REDD+ FOR THE GUIANA SHIELD

Third Working Group Meeting
April 28th and 29th, 2014
Cayenne, French Guiana

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Third Working Group Meeting

Context

The Guiana Shield is one of the largest blocks of primary tropical forest worldwide. Covered with around 90% of intact rainforest, it plays a critical role in mitigating climate change and in water regulation of Amazon and Orinoco basins. This eco-region also has very high biodiversity levels. Until a decade ago, the Guiana Shield forests were under little threat in comparison with other tropical forests. However, countries are burgeoning economically and demographically, leading to increasing pressures on natural ecosystems. The governments are keen to drive their development in a sustainable manner and in that perspective, they have shown strong interest in REDD+ as a mechanism that would enable to financially value their efforts, thanks to carbon revenues.

The project ***REDD+ for the Guiana Shield*** was initiated by Guyana, Suriname and France, at the occasion of the UNFCCC's fourteenth Conference of Parties, held in 2008 in Poznan. Shortly afterwards the state of Amapá in Brazil joined. The project aims at providing information and tools to be used by countries to establish sound science-based policies and measures to tackle deforestation and degradation, in the framework of REDD+ mechanism. The project is funded by the Regional Development European Fund (FEDER) through the Interreg IV Caraïbes program (1.26 M€), the French Global Environmental Facility (FFEM – 1 M€), the French Guiana Region (90 000 €), as well as by the project partners own contributions. Financing Agreements with donors have been signed late 2012 and the project officially started in January 2013.

Cooperation and capacity-building are key strategic components of the project. While in the same eco-region, Guiana Shield countries have different histories and have developed their own priorities. There is therefore high opportunity for lessons learning in the region starting through information and good practices sharing. The project encourages **cooperation** between neighboring countries on REDD+, thanks to a **technical and regional platform** that will focus on inventory of the resources (carbon stocks and forest surfaces), improvement of the quantified understanding of drivers of deforestation and forest degradation, as well as on modeling forest cover evolution. The platform includes four channels for **capacity building**: training and technology transfer; country/state-level support; regional discussions in the framework of Steering Committee meetings; as well as regional **Working Group** meetings.

This document contains the report of the **3rd Working Group meeting**, which was held in Cayenne, French Guiana on 28-29 April 2014. As part of the *REDD+ for the Guiana Shield* project, the event was organized by ONFI and funded by FFEM, European Commission and Région Guyane. Contributing to the project's Component 1, the topic of the working group meeting was **"Design of a Multipurpose National Forest Inventory"**.

Objectives

The aim of REDD+ for the Guiana Shield Working Group Meetings are to compare methodologies that have been developed and are used within or outside the region in terms of REDD+ MRV. Each meeting provides opportunities to discuss specific technical topics in order to enhance a common understanding and identify opportunities for training and technology transfer.

The specific objectives of Working Group 3 include:

- Initiating regional dialogue to identifying gaps (data and methodologies) at national and regional level (i.e. in the perspective of a common view of REDD+ MRV);
- Build capacity (through lessons learnt and sharing of good practices);
- Discuss the development of a Regional cooperation platform;
- Prepare technical inputs and feed into Steering Committee decision making.

The 3rd Working Group Meeting included two days of work divided into four sessions, each one developing a specific sub-topic and enriching the discussion through expert input on National Forest Inventories, reporting on GHG emission factors and forest carbon stocks. The following topics were discussed by participants:

- Introduction to National Forest Inventory (NFI) and its implementation in the Guiana Shield
- Designing a NFI for REDD+ purposes
- Use of NFI for carbon stocks assessment purposes (including discussion on the selection of allometric equations, emission factor) in the Guiana Shield
- Linking results from the national forest inventory with MRV reporting and GHG inventories NFI

Agenda

The meeting followed the agenda below:

28th April 2014

8h15 – 8h45	**Welcoming remarks**
8h45 – 12h00	**Session 1: Introduction to National Forest Inventory (NFI) and its implementation in the Guiana Shield** 08h45-09h00 – Introduction to the session 09h00-09h30 – Status of forest biomass and carbon stock assessment in South and Central America – *Matieu Henry, FAO* 09h30-10h00 – Questions 10h00-10h15 – *Coffee Break* 10h15-12h00 – Country roundtable and discussion
12h – 13h30	**Lunch**
13h30 – 16h30	**Session 2: Designing an NFI for REDD+ purposes** 13h30-13h45 – Introduction to the session 13h45-14h15 – Designing a National Forest Inventory in the context of REDD+ – *Matieu Henry, FAO* 14h15-14h45 – Questions 14h45-15h00 – *Coffee Break* 15h00-16h30 – Country roundtable and discussion

29th April 2014

8h30 – 12h	**Session 3: Use of NFI for carbon stock assessment purposes (including discussion on the selection of allometric equations, emission factor) in the Guiana Shield** 08h30-08h45 – Introduction to the session 08h45-09h15 – Improving accuracy of estimates toward better use of tree allometric equations – *Matieu Henry, FAO* 09h15-09h45 – Questions 09h45-10h15 – Country roundtable 10h15-10h30 – *Coffee Break* 10h30-12h00 – Country roundtable (cont.) and discussion
12h – 13h	**Lunch**
13h – 15h45	**Session 4: Linking results from the national forest inventory with MRV reporting and GHG inventories** 13h00-13h15 – Introduction to the session 13h15-13h45 – Overview of LULUCF GHG inventory, French Guiana – *Etienne Mathias, CITEPA* 13h45-14h15 – Questions 14h15-14h30 – *Coffee Break* 14h30-15h45 – Country roundtable and discussion
15h45 – 16h	**Closing remarks**

List of Participants

Name	Organization
Rene SOMOPAWIRO	SBB, Suriname
Sarah CRABBE	SBB, Suriname
Morena SANCHES	SBB, Suriname
Arjun PRAMSOEKH	SBB, Suriname
Lisa BEST	NIMOS, Suriname
Thiago ZAMPIVA	IEF, Amapá
José Maria ROSÁRIO	SEMA, Amapá
Maria do Carmo VIDAL	SEMA, Amapá

Name	Organization
Laurent DESCROIX	ONF-Guyane, French Guiana
Gaëlle VERGER	ONF-Guyane, French Guiana
Nicolas DEGARNE	ONF-Guyane, French Guiana
Benjamin OULIAC	Région Guyane
Matieu HENRY	FAO UN-REDD
Etienne MATHIAS	CITEPA, France
Marie CALMEL	ONF International
Sabá LOFTUS	ONF International
Sara SVENSSON	ONF International

Access to support materials

All presentations made during the 3rd Working Group Meeting can be downloaded, together with other relevant materials, at http://reddguianashield.com/working-groups/working-group-3/

Sessions Summary

April 28th, 2014

Introduction

Participants were welcomed to Cayenne by Marie Calmel, REDD+ for the Guiana Shield Project Manager, and Laurent Descroix, ONF-Guyane Director of Research and Development. Everybody presented themselves to each other through a round of introductions.

The previous Working Group meeting took place in Paramaribo, Suriname in February and focused on the forest surface aspect and how to measure changes and monitor evolution in forest area. This time the meeting will focus on what is inside the forest and how to find out more about that.

In addition to participants from the Guiana Shield region, two experts have been invited to give presentations and share perspectives about National Forest Inventories and greenhouse gas reporting. Matieu Henry works for the Food and Agriculture Organization (FAO) of the United Nations and UN-REDD in Rome, Italy and Etienne Mathias works for the Interprofessional Technical Centre for Studies on Air Pollution (CITEPA) in Paris, France.

The importance of having open and interactive discussions throughout the meeting was stressed. All participants were encouraged to ask questions at any time and to contribute to the working group meeting by offering to give presentations.

Session 1 – Introduction to National Forest Inventory (NFI) and its implementation in the Guiana Shield

The first session started with a presentation entitled "*Status of forest biomass and carbon stock assessment in South and Central America*" by Matieu Henry, FAO[1].

- It is still very difficult to provide exact numbers on forest biomass and carbon stocks. The bottleneck is the limited access to robust and reliable data from national forest inventories and other sources. It can be estimated that the land use change and forestry (LUCF) sector in South America is responsible for 8% of the global greenhouse gas (GHG) emissions and that tropical forests in South America provide 1/3 of the tropical carbon sink. Large uncertainties are built into both those numbers, since they have been calculated based on various sources of data collected with multiple different methodologies that are difficult to compare.
- Parties to the UN Framework Convention on Climate Change (UNFCCC) must submit national implementation reports that include information on emissions and removals of GHG as well as reporting on activities carried out to implement the convention. The two channels for reporting GHG estimates under the UNFCCC are the GHG Inventory and the National Communications (NatCom). The required content and timetable for submission are different for Annex I and non-Annex I parties.
- So far 95 percent of Latin American countries have provided at least one National Communication to the UNFCCC and 81 percent a second one. All data is available on UNFCCC internet platform. New rules were recently agreed that changed the format and increased the required frequency of reporting to UNFCCC. REDD+ reporting will be linked to Nationally Appropriate Mitigation Action (NAMA) reports that are to be

[1] Available at http://reddguianashield.files.wordpress.com/2014/05/introduction_henry.pdf

submitted every two years, while NatCom will be voluntary for Non-Annex I parties but expected every four years starting from December 2014.

- It is essential to improve country data in many aspects. Changes are often assessed by comparing independent studies or maps and can therefore have substantial errors. Data from MRV can be also used by other departments besides the forestry sector, such as monitoring of flooding, malaria, biodiversity, national defence. It must be adaptable to national circumstances and with a feasible cost. FAO gathers data submitted by countries in its National Forest Resources Assessment (FRA) database. Its bottleneck is the availability of robust country data.
- National forest inventories (NFI) are the basis for stock assessments. Many of the most important countries in the region do not have an NFI, but are planning or have started the process of implementing it. NFI data needs to be complemented with good allometric equations for volume and biomass. There is very little data on below-ground biomass although that is a significant carbon stock and source of emissions when deforestation occurs. Airborne LIDAR is a promising technology for non-destructive estimation of biomass but is still quite expensive and does not replace the need for a field based NFI. The NFI covers many more aspects than just biomass and carbon.

There was a round of questions after the presentation:

- FRA is the only global assessment of forest available since 1980, with its data being provided by the countries. In each country there is a focal point responsible for the data. Data is then compiled by FAO for global database. There are substantial differences in the data from FRA and from Saatchi in some locations, such as French Guiana, which need to be analysed.
- Sarah Crabbe, SBB, added that there were many developments since FRA report in 2010. Amazon countries now have remote sensing units to map forest extent, and Suriname has its NFI pilot. The 2015 version of the report will be better, SBB has already updated the tables that will be submitted. Some changes were required, for example in inland water remote sensing showed that area is much smaller than previously indicated. For carbon stock values, the data sent will not be complete since NFI was not executed yet.
- Thiago Zampiva, IEF, mentioned that in Brazil there are independent reports developed in parallel with national monitoring system managed by INPE, plus data gathered for forest concessions. But a national REDD+ policy still needs to be implemented.
- Etienne Mathias, CITEPA, shared that there is NFI for France and its 2014 report will soon be over. An efficient report system is crucial. For UNFCCC the demand is to report something, but without many requirements for quality, however the improvement process is important.

The discussion continued with interventions from the countries in a roundtable:

- Thiago Zampiva, IEF, stated that the Brazilian forest service is currently extending the NFI. The NFI results from the process of checking forest quality (low forest, rainforest, restinga, mata atlantica). One of the goals of the inventory was to know what were the existing carbon stocks and emissions related to deforestation. Amapá does not have a complete NFI of all its forests, but there is a management plan for state forests relevant for concessions which included an inventory. States in Brazil are autonomous and can have their own policies on this.
- Rene Somopawiro, SBB, clarified that for Suriname, according to the Forest Management Act 1992, the government is responsible for carrying out an NFI. The first forest inventory was only done for part of the forest, mostly to assess the standing timber volume, because it was not a policy priority, there was also lack of capacity, most of the forest in Suriname is not accessible and it is a very expensive exercise. Requirements of REDD+ are helping to improve national policy, so NFI is important. The pilot project will be finished this year, SBB is starting to build capacity to measure carbon stocks and to process data.
- Laurent Descroix, ONF Guyane, indicated that French Guiana has more timber than mainland France. When reporting on the status of the forest was needed, data from northern French Guiana was extrapolated for the all territory, which is problematic because the south part is very different. Now the inventories are more reliable, but the same problems as for Suriname apply. Methods used in mainland France cannot be used in less accessible tropical forest. Now working with extrapolation, we are trying to improve it with remote sensing.

- Gaelle Verger, ONF Guyane, declared that it was important to consider the precision carbon stocks measurements. In French Guiana the level of land occupation and surface is similar to the whole mainland France, but it has been omitted with some catching up done recently. Report with emissions from French Guiana for 2014 now being finalized and will be include data available this year, through remote sensing, but no data whatsoever on volume.
- Thiago Zampiva, IEF, restated Brazilian states create their own policy related to climate change, some are more advanced than others. In Amapá the REDD+ policy was already drafted but was not implemented yet, while in a few states the process is already more advanced.
- Rene Somopawiro, SBB, questioned what is the best way to move forward. From remote sensing we are getting better and faster information than from field because not enough resources are available for it.
- Matieu Henry, FAO, replied that accessible data is not enough, plus its harmonization between different countries is difficult. A clear NFI system makes it easier to implement decisions and identify needs. Data does not need to be limited to the borders of the countries, regional data can be used. Some countries use data from their neighbours even in Europe, e.g., San Marino who did not have an NFI and used data shared by others.
- Benjamin Ouliac, Region Guyane, indicated that using shared data is problematic in French Guiana because emissions available on European level is not applicable there. They need to do their own in the Amazon context, which is heavy work. Etienne Mathias, CITEPA, agreed with Benjamin that specific country data can be justified or not depending on the case.
- Thiago Zampiva, IEF, added that in Brazil all states will have similar processes for forest management. The units that work on deforestation and monitoring are based in the management plans. When creating a preservation area, a forest management plan saying which areas can be exploited and which must be conserved is required by law, with local communities being involved in the process. There is a general diagnosis with a management plan to identify the productive potential, including biomass and carbon stocks, and also identifying where communities are, so that concessions do not intersect with those they used.
- Sarah Crabbe, SBB, declared that for the pilot NFI, they focused first on the timber and carbon stocks for the statistical basis. Now the pilot is finished and a full NFI will be set up. SBB thinks it is important to collect as much info as possible when going to remote areas. It would be interesting to seek collaboration and work together with other institutions more familiar with socioeconomic factors and others will, in order to develop a multipurpose NFI.

The following presentation was by Laurent Decroix, ONF Guyane, on forest inventories (volumes and above ground biomass) for French Guiana[2]:

- The first and largest inventory in French Guiana until now was performed in 1972-1976, which collected information from 1913 plots of 0,5 ha each. Currently more plots are being analysed (35 in 2014) to collect information for a project to map above ground biomass.
- Each plot takes about 10 days to measure, with help of a helicopter and 10 people each time. There is collection of additional data, for example on biodiversity, not only carbon stocks. The amount of plots is improving over time. Initially there inventory areas were identified only where wood was going to be harvested, which was not representative of the major part of the forest. Now more plots were added, there is a gradual build-up of information over time depending on what ONF needs. The identification of tree species is quite reliable due to support from partners doing that work.
- The results indicate that French Guiana has 8-10 million ha of forest, while Saatchi identified 3 million ha. The resolution of the Saatchi map can be useful for large regions but does not work well for small areas such as French Guiana, which represents around 2% of the Amazon. A tropical forest observatory is being set up with partners from the region, which might help getting more detailed data.
- For the 2008 data, inventories were used, forest was divided in low-land and highland forest. Rainfall data also incorporated. Integrating specific data on carbon stocks per hectare is being considered, as data is not very robust, they are in a prospection phase. For example, Saatchi announced recently in an article that his data

[2] Available at http://reddguianashield.files.wordpress.com/2014/05/redd-inventaires-guyane.pdf

had 25% accuracy. The precision is not always the best, but many other things can be learnt, there is need for constant improvement.

- For ONF this data is satisfactory, there is relatively precise information on the areas that are exploited. French Guiana is mostly a protected area, with a smaller area that can be exploited. They need to recover the areas exploited due to carbon footprint, which is not neutral when wood is harvested. There has been an increase of 0.5 to 1 tonne per ha in non-exploited forest. How can that data be processed and used to identify those factors of growth? Permanent SUs give more information since the change can be compared and that gives more information that can be used.
- Matieu Henry, FAO, added that it is important to explain uncertainty, the more accurate your data is, the more accurate the estimations will be, which is important when searching for financial revenue from a REDD+ mechanism. While Gaelle Verger, ONF Guyane, mentioned that ONF is finalizing work on above ground biomass and aim to analyse the impact for carbon of policy decisions through a simulation tool.
- The map could be used for REDD+, as part of a multi-resource approach, not only oriented to carbon. Carbon maps can be useful to validate estimates and compare them, but they should not be seen as an end in itself. The most important is to have well define objectives. ONF Guyane is working on a scheme to analyze the carbon impact of their activities in French Guiana working with the concept of flows, using information on approximately how much is extracted per year, extraction scenarios, etc. For example in low impact forestry it is easier to work on concept of flows.
- Matieu Henry, FAO, referred to the gain and loss and stock difference methods to calculate carbon stocks. When there is a large variability of carbon stocks it is likely the flow method will not be used. The IPCC guideline says that gain and loss methodologies are most often better than stocks in tropical regions. The best is to have as many options as possible available, to see how different calculations work out and what is best for a specific situation.

Next, there has a presentation by Morena Sanches, Officer in Research and Development at SBB, that provided more details on the NFI pilot project in Suriname being conducted by SBB[3].

- She started with a timeline giving an overview of all the activities that have been going on for the NFI. The start was in 2009 with meetings between Suriname and Austria at COP15. The MoU was signed in 2012 and field data collection started in 2013 and finished April 2014. Implementation of the full NFI is now starting, as well as reporting on the pilot project.
- Most of forests in Suriname are remote, especially in the south, with high costs of field sampling, aggravated by limited number of personnel and little being known about the variability of stocks between different forest types. Based on that situation, the decision was to carry out a multi-source sampling design with aerial and terrestrial inventory.The sampling design consisted of a grid of 20x20km covering the entire country where each intersection is a Sampling Unit (SU).
- For the pilot NFI, 6 flight lines overlaying the gridlines with ADAM-C camera were done over September 212 that resulted in around 22000 georeferenced aerial images. These images can be processed to 4 band NIR/RGB ortho-photos, ortho-photo mosaics, 3D landcover models and digital surface, or models. The flight elevation was 750m, as it was not possible higher due to cloud cover, originating Aerial Sampling Units of 750x750m. On image interpretation, first forested areas were identified versus nonforest. If forest, SBB classified it into different forest types. There is not a national classification yet of forest types, so SBB chose to use 9 forest types (in presentation). It is still being analysed if the present classification system should still be maintained or improved. Finally a third level of classification divided forest between different stocking classes, which are somewhat subjective.
- Until now there is no national legal forest definition for Suriname. It is something that is being corrected but SBB needed criteria already, so they decided to use minimum mapping unit of 1ha, minimum crown coverage of 30% and minimum vegetation height of 5m.
- There was also collection of field data in 30 SU. Data has not collected in the whole 750x750 aerial sampling unit, but only in the part called field SU, using a design with 8 principal sample plots of 20x100m that are then subdivided in 4 main assessment plots of 10x10m and 2 subplots of 5x5m. The smaller the plots, the more

[3] Available at http://reddguianashield.files.wordpress.com/2014/05/presentatie-nfi-frguyana_v2.pdf

detailed are the parameters collected (see presentation). Field parameters collected for pilot NFI were adjusted to estimate timber volume and carbon.

- The field data collection was already concluded. Some of the lessons learnt during the pilot NFI: method developed to find the exact central point of the SU; the time between aerial image collection and field work should be short; importance of strengthening community involvement and awareness; outer borders of plots should be physically defined to decide if trees at the border are in or out; different people estimate different tree heights, so estimations from 2 different people are used; and it is required to have better standardization of tree species identification.
- With the pilot finalized, there is need to report and evaluate its results. Preparations towards the complete NFI are starting, with formulation of project proposal, fundraising, evaluation of methodology to use based on pilot results. Additionally, before implementing the complete NFI, improvements are needed on standardization of tree species identification, forest classification system, allometric equations, awareness and communication program especially for forest based communities, and evaluation of registered field parameters after consultation with stakeholders.
- Colleagues from other Guiana Shield countries might be facing similar problems, so SBB presented some ideas from regional collaboration. The first is to establish and/or evaluate allometric equations, which could involve the creation of a regional database, exchange of methods implemented by partners, or joint publications or scientific research. Additionally, exchange on tree species identification would also be useful, it could involve the development of a photo database, a protocol for collection of plant material, a field guide and protocol for identification of tree species, a regional platform for botanists and tree spotters, or exchange information about the approaches being used.

The presentation was followed by a Q&A session where SBB's NFI continued to be discussed, as well as related topics:

- Answering to Matieu Henry, FAO, on what will be the impact of a change in the definitions of forest and its classification on the NFI and sampling strategy, Morena indicated that for the NFI pilot SBB based its classification on other ones and also on what was being seen in the aerial photos. Sarah Crabbe, SBB, added that they are using classes that they are sure will be able to use. Ideally this should have been determined beforehand, but there was no time. Different classes are now being compared and discussed with stakeholders. There is a definition of forest for administrative purposes but not for monitoring, changes are not expected in the parameters. Some issues might change such as if shifting cultivation is considered forest or not. Not relevant impact for the pilot results.
- Asked about what is the distance between the 30 sampling points, Morena clarified that there is no fixed distance between field spots. SBB aimed that the points are proportional to the different forest types, with high dryland forest being the most common. It was also checked where most human activities take place and where forest is changed quickly, mostly in the north of the country. Aerial photos also needed to be available and an agreement reached with local communities.
- In the complete NFI, flights to collect images will be performed north-south, which has more changes in landscape, and east-west. The inventory will be sampled in the intersecting points of the grid, not wall-to-wall. But the idea is that on a second phase, SBB projects them on satellite imagery and becomes wall-to-wall. Not clear yet what methodology will be used.
- Etienne Mathias, FAO, enquired if to get a complete wall-to-wall inventory is forest mapping to be performed or extrapolation based on plots. With current grid design density of points might not be enoug to correctly estimate forest. Sarah Crabbe, SBB, replied that the process is being developed at the moment. One planned activity is to construct a wall-to-wall map with different land use and land change. The methodology is not confirmed yet. For now the wall-to-wall map of forest/non-forest is done with LandSat.
- Rene Somopawiro, SBB, added that the NFI is one of many activities to be REDD+ ready, SBB is also producing a forest cover map, a benchmark map for 2000 and deforestation map 2000-2009. For the NFI, if the regular method was used, it would be required to collect over 400 plots. With this new approach, SBB is trying to find correlation between images and field work, so that ground truthing can be reduced from 400+ plots to 110, to minimize costs. The pilot NFI enabled to build capacity, SBB has 2 field teams ready. Based on the pilot, it was possible to determine that the cost is 10-15 000 USD per sampling unit. SBB does not have helicopters so cars

and boats need to be used. In some locations it was not possible to do the sampling because the local communities refused it, therefore the importance of awareness.

- When asked about more details on the division of the costs for plotting, Rene indicated that the SUs in southern Suriname were more expensive, with one costing 20 000 USD. Most of the cost is for transportation. People from local communities are recruited for the inventory team, which also takes some time.
- Sarah Crabbe, SBB, continued providing additional details on SBB's NFI strategy. The 110 SUs predicted for the complete NFI are not connected to variability, at the moment calculations are being done to refine that number. Processing data efficiently was an issue due to capacity gap. Accuracy assessment was done, although not enough, as part of a capacity building process and now there are two very well trained teams able to collect very accurate information. SBB will probably intensify grid in north and lower it in the south since it has more difficult access and less land use changes. Distribution of plots need some adjustments.
- For French Guiana, Laurent Descroix, ONF Guyane, mentioned that there are prospecting teams doing pre-exploitation inventories, part of the work before concession is granted. The unit cost is much higher than for Suriname. The helicopter is paid with EU funding to reach remote pristine areas that would require days to reach by canoe.
- Matieu Henry, FAO, stated that the forest inventory should be more intense where there is more change in stocks. It is possible to differentiate between managed and non-managed areas and when calculating the change of carbon stocks we can focus on the parts that are considered as being managed. There are a few countries, such as Russia, which identified forest areas where inventories are unnecessary because they are not managed. Other countries have human activities in most areas and it is difficult to differentiate. Here in the Guiana Shield that managed/unmanaged division could be possible. In principle if the area is not managed there is not an obligation to report, GHG balance is only done for land that is managed.
- Etienne Mathias, CITEPA, added that if the forest is seen as unmanaged there is no requirement to report in terms of carbon. But flows from deforested areas even if not managed before need to be reported. Historically for French Guiana the separation is between the coast and all the rest is considered unmanaged. Political discussions made it unacceptable to have such a large area as not managed and politicians wanted to classify all as managed, in the end an intermediate solution was reached. What is the difference of managed vs unmanaged forest? The main criteria ONF is considering are logging activity and biodiversity and educational vocation. They should take measures in terms of carbon calculation. If the purpose is to estimate carbon flows maybe a more modest forest monitoring program is enough, but if the purpose is to have a NFI more detail is required.
- Marie Calmel, ONFI, clarified that for IPCC there is a distinction between reporting requirements for managed and non-managed forests. Reporting is not required on unmanaged stocks, but it still needed on forest cover. Important to consider that even in remote areas illegal activities might be significant.

Session 2 – Designing an NFI for REDD+ purposes

The session began with a presentation from Matieu Henry, FAO, on designing a NFI in the context of REDD+[4]:

- The goal of a national forest monitoring system (NFMS) is to assess the condition of forests for an entire nation using data collected from a sample of field plots. Needs to be precise enough to support government policies and useful for reporting internationally.
- Para 71 of Cancun decision requests the development of a robust and transparent forest monitoring system and refers to a system for safeguards as well. REDD+ activities (forest conservation, degradation, deforestation, enhancement of carbon stocks and sustainable management of forests) are the target. Many countries have not set up any NFI yet, while others have set up more than 6. 128 countries have done at least 1 NFI so far.

[4] Available at http://reddguianashield.files.wordpress.com/2014/05/nfi_design2.pdf

- There is not a unique definition of the objectives of a NFMS, only guidelines (e.g. FAO, 1998). They need to be determined jointly by the people who will use the results and in accordance to national circumstances. The physical effort that will be required to conduct an inventory, organization, estimated costs and time, existing knowledge of resources, availability of specific aspects of inventory technologies, and institutional capability all should be reflected in the objectives, which can be multiple and useful for different ministries. There is not a unique definition of NFI either.
- Different countries use different forest definitions. In the context of FRA, the definition used by FAO is now, 10% minimum canopy, 0.5 ha minimum area, 5m minimum height. In relation to shifting agriculture, according to FAO definition change from forest to non forest needs to be maintained for at least 20 years to be considered permanent.
- Depending on the objectives, several attributes can be measured in the plots, frequently around 100 variables are measured per plot. Is it preferable to have many small or few large plots? Small plots in homogeneous forests may furnish results with higher precision. In heterogeneous forests, the coefficient of variation between small plots may increase so greatly that it would be better to use a larger plot. Changes of size will influence variability of the results. When travel time is significant, as in a tropical forest, the size of inventory plots tends to be large, often in the 0.4–0.5 ha range. Doing groups of plots per sampling unit might lower transportation costs although not necessarily improved results. Circular plots are more accurate when dealing with small plots, but rectangular format is more appropriate for larger ones
- There are four sampling designs: simple random sampling, systematic sampling, cluster sampling, stratified sampling. Cluster sampling is widely used in forest inventories of large areas, such as National Forest Inventories. The major reason does not lie in the statistical performance but in practical aspects, namely cost and time considerations. Stratified sampling is efficient especially in those cases where the variability inside the strata is low and large between strata, it reduces variation in the results and uncertainty. Allocation of samples per strata will depend on stratum sizes, variability inside the strata and costs. Different sampling designs are being used in South America (see presentation for more details), with several inventories being developed in the region at the moment.
- Classification systems can vary and have different goals, such as agriculture, biodiversity or forest management, but should be comparable. For that the description of the class can be based on objects in a complex vegetation layering that allows different users with different goals to combine the information in a classification that maximizes efficiency.

Next, Thiago Zampiva, IEF, provided a prespective of what is being developed in Amapá with a presentation on "*Biomass quantification in Amapá's state forest: carbon stock allometry and estimate*"[5].

- A report in English explaining this topic, developed by IEF, will be available in the website of the project[6].
- In Amapá there are different types of vegetation and problems with forest monitoring. The object of the work presented was the dense dryland forest in the north of the state, in an area part of the state forest and designed as Module IV. The specific objectives were to compare results with those previously obtained for Module II; adjust the allometric models for the state; increase data on above and below ground biomass; and estimate the carbon stock for the state forest in Amapá.
- The sampling design consisted of 12 sampling plots of 1ha randomly selected, which were divided in 100 parts of 10mx10m for data collection. Palm trees, lianas, branches, leaves, where cut and measured in the lab to determine carbon content. In the inventory trees with DBH≥5cm were considered. 940 trees were measured, of which 106 were fell. The average DBH for Module II was inferior (13.43±2.06cm) to Module IV (17.02±3.1cm).
- For the state forest, the results indicate that in average the total fresh biomass was 720.67 ton/ha. Around 86% of that fresh biomass was above ground. And the main result was for total carbon stock, it was estimated to be 182.10±6.02 ton/ha. These results can be found in English in section 3.5.3 of the report shared. They are supporting the development of climate change policies in the state

[5] Available at http://reddguianashield.files.wordpress.com/2014/05/ief-presentation.pdf

[6] Available at http://reddguianashield.files.wordpress.com/2014/05/ief-report.pdf

Further points were clarified by Thiago during the Q&A:

- A total of 106 trees were felled in module II and 24 in module IV. Different allometric equations were tested and the one with better results used. One allometric equation for above ground biomass and a different one for below ground biomass.
- The forest biomass categories considered are according to IPCC guidelines. Living biomass above the soil, including trunks, branches, seeds, fruit, and leaves of trees with DBH ≥ 5 cm. The aerial part of the saplings (trees with DBH <5 cm), as well as vines, and palm trees, were also recorded. Living biomass below ground level, i.e., the weight of the roots of saplings, vines, palms, and other trees with roots within the plot, were also accounted for. Finally, dead biomass was collected from the ground and weighted in five 1x1m subplots for each 10x10m plot.
- Many of the methodologies adopted was inspired in previous experiences from other Brazilian states, mostly Amazonas. The allometric equations considered were already available in the literature and were adapted for the local context based on field data. So results from the equation and the field do not differ largely. Equation about AGB was not really different from other studies conducted elsewhere in similar dense forests.
- There was not any forest inventory in Amapá until 2008. When it was carried it had very specific goals for the sustainable use of forest resources. Areas not intended for forest concessions, such as savannah and mangrove, were not included in the study. The first work was done in the part that is now being allocated for concessions. Two of the main partners of the study, IEF and Embrapa, have different purposes, IEF carries out plans and implement results, Embrapa is a research institution.

April 29th, 2014

Session 3 – Use of NFI for carbon stock assessment purposes in the Guiana Shield

Marie Calmel, ONFI, started with a summary of the discussions in the day before. A good understanding is needed on what is done in the different countries in terms of NFI. Mathieu presented NFI as part of a NFMS. Countries are in different stages of development and NFI might provide information beyond the strictly forestry sector, such as social economic info.

For the Guiana Shield, considering Suriname for example, the preparatory phase is under evaluation phase and NFI will be extended to multi-purpose, where a better understanding of carbon stocks is included. Sarah Crabbe, SBB, stressed that the methodology for the NFI is being tested and SBB will carry forward the process. The plots are permanent (trees and plots are marked), but resampling will not be frequent due to the cost involved.

As for Brazil, Marie summarized that different organisms are involved in designing the NFI, with the state level being interested in sustainable timber extraction and carbon storage, but are there plans to extend it to other purposes and areas outside the state forest? Thiago Zampiva, IEF, answered that the government of Amapá does not have further plans at the moment to increase inventory efforts. The concessions are being launched that is the priority. In savannah and coastal forests, where there are no logging interests, there is less data available. New industrial developments, such as mining concessions or hydroelectric plants, demand that the affected areas are inventoried and then have a management plan.

In French Guiana there is a national forest inventory mostly based on remote sensing, continued Marie Calmel, ONFI. No field data collected for the all territory, but some permanent plots are available and collections will continue for the coming years. French Guiana is not cannot implement REDD+ so work to better understand its carbon stocks is limited, nevertheless understanding of carbon flows has increased. Benjamin Ouliac, ONF, clarified that the evaluation of carbon flows in exploited forests is still in research state. There are also a few projects more focused on industry and sector approaches, forestry and agriculture. Carbon balance activities more than

inventory, including flow data from experimental sites, but there are no plans for exhaustive evaluation of stocks. IRD might map carbon in coastal areas but project not assured yet. It is easy to study the flows from logging since they are working in primary forest, with first cutting cycles where an already exploited plot is revisited 30-40 years later. Agriculture and mining flows more complicated, but ONF is less interested in that.

After the introduction, the session moved on to a presentation by Matieu Henry, FAO, on "Improving accuracy of estimates toward better use of tree allometric equations"[7].

- The basic IPCC equation to assess GHG emission estimates in the LULUCF sector is multiplying activity data by emission factor. Carbon stocks changes. The emission factor can be obtained by two methods: 1) Stock-difference method, where the difference between stocks at two different time points gives carbon emissions; 2) Gain-loss method, where gains (tree growth, etc) and losses (timber harvests, fire, etc) are calculated and their subtraction gives total emissions. The two methods can complement each other. For plantations gain and loss can be more appropriate, for some tree species stock difference, etc. It will depend on available data. In ecosystems with big spatial variability gain and loss seems more robust than differential method. For GHG emissions balance both methods have to be taken into account.
- Allometric equations are one of the basic data that will allow us to calculate emission, both for stock difference or gain and loss approach. More than 20 countries in Latin America need to identify what data is missing in terms of volume and biomass allometric equations (trees, sprouts and stands). Gaps in availability, construction and reporting of information.
- FAO developed a database, named GlobAllomeTree, in partnership with CIRAD and an Italian university. Most of the data comes from scientific journals and reports/books. The database has 84 variables in four categories linked to geographic location, bioclimatic information, equation parameters and references. Data can be compiled without restriction, it is available online and free of charge. The equations are essentially for trees in forests, but also other options such as lianas, mangroves, palm trees, plantations, pastures, agroforestry systems. More than one thousand equations in the database.
- The problems met during the preparation of the database were to copyright restrictions. Many academic journals are restricted. And much data is in hardcopy so it requires getting into libraries, travel and visit universities, etc. Also, many mistakes found on tree species identification. The definitions of big and small branches, leaves/roots included or not, were also an issue. Wrong citations another issue.
- It was necessary to distinguish what is from forestry companies, grey literature, etc. Previous compilations of allometric equations were rare (Europe (Zianis et al. 2005), Africa (Henry et al. 2010), America (Navar et al. 2009, Jekins et al. 2003, Alvarez et al. 2011)). Limited information on different parameters such as climate, altitude, etc. Countries with different systems of classification and difficult to compare. 25% of peer review articles report erroneous allometric equations for Africa, so data has to be compiled very carefully. Interval of validity of the equations need to be considered, not all allometric equations are valid for all sizes of trees.
- Different parts of the tree can be considered in allometric equations. If estimating for commercial purposes, measurements might only include trunk and maybe thick branches, but for other purposes more compartments are relevant, as 50% of biomass may be left in forest after logging. Equations should, as much as possible, be representative for variation in the forest. There are a multitude of options (e.g. specific to species or specific to volumes), most countries use volume. Results of a FAO study demonstrate that model-selection error may introduce 20 to 40% uncertainty into a live-tree carbon estimate. The effect of model selection could be even greater if models are applied beyond the height and DBH ranges for which they were developed.
- To establish a database, 5 steps are required: collect all documentation, enter data under the same template, perform quality control, select the most appropriate equation, create a database. Usually it is better to choose equations from near locations and similar ecological zones. The website of Globallometree has a manual to help in the selection of the appropriate equation, tutorials on how to develop a database and there will be also a forum for technicians to exchange information. Building appropriate volume and biomass equations are then still challenging scientifically. A good candidate set of volume or biomass equations should be simultaneously consistent, generic, robust, and accurate.

[7] Available at http://reddguianashield.files.wordpress.com/2014/05/allometric_equations.pdf

- In scenario 1, a country without equations nor inventory data, the recommendation is to use a generic model and validate it by destructive harvesting. If the raw data are not available but national allometric models were developed and data is being collected, it is possible to use a Bayesian approach to simulate a dataset having the same properties as the original raw data and compared against scenario 1. If the country has reliable raw data and available equations, in this case specialization of the equations to account for tree species, forest types climate and interval of validity can be considered if the dataset is large enough and compared against scenario 1.
- Propagation of errors can be significant, especially when adding all types. Sampling error, measurement error, prediction error, model choice error, all need to be considered. Smaller plots will have more sampling error, while in larger the model choice error is higher. Bayesian model averaging can help decrease that model choice error in larger plots.
- Examples of the development and implementation of allometric equations were then described in three different countries, namely France, Vietnam, and Mexico. In the case of France there is a database for allometric equations, resulting of cooperation between different institutions. In 2004 the system was rearranged and simplified, the data for the 1980s-1990s had to be recalculated. The process is always in progress, Lidar was introduced to estimate volumes. More than 1 million standing trees were measured and 6000 for biomass. As for Vietnam, the first step was to develop database with 5 institutions collaborated. There was capacity building for allometric equation development and as a result specific equations adapted to the national context were created. Now looking into possibility to have 1 single model instead of the 12 that cover all ecological areas. Mexico has developed national database to create 600-700 equations. Developed a decisional tree and started with an NFI, while also using remote sensing and aerial images. Sampling using the maps to estimate the contribution of each type of forest. In the end there is a process to calculate the uncertainty, stock changes etc. Decision tree helps choosing which allometric equation to use.

The session continued with a Q&A based on the previous presentation, where Matieu Henry, FAO, provided the further details:

- Total error is considerably larger in smaller plots (comparing 400m^2 plots with 1 ha), it is the type of error that changes. The model choice error gains more relevance in the 1 ha plot. The error linked to the model can only be solved by collecting right model or statistical corrections, not changing the plot size. The bayesian is one of several methods that can be used to correct. Sampling error smaller because larger plots capture more variability.
- Having more species diversity in the forest does not necessarily mean that the number of equations has to be higher. The important is to choose the appropriate ones. The use of equations for specific species depends on available data. Integration of results from research can help improving those equations.
- Mexico objective was to collect raw data and to use that for developing their allometric equations. For example, USA's database include equations from other countries. If searching for a species, it is not necessary to limit the search to one country. However the same species can have different characteristics in different parts of the world. When very large individual trees are beyond the validity intervals of available equations, it is important to ensure that recalculation processes are workable.
- Regarding IPCC requirements for allometric equations, they mention that the equations need to go through calibration and checks to be validated for use, for Tier 2 or 3. For Tier 1 it will involve the use of general equations. FAO incentivizes the use of equations validated at the country level and specific categories, it can be generic equations that were validated for the country. Most suitable method for validation is the destructive method.
- The Globallometree database gives access to the latest scientific data and software to make comparisons and develop tailored databases. There is a registration process and login is required. Users can submit their own data when logged in, which is added to the database. No newsletter yet but users are informed 1-2 times of year about database updates and there is a journal. IPCC has database with a compilation of data per emission factor, including for forest that remained forest but with change in CO2 emissions.
- Entangled roots in tropical forest makes below ground biomass measurements very difficult. Other measures not as destructive can be used to sample some plots and make it as representative as possible. Those

methods are available in the handbook in the documents tab of the Globallometree platform. Use of destructive methods can be a risk if the trees collected are not representative of the whole population

- In tropical areas it is not possible to have specific allometric equations for each species. Family, forest type or functional group are more practical, for example. Stratification and identification of different type of forest before the NFI should be considered, it can be done by different institutions with other research objectives besides the NFI. As for developing the model, it should be done in line with the NFI.
- It is much better if height can be measured instead of estimated with an equation. In forests where height is difficult to determine, an alternative can be to check along the road or river, measure those trees with visible crown and then estimate for the others.
- Many authors do not quantify the error and uncertainty associated with a model, which is a problem. FAO is working on developing models to do this, by carrying out additional destructive sampling, or developing a reference model and then comparing other data to this reference.
- When different equations give very different results and validation is not possible, it is recommended to first develop a database that can be used at the national level. This includes also allometric equations from neighbour countries. Testing them will eliminate some because of errors of different kinds, and then a certain number of equations can be selected. If a certain generic equation is used, the choice should be justified and explained.
- Both over and underestimating in the results of an equation should be equally avoided because both will have an impact. For example, for REDD+ the choice of model is extremely important by influencing financial compensation. Allometric equations often are based on volume. There are not enough information on variables such as expansion factors or wood density. Logging companies might have data that is more precise than the one shared. In certain countries logging companies play with equations and underestimate commercial volume so they can pay less royalties. Transparent database therefore has also strategic interest for budget of the country.

Saba Loftus, ONFI, provided some information on Guyana's situation. Three major inventories have been made in Guyana. The first was done by FAO in the early seventies and it is the most comprehensive one until now. Work covered the entire country, including the south. Clusters of four to five circular plots of 0.04 hectares were used. Trees with a dbh of 30.48 cm or more were included. A total of 854 clusters were sampled. Results are still used. The second was a CIDA project from 1990 to 1993, which comprised 7992 spots along transect lines and 1849 felled trees from 137 species. The third is the management inventories done by the Guyana Forestry Commission since 2004. Since then, data has been collected on concession (thus not covering the southern parts of the country) using circular plots of 0.1 hectares. It is not a national inventory, nor is it meant to be. Work is concentrated on new production areas. A total of 2935 plots have been measured. Destructive sampling used to determine the appropriateness of the Chave et al. (2005) allometric equation that can be used to estimate above ground biomass. Mokany et al, 2006 used to assess the carbon stock of below-ground biomass.

The session continued with a presentation from Laurent Descroix, ONF Guyane, on two initiatives that are trying to assess available information on carbon stocks in French Guiana[8][9] and to inventory available permanent plots in the Amazon.

- GuyaFor Network is a collaboration between CIRAD and other institutions. It is monitoring permanent plots, with a team of forestry workers, botanists, students. The plots are regularly measured every 2-4 years and data is cross-referenced with environmental data and climatic data. The experimental design consists of 6 logged plots 6 sites (total of 116 ha) and 10 control plots (total of 123 ha).
- For example, site at Paracou was set in 1983, with 75ha. That area is divided in 4 different modalities of exploitation, more or less intensive. In the field the following parameters are collected: localization, above 10 cm DBH follow their evolution, check if alive or mode of death, periodicity, species identification, environmental characterization (soil, climate, history).

[8] Available at http://reddguianashield.files.wordpress.com/2014/05/guyafor.pdf

[9] Available at http://reddguianashield.files.wordpress.com/2014/05/tmfo_presentation_redd.pdf

- The project has as its main research objectives, the study of post-logging forest responses (on biomass and diversity), including the reaction to different type of treatments or the impact of initial environmental conditions; the study of carbon cycling in natural forests, including carbon mapping and quantifying uncertainties; and studying the impacts of climate change. Considering different types of logging methods (low, conventional, heavy) the results show the resilience and how biomass evolves over time.
- Modelling of tree growth allows to identify expected trends in the biomass, for example, determine the growth index of trees in relation to their distance to a logging gap. In the regrowth of logged areas, the study is checking if the same level of biodiversity can be kept or even improved.
- The presentation then advanced for the description of the international project Tropical Managed Forests Observatory (tmfo.org), which aims to bring together three main regions with tropical rainforest - Asia, Africa, and Amazonia and analyse the way in which the forest evolves under selective logging. Carbon, biodiversity and timber extraction are monitored. The network allows to increase synergies between smaller initiatives, the annual funding of 150 000 dollars from CGIER made it possible to come together.
- In the Amazon the TmFO has 11 sites in 5 countries, in a total of 245 plots with 672 ha and an average monitoring period of 15 years. Amongst the institutions involved are: Iwokrama (Guyana), Celos (Suriname), GuyaFor (French Guyana) and Embrapa (Amapá).
- All data is put into a joint database so that comprehensive analysis can be carried out in Amazon region. Schematic post logging evolution, analyze resilience slope the time it takes for forest to recover the level of biomass it had initially. There are interesting results but still need to be consolidated. In the long term the project aims to become more ambitious in terms of the analysis of biomass dynamics in exploited forests and data sharing. It is a network of logged forest, which is quite rare because most focus on natural forest while this focuses on resilience after logging.

After the presentation, Matieu Henry, FAO, highlighted the relevance of the TmFO network. When talking about REDD+, the focus is on stocks and their changes. Having access to these logged plots can help determine expansion factors and emission factors that can be specific to these types of forest management. That is lacking for many countries since focus of stocks is often agriculture. It can be very useful. For Amapá, Thiago Zampiva, IEF, said that estimations in degraded areas were not done yet, the focus are on stocks in the state forest. In Suriname, Rene Somopawiro, SBB, clarified that stock data is now being remeasured which will be published this or next year, in cooperation with the University of Hamburg. Benjamin Ouliac, ONF Guyane, mentioned that for French Guiana the research done in Paracou needs to be the starting point for improving data collection.

Session 4 – Linking results from the national forest inventory with MRV reporting and GHG inventories

The final session started with Etienne Mathias, CITEPA, presenting an "*Overview of LULUCF GHG inventory - French Guiana*"[10].

- CITEPA is a private non-profit organization founded in 1961, with 27 employees and a budget of around € 2.7 million. It works mainly for public services on topics such as GHG balances, audits, technical and economic studies, planning, decision support, training. Sometimes also works with other countries. The French national system for inventories has the Ministry of Ecology in the center, with CITEPA implementing and diffusing the inventories, based on data provided from different sources.
- IPCC LULUCF methodology is based on six main categories: forestlands, grasslands, croplands, wetlands, settlements, other lands. These large categories are subdivided in relation with the former uses of lands (i.e. 36 subcategories) and carbon fluxes have to be estimated for each of these subdivisions. Countries can also include new categories. A GHG inventory is more interested in carbon flows than stocks. Flows between the carbon pools in atmosphere, living biomass, harvested wood products, dead organic matter, and soil.

[10] Available at http://reddguianashield.files.wordpress.com/2014/05/mathias_citepa_f-guiana.pdf

- The IPCC proposes 2 methodologies to estimate emissions and removals of the different carbon pools: method of gains and losses and method of stock variations. In sum, LULUCF inventorying requires two main steps: estimation of areas for each type of land (under conversion or not); and estimation of carbon fluxes on each of these lands, leading to matrix tables on land use change.
- Optical remote sensing allows to get the data required. Different trials from imagery were done. To cover the whole of French Guiana many images are required because of clouds. Data from ESA satellites ERS 1/2 and ENVISAT. There were some difficulties to detect small changes (< 1ha) and a filter was required to minimize systematic noise.
- In 2006 the French Ministry of agriculture designed and tested a new LUCC inventory for French Guiana, which aimed to produce the first global cloudless SPOT mosaic over French Guiana, test a first LUCC inventory for the 1990-2006 period, and define the inventory methods for the commitment period 2008/2012. Stratification was performed to increase focus on all areas with a high pressure of human activity on the forest. These areas were defined using existing information from GIS and included a 2km buffer around roads, agriculture, human settlements, gold mining. The stratification means that sampling is less intense in pristine forest areas, for example, in the south of territory. It would be interesting but at the moment this is what we have.
- On sampling design, square grid was used with 932 m between points in these areas of high pressure. The results indicate that in the 1990-2006 period, the total conversion of forest to non-forest was 94 061 ha (with standard error of 12%). Results for 2006-2008 are also available, and now awaiting the results for 2008-2012.
- There is one main reference on carbon fluxes in French Guiana, compiling information from different studies, the "Expertise sur les références dendrométriques nécessaires au renseignement de l'inventaire national de gaz à effet de serre pour la forêt guyanaise". The data from this report was used to estimate carbon for each carbon pools in French Guiana (table in the presentation).
- For the estimation of above ground biomass, two allometric equations were used: Brown (1997), Brown & Lugo (1992) and Chave et al. (2005). Both methods seemed to be consistent, which adds up to the credibility of results, but still some reliability issues. The mean value was used. The results are based on compilation of data from the 70s, not an NFI.
- The method of fluxes (gains and losses) for forest areas was used, which implies determining annual gains (forest growth and area, increment growth in carbon) minus the annual losses (harvest of commercial wood, harvest of wood fuel, losses to perturbations) to reach the carbon balance and, with a conversion, the carbon dioxide balance. Extraction of wood in French Guiana is extremely low according to FAO data. Estimative of forest growth is 1,9 tdm/ha/yr as indicated by IPCC or 1,5-2 tdm/ha/yr as indicated by ONF/CIRAD/CNRS. These uncertain values give large sinks in French Guiana, these gains are not reported and supposed to compensate only the total losses, which is supposed to be a conservative choice. In IPCC default productivity of tropical rainforest is 0. The assessment of disturbance in managed forest is too crude to produce reliable data.
- Petit-Saut dam region is analysed as a specific strata in French Guiana. It was commissioned in 1994, it flooded forested area, which add a terrible effect as water becomes anaerobic and generates methane. Methane and CO2 emissions resulting from its construction were initially modelled and are now being monitored.
- In the framework of the Kyoto protocol, French Guiana is part of Annex I. Reporting is done according to article 3.3 and 3.4. Afforestation and reforestation credits or debits considered. For forest remaining forest there is a cap for credit. In France the sink is around 65 MtCO2/yr but the cap is 3.2 MtCO2/yr, therefore, the sink for France will be 3.2 MtCO2/yr for the period 2008-2012, whatever the results of deforestation and forest management in French Guiana. For the post-Kyoto period 2012-2020 new rules indicate that instead of a cap for emissions and removals, there is a reference level. In France the sink is around 65 MtCO2/yr, the reference level is around 67 MtCO2. Therefore, the credit/debit for France is uncertain and will depend on the Article 3.3 and the reference level, which is dependent on political orientations. These rules might have limited effect but could renew the interest for monitoring deforestation and forest management in French Guiana.

After the presentation, the following topics were further discussed by Etienne Mathias:

- Every country has their own reference level and the period concerned, through projections with a model. Normally reviewed by auditors but not necessarily. For France that work had been done, with two available results. The European joint research center found a method more appropriate for France. There is a large uncertainty with the projection, when an inventory is actually carried out we will compare the results. When we had 65 ton sink CO2 we could hope to get credit on 67 if we stay on 65 not. Offsetting is not topical anymore. Reference level did not integrate political decisions after 2009 that will lead to more emissions, there is a risk of having a debit, not a credit.
- No default methane emissions associated with wood in the forest itself, from IPCC guidelines. On the use of wasted wood for fuel, those are already accounted emissions, if changed it does not change the emissions of the forest. There is an objective of mobilization extra wood, logging essentially. For substitution, if wood is used instead of other fuel this will show. The use of fuel will decrease, or maintain itself if overall consumption increases.
- Calculations and guidelines used are from 2003, but from September onwards they will be from 2006. Only a few changes have been made for the sectors CITEPA works with so there will not be a large difference.
- France wanted reference level based on historical period to match the year of 1990, then it became projected reference level instead, which cannot be changed anymore due to European compromises. 2009 was chosen as the year to set the reference level.
- Matieu Henry, FAO, added that countries have to use IPCC guidelines, reference levels or the degradation issue must be in line with those. The decision is based on estimations of carbon stocks. Each country determine the relation between degradation and carbon stocks. Consider the evolution in a given period of time, then define activities to be taken into account. The setting of a reference level is an issue currently discussed, and countries are invited to submit feedback. If there is no agreement, the current text is not concrete and clear.

Discussion on regional collaboration opportunities

Participants were asked to reflect on regional collaboration opportunities under moderation of Sara Svensson, ONFI. The project ends in December 2015 and can promote ways and priorities to working together. Decisions cannot be done in the WG, but it can make suggestions to the Steering Committee. Yesterday and today, participants talked of NFI and what is done in different countries and high potential for collaborations on topics such as, allometric calculations, carbon stock assessments, sampling methods, and others.

Possible formats:
- Database development or improvement
- Courses, trainings, capacity building
- Joint publications or maps
- Website, discussion forum, email list
- Study visits
- International experts

What tools to use? Participants were asked to share their thoughts.

- Benjamin Ouliac, ONF Guyane, mentioned that there is interest to have external experts that bring ideas and experiences that normally do not reach the Guiana Shield. Information sharing is important. Not to only focus on the region but collaborate further. We heard about global databases and tools instead of creating our own, we can use those or add data to those so our regional data is available there. Etienne Mathias, CITEPA, added that better planning for forest management is required in the region, as well as support to identify priorities regarding the phases of REDD+/ processes.

- Thiago Zampiva, IEF, noted that much of the research which has been carried out by the IEF receives funds from government. Creating projects with other partners is an added value to the state. Capacity building would be particularly useful, to overcome current technical limitations.
- Marie Calmed, ONFI, indicated that the difficulty is that we are working with countries at different levels, while choice of methodology is not a goal of the project. It might be profitable to clarify phases but not convinced there is a path with a common step related procedure. We can work with a checklist and for each question we would bring an answer and justify why we would bring it to the topic. That may give the impression of no global perspective, but she agreed with the importance of clarification of details.
- Laurent Descroix, ONF Guyane, said that historically past work has been recycled for many different things. Allometric equation not used for what was originally created for. We know we can improve the reporting and it is evolving. A global inventory will be done because it is requested by authorities, it concerns other institutions besides ONF Guyane.
- Sarah Crabbe, SBB, added that it should be analysed how previous experiences can help to exchange data and mainly equations. They need to familiarise with information shared when back home. Destructive sampling and how it happens. Which parts of tree. Then modelling itself. How to validate. How to decide when equations are good or not. A topic not touched on too much is tree species identification. Could be very interesting to see how each country deals with that in the field. Classification system, maybe interesting to learn how that is working as it may allow SBB to create its own approved classification system. It would be good to address protocol for field methods. Capacity building is possible, perhaps a forum?
- Marie Calmel, ONFI, replied that the forum is still an option. It could be based at the website having a discussion on different topics. On species identification, the most important is to develop protocols for the identification. On the allometric equation, the first thing is to create a common database of all allometric equations for the Guiana Shield region. Will look at existing databases and emission factor issue. We can try to develop that at regional level, but not sure how much information is available.
- Gaelle Verger, ONF Guyane, indicated that in terms of carbon stocks and biomass volumes, ONF has lots of test protocols. Unaware of information for burnt plots, which would be useful when analysing slash and burn agriculture. Slash and burn agriculture is very disperse and data is scattered, which is a problem. This is something we can share.
- Thiago Zampiva, IEF, referred to the deforestation control plans that each state in the Brazilian amazon has developed. It would be interesting to look at this plan and see if it is working. One of the types of info we are lacking is on savannah areas. And it would be good to get data on degradation. Data influences political measures to be taken.
- On LIDAR, Laurent Descroix, ONF Guyane, shared that they used LIDAR for some monitoring and results were incredible, with possibility to see forest annual growth tree by tree and calibration points absolutely pristine. Drones not as reliable as planes due to problems with georeferencing. Matieu Henry, FAO, added that in no case can LIDAR allow us to identify the species, which is relevant for commercial purposes. Therefore, LIDAR cannot really replace field measurements.

Regarding who could be involved in regional cooperation, different possibilities were mentioned:
- political and technical staff of forestry services, including field teams
- additional institutions such as herbariums
- experts from abroad
- French Guiana: ECOFOG, CIRAD, etc.
- Amapá: Embrapa, forest services from neighbouring states, research institute in Manaus, etc.
- Suriname: CELOS, NIMOS, Anton de Kom University, etc.

Sara Svensson, ONFI, concluded the discussion on regional collaboration opportunities by asking participants to check the project website, where all resources related with this meeting will be available, see if tools seem useful and think of how we could use it more on regional level. Emails can be send to the project team at any moment to share concrete suggestions about future project activities.

Conclusion and next steps

A list of updated possible topics for coming WGs was quickly presented by Marie Calmel, ONFI. After discussion between participants it was decided that ONFI will send to partners two possible agendas on two different topics: on "slash and burn agriculture/forest degradation/carbon stock enhancement", and on "drivers of deforestation". The project partners will be asked to indicate their preferred topic for the next WG meeting.

Additionally, it was agreed by the participants that the meeting will occur in the last week of July or first week of August. In case of objections, the project partners are welcome to express them by email to the coordinating team.

Amapá volunteered to host the next WG in Macapá, which was accepted by the other participants.

To conclude the meeting, Marie Calmel, ONFI, thanked the invited speakers, Matieu Henry and Etienne Mathias, all participants for their contributions to the discussion, ONF and Region Guyane for providing the room, and the interpreters.