

**Democratic Republic of the Congo
Ministry of Environment and Sustainable Development
Directorate of Forest Inventory and Management**

**Project for Strengthening National Forest
Resource Monitoring System
for Promoting Sustainable Forest
Management and REDD+
in Democratic Republic of the Congo**

**Final Report
Summary**

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1 Background of the Project

Democratic Republic of the Congo (hereinafter referred to as the “DRC”) is located in central Africa, which covers a national land area of 2,345,000 km², with a population of approximately 83.3 million. The Congo Basin in which the DRC is situated has the second largest tropical rainforest after the Amazon, often described as the “one of the global lungs.” It is known for a carbon sink serving as an important reservoir for climate change mitigation. However, this tropical rainforest section in the DRC is diminishing due to various man-made causes, including the development of farmlands, civil wars, and illegal logging. The conservation of the rain-forested area is now a major global issue. In the period between 1990 and 2000, DRC experienced a political upheaval during which forest governance was paralyzed, and this was believed to have exacerbated deforestation and degradation in the country to a large extent. It was about 2002 when the DRC Government re-launched the national forest policy and various initiatives. As a part of its legislative update, the new Forest Code was promulgated on April 11, 2002, replacing the colonial Forest Law of 1949. In line with a forest policy set forth in the new Code, DRC has started to capture the status of forest resources which serve as a benchmark, with the support of multiple international agencies and NGOs, the Western countries, and other partners.

With its grant aid scheme for the Forest Preservation Program (Program Grant Aid for Environment and Climate Change), the Government of Japan has provided DRC with a range of tools and equipment needed for forest inventories and development of forest information system. The grant aid also delivered technical assistance for training on how to operate the equipment provided. This has improved physical settings for which DRC implements its policy-based efforts. Under these circumstances, the DRC Government requested Japan International Cooperation Agency (hereinafter referred to as “JICA”) to implement technical cooperation targeting with the former Bandundu province as a pilot area in order to develop a feasible forest resource inventory system, using the tools and equipment provided.

2 Outline of the Project

(1) Overall goal

Sustainable forest management is promoted whereby REDD+ is implemented with operations of the National Forest Monitoring System (NFMS).

(2) Project goal

The NFMS is developed and operated to enable sustainable forest management and implementation of REDD+.

(3) Expected outputs

Output 1: Forest base maps in the former Bandundu province (the pilot province) are produced.

Output 2: Ground survey modality and procedures for national forest resources inventory are developed.

Output 3: Database on national forest resources inventory is established.

Output 4: National forest monitoring system (NFMS) is established and its operation plan is developed.

Output 5: The methodology to determine the Forest Reference Emission Level (FREL) is described in the forest inventory manual.

(4) Target areas

- The project's office: Kinshasa city
- Pilot province: the former Bandundu province (currently divided into three provinces of Mai-Ndombe, Kwilu, and Kwango)
- Establishment of the forest resources database and forest inventory system: the whole country of DRC

3 Basic Policy of the Project

(1) Overarching policy

The Project for Strengthening National Forest Resources Monitoring System for Promoting Sustainable Forest Management and REDD+ (hereinafter referred to as “the Project”) is implemented with a technical cooperation scheme of Japanese bilateral aid. It is therefore essential that the DRC Government and the counterpart agency (hereinafter referred to as “C/P”) understand the principle underlying the said scheme. In a series of face-to-face briefings, the Japanese study team makes sure that the C/P is fully familiarized with the principle, while keeping in close communication with JICA.

(2) Key strategies on technical matters

- (a) A highly versatile but standard methodology should be developed to create the national forest resources inventory system that is aligned with the global practices.
- (b) Building a specific forest resources inventory system must be tailored to local contexts unique to DRC and/or the former Bandundu province.
- (c) Cooperative and mutual efforts intended in the Project should develop capacities of technical staff in DRC.
- (d) The tools and equipment provided with the grant aid from the Japanese Environmental Program should be used in a practical and effective way.
- (e) Careful coordination should be made with aid projects of other development partners working or planning to work in DRC.
- (f) The Project's achievements should be broadly publicized among local stakeholders and other development partners.

(3) Key strategies on operational matters

- (a) The Project should be implemented in a close partnership with the C/P.
- (b) Responsibilities of the study team members should be defined clearly so that the mission is carried out in a timely and streamlined manner.
- (c) Japan Forest Technology Association (JAFTA)'s pool of knowledge and experiences should be fully used for the Project.

- (d) A risk management mechanism must be created in JAFTA to ensure the safety of the study team.

4 Procedures of the Project Implementation

The Project is implemented in accordance with “2. Matters related to the Survey Objectives and Components” shown in JICA’s TOR and “3. Basic Policy of the Project” outlined above. Initially, the Project was planned for three years from July 2012 to May 2015. However, additional activities were assigned: namely, the construction of FREL and the use of forest type maps in the Mai-Ndombe Emissions Reduction Program. As a result, the Project was extended until May 2017, as stipulated in the Minutes of Meeting signed in March 2015.

In addition to that, clashes erupted in the capital Kinshasa in late September 2016 between police and demonstrators in an opposition rally calling for a change of regime. This drastically increased already worsening safety concerns in Kinshasa, and therefore all three Japanese project members were sent back to Japan on September 27, 2016. The restricted travel to DRC did not allow them to return until January 9, 2017. Planned activities during this period were not implemented, which again required an extension of the Project’s contract. Furthermore, the process of developing DRC’s NFMS has been largely accelerated with an array of aid programs funded by international agencies including FAO, and other development partners. Accordingly, some of the Project’s NFMS-related activities planned in 2012 needed updates. The Ministry of Environment and Sustainable Development (MEDD) and JICA have mutually agreed on an extension of the Project by revising the Record of Discussion (R/D) until February 2018 to complete additional activities.

5 Achievements of the Project

5.1 Output 1: The production of forest base maps in the former Bandundu province (the pilot province).

- Forest type maps

The Project reviewed the existing datasets for forest type mapping. Forest types specific to the Project were determined, upon consultation with the Directorate of Forest Inventory and Management (DIAF), ensuring the consistency with forest inventory methodology and addressing practical limitations (*i.e.* time, target area coverage, and available satellite imagery).

Satellite imagery used in the map-making process are ALOS, SPOT, and Landsat. After preprocessing the satellite imagery, the Project made a primary analysis based on the results, and then selected major points representing forest types and identified unclear ones. Ground truth (GT) data was acquired for training purposes. The GT data was used in forest type mapping with an object-based classification.

Upon completion of the forest maps, their accuracy was evaluated. The data used for their evaluation

was GT, which was acquired for this purpose, points marked in the forest inventory, and ALOS pan-sharpened images.

- Forest base maps

Forest base maps were created by which the forest type maps overlaid other thematic maps of roads and administrative boundaries. Targeting technicians in DIAF's Geomatics Division, the Project provided workshops and OJT on the above-mentioned forest type classification to transfer map-making skills and techniques.

- Multi-temporal forest type maps

Drawing on the 2010 forest type map as a baseline, forest types in the former Bandundu were mapped using multi-temporal data. This was based on time-series analysis of Landsat imagery characterizing forest change. Extracted data of forest changes were integrated into the 2010 forest type map and forest type maps of 1995, 2000, and 2014 were created. The Project provided workshops to instruct extraction procedures for engineers and technicians in DIAF's Geomatics Division.

5.2 Output 2: Ground survey modality and procedures for national forest resources inventory are developed.

- Pre-inventory

Drawing from a FAO-innovated pre-inventory methodology, the Project developed a field manual and field notes, followed by a pre-test and validation.

Targeting technicians and inventory operators in DIAF's Forest Inventory Division, the Project organized a survey team, developed an administration system, and provided forest inventory training.

On-site pre-inventory was conducted in May and June 2014. The former Bandundu province has located six points, which were all surveyed.

- Inventory

Based on findings of the pre-inventory, the survey team discussed over the forest inventory methodology and field notes. Proposed revisions went through a validation meeting, and the revised inventory methodology was validated.

Forest inventory was conducted in accordance with the finalized methodological procedures. The forest inventory in the Project's Phase 1 lasted from July through September 2013. Phase 2 continued the field survey in the dry season. Every year, the Project provided training sessions to surveyors before an on-site forest inventory to improve and maintain the quality of forest studies.

Obtained data were entered into the forest inventory database (hereinafter referred to as the "forest inventory DB"). The study team compiled data, calculated forest carbon stocks, and assessed the accuracy.

As a result of calculating data obtained up to Phase 2, it revealed that the expected accuracy was low in dense and dry forests in the south. Phase 3, therefore, conducted an additional survey on those forest types.

Data obtained during the forest inventory were all stored in the DB. The above-ground biomass was

estimated using the forest inventory dataset accumulated up to Phase 3, where the expected accuracy was statistically calculated. The findings indicate that the accuracy contained an error rate of 7.00% at a 95% confidence interval.

The Project completed technical guidelines for forest inventory in consultation with the C/P.

5.3 Output 3: Database on national forest resources inventory is established.

The Project analyzed requirements for the Project's forest resources database to design its key functions. The findings were incorporated into the logical design (detailed design), and database specifications were defined. Physical design (implementation) was developed in accordance with these specifications.

The Project created two kinds of databases, namely, the Forest Inventory DB and the Forest Geographic Information DB (hereinafter referred to as the "Forest Geographic Information DB"). The former is an Access database to store data obtained in inventories and master tables such as lists of tree species and specific-gravity tables. The latter is a GIS dataset of which geographic information, *i.e.* various drawings and satellite imagery, are combined with inventory plot data.

- Forest Inventory DB

Inventory data was entered into a prototype for trial. To improve the system, corrections were made to bugs detected during trial operations. Furthermore, a dataset was equipped to access photos, GPS, maps and outcomes of soil testing and litter analysis. The Project made a feedback to the inventory team to ensure a consistent understanding of the methodology and improve the quality of inventory. Training was provided for the C/P to make such improvements.

- Forest Geographic Information DB

Satellite data and maps of land cover and forest type classifications were entered into a prototype of the Forest Geographic Information DB. Causes of the bugs detected during trial operations were identified and corrected.

The two kinds of databases were validated, and thus the forest resources database was completed collectively.

At the same time, the Project finalized the technical guidelines for the forest resources DB and a manual in consultation with the C/P.

5.4 Output 4: National forest monitoring system (NFMS) is established and its operation plan is developed

At its outset, the Project envisioned a two-step process of developing the NFMS system. First, it would start from the subnational system in the former Bandundu province, mutually linking three components, namely, forest type mapping based on remote sensing analysis, above-ground forest inventory, and DB system building. Then, with this system, the Project anticipated that DRC should be able to take the lead on creating nationwide data with support of other development partners and international aid programs.

On the other hand, funded by UN-REDD and the World Bank, MEDD worked out a holistic national-level plan called the National REDD+ Framework Strategy (2012), whose components included the NFMS. Later on, the 2015-2020 REDD+ Investment Plan was set out in November 2015, directly aligned with the said Strategy. It defined the NFMS as an essential component to implement REDD+. In 2016, it was pledged that implementation of the Investment Plan would be partly financed by Central African Forest Initiative (CAFI). In January 2017, FAO launched the program to finalize and implement the NFMS.

The FAO-supported program covers components that would constitute the NFMS, such as technical coordination among forest stakeholders, methodological development, FREL construction, NFI implementation, biennial reporting, and monitoring of major deforestation events. Therefore, the Project decided to make collaborative efforts with FAO's NFMS finalization program so as to help develop DRC's NFMS through offering its resourceful assets, including a subnational level methodological approach and relevant data accumulated in the former Bandundu province. In its Phase 3, the Project started to actively take part in the NFMS Technical Coordination Platform (hereinafter referred to as the "Platform"), led by the Sustainable Development Department (DDD) in consort with FAO and other aid agencies. This involvement was intended to reorient the Project's efforts to achieve the initial Output 4 "the establishment of the national forest resources inventory system" ultimately into "the development of DRC's NFMS". In the Platform, the Project's know-how and experiences were valuable contributions, as three components were systematically linked, namely, forest type mapping, the on-the-ground forest inventory, and DB. Nevertheless, it was noted that the methodology piloted in the former Bandundu province would not be immediately applicable, and that relevant modifications or other approaches might be necessary. This was primarily due to potential requirements to be met, such as IT advancement and replication of the Project's model at the national level.

The Project has contributed to the Platform operations. As a part of effort to develop DRC's NFMS, it made presentations and proposals on technical issues highlighting practical experiences and lessons learned in the process of building Bandundu's forest monitoring system. The Platform is generally held on Friday of the first week every month, which has taken place nine times so far to discuss the agenda as mentioned later. Apart from the main session in the Platform, working group meetings and stakeholder meetings are organized, wherever appropriate.

The Project hosted a Platform meeting and a working group meeting. It made four presentations and also served as a moderator.

The Project provided training sessions on forest and land cover classification mapping and forest inventory to enhance the C/P's capacity that would be needed for the NFMS implementation. It also created a manual on the NFMS implementation.

- 5.5 Output 5: The methodology to determine the Forest Reference Emission Level (FREL) is described in the forest inventory operation manual.

Activity data (AD) and emission factors (EF) are required to determine FREL. The forest type maps of 1995, 2000, 2010, and 2014, created with a time-series analysis mentioned in the forest base mapping, used AD. Forest change area was estimated according to these forest type maps. As for EF, forest carbon stocks were estimated by forest types, according to data obtained in the forest inventory.

The quantity of carbon emissions were estimated by the multiplication of the AD by EF, and then FREL was calculated. In consultation with the C/P, the procedures of determining FREL were described in FREL technical guidelines. The Project also provided a FREL workshop to develop the C/P's capacity.

In COP 22 held in Marrakech in 2016, the Project disseminated its achievements and lessons learned.

6 Issues, Tips, and Lessons for Project Implementation

6.1 Challenges in project management

(1) Aid coordination with other development partners

In DRC, many international agencies, aid agencies and international NGOs are implementing their projects in the environment and forest sectors. The Project needed frequent information sharing and consultation with these actors to avoid duplication of aid efforts. Coordinating their respective interventions with the Project was therefore a crucial task to ensure the consistency as to technical approaches, data sharing, integrity and compatibility, and to find opportunities and schemes for potential collaboration.

The Project addressed these challenges through partnering with FAO at various occasions when carrying out pre-inventory and inventory training, having monthly meetings with aid agencies working with DIAF, and organizing the Platform.

(2) Relationship with the provincial government

The Project has been implemented under a bilateral agreement between the DRC Government and the Japanese counterpart in response to the request made by the former. On the other hand, the provincial government has requested its environment unit to cooperate with the Project. The relationship with the provincial government is critical in terms of the followings:

- The Project's study team must be accompanied by local officials during its forest inventory and on site surveys necessary for forest type mapping to ensure the safety and efficiency. They are the key persons who make arrangements with local residents, acquiring access information, and safeguarding against potential security risks.
- Implementing REDD+ activities in the future, if sustaining the relevance and continuity, will raise the crucial issue of maintaining the consistency with the local policies and developing capacities of provincial stakeholders.

<Challenges ahead>

Financial support

Newly allocated provincial institutions, including environmental units, do not have adequate work settings as to their personnel, technical capabilities, and budgetary resources. The previous technical cooperation has earned good reputations as having developed capacities of the provincial institutions involved. Notably, this approach is the key strength underlying JICA's assistance. Such experiences will be conducive to enhancing skills and capacities of provincial officials when they implement REDD+ activities and other projects. On the other hand, given poor financial conditions of the provincial governments, they are mostly likely to request funding support. Such needs should somehow arrive at a solution.

Furthermore, the provincial environment units and MEDD's local coordination offices are not sufficiently provided with IT devices, motorcycles, and vehicles. These material needs must also be met to implement projects on a scheduled basis.

Office

The provincial government of Kwilu, which was separated from the former Bandundu province, is located in the provincial capital of Bandundu in the northwestern end of the territory. When project activities are carried out in Kwilu province, the site will have very poor access from the provincial capital. It is thus desirable to locate a project office in Bandundu ville for the convenience of having meetings and coordination with municipal stakeholders. However, this will make access to the activity site very inconvenient. Nonetheless, discussion and coordination with municipal stakeholders will not take place all the time. It is reasonable that a project office will be located in a city close to an activity site, and have the staff travel to Bandundu ville, when necessary.

(3) Capacity development of the C/P

Capacity development of the C/P is critical to sustain outcomes in JICA's projects. However, the C/P staff in DIAF are not yet fully capacitated to take a leadership in planning and managing the country's forest monitoring system.

The Project has gained a quite positive evaluation from DRC, and one of the major reasons is that it has been committed to capacity development of the C/P with a down-to-earth approach. The Project has been implemented so that the C/P would be equipped with integrated skills in synergetic combination of Off-JT and OJT, so that the C/P has been encouraged to apply their knowledge and techniques learned in its training sessions to practical work, which fosters better understandings. The Project has sought to ensure that the C/P is able to respond to various tasks with their reliable skills. More specifically, it has engaged in the capacity development efforts as below.

- After every forest inventory trip, the Project had a debriefing session, technical evaluation and adjustment of the survey practices, and discussed problems identified during the on-site trip and potential solutions. The DB team gave feedback on errors found in field notes taken from a forest inventory to the inventory team so that the latter could become aware of the errors

and make corrections.

- With the forest inventory data, the Project gave training to assess biomass based on allometric analyses, which was useful to understand how collected field data would be processed. This facilitated the C/P to learn sequential techniques for a forest inventory.
- Together with the C/P, the Project ground-truth remotely sensed data was verified on site so that the staff could develop analytical skills and increase accuracy of the data.

Capacity development efforts do not always bring about perceptible results, which are often difficult to measure. Nonetheless, the following aspects are considered to be noteworthy benefits.

- At present, key team members working on the NFI conducted in DIAF-FAO's NFMS finalization program are those who were trained in the JICA project, taking part in the forest inventories in the former Bandundu province. Seven of the ten leaders in the NFI team are involved in forest inventories in Bandundu.
- Having applied technical skills learned in the DIAF-JICA project, DIAF's Geomatics Division, through its own efforts, created forest and land cover type maps that are essential to REDD+. JICA offered an instruction manual on remote sensing analysis, provided a set of national images mosaicked from the Landsat, leased software for remote sensing analysis, and supported the management of the map-making progress.

<Challenges ahead>

Capacity development

While the Project and FAO's NFMS finalization program help develop DRC's forest monitoring system, it is DIAF's technicians who play a part in the function of the system. To this end, apart from forest inventories and remote sensing analyses, DIAF technicians should enhance their ranging capabilities to work on valid methodologies, budget proposal, schedule management, reporting, quality assurance and control, PDCA cycle implementation. Moreover, they need a coherent understanding of the technical essence to cope flexibly with problems emerging in the monitoring process. A future project must assess the current C/P's capacities and make strategic efforts to develop them on a step-by-step basis. Careful capacity development efforts will nurture a mutually reliable relationship with the C/P, which will facilitate the smooth and effective implementation of a project.

Long-term employment of technicians

DIAF's financial foundation is so weak that even running costs of the office (including rent, utilities, and repairs) and transportation fuel are sourced from the funding of aid agencies. DIAF staff include officially registered public employees and those who are not approved as such and unpaid because they exceed the total number of the predetermined appointments. The latter serve on a project basis with support of aid agencies. As a matter of duty, MEDD should pay personnel costs, and yet, its actual financial situation defies a solution. DIAF notes that MEDD will not be able to resolve this problem

by itself, and that the Minister of Public Function (Ministère de la Fonction Publique) should address it.

The above-mentioned problem undermines a continued, long-term commitment of technicians at their workplace and lowers their morale, which potentially negates positive effects of a project's technical transfer. Aid agencies are unable to remedy this problem, but what they can do is to keep encouraging DRC to alleviate it. This drawback should be kept in mind in implementing a new project. Notably, the aid agencies have their C/P staff recruited for the projects, paying allowances from prime costs instead of salaries.

6.2 Issues related to NFMS

(1) Utilization of achievements in the DIAF-JICA Project

The objectives and components of the Project are much related to the FAO's NFMS finalization program commissioned by CAFI. Therefore, it has worked closely with DIAF and DDD, Congolese implementing bodies, FAO and its partner organization, WCS. This collaboration has been put forward by the Platform, which DDD is steering. The Platform has such members as DRC's government agencies, international agencies, bilateral aid agencies, NGOs and universities related to the NFMS. In partnership with FAO, the Project has supported the Platform's steering body.

The Platform has so far discussed the specific agenda outlined below.

- 1) Forest and land covers (stratification) required for estimation of AD and EF
- 2) NFI methodology
- 3) FREL/FRL

With a view to the above agenda from (1) to (3), the Project has been committed to developing the NFMS, fully drawing on achievements and practical know how obtained in the former Bandundu province. The table below describes how outputs of the DIAF-JICA Project have been utilized, which was elaborated and agreed in the Platform and the working group.

Table Ongoing and prospective utilization of outputs of the JICA Project

Item	Current status
Forest type maps	DRC's official stratification (forest and land cover classification) had been discussed in the Platform with reference to the one used in the DIAF-JICA Project. As a result, it was agreed that the national-level stratification would combine some of the classifications used in the DIAF-JICA Project. Such a combination of those classifications stems from filling a gap; the said project used high-resolution images, while the national-level stratification used low-resolution Landsat imagery. Related documents have been already drafted, which

	<p>will be finalized after going through a validation process.</p> <p>A JICA map was used to estimate a deforestation area in the former Bandundu province, which is required for calculating AD, while forest/non-forest maps created by DIAF-FAO were used to identify such areas in other provinces.</p> <p>FAO calculated AD in its NFMS finalization program by visually checking sample points with Collect Earth to assess the accuracy and then make corrections to the deforested area as necessary (Approach of Oloffson (2013)).</p> <p>DIAF has created nationwide land cover and forest type maps with the object-based classification (which the DIAF-JICA Project has instructed for DIAF). While DIAF intends to use these maps for REDD+ activities in the future, FAO's AD calculation does not require such maps. So, DIAF should explore what specific purposes their maps can serve in the future.</p> <p>In 2018 and onward, FAO will probably start cloud-based classification with the System for Earth Observation Data Acquisition Processing and Analysis for Land Monitoring (SEPAL). Details about a schedule or method are yet released from FAO.</p> <p>Having worked in the DIA-JICA Project, DIAF technicians understood fundamentals of how to interpret remotely sensed data, and are becoming competent to flexibly employ their techniques that meet tasks and circumstances. Human resource development is one of the major pillars of JICA's technical cooperation. This Project in DRC has made a significant contribution to capacity development of technicians and engineers in DIAF's Geomatics Division and Forest Inventory Division.</p>
Forest inventory	<p>FREL to be submitted to UNFCCC in January 2018 will use EF calculated with inventory data of the DIAF-JICA Project, FAO's pre-inventory data, and inventory data of the WWF's carbon map project.</p> <p>An inventory manual of the DIAF-JICA Project was revised to be applicable to the NFI. It was then officially validated. Although having minor modifications such as that plot area representing a larger area, given the accessibility restrictions in DRC, the NFI manual has basically applied the methodology of the DIAF-JICA Project.</p> <p>The forest inventory in the DIAF-JICA Project estimated carbon stocks in five main carbon pools, including dead wood, soil, and litter. Because these data were previously unavailable in DRC, estimated data are now a valuable asset. FREL set for the former Bandundu province are attached as a reference to an upcoming national FREL report to UNFCCC in which these data are mentioned.</p>
Forest	<p>The DIAF-JICA Project had a briefing for FAO's national staff with a manual</p>

inventory DB	and a design specification for the forest inventory DB developed. DIAF and FAO are working hand in hand, mutually understanding that the most crucial component making up the DB is not a physical IT tool, but the forest inventory data stored therein. It is important that data collected and organized in the Project will be stored and used appropriately in DIAF in a post-project phase. To this end, FAO, which will be developing a new DB system in DIAF, must be informed of the existing DB. DIAF will appoint FAO experts in the course of time, and should continue information sharing.
FREL	AD and EF will be based on outputs of the JICA Project. WCS is mainly drafting a FREL report to UNFCCC. As a result of discussions with WCS and in the Platform, it was decided that a FREL report in the former Bandundu created in the DIAF-JICA Project would be attached to technical documents in the above-mentioned national FREL report to UNFCCC as a part of resourceful assets accumulated in DRC.

The above table described how the DIAF-JICA Project has applied its outputs to practical use. In the course of which the NFMS is further developed, the methodology will be modified to cover DRC's vast land and forest area and to adjust itself to technological advancement. Currently, DRC's REDD+ sector underlying the NFMS is robust and rapidly changing. It is vital that Japanese assistance efforts keep relevant information up to date and gets involved in the said sector to maintain a presence in the country.

(2) Support for the Platform operations

Issue

CAFI-funded NFMS finalization program comprises two implementation phases. It is said that successful achievement in the first phase will be a key requirement to receive successive funds in the second phase. FONAREDD and FAO are implementing the program with a particular emphasis on achieving the first-phase objective. At the same time, however, they are concerned with inadequate technical and operational capacities of DDD and DIAF, which may adversely affect the program's implementation progress. JICA's Project, on the other hand, has aided to foster ownership of DDD and DIAF in pursuing their activities and capacity development. Despite this difference in aid approaches, JICA and FAO have the same objective to develop DRC's NFMS. Therefore, their collaboration has an importance in mutually supporting the Platform.

Solution

The Project has delivered its assistance in accordance with DRC's initiative, while paying careful attention to FAO's NFMS finalization program as to what goal it intends to achieve and when such goal is achievable. The Project's specific efforts include strengthening DDD's steering functions of

the Platform, such as preparing an agenda, hosting the Platform (coordination, moderation, and presentation to make technical contributions and proposals), making a record of the proceedings, and improving communication infrastructure. As a result, the Platform has been successfully operated on a regular basis.

When the Platform was launched, DIAF, JICA, and FAO, which were to take the lead in technical exchanges in the working group, did not have a preliminary session as to the agenda. Consequently, it ended up with an unfocused meeting where participants made their respective remarks. Against this backdrop, these three agencies (and DDD, depending on the agenda) started an inter-agency consultation ahead of a working group meeting so as to obtain a consensus on how they would direct discussion. This has led to a more focused discussion in the working group for which participating stakeholders could arrive at an agreement on technical matters. For instance, the Platform eventually decided that JICA and FAO would collaborate on the forest inventory methodology and stratification, chiefly incorporating outputs of the Project.

(3) Revision of the technical guidelines and manuals

The Project's practical deliverables include technical guidelines and manuals on forest remote sensing, forest inventory, DB, and FREL. The items will be submitted to the DRC Government in February 2018. These guidelines and manuals have been chiefly prepared with reference to the Project's activities in the former Bandundu province. At the same time, they have been tailored to be a tool for developing the NFMS. More specifically, the Project used the guidelines and manuals as below.

Forest remote sensing

DIAF created a national forest and land cover map, applying a method learned in the Project. This mapping process used a manual for interpretation of remote-sensing imagery. The manual will be attached to a FREL report which DRC will submit to UNFCCC in January 2018.

Forest inventory

Drawing on a forest inventory manual developed in the Project, a technical manual was created regarding the NFI carried out by DIAF and FAO.

Database on national forest resources

With its technical manual and design specification, the Project gave briefing for DIAF and FAO to describe forest inventory data attributes so that the local inventory data in the former Bandundu province could constitute part of the NFI data. It also explained a data entry process and database management, using the practical experiences in the former Bandundu province.

FREL

The above-mentioned FREL report to UNFCCC will be appended with procedural guidelines on FREL in the former Bandundu province. The guidelines were created to illustrate the Project's model practices developed in DRC. The former-Bandundu FREL covers forest degradation that is not

included in national FREL and also an array of data on carbon pools including soil, litter, and dead wood. Bandundu's FREL construction also uses AD at four-time points (instead of three as used in national FREL), which offers a valuable set of information.

As described above, hands-on experiences in the former Bandundu province have been fed into the NFMS in a form of technical guidelines and manuals created in the Project. These documents must be updated in the process of practical application. Thus, an updating task will need to be somehow carried out, adding experiences and lessons gained in the course of the NFMS implementation in the future.

(4) Forest type mapping

Targeting the former Bandundu province, the Project created the 2010 forest type map with object-based classification, using high-resolution satellite imagery and eCognition software. Based on this map, forest type maps of 1995, 2000, and 2014 were produced by extracting forest changes, and AD were generated.

On the other hand, FAO, in its NFMS finalization program, assessed national AD with statistical computing by extracting forest changes with the Google Earth Engine and then visually analyzing them. This methodological approach is detailed in the Map Accuracy Assessment and Area Estimation - A Practical Guide (FAO). FAO will probably continue to apply this methodology for the future.

DRC set the year 2000 as a reference point for the Intended Nationally Determined Contributions (INDC) submitted to UNFCCC. Accordingly, the same year was benchmarked for the construction of FREL required to implement REDD+. In parallel to FAO-led forest change detection mentioned above, DIAF created a national benchmark map of 2000, analyzing Landsat imagery with eCognition. This will be a key tool to determine where future REDD+ activities will be implemented, subject to monitoring. Accuracy of the benchmark map should therefore be ensured in order to meet this purpose. For a predetermined period from July to August 2017, the Project leased an additional license of eCognition to help increase map accuracy. As a result, DIAF managed to revise the 2000 forest type map. Because the Project has no remaining time to assist DIAF's further efforts, it is strongly advisable that a successive project continue to support Geomatics Division for the improvement of geographic information.

7 Prospective achievement for the objective of the plan

Upon revision of the Project's R/D in April 2017, its goal was modified from "forest resources monitoring is appropriately conducted based on the operation plan for the national inventory system" to "the NFMS is developed and operated to enable sustainable forest management and implement REDD+."

Targeting the former Bandundu province (the current three provinces of Kwilu, Kwango, and Mai-Ndombe), the Project created forest type maps at four-time points, conducted forest inventories, and

developed the DB. This has led to generation of subnational AD and EF and development of FREL. The Project also made contributions to the Platform, offering its know-how and experiences gained in the process of developing the subnational forest monitoring system. The implementation of these activities and resulting outputs have successfully led to the attainment of the Project’s goal in terms of developing the forest monitoring system in the former Bandundu province. On the other hand, efforts toward the above-stated “development and operation of the NFMS” did no more than provide expertise and data accumulated in the target province, develop the NFI methodology, and encourage capacity development. This has been inevitable, considering the Project’s operational framework relative to the extensive scale and timeline required to develop the NFMS. Future assistance must ensure the feasibility and continuity of the proposed activities in DRC’s timeline, if it intends to develop the NFMS, drawing on Project’s achievements.

FAO is currently implementing the NFMS finalization program to consolidate DRC’s national monitoring efforts, which is planned to be completed by 2020. The relation between the Project and the CAFI-FAO program is illustrated in the figure.

It is a challenging task to develop a reliable and accurate NFMS that looks into REDD+ activities across the vast land area of DRC. Joint efforts will be essential among related international agencies, aid agencies, and NGOs.

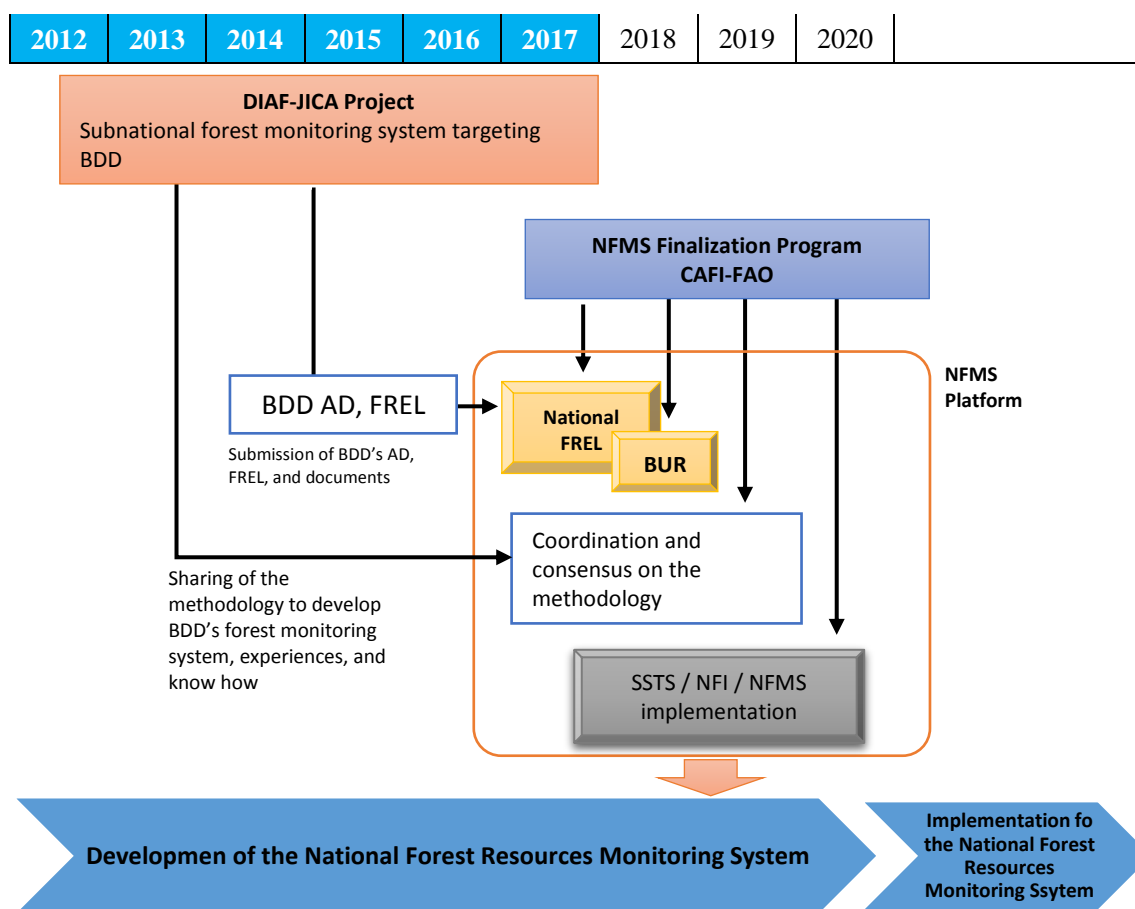


Figure Functional Position of the Project in the NFMS Framework

8 Proposal to achieve the goal by utilizing the cooperation outputs and to implement the next project

8.1 Issues related to project management

Challenges related to the implementation of REDD+

- Development of a reliable system designed for monitoring REDD+ activities

Considering that the monitoring system should be in place to receive result-based payments from the implementation of REDD+, the viability and accuracy needs to be ensured.

- System capable of periodic monitoring

Periodic monitoring of DRC's vast land will need a cloud-based data processing system, for instance, Google Earth Engine.

- Involvement of local stakeholders in monitoring activities

Monitoring of REDD+ activities requires remote sensing as well as data collection in the field, and therefore is important to involve local stakeholders.

- Development of a monitoring system for tracking emission reduction efforts implemented locally and a national registry infrastructure

A REDD+ registry as well as an on-site data collection system need to be built, which facilitates tracking of information on accurate emission reduction accounting, benefit sharing (BS), safeguards (SG) at the full scale implementation of REDD+.

Challenges related to sustainable forest management

- Development of a system useful for sustainable forest management

CAFI-FAO's NFMS finalization program focuses on generation of AD, and does not create forest and land cover maps. However, these maps are essential for the monitoring of sustainable forest management and REDD+ activities. Therefore, the NFMS should include such map making and updating.

- Development of an early warning system for reporting major deforestation events

The early warning system must increase accuracy and develop schemes of data distribution and verification. The above-mentioned CAFI-FAO NFMS finalization program is also developing the same kind of the alert system in collaboration with the World Resources Institute. Nonetheless, it is useful for MEDD to have several alternative warning systems. Thanks to a JICA/JAXA-provided radar sensor, a deforestation detection system is available, free of charge, and less affected by cloud, which brings about substantial benefits when used in parallel with other systems.

8.2 Recommendations for implementation of a successive project

Overarching design of assistance

It is recommended that successive assistance be implemented in the form of a program comprising two elements, namely, the NFMS and the Integrated REDD+ Project (PIREDD). Financing and an

implementation framework must be planned to meet the program's requirements.

NFMS

- (1) Drawing on experiences of the ongoing Project, successive technical cooperation should elaborate on how to demarcate with the CAFI-FAO program. To date, the Project has been partnering with FAO. However, JICA's assistance is not always realizable for such reasons that it must align with requirements of the National REDD+ Fund (FONAREDD) and also that FAO has its own strategy. Matters that cannot be coordinated at the project staff level will need high-level arrangements between JICA and FAO.
- (2) The ongoing Project has gained leverage in the NFMS development process, chiefly because it has achieved solid results stepwise in the former Bandundu province. To maintain the presence of Japanese assistance, it must continue to make contributions built on field activities. A successive project or program must therefore include field activities, while at the same time demarcating and/or partnering with FAO.
- (3) The Platform is a part of FAO's NFMS finalization program, as provided in an agreement between the agency and FONAREDD. Ideally, however, it should be a venue for related partners, under the DDD-DIAF initiative, to elaborate on standardization of MEDD's methodology and how to share and use data. What is important here is that all the partners must collectively understand the methodology and documents agreed and/or created in the Platform are shared outcomes as a whole.
- (4) Technical guidelines and manuals should be in a set of deliverables completed in the ongoing Project, which uniquely targets the former Bandundu province. A successful project or program needs to be modified to contain a monitoring scheme comprising of remote sensing, NFI, and DB, adjusted to technological advancement and potential scaling up at the national level.
- (5) The status of DRC's REDD+ activities, and interventions as to the NFMS, in particular, is rapidly changing. Therefore, it is vital that technical assistance does not create a vacuum in its delivery.

Integrated REDD+ Project (PIREDD)

- (1) If funded by CAFI, a project or program should be aligned with a policy of FONAREDD administrating the grants. The project will probably find a difference between FONAREDD's policy and JICA's approach, which will need mutual efforts to synchronize their underlying concepts. Although they may not always be able to obtain an absolute consensus, their decision-making or conclusions must be made clear eventually.
- (2) Central government agencies (MEDD, DDD, and DIAF) and provincial institutions should clearly define their respective roles and areas in which they take part. The central agencies are to implement a REDD+ action plan and an investment plan, carry out monitoring and registration of REDD+ activities. Related provincial institutions, on the other hand, execute their development plans and environmental policies. It is important that they understand their functional roles and missions to take part in a project and facilitate capacity development efforts.

- (3) Cooperation with local human resources is indispensable for the implementation of PIREDD. Relevant partners need to be found with reference to the previous experiences in the target sites and the REDD+ sector.
- (4) It is foreseeable that CAFI will have its own procedures for contracts, procurement, accounting and/or audit that are different from JICA's ones, and thus a relevant mechanism will be needed to make up for such administrative differences.