countries may therefore help to reduce the need for support elsewhere.
- The **landscape** in Ghana provides technical challenges to REDD+ MRV. The difficulty of distinguishing between cocoa and forest trees with medium resolution remote sensing data, was noted as a particular challenge that has required the use of more expensive high-resolution data that is less straight forward to acquire.

Interviewees Perspectives on Future MRV Support

For Ghana, future requirements for MRV Support identified by interviewees were related to formalising institutional arrangements and finalising operational modalities. There were also some suggestions for how the MRV support process could have been improved.

Intuitional arrangements

The need to further build the capacity of the national team to implement the approaches introduced by FAO was noted. It was also suggested that the sustainability of the system would be improved if there was permanent group mandated with REDD+ MRV as their core function.

Operational modalities

The main component of the REDD+ MRV System that needs further support to complete its development is the finalisation of a web-portal for sharing monitoring data among agencies. Further support is also needed to enable the use of sampling approaches and high-resolution remote sensing data introduced by FAO.

Recommendations

For countries that are earlier in the process of REDD+ MRV System development, it was suggested that lessons learned from countries more advance in the process are incorporated to clearly define the objectives of REDD+ MRV; and that there is an initial capacity needs assessment to be sure that capacity building is well targeted to the specific needs of the national institutions with responsibility for REDD+ MRV.

Identifying relevant policies that will need to be taken into account and that may need to be amended during the development of the REDD+ MRV system was also recommended as an important early step. It was also highlighted that local ownership of the REDD+ MRV system was vital to its long-term sustainability and was best built through a support process that is based around knowledge transfer between external consultants and staff in the relevant agencies and institutions.

Conclusions

Overview of Ghana's REDD+ MRV System

Ghana's National REDD+ Secretariat, hosted by the Climate Change Unit of the Forestry Commission has overall responsibility for REDD+ measurement, monitoring and reporting to the World Bank Carbon Fund and the Environmental Protection Agency, which is responsible for National Communications to the UNFCCC. The Resource Management Support Centre (RSMC) of the Forestry Commission is responsible for collection of field data and analysis of spatial data to generate emissions estimates, with support from a number of research institutes, universities and other organizations that contribute data and technical support.

and responsibilities have been identified. A draft Forest Reference Level was established in 2017, and subnational FRLs are under development. Many of the components of the REDD+ MRV System are therefore in place, although there remains a need to formalize institutional arrangements, enhance the capacity of national institutions to apply all monitoring approaches, and finalize the REDD+ Information Database.

The role of national context in REDD+ MRV Development in Ghana

In 2017 Ghana had around 8 million hectares of forest, around 35% of the country's land area. The rate of deforestation is among the highest in Africa however, at 3.6% per year. Direct causes of deforestation are agricultural expansion, unsustainable timber harvesting, mining, and wildfires; with underlying causes related to policy and market failures, population growth, and reliance on shifting cultivation. There is high level political support for REDD+ though, and Ghana's REDD+ Strategy was published in 2016, with a focus on addressing the drivers of deforestation and forest degradation.

REDD+ MRV development challenges and obstacles in Ghana

The main challenges that Ghana has faced in development of its REDD+ MRV System include a lack of support for products produced by consultants that were not perceived to have effectively engaged with local stakeholders. This, along with feedback from the FCPF and others, resulted in new approaches being introduced quite late in the Readiness period, and there is now the need to ensure that the finance and technical capacity to implement these is available.

The main focus of REDD+ MRV system development has been on the Cocoa Forest Landscape that is targeting results-based finance through the FCFP. The heterogeneous landscape in the country means that there are technical challenges for scaling these approaches to the national level.

REDD+ MRV development successes in Ghana

Support from the FCPF has been fundamental to the progress in REDD+ MRV System development, which has helped to establish institutional arrangements, build the capacity of local institutions, and establish key components of the MRV System. Recent support from FAO, that has focused knowledge transfer between external and national experts has helped to build the sense of national ownership of the system that was considered necessary by some interviewees, for its long-term sustainability.

Perspectives on future MRV support for Ghana

Future requirements for REDD+ MRV support identified by the interviewees were related to formalizing institutional arrangements, and ensuring that capacity within the institutions responsible for REDD+ MRV is built and maintained. The need to finalize development of the REDD+ Information Database so that it enabled sharing of monitoring data among agencies was also noted.

Key lessons

Key lessons that can be taken from experience in Ghana are that:

- Prior to receiving support for REDD+ MRV development, the capacity of local institutions should be assessed so that support can be well targeted to meet their needs.
- Information sharing between countries, and especially from countries more advanced in the process, is an important way for demonstrating how reporting requirements can be met. This will be most relevant between countries with similar context and capacity.
- External consultants engaged to support with REDD+ MRV development should employ collaborative approaches and incorporate knowledge transfer with local stakeholders. As well a building local capacity to implement the systems developed, this will also help to ensure that any products developed by the consultants will be accepted locally. This is perhaps, particularly relevant in countries such as Ghana where there was a relatively high level of capacity in GHG accounting within some government agencies, prior to receiving support for REDD+ MRV.
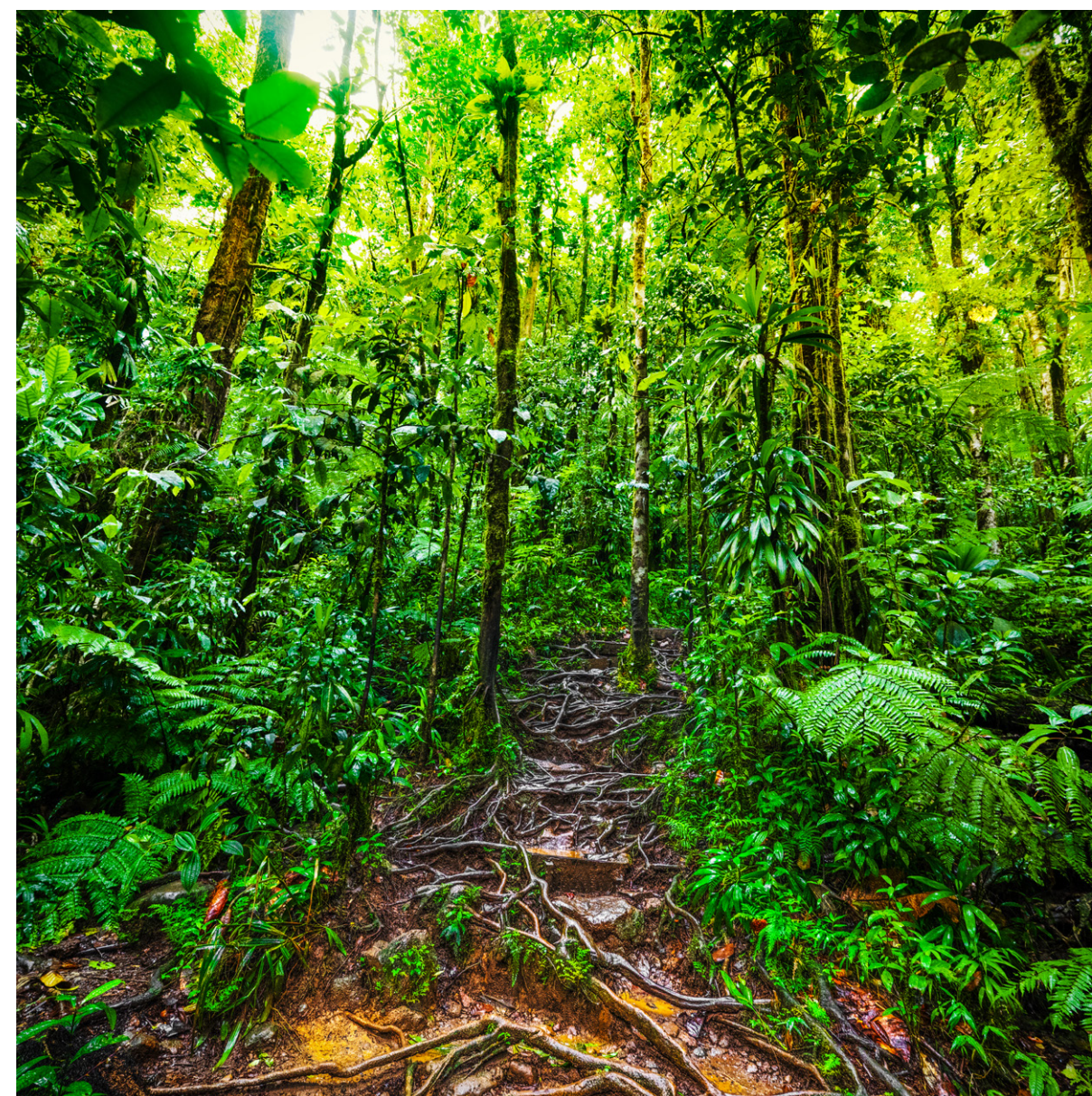
Guyana case study

Descriptive information

Basic country information

Guyana is a small, highly forested country with low population density. According to Global Forest Watch, in 2010 Guyana had 19.1Mha of tree cover, extending over 91% of its land area. The historical deforestation of 0.02% to 0.079% yr1 according to the FREL in Guyana is one of the lowest in the world. From 2001 to 2019, Guyana lost 205kha of tree cover, equivalent to a 1.1% decrease in tree cover since 2000, and 99.5Mt of CO_2 emissions (Global Forest Watch). Drivers of Guyana's forest sector emissions listed in the FREL include Mining (the primary driver), forestry infrastructure, agriculture and other infrastructure. Guyana has been monitoring its forest sector emissions annually since 2010, with support from the Government of Norway. Guyana's status as a High Forest Cover, Low Deforestation Country has defined the development of its FREL and the design of its REDD+ MRV system. The 2019 annual emissions report from the MRVS recorded fire as the key driver of deforestation in that year.

Guyana is listed as an Upper Middle-Income Country on the DAC list of ODA recipients.

Description of NFMS

Guyana's work on REDD+ MRV started in 2009, as part of the Guyana-Norway REDD+ Partnership. According to LTS International (2020), it was a pioneering attempt to design an approach for MRV that could support results-based payments for a country with high forest cover and low historical rates of deforestation. Guyana has been reporting its REDD+ emissions annually to Norway from its MRV system and receiving results-based payments since 2011. The baseline used combines the historical average with a global average deforestation rate given Guyana's low historical deforestation. Results are were externally verified by Det Norske Veritas and are currently verified by Durham University. As one of the very earliest functioning REDD+ MRV systems, it predates the development of the Warsaw Framework for REDD+ in 2013, the FCPF Carbon Fund's methodological framework in 2013 and the Green Climate Fund (GCF) scorecard for an RBP pilot scheme in 2017, and the Architecture for REDD+ Transactions (ART). The scope and coverage of the REDD+ MRVS has increased over time:

- Year 1 – 2010 Landsat, only forest non-forest classes, only rudimentary carbon data, only rudimentary forest degradation
- Year 5 – 2014 RapidEye, mapping of IPCC classes, carbon stratification, robust forest degradation, shifting cultivation, sinks; system also used for community forest monitoring and mining
- Year 8 – 2018 Sentinel and Landsat, mapping of IPCC classes, carbon stratification, robust forest degradation, shifting cultivation, emissions by driver of deforestation and forest degradation; system used for community forest monitoring, mining, scientific publications, broader applications

Guyana Forestry Commission (GFC) is the key institution for REDD+ MRV. With support partners, GFC developed the design, improved and operates the system, producing annual emissions updates on deforestation and forest degradation by driver. The 2019 MRVS Report provided annual data on emissions from deforestation broken down into seven drivers (mining, mining infrastructure, forestry, infrastructure, agriculture, settlements and fire) and degradation broken down by three drivers (timber harvesting, illegal logging, mining). According to the 2019 Annual Report, a Continuous Resource Monitoring System (CRMS), which consists of a suite of tools, has been developed to replace less efficient elements of the original MRV system. Key efficiencies that have been developed into the CRMS include: use of a cloud processing engine for computation. This is hosted by Google Earth Engine under a free license and is intended to: i) reduce the reliance of the REDD+ MRVS on commercial satellite imagery and software; ii) reduce the requirement for local storage and processing capability; and, iii) to remove the need to download satellite imagery, as access and processing is done in the cloud. This addresses the challenge of limited internet connectivity.

The REDD+ MRV system is entering its third five-year development phase. Each phase has involved the development of a roadmap for the phase that has been systematically followed. Phase 1 involved establishing an operational system; Phase 2 involved development of the system (refining methods, shifting to open source software, continuing to build capacities to run the system); and Phase 3 focuses on expanding the use of the system so that it supports Biennial Update Report and Nationally Determined Contribution reporting to the UNFCCC, monitoring against the Sustainable Development Goal indicators, monitoring for the national Low Carbon Development Plan, data use for infrastructure planning and other national uses. It is also intended to expand to move to near real time monitoring for active forest management uses, got prototype working.

Guyana Forestry Commission's key technical partners for REDD+ MRVS development are Indufor Asia Pacific and Winrock International. Wageningen University and FAO have also been important partners.

REDDcompass Building Block progress scores

Guyana was not part of the REDDcompass Building Block Analysis.

Country needs assessment (CNA) areas identified for further support

Guyana was not part of this analysis, however, one of the subsidiary spreadsheets, the MRV Gap Assessment, listed Guyana as finished or nearly finished MRV readiness but requiring additional funds/technical support for MRV implementation.

REDD+ MRV support activities and partners

Guyana has been supported on REDD+ MRV by one donor, Norway, since 2010. Initially this was through the Guyana -Norway REDD+ Partnership Agreement, but more recently this support has been through Norad. Further detail available int Table 20.

Table 0.1 REDD+ MRV Support to Guyana

Support Activity	Funding ($)	Financial Instrument	Donor / financer [if non-donor support]	Support Mechanism
Forest Carbon Partnership Facility Readiness Grant	3.8 million within this, a very small activity on training indigenous leaders and NGOs on MRV issues)	Grant	World Bank	TA, embedded TA, consultancy etc.
Green Climate Fund Readiness Grant	1.2 million (limited if anything on MRV)	Grant	Green Climate Fund	
Guyana MRV Project, ongoing, started 2010		Grant	NICFI, then Norad	TA, consultancy, embedded TA (initially)

Case study narrative

The role of national context in REDD+ MRV development

Guyana is a small country with a centralized system of government and relatively homogenous forest landscape and forest carbon distribution. REDD+ has been strongly supported by the national government since COP 13 in Bali, in line with its national Low Caron Development Strategy. One central government institution has had responsibility for the design and execution of its REDD+ MRV system – the Guyana Forestry Commission. This comparatively simple institutional framework, landscape and country size all make forest monitoring in Guyana relatively simple compared with other REDD+ countries. Guyana has had continuous long-term funding for establishment of its REDD+ MRV system from one single donor. As a country with high forest cover and low historical deforestation rates, Guyana seeks Results-based Payments for avoided deforestation rather than reduced deforestation.

REDD+ MRV development challenges and obstacles in Guyana

Limited capacity starting point

Relevant national capacity for REDD+ MRV was limited to timber concession inventory.

Financial sustainability

A key challenge during Phase 2 of the system development was sustainability of financing. The REDD+ MRV system was expensive to operate and much of the annual running cost came from the partnership with Norway– development aid with a finite lifespan. Hence, one of the key objectives of the MRV's second phase (2015 to 2020) was to improve the system so to allow Guyana to continue to monitor forest change in the event of a "non-REDD+ payment" scenario. GFC is also exploring other potential routes for funding such as the Architecture for REDD+ Transactions (ART) and the Green Climate Fund.

Whilst use of high-resolution, yet expensive RapidEye imagery had enabled Guyana to map area changes according to detailed land-use classes, more recently Guyana introduced a combination of freely available Sentinel imagery with slightly lower resolution Landsat imagery, and is combining that with free license, open-source and efficient cloud based processing. Use of low cost/no cost options are one of the means by which the GFC seeks to ensure the financial sustainability of the system.

Alignment of multiple reporting requirements

This was a challenge early on but become less so as relationships and understanding between entities has developed, and the needs of each are better known.

Maintaining the pool of technical expertise

Whilst very high levels of competence has been built in the Guyana Forestry Commission (GFC) and there has been relatively low turnover of staff the detailed documentation of Standard Operating Procedures, succession planning and ensuring that multiple people have the knowledge necessary for each of the tasks has been necessary to avoid a loss of knowledge when staff move on.

There is an ongoing need to update and refine the system

Whilst technical support is no longer needed to operate the REDD+ MRV system, development of the system still requires the support of GFC's technical partners.

REDD+ MRV development successes in Guyana

Early example of an operational system, which has produced annual reporting and generated results-based payments

The Guyana system is one of the earliest examples of a functioning REDD+ MRV system. Guyana has been receiving payments for verified results achieved as documented by the system, since 2011.

Developed national forest monitoring capacity

There has been a huge increase in technical capacity of GFC staff. From a low capacity starting point most of the system is now run in-house. started in the beginning with no real forest expertise and no real forest inventory. But we have built both over the last 10 years.

Systematic, phased approach to REDD+ MRV system development, with ongoing improvement, refinement and optimisation of the system

The systematic phased approach to establishment and refinement of the system, spelled-out from the start in a roadmap for each phase generated in conjunction with stakeholders was

considered a critical success. The ongoing refinement and development of the system, from 2010 using Landsat, when only forest non-forest categories and only rudimentary carbon data and rudimentary forest degradation monitoring was possible; to 2018 using Sentinel and Landsat (after several years working with high resolution Rapid-Eye) to enable mapping of IPCC classes, carbon stratification, robust monitoring of forest degradation and shifting cultivation, quantification of emissions by driver of deforestation and forest degradation and the routine application of community forest monitoring.

Recent developments have optimised processes and increased operational and financial efficiencies by moving to cloud-based processing and data storage and free and opensource data and software.

Embedding and increasing national value by expanding range of uses of the data

In 2018 the GFC facilitated consultations with several agencies to identify options for further use of MRVS data and outputs for forest monitoring and management. The consultation process found considerable interest in the increased use of MRVS data across Government agencies and non-government organisations, for a broader range of potential applications linked to their areas of work. An overarching theme across agencies was the need for up-to-date information on land cover changes. There has been lots of development in the last five years. The land cover data are also now used to support a range of national needs, from natural resources management, support for students in the University of Guyana to data used by the Ministry of infrastructure in infrastructure planning. A protocol of near real-time monitoring is being piloted to aid forest management in Guyana. The REDD+ MRV system data and staff expertise are also used for a range of international reporting (UNFCCC Biennial Update Reports and NDC reporting; UNCCD reporting; Sustainable Development Goals reporting) and national reporting – for instance against the Guyana Low Carbon Development Strategy.

The role of REDD+ MRV support

The importance of trusted, long-term partners that really understand the context

The GFC's key technical partners have been involved from the beginning of the REDD+ MRV establishment process and their intimate understanding of the local context for the MRV system was considered to be very important in aiding its development.

Capacity building focus of the support

The central focus on capacity building in the early stages of the system establishment are considered by GFC to have succeeded in truly building the necessary capacity of GFC to now operate the REDD+ MRV system independently and this is much valued. At this stage in evolution of the system, GFC's technical partners are drawn on for development needs only.

Interviewees perspectives on future MRV support

Ongoing technical development

This will be an ongoing need as the system and its scope will continually need to adapt and evolve alongside national and international needs.

Conclusions

Guyana is an example of a country that in 10 years progressed from very little capacity to developing and being able to independently operate its REDD+ MRV system. The capacity building focus of the support has enabled the system to be fully owned and operated by the GFC. Technical support is now needed only for system development purposes rather than ongoing operation. The systematic phased approach to development has been very successful, enabling the building in of financial and operational efficiencies and to address the challenge of limited internet connectivity. The current phase of development of the system to embed it by applying the data for a range of national and international uses should hold much demonstration value for other countries that are currently establishing their REDD+ MRV systems.

Key lessons

- A relatively long time period on ongoing development has been required, even with long-term consistent funding and a relatively simple forest landscape and institutional context
- The systematic, phased approach of 1) initial operationalisation; 2) refinement and optimisation; and 3) value addition and expansion of uses for other national purposes has worked well in the case of Guyana.
- The move to cloud-based data storage and processing could be useful for other countries with internet connectivity challenges
- The focus on opensource, license-free data and software options appears to be a useful way to optimise cost-efficiency.
- The Guyana example demonstrates how a capacity building focused support has enabled the system to be fully owned and operated by the GFC. Technical support is now limited to development purposes rather than ongoing operation.

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Indonesia case study

Descriptive information

Basic country information

The Republic of Indonesia is the world's largest island country with a huge land area of nearly 2 million square kilometres spread among seventeen thousand islands and with over 267 million people, it is the world's fourth most populous country. Much of Indonesia's land is forested. According to Global Forest Watch, as of 2010 73% of Indonesia's land area was natural forest cover, consisting of 137 Mha of natural forest, 20 Mha of plantations and 31 Mha of non-forest. Indonesia has high historical deforestation rates. From 2001 to 2019, Indonesia lost nearly 27 Mha of tree cover, a 17% decrease in tree cover since 2000, causing 10.9 Gt of CO_2 emissions (Global Forest Watch).

Indonesia's forest reference emission level (FREL, Republic of Indonesia, 2016) includes both deforestation and degradation is set at 0.351 $GtCO_2e$ yr^{-1} (AGB) for the reference period 1990-2012, plus 0.217 $GtCO_2e$ yr^{-1} from peat decomposition as a result of deforestation and degradation.

Indonesia's REDD+ National Strategy and the Emission Reduction Program Document (ERPD) for the Forest Carbon Partnership Facility (FCPF) Carbon Fund East Kalimantan Subnational Emission Reductions Program list the key emissions drivers in Indonesia's forests as the expansion of oil palm estates, timber plantations, mining, overlogging and poor concession management, illegal logging and other agricultural expansion.

Indonesia was an early starter on REDD+ MRV, with preparatory studies on forest area and forest carbon emissions forming an important component of the Indonesia Forest Climate Alliance outputs during 2007 in the lead up to the formalisation of REDD (as it was then) in the UNFCCC negotiations at COP 13 in Bali. A National Forest Inventory had been developed prior to this, which has subsequently been built on and developed, and by 2009 a National Carbon Accounting System (NCAS) had also been established (Indonesia R-PP, 2009).

Indonesia submitted its' REDD+ technical annex to the UNFCCC as part of its second Biennial Update report in 2018, finalised an ERPA with the World Bank Carbon Fund in later 2020, is receiving payments for measured, reported and verified emissions reductions through its bilateral agreement on REDD+ with Norway and through an agreement with The Green Climate Fund, and has the potential to receive results-based payments through a fourth fund, the World Bank Biocarbon ISFL.

Indonesia is listed as a Lower Middle-Income Country on the DAC List of ODA Recipients.

Description of NFMS

Overview of the Indonesian system for REDD+ MRV

The Indonesian REDD+ MRV system is highly advanced in development (Table 1), subnational in that data collection is decentralised, at the regional level and transferred to the national level and consists of:

- A National Forest Monitoring System;
- A Forest Reference Emissions Level; and,
- A National Carbon Accounting System.

According to MOEF (2018), the National Forest Inventory was originally developed between 1986-1998 through a partnership with FAO. This has been subsequently built on and developed into the current National Forest Monitoring System (NFMS, SIMONTANA-*Sistim Monitoring Hutan Nasional*) which provides comprehensive data on forest resources through satellite based forest mapping and change analysis, national forest inventory and forest and land fires (burn scar data sets), which all are updated regularly and available online.

Indonesia's national Forest Reference Emissions Level (FREL) was submitted to the UNFCCC Secretariat in December 2015 and finalised after UNFCCC TAC review in November 2016.

Indonesia's National Carbon Accounting System began development through a partnership with the government of Australia and FORDA. MoEF tested the NCAS at the subnational level in the REDD+ Pilot Province of Central Kalimantan in 2014. The NCAS was formally endorsed by the Minister of Environment and Forestry as the basis for Indonesia's national MRV system for the land-based sectors, including REDD+ activities, at a public seminar on 27 March 2015. It has subsequently been used to produce the first comprehensive GHG inventory for Indonesian forests and peatlands, nationwide. The NCAS is designed to produce Indonesia's national GHG inventory for the land-based sectors for its National Communication (NatCom) and Biennial Update Report (BUR) to the UNFCCC.

Indonesia's institutional framework for REDD+ MRV

The NFMS is housed within the Ministry of Environment and Forestry, and jointly managed by the Directorate of Forest Resources Inventory and Monitoring (*Direktorat Inventarisasi dan Pemantauan Sumber Daya Hutan,* IPSDH), Directorate General of Forestry Planning and Environmental Arrangement (*Diretorat Jenderal Planologi Kehutanan dan Tata Lingkungan*-Ditjen PKTL). The IPSDH has four sub-units: (1) forest inventory (field data), (2) forest monitoring (satellite based land cover and change mapping), (3) forest mapping (data analysis e.g. deforestation mapping) and (4) spatial data networking (data management, data sharing and outreach).

A range of other institutions also have a role in REDD+ MRV: The National Institute of Aeronautics and Space (*Lembaga Penerbangan dan Antariksa Nasional*-LAPAN), the Geospatial Information Agency of Indonesia (*Badan Informasi Geospasial*-BIG), and the provincial offices of the Directorate General of Forestry Planning and Environmental Arrangement (*Balai Pemantapan Kawasan Hutan*-BPKH).

LAPAN provides pre-processed, cloud-free mosaics of remote sensing data, the BPKHs undertake visual interpretation for land cover mapping at provincial level using a standardized method, IPSDH is responsible for quality control/quality assessment (QA/QC) and integrating the land cover maps generated by the BPKHs.

MRV tasks are integrated and shared with the Directorate General of Climate Change in MoEF, which has overall responsibility for REDD+ MRV. The IPSDH and PKTL are responsible for producing the forest and biomass data, whilst the Directorate of Inventory, GHG and Monitoring, Reporting and Verification (IGRK-MPV) and the Directorate General of Climate Change in MoEF is responsible for using the forest and biomass data in MRV of greenhouse gas emissions using the National Carbon Accounting System.

REDDcompass Building Block progress scores

All four components of the Institutional Arrangements Building Block were scored as Advanced in the REDDcompass Assessment. None are nearly finished so progress on this Building Block is less than the Policy and Design Decisions and the Measurement and Estimation building blocks. The other categories in the assessment were Nearly / Fully Finished; Early Stage; and Falling Behind.

This Policy and Design Decisions Building Block is almost complete, with five of the six components score as nearly / fully finished. The LULC Stratification scheme is scored as Advanced. This Building Block is the closet to being finished.

Two of the five components of the Measurement and Estimation Building block were scored Nearly/Finished, whilst the remaining three were scored Advanced. This building Block is the second nearest to completion after Policy and Design Decisions.

The Reporting and Verification Building Block scored lowest for progress. Whilst the Reference Emissions Level and AFOLU GHG Inventory Reporting were scored Nearly / Fully Finished and Advanced, respectively; the three remaining components all scored Early Stage or Falling Behind. Further detail available in Table 21.

Table 0.1 REDDcompass Building Block scores

REDDcompass Building Block	Second Level Building Block Components	MRV Gap Assessment
Institutional Arrangements	- Forest Policy + Governance	Advanced
	- MRV Institutions	Advanced
	- Processes	Advanced
	- Methods + Tools	Advanced
Policy and Design Decisions	- Forest Definition	Nearly/Fully Finished
	- REDD+ Activities	Nearly/Fully Finished
	- Carbon Pools	Nearly/Fully Finished
	- LULC Stratification Scheme	Advanced
	- Approaches, methods + tiers	Nearly/Fully Finished
	- Spatial + Temporal Scope	Nearly/Fully Finished
Measurement and Estimation	- Remote-Sensing Observations	Nearly/Fully Finished
	- Uncertainty	Advanced
	- Ground-Based Observations	Nearly/Fully Finished
	- Integration + Estimations	Advanced
	- Record Keeping	Advanced
Reporting and Verification	- AFOLU GHG Inventory Reporting	Advanced
	- Non-Carbon Related Reporting	Early Stage
	- Reference Emission Levels	Nearly/Fully Finished
	- REDD+ Reporting	Falling Behind
	- Internal + External Analysis	Falling Behind

Country needs assessment (CNA) areas identified for further support

Indonesia was classed as 'Completed MRV Readiness', according to the CNA assessment spreadsheet, but still 'needs additional funds/technical support for MRV implementation'. Six areas under the Measurement and Estimation Building block are identified as "needs" for further work in the analysis. This seems a little contradictory given the Building Block progress scores in Table 22, which indicate that the Reporting and Verification Building Block is the component of MRV which is furthest from completion. However, the "needs" are aligned with the areas of Monitoring and Estimation that are scored as Advanced rather than Nearly/Fully Finished.

REDDcompass Building Block	Second Level Building Block Components	CNA sub-topics	Identified Need (E.g Ethiopia Example)
Institutional Arrangements	- Forest Policy + Governance - MRV Institutions - Processes - Methods + Tools		
Policy and Design Decisions	- Forest Definition - REDD+ Activities - Carbon Pools - LULC Stratification Scheme - Approaches, methods + tiers - Spatial + Temporal Scope		
Measurement and Estimation	- Remote-Sensing Observations - Uncertainty - Ground-Based Observations - Integration + Estimations - Record Keeping (Documentation)	- Land cover maps - Area Estimation - Activity Data - Forest Degradation - Biomass - Other	-Data Integration - Emissions Factors - Forest Degradation – Satellite Imagery - Documentation QA / QC - Standard Operating Procedures-Fire Monitoring and Emissions
Reporting and Verification	- AFOLU GHG Inventory Reporting - Non-Carbon Related Reporting - Reference Emission Levels - REDD+ Reporting - Internal + External Analysis		

REDD+ MRV support activities and partners

Table 3 has been prepared primarily from the GFOI Inventory of Forest Monitoring Support Activities.

Indonesia has received much support from a very wide range of donors (Table 23). Much of this support in recent years has been for discrete projects, often with a research basis, that tackle improvements to the existing system or capacity for MRV.

Table 0.3 REDD+ MRV support to Indonesia

Support Activity	Funding ($)	Financial Instrument	Donor / financer [if non-donor support]	Support Provider	Support Mechanism
Indonesia-Norway REDD+ Partnership Phases 1 and 2	Some towards MRV	Grant	Norway		
BioCarbon Fund Initiative for Sustainable Forest Landscapes - Jambi Sustainable Landscape Management Project	15 million, of which some goes towards MRV	Grant, potential for RBP	World Bank		
Forest Carbon Partnership Facility - Readiness Fund (FCPF-RF	8.6, some of which goes towards MRV	Grant	World Bank		
UN REDD Programme	5.6, of which some towards MRV	Grant	UN-REDD	FAO	TA
Development of an Improved Peatland Monitoring System			FAO	FAO	TA
Follow-on technical assistance to support the uptake of methods and skills introduced in regional workshops			USAID	SilvaCarbon, Various regional partners	Consultancy
Follow-up Webinar on Open Source Change Detection			USAID	SilvaCarbon, Various regional partners	Consultancy Workshop
Forests 2020: Improving forest monitoring systems through better application of satellite data			UK Space Agency	International Partner(s): Carbomap, Ecometrica, UKSA, University of Edinburgh, University of Leicester Country Implementing Partner(s): Bogor Agricultural University (IPB), PT Hatfield Indonesia, Daemeter	TA, Research Program
Forests and Climate Change Programme (FORCLIME)			GIZ	International Partner(s): GIZ Country Implementing Partner(s): Indonesian Ministry of Environment and Forestry Dinas Kehutanan KPH	TA

Name	Funding	Partners	Type
Global Forest Resources Assessment (FRA) Remote Sensing Survey 2020 National Workshop for Indonesia, Kuta, Bali		International Partner(s): European Union (EU),International Institute for Applied Systems Analysis (IIASA),Joint Research Centre of the European Commission (JRC),National Aeronautics and Space Administration (NASA),Norway's International Climate and Forest Initiative (NICFI),Swedish University of Agricultural Sciences (SLU)	Consultancy Workshop
Global Peatlands Initiative: Assessing, Measuring and Preserving Peat Carbon		International Partner(s): FAO,Greifswald Mire Centre,UN Environment; Country Implementing Partner(s): Ministry of Environment and Forestry; Badan Restorasi Gambut,	TA
Improvements to Indonesia's land sector MRV	Ausaid	International Partner(s): Government of Australia; Country Implementing Partner(s): Indonesian Ministry of Environment and Forestry, Research, Development and Innovation Agency	TA
MOnitoring Mangrove ExteNT & Services (MOMENTS)	UKRI	International Partner(s): Aberystwyth University, UK; Country Implementing Partner(s): Indonesian Ministry of Environment and Forestry	TA, Research Program
MRV system of FCPF and ISFL ER Program	WB FCPF		TA
PYEO (Python for Earth Observation libraries)		International Partner(s): National Centre for Earth Observation (NCEO),University of Leicester; Country Implementing Partner(s): IPB, RMSC, IDEAM, KFS, ECOSUR, National Defence University of Malaysia	Research Program
Peat atlas		World Resources Institute; Country Implementing Partner(s): Peat authority, BRG	Research

Name	Funding	Partners	Type
Peatland Assessment in SE Asia by Satellite (PASSES)		International Partner(s): UKSA; Country Implementing Partner(s): Peatland Restoration Agency (BRG), Asia Pacific Resources International (APRIL), World Resrouces Institute Indonesia (WRI), Geospatial Agency (Badan Informasi Geospatial, BIG), IPB, Global Environment Centre (GEC)	Research
Provision of Baseline Data and Cadastral Maps for Priority Provinces in Indonesia		International Partner(s): LTS International (UK); Country Implementing Partner(s): Indonesian Ministry of Environment and Forestry	Consultancy / Research
Regional GFOI Workshop on Selected Technical Topic		International Partner(s): FAO,SERVIR Hubs,SilvaCarbon,USGS	TA
Regional Training on Forest Landscape Restoration Planning and Monitoring for Meeting National Targets and International Commitments		FAO,IUCN,SERVIR-Mekong,SilvaCarbon,Universities, NGOs and private sector working on restoration	TA
Strengthening Indonesian Forest and Land Monitoring for Climate Actions		FAO,Norway	TA
Technical assistance to REDD+ implementation		International Partner(s): FAO,UN-REDD; Country Implementing Partner(s): Indonesian Ministry of Environment and Forest (MoEF)	TA
Training in TimeSync Remote Sensing Sampling Tool to Improve Classifications of Land Cover Classes for GHG Inventory		FAO,SERVIR-Mekong,SilvaCarbon,USFS,USGS	TA
Indonesia National Carbon Accounting System (INCAS)	Ausaid	International Partner(s):Government of Australia; Country Implementing Partner(s): Indonesian Ministry of Forestry (now MoEF)	TA
Indonesia Forest Climate Alliance (2007-2008)	World Bank, PROFOR, and the British, Australian and German Governments	Ministry of Forestry (now MOEF), FORDA	TA
National Forest Inventory (1989-1998)	FAO	Ministry of Forestry (now MOEF)	TA

Case study narrative

The role of national context in REDD+ MRV development

The national contextual factors that have influenced the development of MRV REDD + in Indonesia are generally divided into several interrelated groups: synchronization context factors between governments at various layers that affect the ability to make progress; factors related to unequal human capacity and other resources; factors of quality of existing or obtained data, and factors of the Indonesian context related to decisions about the scope of the REDD + MRV system. There are several important features of Indonesia that support the development of MRV REDD +, while there are some that hinder progress from the process that is currently being developed.

Strong alignment with national strategies

REDD+ MRV system development is strongly aligned with key national development, sectoral and climate strategies and targets. Indonesia's forests play a strategic role in national and global climate change mitigation and adaptation and Indonesia is one of the REDD+ countries that has played an active role in UNFCCC negotiations related to forests and REDD+.

Long-term donor support

Linked with Indonesia's commitment to reducing emissions related to forestry, Indonesia has four long-term REDD + partnership agreements, which all focus on the receipt of results-based payments for emissions reduced in the REDD+ sector: 1) a REDD+ RBP program with the GCF; 2) a REDD+ partnership agreement with Norway; 3) an ERPA signed with the World Bank's Forest Carbon Partnership Facility Carbon Fund; and 4) an program agreement with the World Bank's Biocarbon Fund Initiative for Sustainable Forest Landscapes.

Together, the combination of ambition at the national level, the presence of long-term grant funding for the development of MRV REDD+ through partnerships that ultimately requires REDD + MRV as the basis for payments for emission reductions, provides a strong mandate for related institutions to develop a REDD + MRV System.

REDD+ MRV is one of the highest priorities to for the Indonesian government

Indonesia, home to the third largest area of tropical rain forests in the world, has been one of the leading countries in the development and piloting of REDD+, the results of which influence the dialogues and development of the mechanism globally. In the G20 meeting in Pittsburgh in September 2009, then President Susilo Bambang Yudhoyono announced Indonesia's plan to reduce emission by 26 percent from business-as-usual levels, or up to 41 percent with international support, by 2020. Indonesia was the first developing country to commit to voluntary emission reduction targets.

Some starting capacity on REDD+ MRV

Through an existing National Forest Inventory and preCOP13 precursor studies on forest biomass and emissions, but this was confined to the national level in MOEF (was Ministry of Forestry) and FORDA, with no starting capacity at the subnational levels.

Heterogenous landscape and accessibility

Indonesia has a large (around 140 million hectares) and highly heterogeneous forest area, spread across 34 provinces. This substantially adds to the complexity of measurement required to be able to monitor forests and produce high quality national data.

REDD+ MRV development challenges and obstacles in Indonesia

The challenges described by resource persons fall into four broad groups: challenges related to capacity; technical challenges and challenges related to system operation.

Capacity related challenges

Lack of general technical expertise; there is currently a major capacity gap at the regional levels

All interviewees stated that previously there was no capacity relevant to REDD+ MRV. Whilst some national level capacity on national forest inventory and from early work on forest carbon and biomass studies existed at the outset, all interviewees noted the lack of national technical capacity as a fundamental barrier to REDD + MRV development. Although a lot of capacity has now been built at the national level, albeit spread across various agencies, the technical capacity at the regional level is still deemed inadequate or absent. The current focus of local level staff is on REDD + more broadly, this creates an important technical capacity gap for a REDD + MRV system as local staff are essential for technical coordination as well as points of contact capable of providing information or aligning information between national and regional level, so there is the same understanding at all levels.

Insufficient technical / IT infrastructure

The necessary technical infrastructure for full operation of the REDD+ MRV system is not yet available. The specific constraints are a lack of good internet connectivity and speed at the subnational levels, which are necessary for using satellite data and performing GIS analysis. The hardware and software infrastructure that is required has not been fully implemented.

Sustaining technical expertise in the system

Turnover of staff in national or regional level due to political changes or government processes of frequent changes in position affected ability to build the capacity in national and regions / provincial level. It is not uncommon that staff changes due to political changes can occur right down to the lowest level of government.

Current technical challenges

Lack of consistent, high quality local data

Consistency of data quality and data validation is a tough challenge across the whole of

Indonesia's vast forest area. The national system and the FREL provide a model that other levels will follow. The provincial MRV and FREL systems are run by the district level MRV and FREL systems, based on the national level reporting and system. Hence, the national level relies on the regional level to provide high quality data, but this level currently has low capacity to do so.

In addition, there are several directorates or institutions that find it difficult to provide access to data, because they are too sensitive, or the data cannot be verified, is of poor quality or methodologically biased or otherwise unsuitable. The result of this lack of local data / poor quality local data is that it is a real challenge for the MRV team to undertake successful analysis and generate activity data due to inaccuracies, lack of data and data quality constraints and resulting wide confidence levels.

Insufficient access to high resolution satellite data

Given the large size of Indonesia's forest area and the heterogeneity of its forest ecosystems, Indonesia requires access to a large amount of high-resolution satellite imagery. Currently it is unable to access full coverage and prioritisation within its forest area is complicated and time intensive as this prioritisation needs to be agreed upon through its decentralised government structure.

Not all necessary methodologies have yet been developed

Methodologies for assessing displacement and reversal have not yet been developed to date.

Challenges with REDD+ MRV system operation

Developing systems and linkages between the national level and regional level

Interviewees stated that some real challenges lie in how to synchronize the different regional REDD+ MRV systems that have been developed within the five pilot provinces/schemes so that there can be replication in other provinces and easy feed up of information to the national level.

There are also differences in the understanding of the importance of REDD+ MRV among regions, and perceptions on how the RBP are allocated and distributed to the regions, which affects the allocation of resources to REDD+ MRV at local levels.

Institutional position within the Indonesian bureaucratic hierarchy

Changes in jurisdiction level for REDD+ activities from the level of the Ministry to within the Ministry, but under the Directorate.

One of the interviewees felt that the basis for the gaps that still exist in the REDD+ MRV system was not only due to technical issues but was also due to the level in which REDD+ activities are managed within the government system. The previous REDD+ Agency was a Ministry level Agency, whereas this work is now positioned at sub-directorate level within a Ministry. This is far lower level within the government administration, which the interviewee

felt resulted in a lack of access to the necessary experts, reduced ability to move quickly and reduced mandate because the sub-directorate must focus on a range of issue. the supported by the bureaucratic and administrative levels which are now very far below (sub-directorate level), so that they lacked access to experts, even internally.

Cross-cutting

How to fill the gaps among regions

Challenges are arising in building the capacity of other regions to catch up with the pilot and other regions that received funding first, and for regions that do not receive funding to catch up with other regions that receive funding.

How to synchronize results monitoring and reporting for different donors and funds

Each of the three current partners that Indonesia has RBP agreements with have their own scoping activities, their own reference period and their own range of measurable carbon pools etc.

REDD+ MRV development successes in Indonesia

Institutional and regulatory framework is established

The institutional and regulatory framework has been established nationally and internationally (in terms of the FREL). This was considered by interviewees to be a major success in the developing of the Indonesian REDD+ MRV system and defines the institutions involved and their roles, as well as outlines the technical components of the system:

- National 1st FREL has been assessed by Technical Assessor UNFCCC and have met all requirements.
- MoEF has issued MoEF Regulation No. P.71/MENLHK/SETJEN/KUM.1/12/2017 on the Implementation of the National Registry System on Climate Change Control, MoEF Regulation no. P.73/MENLHK/SETJEN/KUM.1//12/2017 on Guidelines on the Implementation and Reporting of National Greenhouse Gas Inventories and MoEF Regulations P.72/MENLHK/SETJEN/KUM.1/12/2017 on Guidelines for Implementation of Measurement, Reporting and Verification of Climate Change Action and Resources.
- Decree of DG CC No. P.9/PPI/SET/Kum-1/10/2018 and Book about Guidance of Methodology for Emission Reduction Calculation and or Increasing GHG Sequestration in Framework of Mitigation Action Verification.
- The SRN-PPI (National Registry System DG Climate Change) can be accessed via the URL http://ditjenppi.menlhk.go.id/srn/.
- Integration Process of National Registry System to the Subnational Registry System. This system will be integrated with safeguards and benefit sharing mechanism in FCPF Carbon Fund East Kalimantan.
- Subnational FREL allocation already exists and has been determined by Decree of the Director General of Climate Change No. SK.8/PPI/IGAS/PPI.2/3/2019 on Determination of FREL in Subnational (Province) on March 11, 2019.
- Remote sensing data is processed by the National Forest Monitoring System (NFMS)

named Simontana (Sistem Monitoring Hutan Nasional). It is available online at http://nfms.dephut.go.id/ipsdh/, which coupled with webGIS at http://webgis.dephut.go.id/ for display and viewing.

- Final Draft of SOP for analysis on land use change uncertainty and accuracy on June 2020 and has been consulted with Experts Team from MoEF and University.

Necessary MRV technical expertise built

Most interviewees regarded the increase in government technical capacity for MRV to be one the key success of the REDD+ MRV development process so far, though this is a continuing need at the regional level.

Increased collaboration between institutions

The central government realizes that they are not capable of doing it alone, so they involve other stakeholders outside the MoEF. Also, combination of public and private financing because the public financing that need to work right now is basically to provide room for even larger investment from private sectors to coming, that kind of leveraging needs to be ingrained or to be within the DNA of public financing. This needs to be taken into account when the assistance is designed.

Success factors identified by interviewees

Strong Leadership and commitment from the Indonesian government

Most interviewees mentioned commitment from the government to have been the key factor for the success of the REDD+ MRV development process so far. The highest-level commitment of the president and the government to REDD+ has mobilised institutions to make progress. The current MOEF Minister is considered strong and to have real understanding of what is needed of the REDD+ MRV system, which has also aided progress.

Strong alignment with Indonesia's commitments (NDC) results in strong government support

The interviewees stated that there is close alignment with Indonesia's commitment to emission reduction announced in 2009, implying that there is strong political motivation and government willingness for the creation of a REDD+ MRV system, and that its creation is widely supported by various donor organizations.

Ability to use donor support to bring some of the best experts to Indonesia to build the system

Multi-donor funding has made it possible to include the best international and national experts to assist in building the system, which the government cannot do because of its remuneration policy. Donor funds are used to capture these strategic human resources by employing them under donor agency contracts. This is considered important to gain knowledge transfer and maintain the best national expertise.

Favourable timing

Timing has been important – when the current government came to power in 2015 Indonesia was experiencing some of its worst forest fires. The new government had a very strong political pressure to respond to this and prevent this from happening again, which added impetus to the REDD+ MRV development process.

Importance of sovereignty and national ownership of system, which works with existing systems and institutions

It has been important for Indonesia to build from its existing systems and institutions from a sovereignty and national ownership perspective.

The role of REDD+ MRV support

Long-term provision of experts, that have become trusted partners

The interviewees commented that they had good technical partners that had really helped in planning and implementing the REDD+ MRV development process. The same partners that have been involved since the beginning continue to be involved, alongside newer partners.

Support focused on knowledge transfer

Related to the importance of sovereignty and national ownership of the REDD+ MRV system, interviewees highly valued support approaches that transferred knowledge through training and workshops to Indonesian experts for them to use in developing and operating the system of REDD+ MRV.

Access to high resolution satellite imagery

The role of the Indonesia's support providers in facilitating access to high resolution satellite data was regarded highly.

Future support needs

Facilitation of access to high resolution satellite imagery- Free access to high-resolution satellite imagery (example: Planet Data/SEPAL FAO), or longer time period to download if wall-to-wall-coverage is not feasible. This high-resolution satellite imagery would be used for validation process to increase data accuracy and to decrease uncertainty data ongoing support on technical updates as the state of the art develops; and facilitation of access to high resolution satellite data

Building the coordination among agencies at the national and subnational levels- Coordination among agencies that possess related forest data could be improved and made more efficient

Building the capacity of institutions at the subnational level to operate the MRV REDD+ system- Provincial Capacity Mapping would be a starting point since the capacity is highly variable between provinces. This would cover institutional, technical expertise and technological infrastructure to help prioritize what should be worked on where.

Conclusions

Indonesia was an early mover on REDD+ MRV with precursor studies on forest biomass and forest sector emissions developed in the run up to COP13 in Bali. It had some prior capacity at the national level for MRV through its existing national forest inventory. There has been strong national motivation for REDD+ progress, including on REDD+ MRV because it aligns with national climate change and development policies and targets and other national priorities such as fire monitoring. REDD+ MRV development in Indonesia is challenging technically due to size and heterogeneity of forest area and operationally due to subnational design, requiring sufficient technical competency at regional as well as national level, good linkages between jurisdictions and the federal level, and, ideally, consistency of data across the regions. Whilst Indonesia's REDD+ MRV system is considered advanced for all four of the REDD+ Compass Building Blocks, there remain substantial issues to resolve, particularly low capacity at the subnational level, IT infrastructure challenges at local level, consistency of data and access to sufficient high resolution satellite data. A large number of donors have provided support to Indonesia for the development of its REDD+ MRV system, much of which has involved either research to help with the development of the system or technical knowledge share to national experts. This focus has been important to Indonesia given its desire to develop the system itself and given that there was some relevant capacity for forest monitoring at the outset. Indonesia currently has four agreements that currently, or have the potential to, generate results-based payments for Indonesia, which has provided additional strong incentive for continued progress on REDD+ MRV.

Key lessons

- Strong alignment with national policies and priorities, along with strong national leadership have been key drivers of progress.
- Sovereignty and national leadership of the development and operation of the system has been of critical importance for Indonesia and support provision that is aligned with this has been favourably viewed.
- The capacity development and operational linkages and coordination needed to operate Indonesia's subnational REDD+ MRV system are ongoing and extensive.
- Access to donor funding (as opposed to national government funding) enabled access to the best national and international experts
- Access to satellite imagery needs to be commensurate with forest area and context. In Indonesia's case, lack of access

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Mozambique case study

Descriptive information

Basic country information - Mozambique

Mozambique borders Tanzania, Malawi, Zambia, Zimbabwe, South Africa, and Eswatini. Its long, Indian Ocean coastline of 2,500 kilometers faces east to Madagascar.

About two-thirds of its population of more than 29 million (2018) live and work in rural areas. It is endowed with ample arable land, water, energy, as well as mineral resources and newly discovered natural gas offshore; three, deep seaports; and a relatively large potential pool of labor. It is also strategically located; four of the six countries it borders are landlocked, and hence dependent on Mozambique as a conduit to global markets. Mozambique's strong ties to the region's economic engine, South Africa, underscore the importance of its economic, political, and social development to the stability and growth of Southern Africa as a whole. (The World Bank in Mozambique, 2020)

The forest sector contributes greatly to Mozambique's GDP. In 2011 the sector contributed about US$330 million to Mozambique's GDP in 2011, directly employing 22,000 people, and in 2016, it represented about 13.7% of GDP. (Mozambique Country Forest Note, 2018).

> **Mozambique country facts**
> - Area:78,6 Mha (GFRA 2020)
> - Total population: 28 861 863
> - GDP Per capita: US$ 480
> - Source of economy: Agriculture, Fisheries, Mineral Resources, Energy and Tourism
> - Poverty: 51%
> - Total area of forests: 34 million ha

Aid eligibility category

Mozambique is among the 47 least developed countries[37] in the world based on the DAC List of ODA Recipients (2020). Mozambique´s gross national income (GNI) as published by the World Bank (2019) is 480 USD per capita.

Further on Mozambique's profile under a least developed country category by UN shows following key indicators: Human Capital Index: 45.8; and Economic vulnerability index: 36.7. Mozambique's Human Development Index (HDI) value for 2018 is 0.446 which puts the country in the low human development category and positioning it at 180 out of 189 countries and territories. Between 1990 and 2018, Mozambique's HDI value increased from 0.217 to 0.446, an increase of 106.0 percent. (Human Development Report 2019, UNDP.)

Mozambique is the third most vulnerable country in Africa in relation to extreme weather conditions, which are expected to be more frequent as a result of climate change. It has a long history of catastrophic flooding, cyclones as well as draughts. (Climate Knowledge Portal, 2020. WB.)

37 Un has three criteria for LDC classification, including i low per capita gross national income GNI, ii low level of human capital, iii and high structural vulnerability to exogenous economic and environmental shocks.

Forests

Forest area

According to data from the national forest inventory carried out in 2017, the country has about 32 million hectares of natural forests, which cover 40% of the national territory. (GFRA, 2020) These forests store approximately 5.2 billion tCO$_2$ e.q. of carbon (Mozambique Country Forest Note, 2018). The forest in Mozambique is defined considering 1 hectare of minimum mapping area, 30% of minimum canopy cover and 3 meters of minimum tree height on maturity. (GFRA, 2020) Figure 1. Forest cover map in Mozambique (Land Use and Land Cover. MITADER. 2018) FAO (GFRA) statistics below (Table 24) show total 36.7 Mha of forest cover in 2020.

Figure.0.1 Forest cover map in Mozambique

Table 0.1 Forest cover of Mozambique (GFRA, 2020)

FRA Categories	Area								
	1990	2000	2010	2015	2016	2017	20218	2019	2020
Forest (a)	43 378.00	41 188.00	38 972.14	37 940.00	37 628.29	37 406.60	37 224.17	36 966.11	36 743.76
Other wooded land (a)	15 146.00	14 856.00	14 566.00	14 421.00	15 77.51	15 907.29	16 037.08	16 166.87	16 296.66
Other land (c-a-b)	20 114.00	22.594.00	25 099.86	26 277.00	25 232.20	25 324.11	25 376.76	25 505.02	25 597.58
Total land area (c)	78.638.00	78.638.00	78.638.00	78.638.00	78.638.00	78.638.00	78.638.00	78.638.00	78.638.00

Mozambique is one of the southern African countries that still has a considerable area of native forest and other woody formations, composed mainly by Miombo, Mecrusse and Mopane ecosystems. Miombo is the dominant forest formation, with about 21 million hectares, representing 62% of the forest area. Miombo growth is slow, estimated at 0.5 to 1 m3 / ha / year. Forestry is selective and covers 20% of the 119 forest species identified and the remaining 80% are secondary, with little market demand.

These dry tropical miombo forests are subject to a high rate of deforestation and forest degradation, due to their fragility and the high demand for goods and services to which they are subject and the fact that they are the main livelihood of the rural population.

For many people, forests are one of the most prosperous green banks. In these ecosystems many individuals obtain wood, a place to live, food, medicines for the treatment of various diseases, as well as places for sacred services. It is also important to add that these resources

energize local, regional, national and international economies. In Mozambique, the forestry sector plays a major role in the national economy, as it provides energy for around 70% of the rural population, including part of the urban population and contributes about 4% to annual GDP. (GFRA, 2020)

Current deforestation rate

Although Mozambique's forests have tremendous value and unrealized potential, they are being rapidly depleted. The GFRA 2020 and NFI 2018 indicate that 267,000 ha of forests were lost each year from 2003 to 2013 (Table 25), a historical deforestation rate of 0.79%. (Mozambique Country Forest Note, 2018; GFRA, 2020). This led to almost 40 million tCO_2 being emitted each year, 57% of the country's total greenhouse gas emissions of 67 million tCO_2.[38]

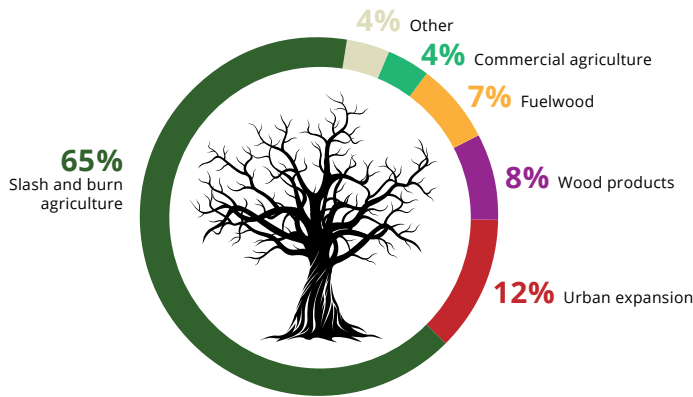*Table 0.2 Deforestation and forest expansion during 2003-2013 in Mozambique. (GFRA, 2020)*

Period: 2033-2013 (11 years)	ha	ha/year
Forest land converted to non-forest land (deforestation)	2,937,322	267,029
Non-forest land converted to forest land (forest expansion)	124,393	11,308

The current deforestation rate is 267,030 ha/year and forest expansion area is 27,780 ha/year. The forest area net change was 239,250 ha/year during 2015-2020 and has been declining since 1990. (GFRA, 2020). Mozambique's average annual net loss of forest was - 0.59 % (or -223,000[39] ha annually) between 2010 and 2020, and it belongs to top ten countries worldwide showing high average annual net losses of forest area. (GFRA, 2020. Main Report, p. 18)

According to the GFW 2020, from 2001 to 2019, Mozambique lost 3.29 Mha of tree cover, equivalent to a 11% decrease in tree cover since 2000, and 816 Mt of CO_2 emissions. Mozambique's National REDD+ Strategy (2016) aims to reduce deforestation by 40% and restore one million ha of forests by 2030. This would have the potential to create 250,000 jobs and produce US$1.5 billion worth of manufactured products and exports. (Mozambique Country Forest Note, 2018)

Drivers of deforestation and forest degradation

The underlying causes of deforestation and forest degradation are poverty, high population growth, and international demand for valuable timber. Rural poverty and population pressure mean alternative sources of income are limited, leading to unsustainable forest use. Conversion to small-scale agriculture is the main direct driver of deforestation, accounting for 65% of forest loss.

4% Other
4% Commercial agriculture
7% Fuelwood
65% Slash and burn agriculture
8% Wood products
12% Urban expansion

38 Other source states 46 million tons of climate change-causing CO_2 being emitted every year into the atmos-phere, representing 43 percent of Mozambique's overall greenhouse gas emissions. (MZ Zambézia Emissions Reductions Payment (P164524), 21 Jun 2018)
39 The rate of change (%) is calculated as the compound annual change rate

The indirect drivers that contribute to deforestation and forest degradation in Mozambique include insecurity over land tenure, inadequate planning for land use, and demographic pressure. Land tenure insecurity discourages investment in longer-term assets with limited to no immediate returns, including forests and other natural resources. This dynamic is made worse by demographic pressure, particularly when agriculturally based population density increases in and close to forested areas, which is happening in several areas of Mozambique. While deforestation rates have fluctuated, forest loss has occurred over time. There has been a large decrease of forest cover since 1980, when around 89% of the country was covered by forest, compared to 43 % today. (Mozambique Country Forest Note, 2018)

The main drivers of degradation are extraction for biomass and the unsustainable, sometimes illegal, harvesting of timber. Deforestation and forest degradation levy high costs on local communities, the national economy, and global community. With forest loss, local communities lose access to forest products they depend on, reducing their resilience to the impact of the climate and the water flows that forests regulate so well. National revenue is lost because of the suboptimal use of forest resources: opportunities for sustainable use (such as nature-based tourism or sustainable forest management) are reduced, while illegal activities lead to much needed state revenue being siphoned-off. The global community faces biodiversity loss and the impact of increased GHG emissions. (Mozambique Country Forest Note, 2018)
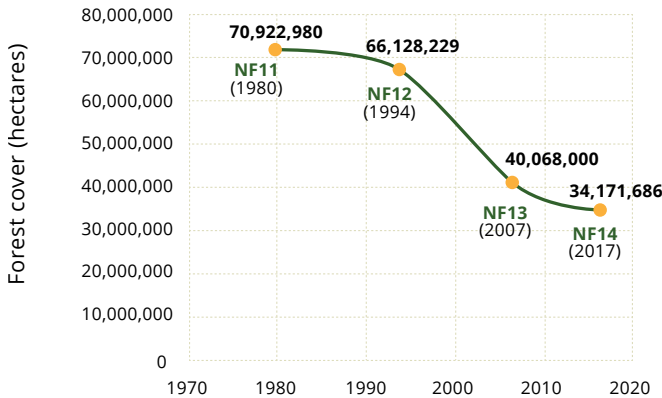
Inventroy	Forest Area %	Forest Cover	AAC (m3/year)
NF11 (1980)	70.922.980	88.6%	-
NF21 (1994)	66,128.299	77.6%	527.866
NF31 (2007)	40,068.000	50%	515,672
NF41 (2017)	34,171.686	42.7%	446.728

Figure 00.2 Historical forest cover and forest cover percentage in Mozambique from 1980 to 2017 (NFI 1980 1994 2007 and 2017 Mozambique country forest note 2018

Forest sector emissions

The land-use change and forestry sector is a net source of CO_2, emitting an average of 39.3tCO_2e per year from 1990 to 2016. This represents 59% of Mozambique's total greenhouse gas emissions over the same period. (Global Forest Watch, 2020).

Similarly the WRI CAIT states that the GHG emissions in Mozambique come primarily from the land-use change and forestry (LUCF) sector (as stated above) of the country's total emissions in 2013. Agriculture was the second highest emitting sector (26.8%). Energy, waste, and industrial processes (IP) accounted for 8.9%, 4%, and 1.5%, respectively, of total emissions. [40](Greenhouse Gas Emissions Factsheet, 2017).

According to the ERPD 2018 (p.57), historical deforestation rate in Mozambique was estimated to reach 0.23% between 2000 and 2012, representing an annual loss of 138,000 ha of forest per year and an amount of emissions close to 12 MtCO_2e per year. Deforestation is

40 According to the World Resources Institute Climate Analysis Indicators Tool (WRI CAIT), Mozambique's total GHG emissions in 2013 were 67 million metric tons of carbon dioxide equivalent (MtCO_2e), totalling 0.14% of global GHG emissions. Mozambique's natural forests store approximately 5.2 billion tCO_2eq of carbon (WB, 2018). This refers to 34 million ha forest: equivalent to 43% of the country's territory.

especially concentrated in in the Central and Northern provinces of the country, where the two REDD+ pilot Emission Reductions (ER) Programs are located.[41]

reference emissions level

In order to respect the FCPF Methodological Framework (FCPF MF), data for the Emission Reduction (ER) Program (ZILM) reference level (RL) have been extracted from national FREL/FRL for the Program accounting area and for the period 2005-2015. During this period total deforestation in the ER Program accounting area reached 213,202 ha – corresponding to 21,320 ha/yr. The Reference Emission Level for the ER Program area is 6,487,447 tCO_2e/yr.

Expected emission reductions

According to the National REDD+ Strategy, *ceteris paribus*, it is estimated that emissions from deforestation and forest degradation could reach 39 $MtCO_2e$/yr by 2030 in Mozambique. The overall National REDD+ Strategy's target in terms of ER is to reduce those emissions to 3 $MtCO_2e$/yr in 2030, through reducing deforestation and increasing carbon stocks. This represents an overall objective of avoiding 170 $MtCO_2e$ during the reference period going from 2016 to 2030.

The ER Program (ZILM) is expected to significantly contribute to this objective, its ambition being to achieve a total of 10.7 $MtCO_2e$ of ER between 2018 and December 2024, which corresponds to reducing deforestation in the ER Program area by 30% in the period (2018-2019) and by 40% in the second period (2020-2024). The level of effectiveness are relatively low in order to be conservative and realistic. Total 10,000,000 tCO_2e could be sold to the FCPF Carbon Fund. The ER Program should therefore contribute to 6% of the National REDD+ Strategy's objectives in terms of ERs. (ERPD, 2018. p. 34; 251; 375)

> *The expected total level of Emissions Reductions over the crediting period (mid 2018-December 2024) is estomated at 10,680,932 tCO_2eq.)*

The First Reporting Period (ERPA with Carbon Fund) is form 16th may 2018 to 31st December 2018; and monitoring period from 1st January 2018 to 31st December 2018. The total ER ambition is highly consistent with national policies and development priorities in Mozambique and the ER Program actually holds a significant place in the national strategy of reducing carbon emissions. GoM's commitment to REDD+ and to the reduction of carbon emissions can be observed in non-regulatory initiatives. This includes also Mozambique's Nationally Determined Contribution (NDC), submitted to the United Nations Framework Convention on Climate Change (UNFCCC) in 2016, which sets targets for greenhouse gas emission reductions of 23 $MtCO_2$ from 2020 to 2024, and 53 $MtCO_2$ from 2025 to 2030 42 (ERDP, 2018, p. 122; and Mozambique Country Forest Note, 2018.)

Key emissions drivers

The main direct drivers of deforestation and forest degradation and related emission drivers in the ER Program (for FCPF RBPs) area in Zambézia are: i) Unsustainable small-scale

agriculture is the main driver of deforestation, and ii) Illegal logging and informal charcoal production (i.e. unsustainable extraction of wood for domestic uses) are the main drivers of forest degradation. About 30 % of total emission are forest related.

In order to address key emission drivers, it is important to build on comprehensive approach that recognizes the link between agricultural development, natural resources management and governance. The Mozambique ER Program is therefore based on an integrated land management approach and activities extended beyond the agricultural sector *per se*. Since the ER pilot will only account for ERs resulting from reduced deforestation, and not degradation - considered as not significant enough (less than 10% of emissions), activities focusing on the adoption of sustainable agricultural techniques will be key to its success. There are several related projects under implementation in the area.

Latest ER Monitoring report of Mozambique (August 2020) states that clearly that more than 70% of the changes detected were due to unsustainable small-scale agriculture both in the program area and outside. Other drivers such as forest activities for timber and charcoal could not detected directly as drivers. The solution is to improve the tool to detect the forest degradation which combines with updated high-resolution imagery or/and ground trothing. The MRV team of FNDS has developed a tool to detect annual deforestation for the whole country and currently, the data is accessible through the geospatial platform (ERPD, 2018; ER Monitoring Report, 2020).

Description of NFMS

National forest monitoring system defined by UN REDD+

A national forest monitoring system is one of the elements to be developed by developing country Parties implementing REDD+ activities (according to paragraph 71 of decision 1/CP.16). The key to any functional measurement and reporting of forest carbon is reliable data of forest area and forest area changes. Already in 2009, the COP adopted guidance on the establishment of robust and transparent national forest monitoring systems. Depending on national circumstances, these systems may also be a result of combining subnational systems as part of national forest monitoring systems. As an interim measure, subnational monitoring and reporting can be implemented in accordance with a stepwise approach.

National forest monitoring systems should be flexible, allow for improvement and build upon existing systems, as appropriate. They should reflect the phased approach of REDD+ implementation and enable the assessment of different types of forest in the country according to national definitions, including natural forest. They may also provide relevant information to the safeguards information systems.

The data and information provided by national forest monitoring systems should be transparent, consistent over time, and suitable for measuring, reporting and verifying, taking into account national capabilities and capacities. In order to achieve this, the systems should also use a combination of remote sensing and ground-based forest carbon inventory approaches for estimating anthropogenic forest-related greenhouse gas emissions by sources and removals by sinks, forest carbon stocks and forest area changes.

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41 Zambézia Integrated Landscape Management Program (ZILM), and the Cabo Delgado/Quirimbas Emissions Reductions Program (PROGIP-CD).
42 The GoM ratified the Paris Agreement on November 8th, 2017. Mozambique launched its NAP process in December 2016 and developed a draft NAP roadmap 2025-2020 in 2017, and prepared its revised NDC (in April 2018).

Having the national or, as an interim measure, subnational forest monitoring system in place is one of the requirements in order to be eligible for results-based payments in accordance with decision 9/CP.19, and information on the forest monitoring system should also be provided in the Lima REDD+ Information Hub. (REDD+ Web Platform).

NFMS of Mozambique

In 2016, Mozambique received additional funds (5 MUSD) from the FCPF for finalization of the Readiness Preparations to establish a National Forest Monitoring System (NFMS) and the Forest Reference Emission Level / Forest Reference Level (FREL/FRL) of greenhouse gas emissions (GHG) for REDD+. Thereafter a NFMS is being developed with the main objective to monitor, report and verify REDD+ actions implemented at country-level and coordinate with various institutions of interest in the National Forest Monitoring System. These actions include deforestation, forest degradation and enhancement of carbon stocks through the implementation of a continuous Forest Inventory (National Forest Inventory and National Net of Permanent Plots) combined with Forest area change mapping (mainly through several Earth Observatory System approaches). These results will be gathered and integrated at National Level with access from the provincial and local levels.

The NFMS considers a multi-scale system at three (3) different levels: National, Provincial and Local and is centralised at national level in line with UNFCCC decisions to consider existing systems, to ensure the sustainability of the system, and avoid duplications. DINAFs' natural resources platform 43has been under development since 201344 and has achieved significant developments in 2017 regarding to the establishment of the NFMS. (FCPF Readiness Fund: REDD+ Country Participant Annual Progress Report, 2018).

The latest ER Monitoring report (August 2020) states that Mozambique has not formalized its national forest monitoring system (NFMS). There is a work in progress between the National Directorate of Forest (DINAF) and FNDS and other relevant stakeholders to formalize the NFMS. However, the NFMS including the MRV function for REDD+ is fully operational and is managed and coordinated by the MRV Unit of FNDS.

The NFMS system has three overall functions including 1) monitoring function, 2) MRV function, and 3) data management function (see Figure 2 below). The three sub-systems of the NFMS are: 1) Satellite and land monitoring system (providing activity data to monitor forest cover change, forest fires), 2) National forest inventory (four NFIs, latest was in 2016-2017 which produced the emission factors used for the FREL submitted to the UNFCCC in 2018), and 3) National GHG inventory (for the purpose of REDD+ combines the Activity data and the emission factors to estimate the annual emissions and the FREL.

Figure.0.3 NFMS, including the MRV (Presentation at COP 25, 2019)
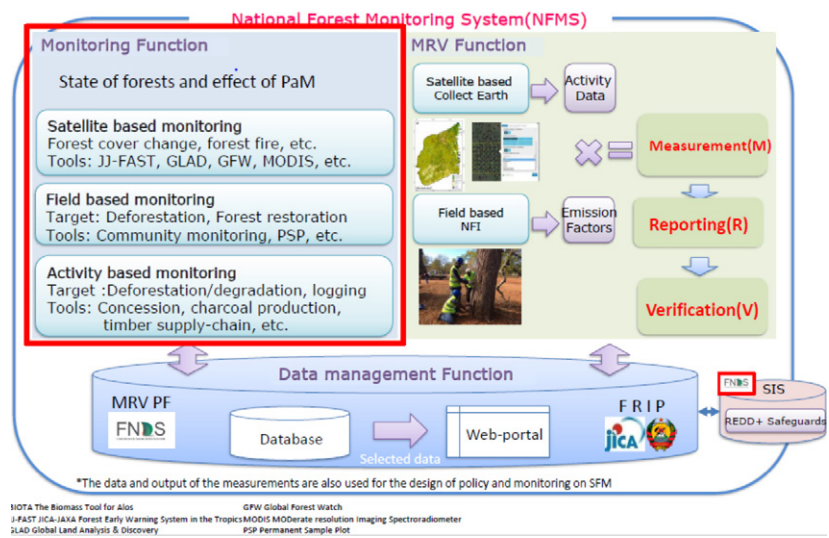
Source: Joaquim A. Macuácua, Presentation on National Forest Monitoring System (NFMS) to support GHG report in Mozambique. COP25, Madrid, 6th December, 2019. The Project for the Establishment of Sustainable Forest Resources Information Platform for Monitoring REDD+.

The overall objective of the NFMS is to have an instrument that enables policymakers to improve sustainable forest management in Mozambique. The NFMS must provide reliable, up-to date and transparent information and REDD+ data.

Key institutions involved in NFMS and their roles, current status and progress on Institutional Arrangements

The main institutions involved in the development of the NFMS are DINAF, FNDS, and IIAM; and there are also several other institutions involved (see Figure 3 below). As explained above DINAF started the development of the FRIP (i.e. the NFMS as understood) back in 2013 with support of JICA. The National REDD+ Strategy (2016) laid out clear institutional arrangements to facilitate the flow of information within the State institutions and ease cooperation with the private sector and civil society, service providers and members of local communities. Those institutional arrangements completed the initial institutional design for REDD+ implementation, described in the Decree No. 70/13 of December 20th, 2013 ("Regulation of the procedures for approval of projects for reducing emissions from deforestation and degradation") (Governo de Moçambique, 2013). The Degree enabled a more efficient implementation of the ER Program, with the creation of the FNDS and the establishment of the provincial Program Implementation Unit (PIU) with local MRV unit. (ERPD, p. 35). Further, during 2015-2019 a MRV Unit within FNDS at central level was built up and capacitated.

In April 2018, a new REDD+ Decree was adopted by the Council of Ministers in order to best reflect the evolution of REDD+ policies in Mozambique since 2013 and meet all the requirements of the FCPF. The new REDD+ Decree, which now regulates and defines principles and standards for the implementation of all REDD+ programs and projects in the country, including support in development of the NFMS and MRV, provides a more precise

framework with regards to, inter alia, REDD+ data management systems and registries, ER titles ownership and institutional arrangements. Defining the institutional and legal framework were conditional to be clarified through the REDD+ Degree in order to have the ERPD approved in 2018. The REDD+ Decree defines today FNDS as the primary actor responsible for the REDD+ process in Mozambique.

The Measurement, Monitoring and Reporting (MRV) system builds on the national MRV system, which is a Participatory MRV (PMRV). The national coordination and supervisions of the PMRV is the responsibility of the FNDS. As clarified in the new REDD+ Decree (Article 10), the FNDS supports all institutions engaged in REDD+ policies and coordinates the development of the MRV which an essential part of developing the NFMS. Among various responsibilities, the REDD+ Degree 2018 establish, operationalize and ensure the maintenance of the components of the National MRV System.

There has also been an institutional change in 2019 due to the government change, and the current status of institutions involved in the NFMS is:

- The AFOLU sector was led by the Ministry of Lands, Environment and Rural Development (MITADER) and *changed to Ministry of Land and Environment (MTA) in 2019*. The Ministry of Agriculture and Food Security (MASA) Commission *changed to Ministry of Agriculture and Rural Development (MADER)* in 2019 as well as other contributors from the Research and Academia (IAM);
- The National Directorate of Forestry (DINAF) – moved from MITADER under the Ministry of land and Environment (MTA).
- Implementation of REDD+ is assigned to FNDS - moved from MITADER under MADER which is implementing REDD+ in two projects (Local MRV) and is hosting the MRV-Unit.
- The National Directorate of Climate Change is new setting as FNDS and DINAF now interact with the national Directorate of Climate Change on issues related to Reporting. The National Directorate of Climate Change is responsible for the communication of GHG emissions of Mozambique, as the focal point for climate change with the UNFCCC. This new setting is important as FNDS and DINAF now interact with the national Directorate of Climate Change on issues related to Reporting. Despite these changes on the institutional arrangements and lack of a formal institutional arrangement, the components of the Forest Monitoring System can deliver the function of producing the emissions from deforestation at all levels.
- The government has been a key factor influencing the effectiveness of institutional arrangements and, in particular, the strength of the body's mandate and its ability to conduct inter-ministerial coordination.
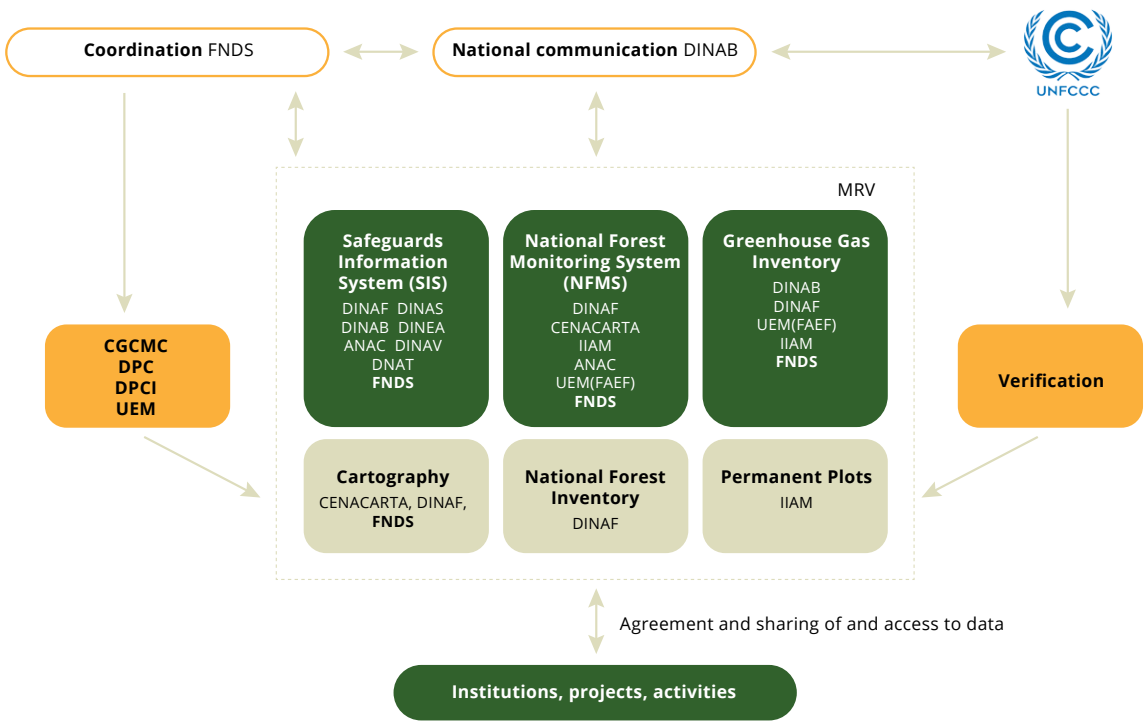
National supervision and coordination of the MRV system is the responsibility of the FNDS, at central level, and Project Implementation Unit (PIU), representation of FNDS at program level (subnational level). The MRV Unit and team is responsible for coordinating all works related to MRV, including the implementation of the NFMS, the SIS and the GHG inventory (see Figure above). According to the new REDD+ Decree (April 2018 – article 10), the FNDS is responsible for managing the national REDD+ Programs and Projects Data Management System and for communicating to the entity in charge of managing the ER Transactions Registry (who will be the Ministry of Economy and Finance, according to the same decree – Articles 14 and 26) all information related to ERs generated by REDD+ projects, including by the pilot ER pilot Zambezia Integrated Landscape Management Program (ZILMP) that will produce the ERs for Carbon Fund result based payments. (ERPB 2018, p. 211).

Under the NFMS there exist also NFMS Task Force for political dialogue, design and operationalization of the NFMS with DINAF; and Working Group to provide related technical information, inputs and advice.

- Regional Platforms (Zambézia, Cabo Delgado).
- FNDS/MRV Unit developed geoportal for open information sharing.

Institutional arrangements for developing NFMS require:

- Assignment of clear responsibility for each instruction/ sector involved in NFMS (Data generation, Data Management, Quality Assurance, Authorization);
- Consistent Data management: LULC data (Methodology: Sampling, Wall-to-wall, Annual deforestation), Biomass data (NFI, PSP);
- Systematic Reporting process (UNFCCC (FREL/FRL, NC/BUR, REDD+ TA), FRA, NFP, NRS&AP, ZILMP).

Policy and legal framework

In Mozambique, the main legal and regulatory frameworks are in place concerning to the land and forests that support the NFMS/MRV:

- The Constitution of the Republic of Mozambique (CRM, 2004)
- The Law on Forests and Wildlife (1999)
- The Land Law (1997)
- Mozambique adopted the Decree 70/2013 in December 2013 and was one of the few countries worldwide to establish rules and procedures to guide investments in REDD+ as well as define the legal treatment of REDD+ demonstration projects.
- The main legislation with regards to REDD+ in Mozambique is now the REDD+ Decree (April 2018), which regulates and define all principles and standards for the implementations of REDD+ projects and programs in the country. It deals with, inter alia:
    - The institutional framework, which is greatly clarified; and clearly specifies the responsibilities of the FNDS (which today is under the Ministry of Agriculture and Rural Development, MADER) and other key institutions.
    - The process for the approval and issuing of licenses for projects involving carbon credits and the procedures for the approval of REDD+ projects, putting great emphasis on community consultations.
    - Establishes the uncontested ownership of ER titles to the State of Mozambique;
    - Details administrative procedures for the management of the ER Transactions Registry and the REDD+ Project and Data Management Registry.
- In addition, the most important legal acts with regards to land and forest management in Mozambique are the Law on Forests and Wildlife (1999) and the Land Law (1997).
- The Ministry of Land and Environment (MTA) (previously MITADER) is the lead agency for the implementation of these two laws and has dedicated National Directorates focusing on these legal mandates. The laws are implemented through regulations and ministerial decrees, which provide some leeway for adjustment and improvement without further legislative action. This is coherent with MTA (previous MITADER) being also responsible for the overall National REDD+ Strategy.

Description of approach to, and current status of, Measurement and Estimation

The national MRV system has the overall objective of organizing and coordinating, with standardized and internationally accepted procedures, the quantification of emission and removal of greenhouse gases (GHG) from the Agriculture, Forestry and Other Land Use (AFOLU) sector. The national MRV for Mozambique will measure, report and verify deforestation, forest degradation and enhancement of carbon stocks (A/F) through the implementation of the National Forest Inventory (NFI) and the National Net of Permanent Plots, combined with forest area change mapping.

The MRV system is centralized at national level, in line with UNFCCC decisions relying on existing systems, ensuring the sustainability of the system and avoiding the creation of duplicities. The reported results must be consistent with UNFCCC communications. Any results reported at sub-national level have to be fully consistent with the UNFCCC communications, meaning consistent with the reported results by the national MRV system. The aspects not related to carbon will be monitored through the Participatory Monitoring

System (PMS) which is a multi-scale system (national, provincial and local) respecting a top-down approach, with integration of low level data at higher level.

Description of approach to, and current status of, Reporting and Verification

Emission Reductions Payment Agreement (ERPA). Mozambique signed the ERPA on February 2020 with the WB, unlocking performance-based payments of up to US$50 million for the country. The payment will reward community efforts to reduce carbon emissions by tackling deforestation and forest degradation. The ERPA agreement marks a significant step forward in Mozambique's efforts to tackle climate change. Mozambique is committed to playing an active role and pursuing strong global action on reducing emissions from deforestation and forest degradation.

It is estimated that the implementation of activities will lead to a generation of 12.64 million ERs during the ERPA term. This estimate was calculated by first applying an efficiency rate to the Forest Reference Emission Level (FREL) of the ZILMP area (30 percent for the first three years of the ERPA term and 40 percent for the remaining years of the ERPA term), which resulted in 18.8 million ERs over the ERPA period (2017-2024) and 33 MtCO$_2$eq of emissions from deforestation. Uncertainties associated with the estimation of ERs were at the threshold of 17 percent at 90 percent of confidence level. Hence, four percent of the total ERs were also set aside in a buffer reserve. A fraction (30 percent) of these ERs was allocated to a buffer reserve so as to mitigate any uncertainty risk and non-permanence risks resulting in an overall discount of circa six million ERs.

Forest Reference Emission Level (FREL). Mozambique submitted its proposed national Forest Reference Emission Level (FREL) to UNFCCC in 2018 which approved the FREL of 38,956,426 t CO$_2$ eq/year. The FREL covers the activity "reducing emissions from deforestation", which is among the activities included in decision 1/CP.16, paragraph 70. The assessment team for the same noted that the data and information used by Mozambique in constructing its FREL are largely transparent, complete and in overall accordance with the guidelines contained in the annex to decision 12/CP.17.

- The national FREL proposed by Mozambique for the historical reference period 2003–2013 is the annual average historical emissions of carbon dioxide (CO$_2$) associated with deforestation, defined as the anthropogenic conversion of natural forest to non-forest land. The proposed FREL includes deforestation only and excludes the conversion of forest plantations to other land uses. The activity data used for the construction of Mozambique's FREL were obtained from an annual historical time series analysis of land use, land-use change and forestry carried out by its measurement, reporting and verification unit for the period 2001–2016 using the Collect Earth tool.
- Mozambique used activity data for the period 2003–2013 in the construction of its FREL in order to align the time period of the FREL with the Party's previous analyses of land-use and land-cover change (for 1980–1990 and 1990–2002). Hence, the starting point was 2003, and the end point was 2013 since the Party's REDD-plus10 decree was approved in 2014.
- Information on carbon stock prior to deforestation was obtained from Mozambique's NFI, which was undertaken from 2015 to 2017. The FREL presented in Mozambique's modified submission, with the aim of accessing results-based payments for REDD-plus activities from 2014 to 2023.

- The proposed FREL includes the carbon pools above-ground and below-ground biomass. The values for carbon stock in above- and below-ground biomass after conversion are based on default values from the Intergovernmental Panel on Climate Change (IPCC) 2006 IPCC Guidelines for National Greenhouse Gas Inventories (hereinafter referred to as the 2006 IPCC Guidelines). Regarding greenhouse gases (GHGs), the submission includes CO_2 only.
- In decision 1/CP.16, paragraph 70, the COP encourages developing country Parties to contribute to mitigation actions in the forest sector by undertaking a number of activities, as deemed appropriate by each Party and in accordance with their respective capabilities and national circumstances, in the context of the provision of adequate and predictable support. The FREL proposed by Mozambique, on a voluntary basis, in the context of results-based payments, covers the activity "reducing emissions from deforestation", which is one of the five activities included in decision 1/CP.16, paragraph 70. Pursuant to paragraph 71(b) of the same decision, Mozambique has developed a national FREL that covers its entire territory. The total area of Mozambique is 823,588.75 km^2, of which 41 per cent is covered by forest. For its submission, Mozambique applied a stepwise approach to developing its FREL, in accordance with decision 12/CP.17, paragraph 10. The stepwise approach enables Parties to improve their FRELs/FRLs by incorporating better data, improved methodologies and, where appropriate, additional pools.
- FCCC has recommended Mozambique for initiating a process to develop a methodology for estimating emissions from forest degradation to allow for the inclusion of the activity in future FREL submissions. As part of the stepwise approach Mozambique could consider the inclusion in the FREL of the activity "enhancement of forest carbon stocks", if it is found to be significant. Mozambique could also consider assessing the significance of the other activities (sustainable management of forests and conservation of forest carbon stocks) to determine their possible inclusion in future FREL submissions. (FCCC, 2018. Report of the technical assessment of the proposed forest reference emission level of Mozambique submitted in 2018)

REDD+ Reporting. Deforestation and associated ERs will be measured annually by the MRV unit within FNDS. Measurement and reporting from the GoM to the FCPF CF will take place every year, and started in late 2018 and early 2019. The verification might take place every year by a third party contracted by the Bank following the submission of a monitoring report by the GoM. Payments from the FCPF CF to GoM are expected to be made annually upon verification of the emission reductions, or upon interim progress reports (in case verification doesn't take place annually).

ER payments will be distributed by GoM in accordance with the final BSP. The ERs sold to the Carbon Fund and those set aside in the buffer will be registered in Mozambique's transaction registry or in a centralized transaction registry managed by the FCPF, if the national registry is not ready by the time of the first payments.

Mozambique has submitted the ER Monitoring report (ER-MR) for the period of 16.05.2018 - 31.12.2018 in August 2020 (the report is currently under WB verification/validation). It includes FCPF ER of 1,340,317, and Potential ERs that can be transferred to the Carbon Fund before reversal risk set-aside is 1,914,739.

AFOLU GHG Inventory Reporting. The National GHG inventory for the purpose of REDD+ combines the Activity data and the emission factors to estimate the annual emissions and the FREL.

Mozambique reported that its FREL estimates are inconsistent with the national GHG inventory included in its national communication submitted in 2003. The Government of Mozambique has produced a number of documents (guidelines) that will be used to ensure consistency between the FREL submission and the national GHG inventory in the future. Steps will also be taken to (1) produce a report on the NFI and make it available to the public, (2) improve communication between the institutions working in coordination with the REDD-plus unit to ensure that consistent GHG data are produced and (3) formalize the institutional arrangements for institutions involved in the measurement, reporting and verification of REDD-plus. These efforts, which could facilitate the provision of an updated FREL in the near future and ensure consistency with the national GHG inventory.

The FREL does not maintain consistency, in terms of sources of activity data and emission factors, with the GHG inventory included in Mozambique's latest national communication. However, the latest national communication was submitted in 2006 with the most recent inventory year being 1994, and Mozambique stated in the FREL submission that it will work to ensure consistency between the FREL and future GHG inventories by using the same methods and assumptions for both.

Non-Carbon Related Reporting. Mozambique's FREL includes CO_2 emissions but excludes methane and nitrous oxide emissions from forest fires and biomass burning. A significant proportion of land is burned annually due to clearing for agriculture, which is common practice in the country. Data from the 2015 FRA indicate that from 2003 to 2012 a minimum area of 8.8 million ha of Mozambique was burned annually, of which about 16–44 per cent constitutes burning of forest area. This implies that emissions of methane and nitrous oxide from fires could be significant. As part of the stepwise approach Mozambique may wish to monitor and, if found to be significant, include non-CO_2 emissions from biomass burning in future FREL submissions. Recommendation by the monitoring non-CO_2 emissions from biomass burning and, if found to be significant, including them in future FRELs.

Key donors and support modalities

The World Bank is currently financing through multi-donor support several investment projects (grant and loan) which directly address the drivers of deforestation and degradation and climate through an integrated landscape management approach. These key REDD+ implementation projects are organized under the Bank's "Integrated Forests and Landscape Management Portfolio", which includes the Mozambique Conservation Areas for Biodiversity and Development project (MozBio) (P131965), the Agriculture and Natural Resources Landscape Management project (Sustenta Project) (P149620), the Mozambique Forest Investment project (MozFIP) (P160033), and the Dedicated Grant Mechanism for Local Communities project (MozDGM) (P161241). The Sustenta Project is implementing an innovative Matching Grant Scheme to co-finance agriculture and forestry activities by small emerging commercial farmers and small and medium enterprises. This scheme is expected to be used for the Benefit Sharing Mechanism under this project. The projects are implemented by GoM's FNDS (at both national and provincial levels), in coordination with relevant actors, such as the Ministry of Agriculture and Rural Development (MADER), the Ministry of Public Works (MOP), the National Protected Areas Agency (ANAC), the National Irrigation Institute, NGOs and the private sector, among others.

The establishment of the national MRV system is supported by the World Bank, mainly through the FCPF, since 2013 through capacity building, staff, and investing in hardware and software. The NFMS and MRV has also been supported by the Japanese International Cooperation Agency (JICA) through a project initiated in 2013 to 2018 that aimed to: (i) establish a Forest Resource Information Platform for monitoring REDD+; (ii) develop the basis for a MRV; (iii) create RELs/RLs and; (iv) prepare a data set of biomass and carbon estimation. MRV is to be undertaken with consideration of consistency in recording and collection procedures, data base structure and management, and in light of the integration of a new, more comprehensive system of cartography. FAO (through WB funding) continues providing support to DINAF in the digitalisation of data and information relevant for building up the NFMS further.

REDDcompass Building Block progress scores

Mozambique was described as over half way through its REDD+ MRV system development, with total average of 58 % (Table 26).

1. **Institutional Arrangements:** This Building Block is Advanced (60%) as average score. Two components of the Institutional Arrangements Building Block were scored as Advanced in the REDDcompass Assessment, and one Nearly / Fully Finished. Only one area was at Early Stage, namely the MRV Institutions. The progress on this Building Block is less than the Policy and Design Decisions, *the second nearest to completion after Policy and Design Decisions.*
2. **Policy and Design Decisions:** This Building Block is almost complete (85 %), with five of the six components score as Nearly / Fully finished. The Approaches, Methods + tiers scheme is scored as Advanced. *This Building Block is the closet to being finished.*
3. **Measurement and Estimation:** This Building Block is in the half away of its progress (48 %). Three of the five components of the Measurement and Estimation Building block were scored Advanced, whilst the remaining two were scored at Early Stage.
4. **Reporting and Verification:** This Building Block scored lowest for progress and on average is Falling Behind (12 %). Whilst the Reference Emission Level and Non-Carbon Related Reporting were scored at Early Stage Nearly; the three remaining components all scored Falling Behind.

Table 0.3 REDDcompass Building Block scores

REDDcompass Building Block	Second Level Building Block Components	% Score MRV Gap Assessment
Institutional Arrangements	- Forest Policy + Governance - MRV Institutions - Processes - Methods + Tools	Mozambique Scores: - Nearly / Fully Finished, 90 % - Early Stage, 30 % - Advanced, 60 % - Advanced, 60 %] Average Scores: Advanced (60 %)
Policy and Design Decisions	- Forest Definition - REDD+ Activities - Carbon Pools - LULC Stratification Scheme - Approaches, methods + tiers - Spatial + Temporal Scope	Mozambique Scores: - Nearly / Fully Finished, 90 % - Nearly / Fully Finished, 90 % - Nearly / Fully Finished, 90 % - Nearly / Fully Finished, 90 % - Advanced, 60 % - Nearly Fully Finished, 90 % Average Scores: Nearly Finished (85%)]
Measurement and Estimation	- Remote-Sensing Observations - Uncertainty - Ground-Based Observations - Integration + Estimations - Record Keeping	Mozambique Scores: - Advanced, 60 % - Early Stage, 30 % - Advanced, 60 % - Advanced, 60 % - Early Stage, 30 %] Average Scores: "Half away" (48 %)
Reporting and Verification	- AFOLU GHG Inventory Reporting - Non-Carbon Related Reporting - Reference Emission Levels - REDD+ Reporting - Internal + External Analysis	Mozambique Scores: - Falling Behind, 0 % - Early Stage, 30 - Early Stage, 30 - Falling Behind, 0 % - Falling Behind, 0 % - Average Score: Falling Behind (12 %)

Country needs assessment (CNA) areas identified for further support

The CNA assessment of Mozambique is analyzed and summarised as follows:

- Mozambique is classed as a country "still in MRV readiness", according to the CAN assessment spreadsheet, and it lacks "technical support to finalize MRV readiness" (Category 2 country) and therefore needed to be included in funding request.
- Three sub-topics under the Measurement and Estimation Building block are identified for capacity needs, namely forest degradation, documentation, and "other" for further work in the analysis.
- Six areas under the Measurement and Estimation Building block are identified as "needs" for further work in the analysis. Particularly 4 needs are under the sub-topic of "Documentation", namely i) establishment of institutional arrangements for GHG reports, ii) NFMS processes documentation, iii) QA/QC, iv) scope and operationalization documentation, and v) standard operating procedures. This

seems to align overall with the areas of Measurement and Estimation in which the record keeping is only at early stage showing highest gap. In addition, Reporting and Verification is overall "falling behind", particularly the AFOLU GHG Inventory Reporting as well as REDD+ Reporting.

Table 0.4 Further support needed identified in the REDDcompass country needs assessment

REDDcompass Building Block	Second Level Building Block Components	CNA sub-topics	Identified Need (E.g Ethiopia Example)
Institutional Arrangements	- Forest Policy + Governance - MRV Institutions - Processes - Methods + Tools		
Policy and Design Decisions	- Forest Definition - REDD+ Activities - Carbon Pools - LULC Stratification Scheme - Approaches, methods + tiers - Spatial + Temporal Scope		
Measurement and Estimation	- Remote-Sensing Observations - Uncertainty - Ground-Based Observations - Integration + Estimations - Record Keeping (Documentation)	- Forest Degradation - Documentation -Other	- Forest Degradation – methodology - Establishment of institutional arrangements for GHG reports - NFMS processes documentation - QA/QC - Scope and operationalization documentation - Verification process
Reporting and Verification	- AFOLU GHG Inventory Reporting - Non-Carbon Related Reporting - Reference Emission Levels - REDD+ Reporting - Internal + External Analysis		

REDD+ MRV support activities and partners

According to the Climate Funds Tracker (Mozambique) amount of total funding approved is   195 million USD of climate funding. Same source identifies that 46 million USD is REDD+ funding for climate change mitigation.Based on WB Integrated Landscape Management (ILM) Portfolio, the total climate funding of Mozambique including only WB funding is over 300 million USD.

Table 0.5 REDD+ MRV support to Mozambique

Support Activity	Funding ($)	Financial Instrument	Donor / financer	Support Provider	Support Mechanism
The Zambézia Integrated Landscape Management Program (ZILMP), the ER Program in 9 districts and implemented through following WB/FCPF funded projects:					
The Mozambique Conservation Areas for Biodiversity and Development project (MozBio), Phase II, 2018-2023 Phase I, 2014-2019	45M 40 M	Grant (IDA)	WB/IDA	WB/IDA	FNDS Project; TA (MITADER/MADER)
Additional Financing to the Agriculture and Natural Resources Landscape Management project (Sustenta Project), Phase II, 2019 -	60M	Grant (IDA)	WB/IDA	WB/IDA Crises Response Window (CRW)	FNDS Project; Embedded TA (MITADER/MADER)
Agriculture and Natural Resources Landscape Management Project (Phase 1), 2017-2019	80M	Multi-donor Trust Fund Grant	WB		MITADER, FNDS
The Mozambique Forest Investment project (MozFIP), 2017 - 2022	47M	Grant; RBPs; Loan	WB/IDA/ Strategic Climate Fund	WB/IDA/IBRD	FNDS Project; Embedded TA (MITADER/MADER)
The Dedicated Grant Mechanism for Local Communities project (MozDGM), 2018-2020	4.5M	Grant	WB	WB	FNDS (MITADER/MADER)
6.1 Total	**276,5M**				
Mozamique ERPA with WB/FCPF, 2020-2024	50M	Result Based Payments	WB	FCPF	MIF, RBP
REDD+ Readiness, Additional Finance, 2015-2017	5m	Grant	WB	FCPF	FNDS; TA (MITADER)
REDD+ Readiness, 2013-2015	3.4 M	Grant	WB	FCPF	(MITADER) UT-REDD+
MRV system of FCPF ER Program (under FNDS), 2019-2021	?		FCPF/WB	JICA, University of Edinburgh, World Bank FCPF	FNDS
6.2 Digitization of forestry information in Mozambique	6M	Grant	WB	FAO	DINAF

Support Activity	Funding ($)	Financial Instrument	Donor / financer	Support Provider	Support Mechanism
The Project for Establishment of Sustainable Forest Resources Information Platform for Mozambique REDD + (2013-2018)	?	Grant	JICA	JICA	DINAF
The Land Use Planning for Enhanced Resilience of Landscapes (LAUREL) program, 2017-2019	660 000		WB, CIRAD, University of Minas Cerais	ETC Terra (Nitidae)	TA GoM, DINOTER, DINAB, FNDS

The FCPF financially and technically has supported the GoM on the REDD+ Readiness process through a first grant of USD 3.8 million in 2013-2017 and an additional USD 5 million grant in 2016-2018 to finalize the Readiness process. The ZILM Pilot Program is implemented on the ground namely through the MozBio, Sustenta, MozFIP, and the Moz DGM corresponding over 270 MUSD funding from the WB. The RBP Carbon Fund is set for maximum 50 MUSD for selling 10 million ERs with 5 USD per each carbon credit.

In addition International Finance Corporation (IFC) is funding forestry investments in plantation forestry, agriculture, pulp and green energy investment in Zambezia and Manica provinces of Mozambique through Portucel Mocambique Ltda. The initial investment is around $30 million to support the first phase of Portucel's integrated plantation forestry operations in Mozambique since 2014 onwards. Furthermore AfDB is financing climate related and green economy investments projects (with about 50 million USD in Gaza province) (FIP, 2016).

Case study narrative

REDD+ MRV development successes in Mozambique

Enhanced capacity through trainings and consultancies

Capacity building has paid off and is demonstrated with fast results on the REDD+ MRV in Mozambique. *The results from investing in capacity building during past years were defined mainly as spectacular by all interviewees as in in 1-2 years the MRV Unit, developed/up-dated the land cover map 2016, conducted the 4th NFI (2018) with local technicians and co-working with DINAF, and submitted the first ER monitoring report in 2020.*

Overall the knowledge on MRV REDD+ and specially regarding to ERs was described very limited at the start of the process. Since 2013 Mozambique has built technical capacity, particularly on the MRV capacity and skills through established MRV Unit centrally and at local ER program level under the FNDS (2016). Capacity has been created through dedicated short- and long-term training and knowledge exchange between different players and stakeholders in country (i.e. DINAF, UEM, IIEM, MRV Unit of FNDS) as well though knowledge exchange between various countries peer organizations (e.g. with Brazil, Guatemala, Kenya, Italy few to mention).

DINAF's training and capacity building though JICA project was mentioned very important at early stage, as well as further DINAF transferring its knowledge and skills to the MRV Unit particularly regarding to NFI. The JICA funded Project for Establishment of Sustainable Forest Resources Information Platform for Monitoring REDD+ which was implemented from 2013 to 2018 and focused on training and capacity building in forest monitoring at provincial level. Also Norway provided support at very early stages for organisation and preparing the R-PIN in 2008.

International TA support through individual consultants/experts and TA projects supporting in capacity building of the MRV Team needs based was also described crucial. The long-term TA support though WB at the start was described very important and built the bases with capacity, incl. a roadmap for MRV. More recently, developing the ERPD was strategically supported by an international consultancy company and further ensured capacity and skills transfer.

At the start FNDS selected young recently graduated foresters from the UEM, with recent knowledge from the carbon accounting related issues and lots of motivation for learning and working in the institution for at least for 5 years. Lots of effort and investment overall (3.3 MUSD for capacity building and institutions through RPP in 2013, and later 5 MUSD readiness fund 2015) has been put in technical capacity building. This funding has been crucial from the capacity building point of view in Mozambique as well as equipping the FNDS/MRV Unit. The MRV Unit has been built up successfully based on step-by step process starting first with 2 people, then 5 technicians and one coordinator, and today consisting of 12 qualified technicians to do all components of MRV. The MRV Unit has been well equipped with technology and training of the HRs for using the equipment. Also under the MozFIP program, DINAF has been receiving training recently and particularly through FAO technical assistance (with WB funding) for data digitalisation.

Institutional and legal frameworks defined and clarified - Genesis

From REDD+ Degree 2013 to approval of REDD+ Degree 2018 clarifying institutional arrangements

Until 2013 REDD+ activities in Mozambique were coordinated by ad hoc structures, but building on existing institutional participation and set-up, with emphasis on the cross-institutional role played by technical group of REDD+. This worked as such mainly for the preparation of the proposal R-PP. Mozambique first set up the institutional framework by adopting of Decree 70/2013 in December 2013 and was one of the few countries worldwide to establish rules and procedures to guide investments in REDD+ as well as define the legal treatment of REDD+ demonstration projects. With the adoption of the Decree No. 70/13, REDD+ became formally a structure coordinated by the Government, particularly by the National Directorate responsible for the environmental management of the Ministry for the Coordination of Environmental Action (MICOA) and by the National Directorate for the management of land and forests, in the Ministry of Agriculture (MINAG).

Mozambique has worked through all REDD+ process starting in 2013 with RPP and followed the CPF methodology during 2015-2019 until today. Major institutional achievements under Readiness funding phase included: (i) the creation of the Zambézia Multi-Stakeholders Landscape Forum (MSLF), which is a crucial instrument for stakeholders consultation and

participation in the design and implementation of the ER Program; and (ii) the adoption of Decree 70/2013[45], which created officially and institutionalised the REDD+ Technical Unit (UT-REDD) and the inter-ministerial Technical Committee (CR) for REDD+, which was later on completed and merged with the FIP National Steering Committee (NSC) in order to ease cross-sectorial coordination for REDD+ subjects. The structure approved by this Decree 2013 is in line with the proposal in the R-PP.

In the beginning of 2015 as result of restructuring of government institutions due to new government, the REDD+ and staff and functions of the UT-REDD became a subordinate to the Ministry of Land, environment and Rural Development (MITADER). The Decree No. 70/13 established in paragraph 1 of article 7 that the Technical Unit of REDD+ was the unit responsible for carrying out activities relating to REDD + and the article 8 sets out the powers of the UT-REDD +. The staff and functions of the UT-REDD are today placed inside of the National Sustainable Development Fund (Fundo Nacional de Desenvolvimento Sustentável – FNDS) which became responsible for overall strategic guidance and coordination and implementation of the REDD+ and the ER Program implementation.

Establishment of new organisation (the FNDS) with MRV Unit took place in 2016 with support of WB/FCPF, and parallel the capacity building and training of the MRV Team (consisted of 5 experts in 2016) took place for establishing the national FREL/FRL from the 4th NFI. DINAF (under same ministry of MITADER with FNDS) provided conditions to train the MRV unit team to learn the use of Collect earth used to produce the activity data; provided the National 4x4 km grid and did the Quality assurance of the activity data. A complete geospatial laboratory was designed and purchased in the framework of the R-Package development to set-up the MRV Unit in FNDS. The National Platform for Management of Natural Resources that initially was being developed by DINAF (with support of JICA) was in a process of redesign due to the new requirements of the MRV system. In general, the data sharing policies, quality assurance and quality control, and institutional coordination were reflected in the reform that was happening in the forest sector. Several other key institutions (e.g. UEM and IIEM) took part in defining the FREL/FRL as described by the interviewees (with reference to FREL report of 2018). With regards to the production of activity data and emission factors, the arrangements were agreed to, but not formalized. One of the challenges mentioned was the formalization of institutional coordination, which required policies on data sharing to be well defined and the institutions strategic plans harmonized.

As result, there was a new set-up created compared to the earlier defined where DINAF had been described as main institution with the mandate to coordinate and approve of all activities in the forest sector including development of National Platform to Monitor REDD+ and establishment of National Forest Monitoring System with support of JICA. The FNDS was chosen as the trust-worth partner of WB/FCPF and became the principal anchor institute to receive REDD+ related WB/FCPF funding to finalise the readiness, building the MRV system at all levels, as well as to manage all WB funded projects supporting the implementation of REDD+ in Mozambique through integrated landscape management approach through the Zambézia Integrated Landscape Management Program (ZILM) which is the ER pilot program.

Submission and approval of the ERPD (2018) was a steppingstone to accept Mozambique in the carbon fund pipeline. Conditional for approving the ERPD was the need to clarify

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45 The main legal instrument concerning REDD+ was the "Regulation of the procedures for the approval of projects for reducing emissions from deforestation and degradation - REDD+" approved by Decree No. 70/13 by the Presidential Cabinet in Dec 2013. The regulation of Decree No. 70/2013 highlights briefly the key components of the implementation mechanisms of the carbon rights, benefit sharing, REDD+ financing mechanisms and procedures for the approval of projects. By indication of the Decree other complementary legal instruments were created.

the institutional and legal framework through approving new REDD+ Degree. The REDD+ Degree 2018 was adopted by the Council of Ministers in order to best reflect the evolution of REDD+ policies in Mozambique since 2013 and meet all the requirements of the FCPF. It provides a more precise framework with regards to REDD+ data management systems and registries, ER titles ownership and institutional arrangements. It now defines the institutions and mandates, and particularly the FNDS as one single institution and key organization managing REDD+ national supervision in Mozambique. As clarified in the new REDD+ Decree 2018 (Article 10), the FNDS supports all institutions engaged in REDD+ policies. Its main responsibilities among others is to establish, operationalize and ensure the maintenance of the components of the National MRV System; and to propose and approve standards and technical methodologies for establishing the levels of reference, the monitoring, the evaluation of emission reductions, the reporting, the verification and the validation of REDD+ programs and projects.

The national supervision and coordination of the MRV system is responsibility of the FNDS, at central level, and representation of FNDS through Project Implementation Unit (PIU) at program level. The MRV Unit team (FNDS) is today responsible for coordinating all works related to MRV, including the implementation of the NFMS, the SIS and the GHG inventory. FNDS coordinates the work and collaboration with other key institutions as stated by key interviewees. Some interviewees also stated that they would like to see more follow-up on the coordination of started activities.

Major institutional changes since the Approval of ERPD in institutional arrangements are related to the new government 2019: (1) Changes in the Ministries; (2) Change in the institutions. This new setting is important as FNDS and DINAF are now under different ministries, but now interact with the national Directorate of Climate Change (focal point) on issues related to reporting to UNFCCC. The National Directorate of Climate Change coordinates with DINAF and FNDS on the production of such information. (ER-MR, 2020) The interviewees stated that despite these changes on the institutional arrangements and therefore some challenges on formal institutional arrangement overall, the components of the Forest Monitoring System can deliver the function of producing the emissions from deforestation at all levels including national level.

Success of the MRV system development

Mozambique has advanced from the REDDcompass Building Block assessment (April 2019) regarding measurement and reporting

The initial readiness fund allowed drafting of several important documents during 2015-16, incl. national REDD + strategy, study of drivers of deforestation, and definition of forest allowed to setting-up the national MRV system which is fully operational and has generated the first ER-MR in August 2020 based on ERPD and ERPA.

Other important factors mentioned that have influenced the development of the REDD+ MRV system is the *good initial design of the MRV which allowed capacity to be built up based on the needs of the country and building on the process*. Starting with small dedicated team of young experts and *growing step-by-step* in terms of capacity and resources was described as a good approach. The unit was originally setup with local technicians, initially 4 junior

Forest Engineers (foresters) with a coordinator + senior MRV specialist (international). Today, the *MRV team has in-house capacity and skills built up to work fully independently.* The work is described as *purely technical and the MRV Unit.* Technically the MRV Unit has built its work and decisions based on most appropriate way of doing things technically, achievability and suitability for the country (fitting on the realities to achieve results.

The MRV system is based on the NFMS (National Forest Monitoring system), which is being developed operationally since 2016 at national level by the MRV team in the FNDS. The national MRV system, is described as a Participatory MRV (PMRV) in the ERPD 2018. The national coordination and supervisions of the PMRV is the responsibility of the FNDS at national and program level through Project Implementation Unit, in which a small MRV team is located (in Mocuba, Zambézia). The current monitoring system has three sub-systems (as described earlier): i) Satellite and land monitoring system, ii) National forest inventory, and iii) National GHG inventory. The historical analysis of Activity Data at national level uses the reference period 2001-2016 and the MRV system is based on the LULC reference map produced with 2016 Sentinel-2 and Landsat data (most recent date *for which forest-cover data is available to enable IPCC Approach 3).*

Mozambique has succeeded in developing a robust system that is operational and supported with following results achieved by the MRV:

- 4th National Forest Inventory (2018)
- Elaboration of the forest cover map 2016
- Conducting historical estimates of deforestation of the country (never done earlier in Mozambique)
- Activity data (collected) for REDD+ activities for the whole country
- Estimate forest carbon emissions and the FREL (at different levels) with transparent accurate data
- Contribute on the preparation of the ERPD 2018 (with consultancy company Etc. Terra support)
- Monitoring of deforestation, and annual deforestation maps for 2017, 2018 and 2019
- Monitoring of forest degradation under process
- Land cover and land change maps
- Spatial database management
- National GHG inventory for the purpose of REDD+ and emission reporting of Mozambique for UNFCCC (by DINAB through BURs)

Organisational strengths, building on teamwork, and good management and leadership

High commitment of MRV Team and low staff change combined with good institutional leadership and efficiency has enabled the success of MRV development as expressed by the interviewees. The MRV Unit was created in 2016, with the coordinator and 5 technicians (in 2017) trained to remote sensing and forest resources analysis. They designed the MRV system, produced different documents, and are working with independent nat. and int. consultants who have been crucial for QA/QC, e.g. in evaluating the methodologies used for inventory, reviewing sampling design and estimations, and uncertainty analysis for activity data. These 5 people have been controlling everything, also the contracts with companies, and there has not been changes in the original team composition and same people are still continuing (even ministries have changed).

Growing interest and need for accurate data and information on ALOFU has resulted that in 2019 the unit was strengthened with 3 experts having total 9 experts incl. the coordinator. Therefore, various efforts have been made in terms of personnel and resources in order to *maintain the capacity of the MRV system* to monitor and report emissions and emission reductions. Success is achieved and results demonstrated through production of the first monitoring report for ER program (before Chile and Mexico which are countries that had lots of experience of general carbon accounting systems).

After changes in ministries and MADER hosting the FNDS today, the MRV unit is now adding new elements and hiring 4 agronomists to support in expanding of the MRV to generate data and information and reporting on other land uses, namely the agriculture. This will further facilitate development of monitoring and reporting on deforestation caused by slash and burn activities and therefore MADER is keen having the MRV Unit to work closely with it.

As stated, *the major success described in development of the REDD+ MRV system in Mozambique has been the committed staff and high in-house capacity built* based on the needs of the country, and therefore ability to produce data in-house. Also good leadership, and open and enabling organisational learning and team work were mentioned as success factors by the interviewees, as well as relationships with supportive partners.

Enhanced communication and collaboration, and hands-on problem solving

The interviewees stated the importance of applying transparent processes for MRV development, decisions taken on best practices internationally as well as in most appropriate way (i.e. technically achievable and suitable for the country), and focusing on technical work with no political interference. Any evaluations (also external ones) on the MRV system have been positive so far.

MRV Unit´s work is built on interaction with DINAF (particularly for the NFI) and close cooperation with other key stakeholder and partners. For example doing the NFI during 2016-17 in case of technical disagreements expressed on the activity data and methodologies which required lot of time spent, but were always solved to best align the activities.

Enhancing the interaction with DINAF and following-up constantly is considered very *important by all interviewees* in terms of i) sharing data and information openly, ii) avoiding any duplication of activities and works, and iii) improving existing other systems to become operational e.g. DINAF´s Forest Resource Information Platform under preparation since 2013 (with JICA support) and assessed with low process of results as the system is not yet operational or have any open platform supported with a database.
Under the new ministerial setting (FNDS hosted by MADER, and FNDS by MTA since 019) it was stated that it is important for FNDS and DINA to interact with the national Directorate of Climate Change on issues related to Reporting of GHG inventory at national and international level (through the BUR).

The MRV team of the FNDS has also been closely collaborating with IIAM and UEM for biomass assessment and soil analysis during the process. The Permanent Sampling plots (RNPAP - Rede Nacional de Parcelas de Amostragem Permanentes) are another component of the National Forest Monitoring System that will improve the estimation of emissions factors and the IIAM leads it. Currently, under the MozFIP project, a joint group of institutions that

involves IIAM, FNDS, UEM and DINAF are establishing the network of Permanent Sampling plots in key ecosystems in Mozambique to deepen the knowledge of species composition, structure, dynamic, and specifically to serve as a basis of the MRV system allowing estimate repeatedly over time key carbon stocks and EFs. Monitoring of Permanent Sampling Plots (PSPs) was mentioned being quite challenging.

It has been intended to add 60 permanent plots to the existing 36 and complete the representativeness of the different vegetation types. The total net of permanent plots should be measured again every two years to report differences in carbon stocks and EFs (half of the plots are measured per year). It is a sustainable proposal on which the EFs' updating process (Tier 3) could be based, rather than on the National Forest Inventory that should be updated every 10 years).

Documentation and record keeping, and QA/QC

The production of the various Standard Operating Procedures (SOPs) has contributed to the knowledge management of the MRV Unit. In addition, there is no task that is performed by only one person, which increases redundancy. The MRV Unit recognizes that there is a need for continuous improvement of its knowledge management process, to ensure that all activities, approaches, methods and data sources are standardized and documented systematically and transparently (ref. the Geoportal of FNDS MRV Unit).

To ensure a good quality of data the MRV team has developed and implemented QA/QC processes in all production processes including the development of SOPs. This ensures a high standard of quality of the data produced. To guarantee the replication of processes, the MRV unit has developed e.g. a Portuguese version guideline to produce activity data. Data collection is conducted by a core team of professional interpreters who work permanently for FNDS and who have received adequate training in the implementation of the SOPs. The SOPs developed include for instance: 1) Map production (SOP0), 2) Sampling Design (SOP 1), 3) Response Design (SOP2), 4) Data Collection (SOP3), and Sample-based Area Estimation Analysis (SOP4). (ER-MR, 2020). As result, the REDDcompass Building Block in terms of measurement and estimation and regarding to documentation has improved from the situation of April 2019.

Emphasis on open communication and sharing of information

The Geoportal platform established under FNDS MRV website was mentioned as a *powerful tool* having three type of users, administrators (full access), as well as giving access to the public to have reports, data, spreadsheets on deforestation and ERs among other. *FNDS is committed to make all possible information public.* However, information policy is an issue, and some data needs to be asked for permission, and forest inventory data is not yet accessible in the Geoportal to avoid misuse of the data. Standardisation and documentation and sharing are key to ensure the sustainability of the REDD+ MRV also from financial sustainability perspective to ensure potential duplication of efforts in future.
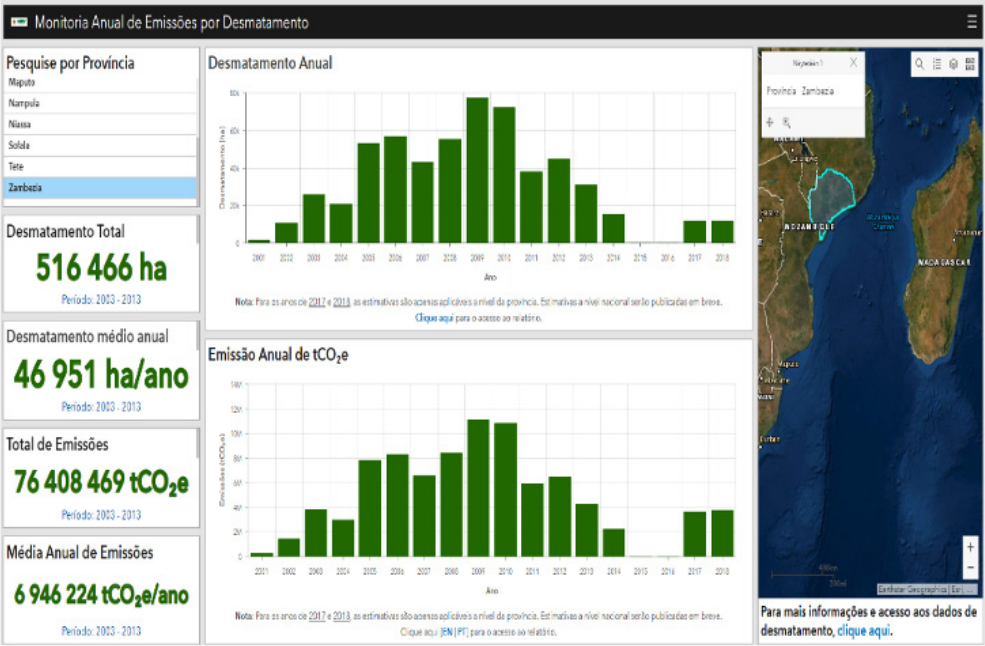
REDD+ MRV development challenges and obstacles in Mozambique

Competition among institutions for funding and duplication of efforts

Challenges defining the institutional framework and mandates on the MRV were mentioned by all stakeholders most critical - even in practice various institutions work and cooperate together and results are achieved. These challenges and the WB decision to allocate majority of REDD+ funding under the FNDS instead for example of DINAF has created *some competition and confrontation between these institutions as expressed by the interviewees*. However, agreeing on a single body (with experience in managing and funding projects) assigned for overall coordination of REDD+ was very much needed. "Creating a new institution for REDD+ MRV" has been explained mainly due to the need of achieving fast results in MRV REDD+ development in reflection to the "not so good experience" of achieving results earlier building the NFMS. Also some methodological and operational differences in thinking towards development of national MRV system have been challenging to agree between the key institutions, including overall data management responsibilities. However, the methodological issues have always been solved based on technically most appropriate solution.

JICA cooperation was supporting DINAF at early stage of process in the establishment of provincial FRL in Cabo Delgado and Zambézia. JICA made lot of investments working at provincial level, training in inventory methods, and remote sensing for the national MRV investment Technology, training, from Japan to Mozambique was described a big step for Mozambique for the national teams of DINAF (this is a success). DINAF was working with Japanese team trying to engage with them. DINAF became very strategic partner to conduct MRV Roadmap, however there were different ideas and plans by JICA cooperation including interest in concentrating in provincial and district level forest monitoring as stating point.

The REDD + degree (2018) defined and clarified the different roles of institutions (FNDS and DINAF), where FNDS/MRV Unit is fully responsible on the MRV and NFMS. However, *all interviewees stated that there are overlapping activities between the FNDS and DINAF*; and that most of activities should be under the DINAF historically (e.g. detecting deforestation), and it takes time to delivery by DINAF. To avoid parallel efforts needs a lot of coordination for monitoring and mapping. MRV is doing these tasks as it has the technical capacity, funding and training. Legally based on the REDD+ Degree 2018 the NFMS has to be done by FNDS; historically by DINAF. The NFMS is under the responsibility of the MRV Unit/FNDS based on the REDD+ degree. In addition, DINAF has and is developing the National Forest Resource Platform (supported earlier by JICA), but it is far from being operational today as referred in the interviews.

Lack of formal procedures

Unclarity or lack of formal process for approving /validation of the land use change map was reported. DINAF is responsible on this, but it was mentioned that there is no formal procedure (that has been put in practise) for validating it. Institutional arrangement was mentioned as reason for the unclarity and that it depends on joined work at higher level between the institutions to make further clarity and agreement.

Access to information and data has been a challenge

Generally speaking, open and transparent data and information sharing between key institutions (e.g. MRV Unit, DINAF, IIEM, UEM) enhance good forest governance and enables development of the NFMS. MRV uses state of art systems and methodologies to do estimations, and commonly there is *challenge mostly regarding to activity data as things change rapidly*, and therefore it is important to be on top of the events by using the remote sensing. The MRV unit is following this very closely having engaged with best of the best of scientists. The MRV ensures being in line with the methodologies that the scientific community accepts. This requires the MRV to be in top of using best systems that can best support the work on medium term (avoiding changing too rapidly but going step-by-step and staying focused). The lack of easy access to high resolution satellite data to avoid discrepancy on data generation has been commonly mentioned as challenge at early stage of development.

Component to monitoring, there remain several critical issues, e.g.:

- Impossibility currently to validate the biomass change maps, unless clear cuts have occurred, and validation using medium-high resolution imagery (Sentinel-2 and Planet) do not have the required quality to detect loss of individual trees.
- No clear good practice guidance exists on how to validate biomass change, including how to avoid double counting of degradation and deforestation. (ER-MR, 2020)

Inclusion of other additional carbon pools in the estimation of carbon stocks have also been mentioned. However, for the ER program for RBPs the sources and sinks (emissions from deforestation), carbon pools (above- and belowground biomass in trees), and CO_2 as GHG type have been agreed and justified.
Also improvement of methodologies for quality control and quality assurance have been mentioned as challenging. However, for all matters requiring specialist knowledge to support and bring new capacity/training, Mozambique has used dedicated individual consultants and expert facilitation.

The role of REDD+ MRV Support

Sustainability of the REDD+ MRV is non-predictable

Mozambique has received a lot of external donor support for REDD+ though WB/FCPF and created strong capacity as well as good reputation managing the REDD+ projects, including MRV and building up the NFMS (that originally was planned to be DINAF's role). FNDS as new institution (evolved from Fundo Nacional do Ambiente, FUNAB) has been mainly the government institution benefitting on donor REDD+ funding through implementation of various projects as well as benefitting on political support (regarding to climate and NRM being at high agenda) during the recent years. DINAF as traditional national forest institute with historical mandate to monitor forests feels that it has been affected particularly by political interference due to changing institutional structures, and somewhat "left behind" since the JICA support finished and REDD+ and funding has been mainly channelled for and through the FNDS. Both institutes belonged under same minister (MITADER) from 2015 to 2019, and MRV Unit is coordinating increasingly with DINAF for the NFMS. Today DINAF as well as FNDS have mandates legally clarified and agreed through the REDD+ Degree 2018 on paper, however parallel mandates and duplication of efforts were reported by interviewees as DINAF is traditionally the national forest institute to monitor national forests overall.

The institutional reform regarding to MRV has been made through creation of the FNDS as result of REDD+, and therefore ensuring its sustainability (financial, institutional, and capacity) is crucial for all parties. It was mentioned by interviews that it is out most important for Mozambique to best ensure the institutionalisation of the MRV within the government systems and structure (incl. budget) in sense that it can be maintained operational and equipped with the highly skilled and trained staff. Interviewees also mentioned that there might be risk of capacity leakage from the MRV as soon as the donor funding (the WB) for REDD+ MRV will finish 2026/27. Government's own direct funding for the REDD+ MRV has been limited and it was mentioned that the MRV is not integrated within the government's budgeting system; therefore, it is seen as project driven intervention as of today. It was mentioned that only small portion of funding (10 %) shall come back from the agriculture revenue which is invested in MADER's agriculture extensionists equipping (this is important as 4000 EAs are to collect agriculture/food security related data to expand the MRV system in coming years). Also, the institutional changes have generated a gap in terms of DINAF being responsible of selling timber licences, but that revenue goes to MADER instead of the MTA where the institute (DINAF) itself is hosted. Political support will be needed to keep the MRV up and running with public funding after the project termination, and building sustainability based only on political support is not preferred way of going forward as also mentioned in the interviews.

The MRV is supporting both ministries of MADER as well as MTA. The MRV Unit also aims to ensure its sustainability practically by enhancing other existing functions to become operational, e.g. by collaborating and working closely with DINAF having the ("originally") planned forest information platform built operational, i.e. the Forest Information System Platform (FISP) which is still under construction by DINAF.

It was mentioned in the interviews that the MRV Unit enjoys political and financial interest by the GoM as long as the information produced by the MRV Unit is needed and that it supports the decision making and particularly the Ministry of Agriculture having current

mandate hosting the MRV Unit / FNDS. So far the MRV unit has been able to concentrate fully working technically without political interference per se and through coordination with various partners and stakeholders focusing on forestry until 2019. Currently the MRV system is expanding by adding activity data generation from agriculture (and weather) that will particularly support monitoring and reporting regarding to food security as well as on forest degradation in the future.

Formal institutionalisation and non-dependency from government structures can be sought as mentioned by interviewees. An idea of MRV Unit becoming an autonomous or semi-autonomous organisation serving both public and private sector has been discussed. This is was mentioned as ongoing important strategic visioning by the MRV Unit of FNDS as the WB support will slowly reduce reaching 2027.

It was mentioned that when assistance ends the same institutions that benefited from the assistance maintain, but they are not as resourced as with the assistance. Some but not all components are internalized in the institutions, procedures, SOPs and staff when the assistance ends.

The role of national context in REDD+ MRV Development

Forest plays an important role socio-economically in Mozambique. Both for the people who depends on this resource, forest industries and trade, and for the climate. The national contextual factors that have affected REDD+ MRV development in Mozambique being successful on the REDD+ MRV process up to date fall broadly into three interlinked factors, including i) socio-political context that affect the ability to make progress, ii) human and other resource capacity related factors that determine the starting point for establishment of the REDD+ MRV system, and iii) factors that relate to decision on REDD+ MRV system scope. There are several important features of the Mozambican context that are supportive to the development of REDD+ MRV, whilst others hinder or can complicate the process. For instance following factors may have impacted overall on the development of Mozambique's REDD+ MRV system:

- Large country and its location and infrastructure (forest sector development potential, cost- and real competitiveness factors).
- Forests' importance socio-economically and for national economic development.
- Potential competitiveness of commercial forest investments has been recognised.
- Forest Inventories integral role in providing information vital to managing the Nations forest resources since 1975 (history and knowledge). Provincial and National forest inventories have provided essential data for formulating national forest policies, planning forest industry investments, forecasting wood production, monitoring forest ecosystem dynamics, and assess the status, trends, and sustainability of forests.
- Overall homogeneity of the landscape under the ER program area (i.e. miombo).
- Political willingness to support the process.
- Importance of deforestation and land use and land use change.
- Plantation forest initiatives.
- Overall capacity, and pool of potential young people (foresters etc.).
- Inter-sectoral and cross-sectoral collaboration.
- Institutional capacity of relatively new and modern institution (FNDS).

- External donor support and commitment (e.g. multi-donor support of WB/FCPF, GFOI, FAO, etc.).
- Strategic decision to organise the MRV on pilot and at national scale at early stage of the process.
- Policy and legal framework in place for ER and RBP program.

As mentioned earlier, the role of REDD+ MRV support has been fundamental to reach to the point of submission the first ER-MR in August/September 2020. The MRV support has been channelled through/by the FNDS which has demonstrated capacity to manage and administrate large complex programs and projects in addition having the technical up-to date capacity and tools developed as well as the political support. FNDS is in the position of governing and channelling the support as well as coordinating closely with all other inter-institutional, inter-sectoral, and cross-sectoral players which are well identified. For instance, it was reported that 6 MUSD (needs corroborating) WB funding is channelled to DINAF through FAO to support in digitalization of all forest information until 2021 through the Forest Information System (SIF) developed. This system was developed with the technical support of FAO, through the MozFIP project, funded by the World Bank and the Government of Mozambique through the National Fund for Sustainable Development (FNDS). However, as stated before the country's own finance to the REDD+ MRV has been limited, and the MRV is not within the government budget planning but managed as donor funded project.

The REDD+ Decree clearly establishes State property on all ER generated in the country (Articles 4 and 6): although non-state DUAT holders and communities will have to benefits from the sale of ERs generated in the country, through specific benefit sharing plans, no formal agreements will need to be reached between each individual DUAT holders or local communities and the State. However, they will have to be properly consulted, as per national law. In order that the process has been implemented, taking into account national legislation, several meetings have taken place, between 2018 and 2019, from where 564 individuals participated in 6 consultation events at national, provincial and district level. The main objectives of these consultations were to discuss the program approach, the percentages of benefit allocation to each group of beneficiaries, allocation models/processes, priorities areas and benefits sharing challenges of the Benefit Sharing Plan (BSP). (ER-MR, 2020)

Interviewees perspectives on future MRV support

Key considerations by the interviewees for the future support of REDD+ MRV in Mozambique:

- MRV can support the decision making of MADER and information needs of the GoM regarding to the food security and preparedness issues and understanding the importance of agriculture activities (slash and burn) being major driver for deforestation in Mozambique.
- Support MRV Unit in recruitment of new technicians with background in agriculture. Support with specific, dedicated and needs based technical support to ensure state-of-art system development, for example up-dating and further developing the MRV system to incorporate new technology utilisation (e.g. digitalisation, machine learning, blockchain), and knowledge exchange to overcome the technical challenges to monitoring degradation and other pools.
- Support to official recognition/formalisation of REDD+ MRV system as part of governmental budget, to enhance sustainability of the MRV system, the MRV Unit within

FNDS and the NFMS in the long run with semi-automatic detecting and reporting of deforestation as well as forest degradation.

- Facilitation with stepped process of donor assistance (WB/FCPF) during coming 5-6 years before FCPF CF related projects final end with the expectation that the same institutions that benefited from the assistance will remain but be less resourced than with the assistance.
- Support FNDS strategically in ensuring the sustainability of the MRV System and the Unit (institutional, financial, technical), and enabling its full continuous running after completion of the FCPF financial support.
- Support the REDD+ MRV Unit with its strategic planning regarding to process to become independent or semi-independent having autonomy freeing it from dependence on the government structure and becoming service-oriented organisation serving both public and private sector in future, and supporting possible other GFOI countries in knowledge exchange and skills transfer.
- Support to ensure the ER Transactions Registry and the REDD+ Project and Data Management Registry to become operational by The Ministry of Economy and Finance (MEF).
- Support to build capacity in forest monitoring at the local level by enabling local level actors and stakeholders to participate in the process in meaningful way to enhance envisaged impact and to build ownership on the REDD+ at local level.
- Support IIEM and other key partners regarding to establishment, management and measurement of the PSPs.
- Continue support in sharing any necessary data and information from the MRV to DINAF in operationalising and finalising of the Forest Information System Platform.
- Facilitation of cooperation and collaboration, and exchange of knowledge and skills, and continuous open information sharing between key national stakeholders - as well as supporting MRV Unit piloting and sharing its knowledge and lessons learned internationally with other countries developing their REDD+ MRV bring value addition to the beneficiaries.

The MRV Unit has the in-house HRs, capacity and skills to monitor deforestation and report annual ERs fully, therefore it is expected that it will be needing much less external consultancy support in the coming years. However, this will depend naturally whether the REDD+ MRV is to expand and harmonize fully with other land uses monitoring and adding extra pools and sources (developing monitoring of degradation is under process); and/or whether the MRV will be taken to national level including also other sectors in addition to LULUC (e.g. transport) one day. The MRV should remain focused on the AFLOLU sector at this point and grow based on interviewees' opinion, but to avoid its fragmentation.

There is also intention to disseminate the use of activity data to communities and other stakeholders to monitor deforestation in their area of interest at provincial and local levels in future. The implementation will be effective in 2021 as the COVID-19 situation did not allow the project to test the methodology in 2020. This is crucial ensuring and improving the understanding and importance of forest monitoring at local level, e.g. districts' and communities' roles in the same and becoming key players and rights holders for benefitting from the ERs payments according to Mozambique benefit sharing plan.

Conclusions

Summary of key success and challenges

Success	Challenges
Institutional - Government of Mozambique successful implementation of REDD+ / MRV process. - FNDS as institution and with mandate to coordinate all REDD+ / MRV activities in Mozambique since 2016. - FNDS as responsible for development of the NFMS. (REDD+ Degree 2018) - Cooperation and collaboration among the institutions (cross-sectorial) well established, even some institutional arrangement and processes are not fully formalised.	**Institutional** - Duplication of efforts between institutions of FNDS and DINAF on MRV and development of the NFMS. - Formalisation of the NFMS.\ - Ongoing institutional reform process.- Changing institutional set-ups every five years.
Policy and Design Decisions - REDD+ Degree 2018 defines legally mandates and roles or institutions, incl. FNDS. - Building on process as before REDD+ Degree 2018 there was the REDD + Degree 2013. - National forest and related legislation is in place.	**Policy and Design Decisions** - Reform process within the natural resource sector, including private sector, takes time.
Measurement and Estimation - 4th NFI as joint work of DINAF and FNDS; DIRN; IIAM. - Focus of the NIF has shifted from being primarily focused on wood production to sustainable ecosystem management. NFI has broadened to include new variables to meet new information requirements for reporting at both national and international level, e.g. carbon sequestration. - Definition of forests. - FREL/FRL set-up. - Semi automatized tool for satellite images processing and monitoring of Activity Data. Monitoring of the ER is accurate, and not many developing countries have that currently. - Robust MRV system established since 2018. NFMS set-up. - Digitalisation of all data started (DINAF), and NFMS frame established.	**Measurement and Estimation** - Monitoring Permanent Sampling Plots (PSPs). Slow process? - Knowledge about natural forests species composition, structure, and dynamic is still limited, which makes it difficult to elaborate sustainable management plans. - NFMS, i.e. the DINAF Forest Information System (Platform) not operational yet. - Monitoring of forest degradation is challenging (most of the world is still grappling with this). Same with activity data on other carbon pools, data on fires.

Reporting and Verification	**Reporting and Verification**
- Technical outputs have been several and many of them done first time in Mozambique (e.g. historical estimates of deforestation of the country, FREL reported for UNFCCC with transparent accurate data in 2018, LULUC map at the level 2 in 2018 and the final version at level 3 was made available in July 2019). - Mozambique is the most advanced country among the FCPF supported countries for REDD+ MRV as it was 2nd in the world agreeing for the ERPD (2018), and 1st in the world submitting the Benefit Sharing Plan (2019) and the ER-MR report (2020). - Annual deforestation maps and reports at national, district and local level. - Several SOPs established. - Information sharing and knowledge management: Geoportal established under FNDS MRV website with public access and with up-to date information and data.	- No clear (formal) process between FNDS and DINAF for approving /validation of the land use change map (< inst. arrangements). - Clear written up procedures of data management.
System Governance	**System Governance**
- Funding from WB has been fundamental to set-up the MRV with human, technical and material resources, and build up the capacity. - Good leadership, and team work - Project management skills, and modern institution created. - Learning by doing and building on process. - Skilled staff. - External TA support when needed, incl. capacity building. - Use of new technology in monitoring and reporting. - Close technical support of the World Bank both in Mozambique and DC.	- Government direct budget is very limited for the MRV. - Integration of MRV within the government planning process.
Political support	**Political support**
- There is certain political will for REDD+ MRV which has been important enabling factor. - MRV is receiving political support; people trust the data that is produced and published. - Trust built up between different partners.	- Institutional changes are un-predictable due to changing government structures.
Sustainability of the system	**Sustainability of the system (financial and human resourcing)**
- WB/FCPF funding until 2026/27. Highly skilled in-house capacity and committed staff. - Experienced MRV Unit under FNDS mandate. - Robust Information Management System. - Open communication, information sharing and knowledge management. - SOPs and documentation. - MRV=NFMS.	- No direct government budget included. - Funding trough donor funded project when the funding ends. - Staff leakage is a risk in future. - Provincial and local level forest monitoring (national wide participatory or community-based MRV).

Success up to date and key success factors

Investments in capacity building and technology through creating new specialised organisation (FNDS, 2016) embedded with MRV function are today making the **fast success of MRV REDD+** reality in detecting semi-automatically deforestation and emissions in Mozambique.[46] The success is witnessed by Mozambique's results being the **most advanced country among the FCPF** so far, as it was the second country to sign the ERPA (2018); first country to submit the Benefit Sharing Plans (BSP) for the Zambézia ER Program[47] (2019); and the first country to submit the ER monitoring report (2020), and is foreseen to be the first country to receive first result based (RB) payments from WB/FCPF Carbon Fund in 2020. **The MRV is fully operational,** exposed with using different methodologies, and can produce independently ER monitoring (annual forest carbon emission changes), and assess and report on annual deforestation (annual LULC change maps) at all levels (national, provincial, district). This information is openly and publicly shared through FNDS MRV Geoportal and provided free of charge. Currently degradation is another component of forest monitoring that the MRV is developing and defining a methodology for **monitoring forest degradation**, this is expecting to be available in 2021.[48]

The results from investing in capacity building has been defined mainly as spectacular and the investment has paid off. Cooperation, collaboration and exchange of knowledge and skills and information between national key stakeholders (e.g. DINAF, UEM, IIAM, MRV Team) has been and continues being crucial, as well as benefitting the support from consultants and individual experts throughout the process. Particularly support from international consultants was described very important at the beginning of the process to build capacity, including a roadmap for MRV. Hands-on expert support (from WB, FAO) has been ensured throughout the process strategically and needs based to solve any technical and methodological issues with aim to establish a robust MRV system. The MRV unit is responsible (and described most specialised) to produce the activity data for the ER Program as well as for the whole country, and to produce annual forest carbon change, and it has gained experience and expertise from training provided with FCPF finance. Similarly, scientific expertise has been used smart way for reviewing and QA/QC purpose (e.g. for the sampling design and estimation, uncertainty analysis).

Institutional and legal framework clarified

Clarifying the institutional and legal framework for REDD+ MRV[49] were described most challenging during the process. The new REDD+ Degree 2018 clarified legally the different roles and mandates of institutions (particularly FNDS and DINAF) and that FNDS/MRV is fully responsible in creating and coordinating the REDD+ MRV and NFMS. However, in real world many activities are overlapping between DINAF and FNDS who have been able in practice to coordinate the work and succeeded. DINAF has historically the mandate to develop the NFMS (through the Forest Information Platform System) which was initiated with support of JICA back 2013 but has not become operational up to date (no online database or portal exist).

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46 Over 250 million USD is channeled by WB/FCPF to Mozambique (through FNDS) to support in REDD+ preparation and implementation. This does not include the FCPF Carbon Fund for result based payments of 50 million USD for selling 10 million accounted ERs from the ZILMP during 2020-2024.
47 The REDD+ ER Program; the Zambézia Integrated Landscpape Managemnt Program (ZILM).
48 As result of Mozambique's submission of the first ER-MR (August 2020), it has further advanced in terms of the REDD+ Compass Building blocks particularly regarding to Measurement and Estimation.
49 This was conditional for Mozambique to be able to sign the ERPD (2018) between the parties and in order Mozambique to enter into the carbon fund pipeline.

Original approach (methodologies) used were different to the REDD+ (FCPF) planned as the forest monitoring focused on provincial level and thereafter was to expand to national level. Therefore, this system planned to be built up was assessed slow process (with data sharing) in terms of outputs and did not come into light to be further developed/funded as REDD+ MRV system directly with the WB/FCPF funding.

Furthermore, **the REDD+ Decree 2018** provides all the principles and procedures to be respected for the design and implementation of the ER Program enabling Mozambique to enter the carbon funding pipeline. It deals with, inter alia: (i) the institutional framework, which is greatly clarified; (ii) the process for the approval and issuing of licenses for projects involving carbon credits and the procedures for the approval of REDD+ projects, putting great emphasis on community consultations; (iii) establishes the uncontested ownership of ER titles to the State of Mozambique; and (iv) details administrative procedures for the management of the ER Transactions Registry and the REDD+ Project and Data Management Registry.

The institutional arrangement for the ER Program will fully respect the layout describes in the REDD+ Decree. According to the REDD+ Decree, The Ministry of Economy and Finance (MEF) is responsible for the ERPA and management of ER Titles transfer. FNDS is working closely with the MEF after the verification process, in order to provide technical support on this process.

Embedding REDD+ MRV trough creation of new institution

Transparent sharing of information, management capacity and ability to learn and generate results fast became crucial during the REDD+ MRV process and determined its additional and further funding through new organisational set-up, i.e. FNDS in 2016. Same time DINAF opened space for MRV Unit to learn to carry out NFI with support of DINAF. FNDS in turn is closely coordinating and willing to support DINAF with any necessary data transfer and other support as deemed necessary to support the work and enable the FISP plan to become operational – and therefore formalize this national forest monitoring system.

The current **NFMS developed and run by the FNDS/MRV** has sub-systems fully operational to measure and report on ERs and deforestation at national level, i.e. i) Satellite and land monitoring system, ii) National forest inventory (DINAF's mandate), iii) National GHG inventory. The FNDS MRV system is currently evolving and expanding with big data analysis needs (from agriculture), and monitoring of degradation.

Knowledge management (documentation)

The MRV Unit has produced various **Standard Operating Procedures (SOPs)** and therefore contributed to the **knowledge management of the MRV** (documentation). In addition, there is no task that is performed by only one person within the MRV Unit, which increases redundancy. The MRV Unit recognizes that there is a need for continuous improvement of its knowledge management process, to ensure that all activities, approaches, methods and data sources are standardized and documented systematically and transparently (as well as shared openly, ref. the Geoportal of FNDS MRV). The SOPs also ensures a high standard of quality of the data produced. According to the ER-MR 2020, to guarantee the replication of processes, the MRV unit has developed a Portuguese version guideline to produce activity data. Other SOPs developed include e.g.: Map production (SOP0); Sampling Design (SOP 1);

Response Design (SOP2); Data Collection (SOP3); and Sample-based Area Estimation Analysis (SOP4). As result, the REDDcompass Building Block in terms of measurement and estimation and regarding to documentation (record keeping) has improved from the situation of April 2019.

Key obstacles - changing institutional set-ups due to the politics

Political will and good leadership to support the REDD+ MRV process overall and keeping climate and natural resources at high position in the political agenda has been described an important factor enabling Mozambique's MRV REDD+ to success. However, **changing institutional set-ups every five years** may create risk and problems of reorganisation, changing and loosing focus of the REDD+ MRV, and/or possible affecting in its further evolvement with new context. The MRV is seen 100 % technical and therefore it should be fully free of political will and pressure.

Future of the MRV (sustainability, expansion, future support needs)

Going forward, there is also an important task associated (and support need) to ensure the **institutionalisation of the MRV** to make it financially sustainable while maintaining its staff with high capacity, but not being dependent on the donor funded projects in the future (as WB support will slowly reduce reaching 2026/-27). **To further sustain the system, it was recommended that the country should include government financing and work on having dedicated personal on official budget.** With official recognition/formalisation of REDD+ MRV system as part of governmental budget, dedicated staff can be allocated and sustainability on long term established, facilitating the process of semi-automatic detecting and reporting on deforestation as well as forest degradation.

It has also been discussed among the partners the REDD+ **MRV Unit to become independent or semi-independent having autonomy**[50] (i.e. non-dependency from the government structure) and serving both public and private sector in future. The MRV Unit is currently visioning its way forward to expand its support more broadly by combining information (not only forest and emission related) to possible serve the society more broadly. It is also interested to see new opportunities possible arising with support from GFOI to go further, e.g. as service provider to support other countries.

When donor assistance ends expectation is that the same institutions that benefited from the assistance will remain but be less resourced as with the assistance. Some but not all MRV components are already internalized, e.g. procedures, SOPs. At this point it will still be unclear (in general) how FCPF countries will be able to report regularly without the assistance.

As the MRV unit has technical and management capacity created, it is assumed that **external consultancy support will be less needed at this stage**. However, specific and dedicated technical support might still be needed to ensure state-of-art system development further, e.g. up-dating and further developing the MRV system regarding to new technology utilisation (digitalisation, machine learning, blockchain), and knowledge exchange to overcome the technical challenges to monitor degradation (development ongoing).

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50 The National Meteorological Institute (INAM) was mentioned as an example of independent autonomous institute in Mozambique. However, INAM is mainly dependent of public as well as donor funding.

Also, it will be important to **transfer knowledge in forest and ER monitoring at local level** by enabling actors and stakeholders to participate in the process in meaningful way (e.g. at district and local levels) to enhance envisaged impact and building **ownership on the REDD+ process at local level.**

An area that still needs work in Mozambique is the creation and establishment of the **Transaction Registry** by the Ministry of Economy and Finance (MEF). Until now, MEF has not ER Transaction Registry established. However, FNDS is committed to working with the MEF further in order to speed up the process of registering transactions. As such, the MEF will be responsible the sale of ERs to the Carbon Fund (as defined in the REDD+ Degree 2018..

FNDS' role is to manage the national **REDD+ Programs and Projects Data Management** and this will be need to be ensured by FNDS. Mozambique is developing and implementing its own comprehensive national REDD+ Program and Projects Data Management System. The system is hosted and managed by FNDS as per de REDD+ decree 2018 "the FNDS is responsible for (vi) managing the national REDD+ Programs and Projects Data Management System and for (vii) communicating to the entity in charge of the ER Transactions Registry all information related to ERs generated by REDD+ projects". Currently the system is implemented through the FNDS WebGIS platform alongside with the NFMS and the projects M&E Web portal. The system is still under development, and currently Mozambique only has one ER program.

Political dependency

Due to new government established in 2019, the **institutional changes have not affected in practice in negative way in the MRV** Unit's work dedicating on technical matters. The MRV Unit enjoys political and financial interest by the GoM as long as the information produced by the MRV Unit is needed, seen useful and supporting the decision making, and particularly the Ministry of Agriculture having current mandate to host the MRV/FNDS. However, the sustainability cannot be created through political support on the long-run. So far MRV Unit's work and demand has expanded gradually, and it is now looking for to be strengthened with four new experts (staying focused on LULUC) and thereafter the team become total 16 experts. MRV is foreseen to be expanded and it will have lots of new systems to be created regarding to programming and machine learning (using AI) as agriculture and weather related big volume of data will increase, and there is need to generate information that can do forecasting and predictions automatically[51].

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51 The MRV is currently supporting work regarding to food security analysis, volume of agriculture related data will be large and to be collected by 4000 extensionists to combine events from agriculture, to collect all weather data combined with food security, in order to will get information where the food stock are located in Mozambique.

Key lessons

Key lessons that can be learned from the Mozambique case study are:

- Fast success of the MRV system producing ER monitoring and detecting deforestation has become reality through considerable high but dedicated investments in capacity building, training and technology transfer regarding to REDD+ MRV
- The MRV Unit can today fully operate independently (without external support).
- Strategic decision to support establishment of new institution/organisation dedicating on REDD+ coordination and implementation (as main Contracting party with WB/FPCF); and realistic understanding of requirements of the MRV system embedded in the new organisation is showing fast success.
- Step-by-step process building up the MRV system starting from small and focusing on development of a robust and state-of-art system; and growing/expanding the MRV system on needs based.
- Clarifying the institutional and legal framework with clear mandates and responsibilities at early stage. Defining a single organisation to coordinate the establishment and running of the MRV system.
- Overall participatory REDD+ approach; Cooperation and collaboration between key stakeholders; as well as trusted partnerships are essential to enable good progress through open communication and collaborative learning among different stakeholders and parties.
- The creation of competition between institutions should be avoided; and MRV structures and human resources should carefully consider including government funding (embedding with government planning and budget) to enhance sustainability from the start.
- Knowledge management and communication though documentation and sharing information enhance the importance of MRV for decision making in LULUC, broad based learning and sustainability of the MRV in the country.
- The importance of MRV seen 100 % technical and therefore fully free from political will and pressure; and therefore, having less dependence from Government cycle would be ideal.

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Republic of Congo case study

Descriptive information

Basic country information

The Republic of Congo is a typical example of a high forest cover low deforestation country (HFLD). Its deforestation rate was a mere 0.052% per annum between 2000 and 2012. Keeping deforestation rates low in HFLD countries is one of the main strategies to deliver on the Paris agreement goals to limit temperature increases to below 2°C. The Republic of Congo is a small to medium size country with a low population density (16 per km[2]) but a very high fertility rate of 5.1%, which leads to a population growth rate of 3%.

In 2010, (according to Global Forest Watch) the Republic of the Congo had 26.6 Mha of tree cover, extending over 78% of its land area. From 2002 to 2019, the Republic of Congo lost 324kha of humid primary forest, making up 43% of its total tree cover loss. The total area of humid primary forest decreased by 1.5% in this time period. In 2019, it lost 73.8kha of tree cover, equivalent to 26.8Mt of CO_2 emissions (Global Forest Watch).

Accelerated development during the recent period of high oil prices led to the opening up of previously remote forest areas for economic activity. Agriculture, forestry and mining are among the key alternative sectors identified for development. The main direct drivers of deforestation and degradation i are logging exploitation, palm oil production, slash and burn agriculture and mining. Indirect causes of deforestation include weak governance, poor policy coordination and land-use planning, poverty, population growth and infrastructure developments.

The Reference Emission Level (REL) is calculated based on average historical annual emissions for the period 2005 to 2014 and includes an upward adjustment (as per FCPF eligibility requirement). The total REL for the ER-Program over a five year ERPA period (2019 to 2023) is estimated at 64.518.985 $teCO_2e$.

The Republic of Congo is listed as a Lower Middle Income Country on the DAC list of ODA recipients.

Description of NFMS

The national UN-REDD program has supported the development of the MRV and the strengthening of national capacities through the National Centre for Inventory and Development of Forest and Fauna Resources (CNIAF) which houses the Measurement, Reporting and Verification Unit (MRV) of emissions. of forest carbon from the National REDD + Coordination (CN-REDD). Four pillars of the MRV have been developed: a geo-portal to ensure a REDD + monitoring function; remote sensing of historical changes in deforestation and the establishment of a national satellite land monitoring system (Terra Mayombe); the finalization of the national multi-resource forest inventory; and capacity building for greenhouse gas inventory (GHGI). In addition, the country has already presented two national communications and the third national communication is under preparation.

The Status of the country's NFMS

The NFMS is in a preliminary construction phase. Congo has completed its first comprehensive national forest inventory, in addition to conducting a historical analysis of change in its forest cover. These two projects have enabled it to establish robust activity data and emission factors for the construction of its FREL as well as the regular monitoring of emissions from forests on its territory. In 2017, the country will finalize the methodology of its NFMS to ensure continuous monitoring of these emissions and report REDD + results in its BUR. NFMS institutionalized and producing REDD + monitoring and MRV (satellite land monitoring system, national forest inventory, greenhouse gas inventories)

Level of achievement to date by UN-REDD measures

Historical analyses of deforestation have been published and the methodology for monitoring deforestation is in place using the Terra Mayombe platform. The NFMS includes a Satellite Land Tracking System (SLTS) and the National Forest Inventory. The NFMS also includes a national greenhouse gas inventory (IGES). As the FREL document shows, the NFMS is capable of estimating anthropogenic forest greenhouse gas emissions by source and removal through sinks, forest carbon stocks and area change in forests as a result of the implementation of REDD + activities. Maps and a nationwide forest inventory covering all the forests of the countries, including natural forests, are available. In short, the NFMS complies with the guidelines and directives of the Intergovernmental Panel on Climate Change (IPCC), in all aspects.

Key Donors have been the World Bank, FAO, UNDP and UNEP. The key implementation partners have been the FAO and the World Bank. Both organizations supplied consultants to undertake work, and FAO also supplied a resident consultant for two years who helped to train and capacitate RoC staff. RoC's Emission Reduction Payment Agreement (ERPA) was signed late 2018, paving the way for future performance-based-payments of up to $55 million for verified emission reductions running through 2024 by the Carbon Fund of the FCPF.

REDDcompass Building Block progress scores

RoC is described to be overall Advanced in its REDD+ progress with total average scores of 58% (in April 2019). The REDDcompass Building Block progress is defined as follows:

- Institutional Arrangements: This Building Block is Advanced (60 %) as average score. Two components of the Institutional Arrangements Building Block were scored as Advanced in the REDDcompass Assessment, and one Nearly / Fully Finished.
- Only one area was at Early Stage, namely the Processes (see further below). The progress on this Building Block is less than the Policy and Design Decisions, and the Measurement and Verification.
- Policy and Design Decisions: This Building Block is well advanced (75 %), with three of the six components score as Nearly / Fully finished. The REDD+ Activities, and Carbon Pools, and LULC Stratification Scheme are scored as Advanced. Rest are Nearly/Fully Finished. This Building Block is the best advanced from the four building blocks themes.
- Measurement and Estimation: This Building Block is also overall Advanced (72 %). Three of the five components are scored Nearly/Fully Finished. Record Keeping is scored at Early

State only which lowers the overall score of this Building Block.
- Reporting and Verification: This Building Block scored lowest for progress, but is on the way to becoming at Early Stage (24 %). Whilst the Reference Emission Level and Non-Carbon Related Reporting is scored at Nearly / Fully Finished; three components all scored Falling Behind; and at an Early Stage.

Table 1 REDDcompass Building Block scores

REDDcompass Building Block	Second Level Building Block Components	%Score MRV Gap Assessment
Institutional Arrangements	- Forest Policy + Governance - MRV Institutions - Processes - Methods + Tools	- Nearly / Fully Finished, 90 % - Advanced, 60 % - Early stage, 30 % - Advanced, 60 % Average: Advanced 60 %
Policy and Design Decisions	- Forest Definition - REDD+ Activities - Carbon Pools - LULC Stratification Scheme - Approaches, methods + tiers - Spatial + Temporal Scope	- Nearly / Fully Finished, 90 % - Advanced, 60 % - Advanced, 60 % - Advanced, 60 % - Nearly / Fully Finished, 90 % - Nearly / Fully Finished, 90 % Average: Advanced: 75%
Measurement and Estimation	- Remote-Sensing Observations - Uncertainty - Ground-Based Observations - Integration + Estimations - Record Keeping	- Advanced, 60 % - Nearly / Fully Finished, 90 % - Nearly / Fully Finished, 90 % - Nearly / Fully Finished, 90 % - Early Stage, 30 % Average: Advanced 72 %
Reporting and Verification	- AFOLU GHG Inventory Reporting - Non-Carbon Related Reporting - Reference Emission Levels - REDD+ Reporting - Internal + External Analysis	- Early Stage, 30 - Falling Behind, 0 % - Nearly / Fully Finished, 90 % - Falling Behind, 0 % - Falling Behind, 0 % Average: Falling Behind / Almost Early Stage 24%

FAO comments further on the RoC country MRV gap assessment as follows:

Institutional arrangements

Forest policy and governance. Country has made good progress, finishing its REDD+ strategy and ER-PD, and signing up to the Carbon Fund, FIP and CAFI. However, it hasn't quite figure how to use its NFMS/MRV to support policy processes.

MRV institutions. Responsibilities have somehow been assigned through official mandates to CNIAF and the Environment Division of the MEFDD. Yet, Congo has limited consistency in its reporting and interaction with the UNFCCC, and has not assigned regular staff for it. Also, the technical staff doesn't fully understand the UNFCCC requirements or Carbon Fund requirements, particularly with respect to FRLs, GHG reporting and results-based payment reporting.

Processes. The country has allocated limited funding to ensure that it can, without external assistance, maintain its NFMS. Also, it doesn't have a regular process to QA/QC its MRV data and learn from past experiences. All of it is done on an ad hoc basis.

Methods & Tools. The country has developed an MRV action plan and mostly thought about how to interact between different agencies to measure, report and verify data. Some work remains to be done on QA/QC and reporting.

Policy and design decisions

Forest Definition. The country has adopted its forest definition through a multi-stakeholder consultation process.

REDD+ Activities. The country has somehow identified its priority activities, at least for its first FRL and for the Carbon Fund. Deforestation, degradation and enhancement have been identified as priorities although the lack of data prevents Congo for reporting accurately on degradation and enhancement. Also, it is unclear whether the country will eventually include other activities such as conservation. At the moment, those are not considered due to lack of data.

Carbon Pools. Congo has thus far reported on AGB and BGB in its FRL, arguing that the other pools weren't significant. More work should be done on the soil pool to demonstrate its exclusion in a more accurate manner. Also, existing data could be collected more extensively.

LULUC Stratification Scheme. Congo needs to further stratify to be able to report on the six IPCC categories. At the moment, most of the stratification work has focused on the forest class but little work has been done to differentiate between the grassland and cropland categories, for instance.

Approaches, Methods and Tiers. Congo has done some good planning through its MRV Action Plan and ER-PD.

Spatial + Temporal Scope. Done with the FRL

Measurement and estimation

Remote-Sensing Observations. Congo has made good progress in establishing a remote-sensing team/lab to regularly update its forest cover with the support of various international experts. They could use some additional help to identify best methods to map degradation/enhancement but those activities are in the plans.

Ground based observations. Congo has carried out a forest inventory and collected a fair amount of ground data for this. However, it has not collected ground data for other land uses nor does it have plans/money for it.

Integration and Estimations. Congo has not started reporting yet, but has developed its

first FREL. It has used its systems/tools to do so and has applied QA/QC procedures on the data it submitted (although it was made on an ad hoc basis).

Record keeping. Data is often stored on various computers, not easily available to others and not systematically organized.

Reporting and verification

AFOLU GHG Inventory Reporting. Because GHG reporting and NatComs are not yet done in a systematic and regular manner, the REDD+ National Coordination and the CNIAF do not have regular exchange with their counterparts at MEFDD responsible for UNFCCC reporting.

Non-Carbon Related Reporting. Although Congo says it wants to consider multiple-benefits and ensure fair benefit sharing, it doesn't have clear plans, nor funds, to report on non-carbon benefits. Also, it has not made much progress on benefit sharing, since the country has been waiting to see what type of REDD+ activities/investment it would do and how it would pay for it before making decisions on benefit sharing. It is unclear whether the country wants to use its NFMS/REDD+ MRV system to report to other international processes.

Reference Emission Levels. The country has submitted its first FRL to the UNFCCC but did so with a lot of technical support by FAO. Also, the national coordination process for the submission and TA was not consistent and characterized by ad hoc and delayed responses. The country depends greatly on external support to put in place and structured assessment/review process in place.

REDD+ Reporting. The country has not started reporting to the UNFCCC just yet.

Internal + External Analysis. The country has not engaged in the ICA process yet, nor has it invested to develop capacities of its national experts to support it.

Country needs assessment (CNA) areas identified for further support

- The Republic of Congo is classed as a Country "finished or mostly finished MRV readiness, according to the CNA assessment spreadsheet, and it "needs additional funds/technical support for MRV implementation" (Category 1 country) and therefore needed to be included in funding request.
- Four sub-topics under the Measurement and Estimation Building block are identified for capacity needs, namely: Uncertainty; Area estimation; Forest degradation; and Documentation for further work in the analysis.
- Five areas under the Measurement and Estimation Building block are identified as "needs" for further work in the analysis. Particularly 2 needs are under the sub-topic of "Documentation" (QA/QC and Standard Operating Procedures). This seems to align overall with the areas of Measurement and Estimation in which the record keeping is only at early stage showing highest gap. In addition, Reporting and Verification is overall "falling behind", particularly the Non-carbon Related Reporting as well as REDD+ Reporting.

Table 0.2 Further support needed identified in the REDDcompass Country Needs Assessment

REDDcompass Building Block	Second Level Building Block Components	CNA sub-topics	Identified Need
Institutional Arrangements	- Forest Policy + Governance - MRV Institutions -Processes - Methods + Tools		
Policy and Design Decisions	- Forest Definition -REDD+ Activities - Carbon Pools -LULC Stratification Scheme - Approaches, methods + tiers Spatial + Temporal Scope		
Measurement and Estimation	- Remote-Sensing Observations - Uncertainty -Ground-Based Observations - Integration + Estimations - Record Keeping (Documentation)	- Uncertainty - Area estimation - Forest degradation - Documentation	- Uncertainty analysis - Activity Data/estimates - Forest degradation - field data - QA/QC - Standard Operating Procedures
Reporting and Verification	- AFOLU GHG Inventory Reporting - Non-Carbon Related Reporting - Reference Emission Levels - REDD+ Reporting - Internal + External Analysis		

REDD+ MRV support activities and partners

Table 0.3REDD+ MRV Support to Republic of Congo

Support Activity	Funding ($)	Financial Instrument	Donor / financer	Support Provider	Support Mechanism
Creation and realisation of a functioning MRV information system		Grant, RBP etc.			TA, embedded TA, consultancy etc.
	$1,368,263	Grant	FAO	FAO	TA and consultancy
	$1,813,188	Grant	UNDP		
	$818,550	Grant	UNEP		
	$8,200,000	Co-financing arrangement	World Bank	World Bank	TA and consultancy
	$0,200,000	Co-financing arrangement	RoC State Budget	Government of RoC	Institutional and equipment support

Case study narrative

National context in REDD+ MRV development

The Republic of the Congo is a lower middle-income country whose main earlier engagement with forests has mainly been concerned with timber concessions and protected areas. The main body concerned with managing the MRV process, CNIAF, is based on the Ministry of forests. As a country with high forest cover and low historical deforestation rates, the Republic of the Congo seeks Results-Based Payments for avoided deforestation. However weak governance and poor capacity to collect taxes in the forest sector in the past suggest that major changes in the sector will be needed in the future for such payments to become a reality.

REDD+ MRV development challenges and obstacles in republic of Congo

Low starting levels of technical capacity

National capacity relevant for Redd + and MRV was limited to some mapping capacity and to timber concession inventory. The capacity challenges are enormous for the systems required, and it takes much time and training to bring local staff up to speed.

Low levels of financial resources once initial support was complete

Staff have been trained and their skills of been built up, but it is been a one-time investment. Staff need a continuing budget, computers, vehicles, software, be paid well enough to stay in

post. In CNIAF only two computers and are working out of the 10 given by FAO. If resources are lacking staff who have been trained over time cannot easily implement what they have learnt.

Obstacles to a full recognition of the importance of REDD+ MRV

Staff directly involved with the Republic of Congo's REDD+ MRV have been passionately committed to their work. But the value of these systems was not always effectively communicated upwards to government as a whole and important linkages were not always made. For instance carbon calculations for the REL were not always linked coherently with forest inventory and monitoring.

Unreliability of the Internet

Although staff in CNIAF have been trained to use satellite imagery, and are delighted that access to Sentinel is free, the Internet is often unavailable in the Republic of Congo. Partners have helped by sharing imagery on disk.

REDD+ MRV development successes in the republic of the Congo

Capacity building

Those interviewed all commented on the value of the capacity building that staff have received. Staff began with none of the relevant skills and they are in a strong position now. So long as funding is available they know how to move forward. Staff have got on top of both MRV and REDD+ issues and understand the tools which must be used to operationalise and measure them. The REL was done by the government, which was a major milestone.

REDD+ Compass scores

Redd + Compass scores are quite good.

Forest inventory and mapping

The completion of the forest inventory and the mapping undertaken in the northern regions are both to the credit of the CNIAF staff. Emissions are estimated from logging using a model which the IPCC invented, based on volume harvested and using biomass factors. There is a national biomass map and a series of other maps and good quality estimates for industrial logging

The role of REDD+ MRV support

Considering the REDD+ MRV system was effectively imposed, being required by UNFCCC and implemented by the World Bank and consultants, the Republic of Congo has benefitted

as best it could from the situation. But both donors and government could perhaps have produced a more sustainable outcome.

Contrasting approaches to REDD+ MRV support

The two main donors with staff on the ground have been the World Bank and FAO. They have not always collaborated effectively and their approaches to the work were very different. The World Bank wanted to get the job done and sent consultants to do the work of carbon accounting, working alone and developing only weak country links. The justification is that this method avoids corruption and lowers transaction costs, but it fails to up skill local people. The FAO by contrast built much more ownership into the process and trained local parties as it got on with the work required. It taught them analytical skills and provided them with equipment and with a consultant who stayed with them to complete years in the early stages.

Weak government management of multiple REDD+ MRV players

There have been too many players, and government needed to be stronger to harmonise different and competing inputs. For instance, in the northern regions of Sangha and Likouala there have been at least six different maps produced by FAO, Norway, the University of Maryland, the EU, the World Bank and now AFP, the French Aid agency. Government welcomed help from all quarters, and claimed to want to compare approaches, but the result has been duplication of effort in some places and a lack of resources in others.

Interviewees Perspectives on future MRV support

The system is likely to take 5 to 10 years to be fully functional. The forests of the Republic of Congo are of global significance, and the World Bank is currently using funds from another project to keep the MRV operational for another 18 months. Political support will currently stand or fall by the receipt of REDD+ Funds.

In the long run funding will only come from results-based payments, so if the results are not there, there will be no money, but the Congo needs more help before it will be ready to stand alone. The Redd plus programme needs to be planned for the long term with sufficient staff and a proper annual operational budget. Sustainability will only come with the assurance of long-term funds so that proper access to satellite imagery can be obtained, there are resources to go to the field, and the support of further training as newer methods become available.

Conclusions

Considering that the Republic of Congo has not had many years to address REDD+ and MRV it has made strides in the right direction. But it is dispiriting to think that this support is about to come to come to an end long before the investment in capacity building has had enough time to produce long-term capacity. It is also clear that without further funds the process will inevitably come to an end. The country is far from ready to stand on its own feet and does

not have the very substantial funds to spend on prolonging the process. The country has much to learn from other countries with longer experience such as Guyana (which is similarly a country with high forest cover and low historical deforestation rates). But it is clear that such comparative learning would need financial support for some years to come.

Key lessons

- A much longer period is required to reach sustainability and independence than the Republic of Congo has been able to enjoy.
- A capacity building approach by donors to developing REDD+ MRV is absolutely essential even though this means that reaching various goals and milestones will take longer.
- It is also essential for sustainability that the government is kept informed by forest specialists about the reasons for REDD+ MRV and its importance to the country. Busy professionals may not always make a priority of this and may need help from communication specialists.

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