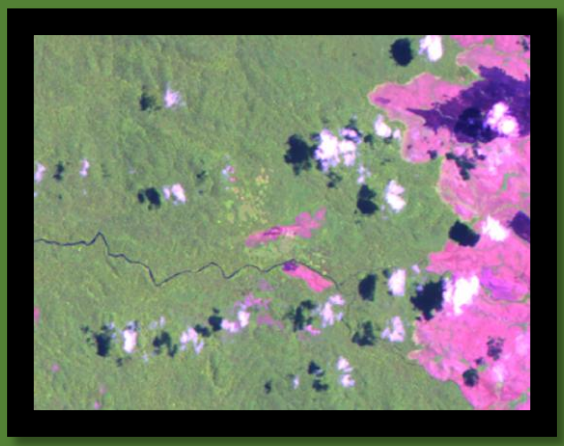

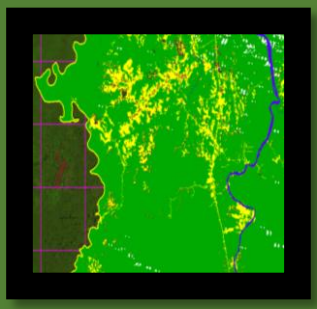

National Plan for Forest Cover Monitoring

Suriname

Prepared in 2014

MINISTERIE VAN RUIMTELIJKE ORDENING GROND- EN BOSBEHEER

SBB

ACTO

Amazon Cooperation Treaty Organization

Submitted in June 2014

Suriname National Plan for Forest Cover Monitoring (FCM Plan)

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Project: Monitoring Deforestation, Logging and Land Use Change in the Pan-Amazonian Forest (RED PD 029/09 Rev.1F). New name: Monitoring of Forest Cover in the Amazon Region

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INTRODUCTION

Forest cover monitoring provides an overview of the land area that is forested and brings attention to deforestation. Located within the globally vital Amazon forest, Suriname is one of the countries in the world with the highest percentage of forest cover. This National Plan defines activities that will be carried out over a five-year period to keep the forests of Suriname under review. The overall goal is *"to contribute to the strengthening of the National Forest Monitoring System (NFMS) by generating information about changes in forest cover for Suriname that is reliable, up-to-date, accessible, understandable and transparent, serving multiple purposes amongst others optimized policy, policy implementation (e.g. national land use planning, sustainable management of the forest, REDD+) and law enforcement in the field (e.g. gold mining, mangrove forest)"*.

In 1978 Suriname signed the Amazon Cooperation Treaty (ACT) together with Bolivia, Brazil, Colombia, Ecuador, Guyana, Peru and Venezuela. This legal instrument seeks to maintain balance between economic growth and conservation of the environment by promoting collaboration for harmonious development in the Amazon region, recognizing the transboundary nature of the Amazon while respecting national sovereignty. In order to strengthen implementation of the ACT, the Amazon Cooperation Treaty Organization (ACTO) was created in 1995.

Sustainable Forest Management (SFM) is one of the long-standing areas of collaboration within ACTO. In the year 2000, the ACTO member countries adopted a set of Criteria and Indicators (C&I) for SFM, selected based on the Tarapoto and International Tropical Timber Organization (ITTO) processes aimed at identifying the most relevant C&I for guiding public policies and governance. Forest cover was identified as a fundamental key indicator in all these processes and was confirmed as being important also on the national level in Suriname. Monitoring of changes in forest cover was further expected to generate means of verification for other indicators.

With the goal to improve forest cover monitoring both on the national and regional levels, ACTO coordinated the *Amazonian Common Agenda Project* in 2005-2006, including a component with a strong emphasis on satellite forest cover monitoring. As a follow up, in 2011-2014 ACTO coordinated the project *Monitoring Deforestation, Logging and Land Use Change in the Pan-Amazonian Forest* with funding from the ITTO and the German and Dutch organizations for development cooperation, BMZ/GIZ and DGIS. This project established a Forest Cover Monitoring Unit (FCMU) in Suriname to ensure national capacity to deliver mapping products for the regional project. With additional funding from the Brazilian Development Bank (BNDES) through its Amazon Fund, the project has been extended into a second overlapping project phase 2013-2017 under the new name *Monitoring of Forest Cover in the Amazon Region*.

In 2013, ACTO requested the formulation of a National Plan for Forest Cover Monitoring (FCM plan) to guide the work of the FCMU and to ensure that its activities remain useful both for regional and national needs throughout the new project phase. The FCM plan is formulated by the consultancy firm ONF International (ONFI) in close collaboration with the FCMU, the Foundation for Forest Management and Production Control (SBB) and with valuable input from multiple stakeholders. It seeks to synchronize the ACTO project with other initiatives and requirements for forest cover monitoring in Suriname.

In parallel with the formulation of the FCM plan, a simultaneous process took place to divide responsibilities and define activities that will prepare Suriname for participation in the United Nations mechanism for Reducing Emissions from Deforestation and Forest Degradation (REDD+). Forest cover monitoring is required within a Measurement, Reporting and Verification (MRV) system for REDD+. Section 3.2 provides more details on the synchronization between the REDD+ readiness process and the FCM plan and how the MRV system will become an integral part of the multi-purpose National Forest Monitoring System (NFMS).

What is forest cover monitoring?

Forest cover monitoring is the process of keeping changes in the forest cover under review.

What is the purpose of monitoring changes in forest cover?

It brings knowledge about the health of the forest ecosystem, and the changing size of the forest, so that we discover when it declines.

Why do we need to care about the size and health of forests?

Because if we discover negative trends on time, we can do something to change the situation.

But why does it matter? There's so much forest in Suriname. Why should we do something to save it?

Forests are very important. We depend on them every day here in Suriname.

From a global perspective, healthy forest ecosystems can help protect the climate and biological diversity. Climate change threatens the very survival of humans, and would affect us here as well.

Suriname has some of the healthiest and most undisturbed forests in the world. Keeping them standing is important.

Can we still use the forests if we commit to prevent forest loss?

Yes, with sustainable forest management. Monitoring forest cover is a tool for sustainable forest management in Suriname.

Ok, so we want to keep the forests big and healthy, while practicing sustainable forest management.

Then how can we prevent forest loss from happening?

For this we need to understand all the possible causes of deforestation and forest degradation, and we need to analyze what may trigger those drivers in Suriname. Knowing more about the context may help us to discover the risks before they break out, and prevent them before it is too late.

We need to remove the incentives for forest loss. Every person in Suriname should know and feel that they are better off by leaving most of the forests standing, than by using the land for mining or other purposes.

Different kinds of policy responses could result in reduced deforestation and forest degradation by stimulating sustainable forest management: providing alternative livelihoods, taking action against unplanned land-use, taxing forest removal and rewarding protection in different ways.

Knowing what is happening with the forest is crucial information for those who are trying to design and execute policy responses effectively.

Forest cover monitoring can provide such information.

Ok, so monitoring forest cover is important. Then how do we do it?

That is what this plan is all about.

SUMMARY

The Suriname National Plan for Forest Cover Monitoring (FCM plan) is developed in the context of a monitoring project coordinated by the Amazon Cooperation Treaty Organization (ACTO) of which Suriname is a member country. The FCM plan will be implemented dynamically with adaptive management over the coming years. While there is no absolute end date to the FCM plan, the current version includes a calendar of activities for the years 2014-2018.

The first part of this document provided an introduction that described the significance of forest cover monitoring, introduced the context in which ACTO encouraged Suriname to develop this plan and explained that forest cover monitoring will serve multiple purposes including REDD+.

Section 1 presents the 'Conceptual Framework' that identifies some definitions, concepts and fundamental principles used as a basis for designing a National Forest Monitoring System (NFMS) of Suriname, which this FCM plan will be a contributing part of.

Section 2 includes a 'Diagnosis' that provides an overview of the national and regional socio-economic context that makes it relevant to monitor changes in forest cover. It outlines the current and expected future situation for Suriname's forests.

Section 3 on 'Existing policy measures and instruments' introduces existing laws and policies in Suriname that may be of relevance for the plan. This section also includes a description of the ACTO monitoring project and the REDD+ readiness process in Suriname.

The planning itself starts in Section 4 with the 'Strategic framework' for the Suriname National Plan for Forest Cover Monitoring. The strategic framework defines the rationale and need for the plan. It outlines the vision, goal, strategic objectives, problem tree, logical framework and guidelines for implementation of the FCM plan.

Section 5 details the 'Programs' that will be implemented and is the most comprehensive section of the plan. It describes the outputs and specific activities related to forest cover monitoring in Suriname planned as part of three programs 2014-2018: *1) National capacity-building on forest cover monitoring, 2) Data generation on forest cover and its changes,* and *3) Information and data sharing about forest cover and monitoring efforts.*

Section 6 provides the 'Management Tools' such as the institutional arrangements, the financing plan, evaluation procedures and opportunities for international and regional collaboration. The document is then wrapped up in a short concluding section.

LIST OF ACRONYMS

ABS	General Office of Statistics
ACT	Amazon Cooperation Treaty
ACT	Amazon Conservation Team (NGO)
ACTO	Amazon Cooperation Treaty Organization
AD	Activity Data
AdeKUS	Anton de Kom University of Suriname
AFOLU	Agriculture, Forestry and Other Land Use
ALOS	Advanced Land Observing Satellite
ANRICA	Austrian Natural Resources Management and International Cooperation Agency
ArcGIS	A geographic information system for working with maps and geographic information
ATM	Ministry of Labour, Technological Development and Environment
BBS	National Herbarium Suriname
BMZ/GIZ	German Federal Ministry for Economic Cooperation and Development (BMZ) /Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ)
BNDES	Brazilian Development Bank
BSc	Bachelor of Science
BUZA	Ministry of Foreign Affairs
C&I	Criteria and Indicators
CBD	Convention on Biological Diversity
CBERS	China-Brazil Earth Resources Satellite
CBL	Centraal Bureau voor Luchtkartering
CELOS	Center for Agricultural Research
CEO	Chief Executive Officer
CI	Conservation International
CITES	Convention on International Trade in Endangered Species
CRA	INPE Amazon Regional Center
DBK	Dienst Bodem Kartering
DGIS	Directorate-General for International Cooperation (Netherlands)
EF	Emission Factors
ERDAS	Remote sensing application with raster graphics editor abilities designed by ERDAS for geospatial applications
ENVISAT	Environmental Satellite
ESA	European Space Agency
ESRI	International supplier of the ArcGIS Geographic Information System software, web GIS and geo-database management applications
FAO	Food and Agriculture Organization of the United Nations
FCM	Forest Cover Monitoring
FCMU	Forest Cover Monitoring Unit
FCPF	Forest Carbon Partnership Facility
FEDER	European Regional Development Fund
FFEM	French Global Environment Facility
FIRMS	Fire Information for Resource Management Systems
FRA	Forest Resources Assessment (of FAO)
FUNCATE	Brazilian Foundation for Science, Technology and Space Applications

G8	Group of eight leading industrial countries
GDP	Gross Domestic Product
GEO	Group on Earth Observations
GEOSS	Global Earth Observation System of Systems
GFC	Guyana Forestry Commission
GFC	Global Forest Coalition
GFW	Global Forest Watch
GHG	Greenhouse gases
GIS	Geographical Information Systems
GISsat	Geographical Information Systems Software Applications & Training
GMD	Geological Mining Service
GOFC-GOLD	Global Observation for Forest Cover and Land Dynamics
GPS	Global Positioning System
GSF	Guiana Shield Facility
HFLD	High Forest Cover, Low Deforestation
IAMGOLD	International African Mining Gold
IEF	Amapá State Forest Institute
IT	Information Technology
IDB	Inter-American Development Bank
IDRISI	Geospatial software for monitoring and modeling the Earth system
INPE	Brazilian National Institute for Space Research
IPCC	Intergovernmental Panel on Climate Change
IPG	Indigenous Park Guards
ITTA	International Tropical Timber Agreement
ITTO	International Tropical Timber Organization
JAXA	Japan Aerospace Exploration Agency
LACFC	Latin American and Caribbean Forestry Commission of the FAO
LC	Land Cover
LU	Land Use
LULC	Land use/ land cover
LVV	Ministry of Agriculture, Livestock and Fisheries Suriname
LULUCF	Land Use, Land Use Change and Forestry
MAS	Maritime Authority Suriname
MB	Megabytes
MEA	Multilateral Environmental Agreement
MGC	Major Groups Collective
MI-GLIS	Management Institute Land Registration and Land Information System
MODIS	Moderate Resolution Imaging Spectroradiometer
MoU	Memorandum of Understanding
MRV	Measurement, Reporting and Verification
MSc	Master of Science
MUMA	Multiple-Use Management Area
NARENA	Department of Natural Resources and Environmental Assessment (of CELOS)
NASA	National Aeronautics and Space Administration
NCCR	National Coordination Center For Disaster Relief
NDVI	Normalized Difference Vegetation Index

NFI	National Forest Inventory
NFMS	National Forest Monitoring System
NGO	Non-Governmental Organization
NH	Ministry of Natural Resources
NIMOS	National Institute for Environment and Development in Suriname
NRTM	Near Real-Time Monitoring
NTFP	Non-Timber Forest Products
NZCS	National Zoological Collection of Suriname
OGS	Commission for the Ordering of the Gold Mining Sector
ONF	French Forest Office (Office National des Forets)
ONFI	ONF International
OW	Ministry of Public Works
OW-Meteo	Meteorological Department, Ministry of Public Works
PALSAR	Phased Array type L-band Synthetic Aperture Radar
PhD	Doctor of Philosophy
PRODOC	Project Document (elaborating the R-PP)
PSP	Permanent Sample Plots
QGIS	Quantum Geographical Information Systems
Radar	Radio Detection and Ranging
RED PD	Project ID
REDD+	Reducing Emissions from Deforestation & Forest Degradation +
REL/RL	Forest Reference Emissions Level / Reference Level
RGB	Ministry of Physical Planning, Land and Forestry
RIL	Reduced Impact Logging
RO	Ministry of Regional Development
R-PIN	Readiness Plan Idea Note (for REDD+)
R-PP	Readiness Preparation Proposal (for REDD+)
RS	Remote Sensing
SAR	Synthetic Aperture Radar
SB	Statute Book
SBB	Foundation for Forest Management and Production Control (Stichting voor Bosbeheer en Bostoezicht)
SCF	Suriname Conservation Foundation
SCPAM	Suriname Coastal Protected Areas Management
SELPER	Sociedade de Especialistas Latinos-Americanos em Sensoriamento Remoto
SESA	Social and Environmental Strategic Assessment
SFM	Sustainable Forest Management
SGPS	Small Grants Programme Suriname
SMNR	Sustainable Management of Natural Resources
SMS	Short Message Service
SPOT	Satellite for observation of Earth (Satellite Pour l'Observation de la Terre)
SPS	National Planning Office Foundation (Stichting Planbureau Suriname)
SQL	Structured Query Language
SURALCO	Suriname Aluminium Company
TBI	Tropenbos International Suriname
TCT	Ministry of Transport, Communications and Tourism
ToR	Terms of Reference
UCC	University Computer Centre
UN	United Nations
UNCCD	United Nations Convention to Combat Desertification
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
UNFCCC	United Nations Framework Convention on Climate Change
UNFF	United Nations Forum on Forests
UN-REDD	United Nations- Reducing Emissions from Deforestation and forest Degradation
UPS	Uninterruptible Power Supply
USD	United States Dollar
VIDS	Association of Indigenous Village Leaders in Suriname
VSG	Association of Saramaka Authorities
WGS	World Geodetic System
WSSD	World Summit on Sustainable Development
WWF	World Wildlife Fund

1. CONCEPTUAL FRAMEWORK

This theory section introduces some fundamental concepts and discusses definitions of terms that were used when formulating this National Plan for Forest Cover Monitoring. It provides a theoretical introduction to principles important to consider when designing a National Forest Monitoring System.

1.1 The FCM plan and the National Forest Monitoring System (NFMS)

The National Plan for Forest Cover Monitoring (FCM plan) provides strategic direction and details the technical activities to be carried out in the framework of a National Forest Monitoring System (NFMS) of Suriname. The NFMS is meant to improve forest related policy-making, policy enforcement and reporting on the local, national, regional and international levels, by producing information that may be used by multiple actors about changes in the forests of Suriname.

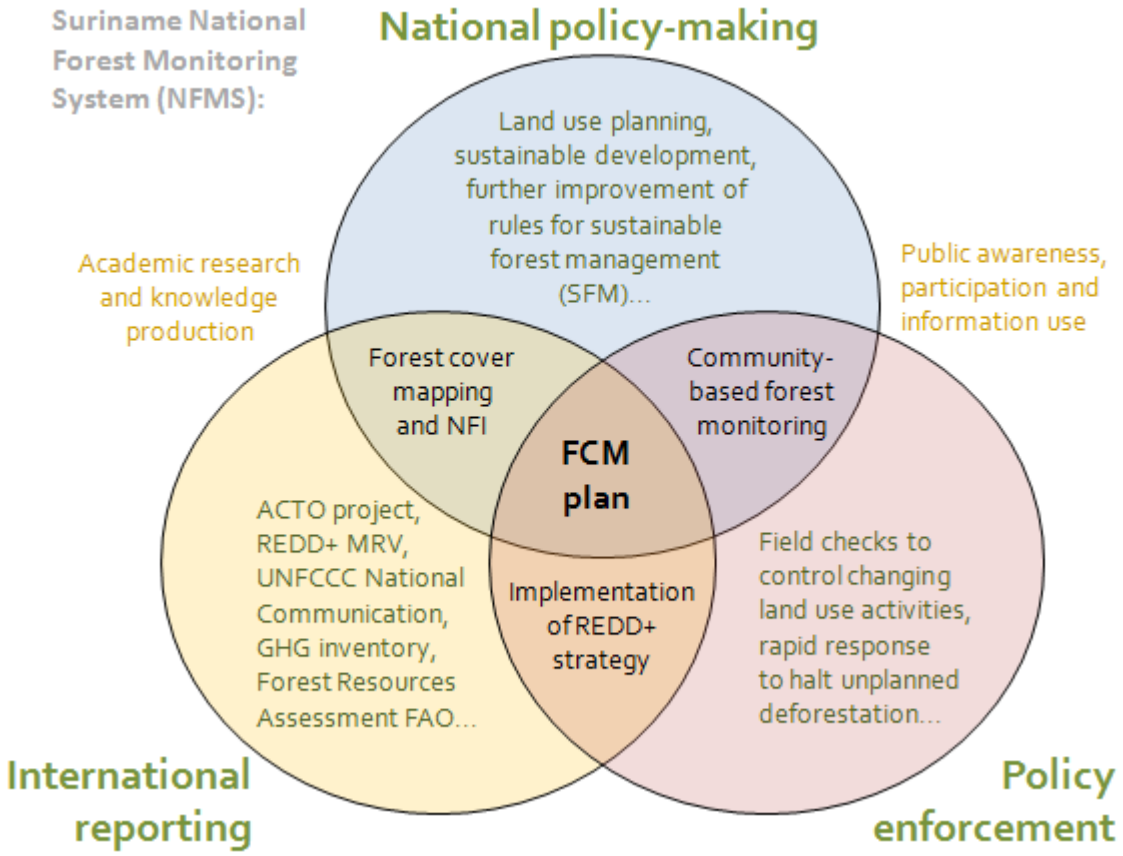


Figure 1. The FCM plan supports the multi-purpose NFMS of Suriname.

As indicated by its name, the main focus of this plan is the forest *'cover'*, meaning the size of forested area and how that changes over time. The FCM plan describes in detail how data about forest cover and its changes will be collected (often using satellite imagery) and how this data will be processed (using remote sensing and GIS software), quality checked and distributed as information and thematic maps targeting different audiences. The FCM plan takes a broader scope by recognizing that not only the quantity of forest cover matters, but also the quality of what is inside the forest. Linkages with other aspects of the multi-purpose NFMS are recognized in the plan by including less detailed descriptions of field data collection and partnerships with forest based communities. More detailed plans of such activities will be elaborated in forthcoming documents. Implementation will be synchronized in support of a fully functional NFMS.

1.2 Definition of 'monitoring' for the purpose of this plan

Monitoring of forest cover is the key activity that will be carried out in response to this plan. In general terms, the word 'monitoring' means to *"observe a situation for any changes that may occur over time"*. However the definition often does not stop there. In the context of project management or business/organizational management, monitoring is usually defined as something similar to *"supervising activities in progress to ensure that they are on schedule and on course for meeting the objectives and performance targets"*. The second definition implies that the information derived from the process of monitoring is not understood in objective terms but is rather interpreted as being good or bad. If negative trends are discovered, action must be taken to steer the development back on course toward pre-agreed and normative targets and goals.

In the context of this National Plan for Forest Cover Monitoring, both definitions are used but on different levels. The Forest Cover Monitoring Unit (FCMU) that is in charge of technical implementation of the plan focuses on observing the forest cover and providing factual data on its condition and changes. The mandate of the FCMU is limited to making sure that this data is reliable, up-to-date, accessible, understandable and transparent. It is then up to the government and more politically oriented stakeholder institutions to interpret the data in light of their targets and make use of it for taking action. This may include policy enforcement to halt unplanned deforestation.

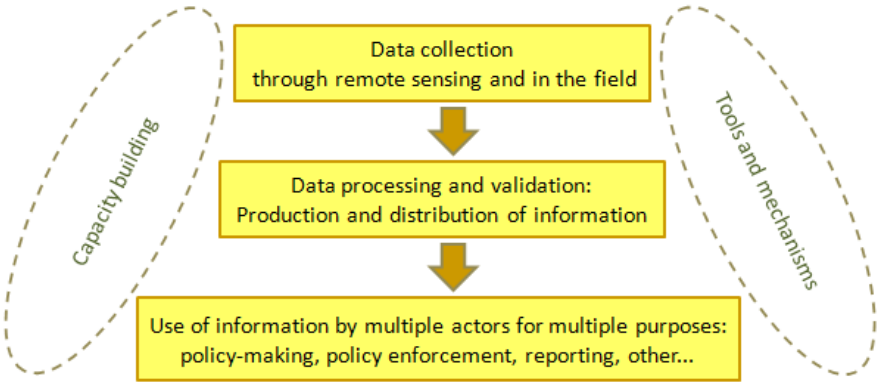


Figure 2. A narrow definition of monitoring includes the two upper boxes in this image, while an extended definition includes the third step as well.

1.3 Conceptual model for deciding what and how to monitor

Changes in forest cover occur due to land use change caused by different drivers or phenomena that vary between countries. When designing an NFMS, it needs to fit the national conditions. Forest cover monitoring needs to be carried out at a scale and frequency that are in line with what is happening in the field.

The figure below shows a conceptual model that was used when formulating the FCM plan. When satellite images and remote sensing are the tools for analysis, this model guides the process of deciding what to do when discovering different types of reasons for changes in forest cover. The question "how does it manifest" is central for supporting the choice of priorities for what to monitor, since it helps define what type of activities deserve attention in the given context, combined with the technical feasibility of monitoring this type of change. By getting the priorities right, chances are bigger that forest cover monitoring will contribute to better land management.

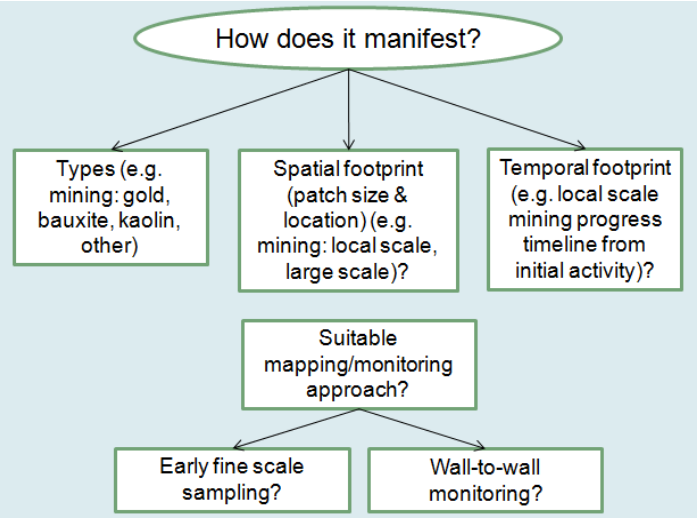


Figure 3. Considerations to be made when prioritizing which phenomena should be monitored and how.

1.4 Principles of participation and co-production of knowledge

Forest cover monitoring is a technical process that requires the leadership of people trained in satellite image interpretation, geographical information systems (GIS) and remote sensing (RS). While a high level of specialization and growing expertise will be needed for execution of the most technical parts of the FCM plan, implementation is not exclusive to those with technical skills. The ambitions of the FCM plan are more likely to be met through broad collaboration and shared responsibility between many different actors. Public participation is a fundamental cornerstone of the plan and everyone who wants can play a role in FCM.

Participation of multiple institutions, stakeholders and communities is important for many reasons. Input from stakeholders can provide valuable contributions to the assessment of the state of the forest and it is widely recognized that public participation is a tool to call attention to and address emerging environmental problems, improve governance and steer on course towards sustainable development. With respect for diversity of views and roles among stakeholders, the full spectrum of voices and self-identified responsibilities will be embraced in the NFMS.

A wide range of public institutions and the private sector have important roles to play in forest cover monitoring, as well as civil society. NGOs are natural allies and their involvement may provide ways to channel the voices of those most likely to be affected by unplanned deforestation and related problems, taking into account the interest of future generations and reach out to society and the public at large. Indigenous peoples, Maroons and other forest based communities in Suriname may contribute significantly to forest cover monitoring given their special relationships to the forest, traditional knowledge and presence on the ground. Broad participation in the NFMS is likely to increase the flows of data, information and funding and improve the performance of the system overall, since systems tend to work better when their flows are moving freely without stagnation.

Improved access to information and opportunities reduces the risk of marginalization and enhances the access to justice in environmental matters. Citizens actively involved and empowered are in the position to hold their government accountable for action or inaction. This increases the likelihood that forest cover monitoring will be more than merely data production and passive observation of facts, but linked to policy enforcement against unplanned deforestation in a fully functional NFMS.

Throughout the implementation of the FCM plan, existing structures and new mechanisms for participation will be tapped into and explored to promote transparency and effective engagement, constantly striving for greater openness.

1.5 Other principles of a highly functional National Forest Monitoring System (NFMS)

A system can be defined as *"an interconnected set of elements that is coherently organized in a way that achieves something"*. This definition suggests that the internal structure of systems include three kinds of components: 1) elements or parts, 2) interconnection or flows, 3) functions or purposes.[1]

As an example, the Republic of Suriname can be seen as a human-created system that is embedded in the Amazon forest ecosystem. The Amazon is composed of elements such as trees, animals and carbon stocks and is interlinked with human societies by receiving flows of greenhouse gases and providing flows of water and natural resources that may in turn bring economic flows. Its many ecosystem services provide life-supporting functions. Similarly but on a smaller scale, an NFMS is composed of elements such as offices, team members and computer hardware located in different collaborating institutions. Those parts are interconnected and held together by flows of data, funding for activities and communication between people. The direct function of the NFMS should be to monitor forests effectively, and this is linked to larger purposes such as enabling good governance in Suriname and protecting the Amazon ecosystem for global sustainable development.

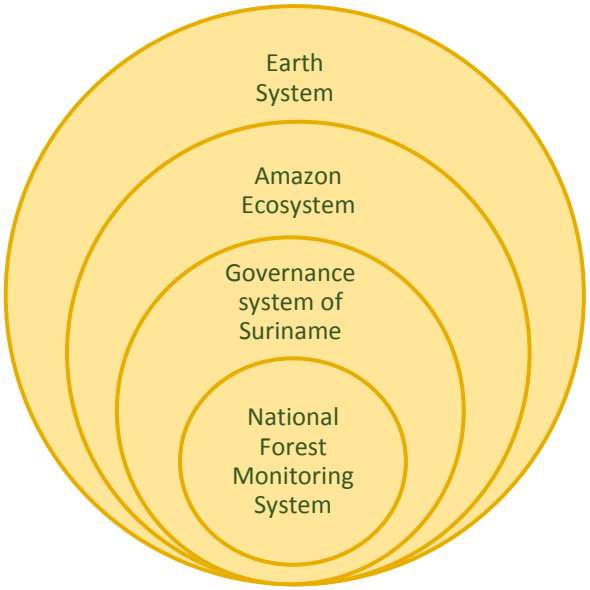


Figure 4. Systems embedded in systems.

When designing the National Forest Monitoring System (NFMS), it is relevant to be aware of principles that characterize the most successful kinds of human-created systems, which are similar to processes active in natural systems. In a highly functional system, parts and flows are coordinated to meet the purpose desired of them. If this is not the case, the actual purpose or function of the system might steer away from the goals and objectives that humans set up when creating it, so that the system strives toward a purpose that may not be intended by any single actor within the structure. For managers it is crucial to keep the system under review in order to discover when this happens, so that actions can be adjusted back on track.

The systems-thinking approach motivates adaptive management and dynamic planning, in which decision-making is allowed to be a flexible process, designed for adjustment and prepared to respond to changing circumstances. This kind of management is becoming increasingly necessary in our complex and changing world. Flexible planning and adaptive management is recommended

[1] Meadows, Donella (2001). *Thinking in Systems - a Primer.* Edited by Diana Wright, Sustainability Institute. Chelsea Green Publishing, White River Junction, USA.

for unlocking the potential for sustainable development and will be guiding principles throughout the implementation of this plan.

Keeping systems static or constant over time is impossible in most cases and it is a common mistake to think that systems should be stabilized through strict control. The FCM plan needs to be flexible and adaptive to new circumstances that will inevitably arise from outside and challenge the planning. The NFMS will be encouraged to evolve, self-organize and learn.

2. DIAGNOSIS

Principles of adaptive management promote planning to be based on a collective analysis of the current situation. This section describes the national and regional socio-economic context that makes forest cover monitoring relevant in Suriname. The diagnosis includes a brief assessment of current problems, problem causes and effects.

2.1 Suriname as a country in the Amazon region

Figure 5. The Amazon rainforest in South America

The forests in Suriname are part of the greater Amazon ecosystem that is resilient and self-organizing when undisturbed.

Embedded in the north-eastern part of this ecological system, on the South American coast, the Republic of Suriname covers a surface area of 163 800 km2. The country is located between 2 and 6 degrees north latitude and 54 and 48 degrees west longitude.

Suriname is a multicultural country that gained independence from the Netherlands on 25 November 1975. It has a population of approximately 550 000 inhabitants, of which almost 250 000 live in the capital city Paramaribo. The official language is Dutch, but local and traditional languages are also used. Suriname is a newly established upper middle-income economy according to the World Bank's classification scheme.

Suriname is divided into three administrative levels: Federal, district, and resort. Of the 10 districts, the three rural-interior districts are called Sipaliwini, Brokopondo and Marowijne, the five rural-coastal districts are Para, Commewijne, Nickerie, Coronie and Saramacca, and the two urban-coastal districts are Paramaribo and Wanica. Suriname's capital city, Paramaribo, acts as the economic and administrative centre of the country. A large part of the total population of Suriname resides there and no other competitive urban regions exist in the country. This type of urbanization is called urban primacy and may be a logical model for small countries with small populations to achieve economies of scale. On the other hand it risks to cause inequality in access to services and resources, since economic activities and opportunities are concentrated to the city and less available in other parts of the country.

Ecological sub-systems of Suriname

From a geographical perspective, Suriname can be divided into four main regions that each have unique ecology. They are, from south to north: the Interior, the Cover Landscape, the Old Coastal Plain, and the Young Coastal Plain.

The Interior covers about 85% of Suriname, or 136 000 km2. It is part of the Guiana Shield, which is a geological formation from the Precambrian era that covers part of Suriname, Guyana, French Guiana, Brazil, Venezuela and Colombia. The Guiana Shield is covered by a large area of undisturbed tropical rain forest and is one of the regions with the highest biodiversity in the world. In Suriname, the interior landscape ranges from steep and mountainous highland to hilly or undulating land. The highest mountain is about 1200 meters. The most common forest type is high dryland forest, but there are many different forest types (planned to be classified - see section 5 output 2.1). Most of the interior is only accessible by rivers and creeks or by plane or helicopter.

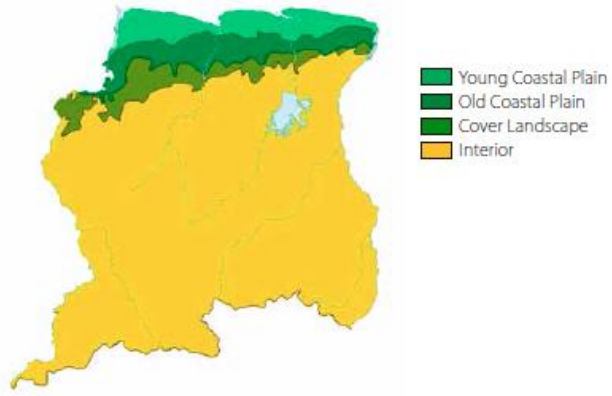


Figure 6. Geographical areas of Suriname

The Cover Landscape (also called the savannah belt) is lower than the interior and reaches 10-100 meters above the mean sea level. It covers approximately 10 000 km2 with coarse bleached white sand, yellowish brown sands and clay loams that were deposited by rivers during the Pliocene epoch. It is covered with grasslands, palms, bushes and other low dispersed vegetation. The savannah belt contains freshwater aquifers that are the only rechargeable ones in Suriname. Parts of the area is also covered with rainforest known as the forestry belt. Most of the logging and selective timber harvesting has taken place in this part of the forest because of easier access, but this is now shifting to the interior.

The Old Coastal Plain is also about 10 000 km2 in size and its height varies from 4-10 meters above sea level. It originates from deposits made during the Pleistocene geological epoch that were split by small rivers and creeks and then filled up again. This has created a structure of densely forested clay flats and ridges mixed with grass covered swamps and gullies. Open pit bauxite mining and deforestation has taken place here since the beginning of the 20th century. Large amounts of soil has been reallocated and soil structures are damaged since older clays become irreversibly compacted when exposed.

The Young Coastal Plain has height variations between 0-4 meters above mean sea level and ranges in width from about 100 km in the west to 20 km in the east of the country. It has mangrove forest, fresh water swamps with fertile clay soils, and sandy and shell ridges. About 90% of the population lives here, which makes it worrisome that the area is vulnerable to sea level rise due to climate change. The land is used for a variety of economic activities. Many swamps have been converted to residential areas, farms, road infrastructure and industrial areas. Crude oil has been exploited since 1983. The coast itself is 386 km long and has extensive mud flats, sandy shell beaches and mangrove forest. The mangrove provides spawning grounds and protects the marine ecosystem and defends the shoreline from the effects of wave erosion. Natural land loss and land acquisition takes place here.

2.2 Status of forest cover and deforestation

Suriname is a High Forest Cover Low Deforestation (HFLD) country with 90-95% forest cover and low deforestation rate throughout its history until today.

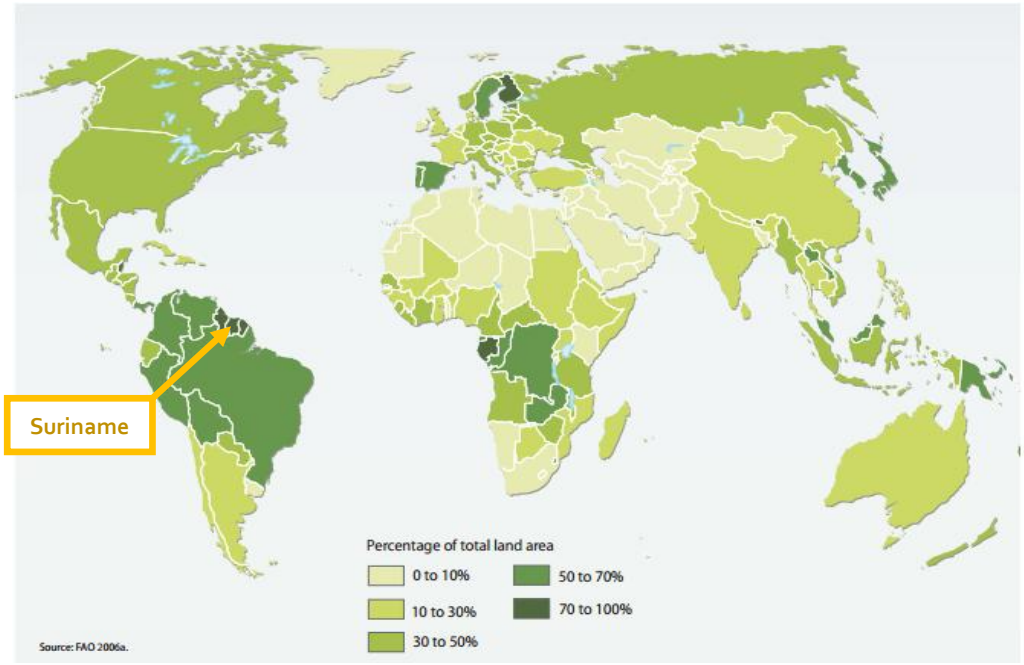


Figure 7. Suriname is one of the countries with the highest percentage of forest cover in the world

Suriname's REDD+ Readiness Plan Idea Note (R-PIN) from 2009 provided the figure 0.02% annual deforestation rate. While an official updated deforestation rate is yet to be calculated and released, the numbers that can be drawn from the latest monitoring efforts of the years 2000-2009 are in the range of 0.02-0.03% per year. On the following maps, the red colour shows where deforestation took place in the years 2000-2009 (though the size of the red areas has been enlarged for higher visibility on the map):

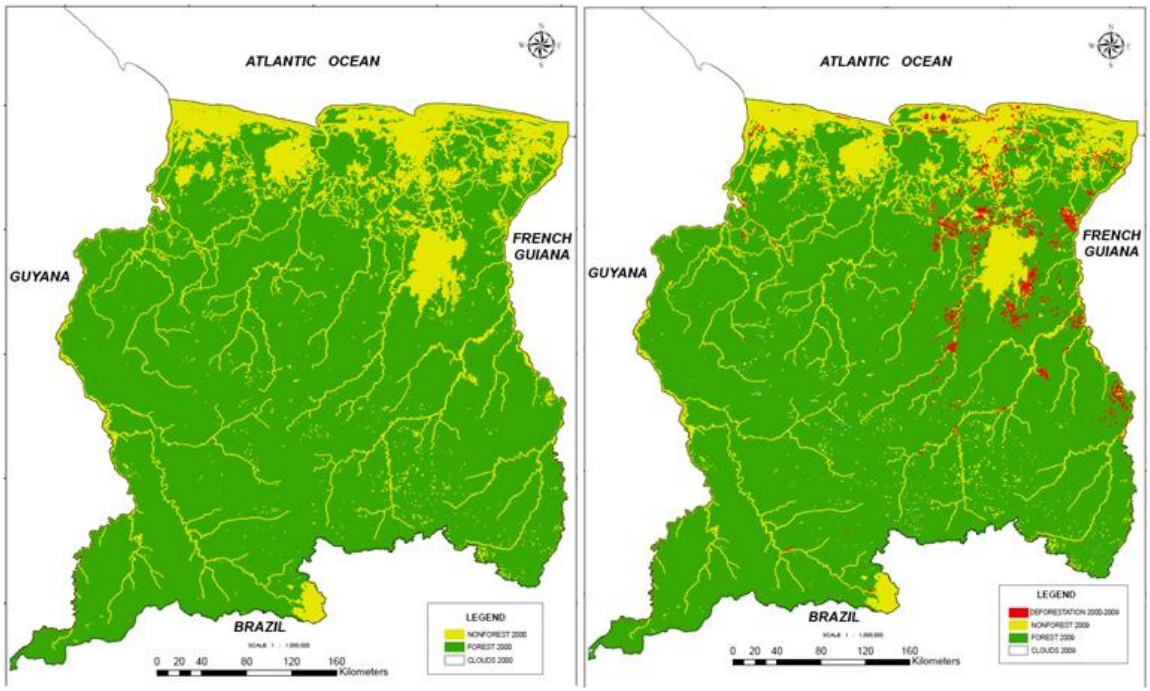


Figure 8. Suriname's forest cover base map 2000 and gross deforestation map 2009.

2.3 Expectations regarding the dynamics in forest cover

While the forests in Suriname have a long history of being relatively undisturbed, current trends point at possible changes in that situation in the future. Drivers and pressures on Suriname's forests, in other words the underlying and direct causes of deforestation and forest degradation, are becoming increasingly pertinent since the country has entered a new era of economic and industrial development. In the Suriname Readiness Preparation Proposal (R-PP) for REDD+, the main direct causes of deforestation and forest degradation were identified as mining, logging, infrastructure development, agriculture, and energy production. Building agreement around what should be recognized as drivers and pressures on forests is a challenging exercise since it may have possible political consequences. Consensus building on the drivers of deforestation is included in the REDD+ readiness process and is also addressed through the FCM plan. Section 5, output 2.5 of the FCM plan identifies a set of activities that will be carried out in Suriname to improve the understanding of and build national consensus on the drivers of deforestation.

The Government of Suriname released a National Development Plan of Suriname for 2012-2016, adopted by the National Assembly in December 2011. Political analysts describe this development plan as a capitalist model that includes aspects of socialist and sustainable developments. The path described in the plan would increase deforestation and forest degradation substantially. While REDD+ is mentioned as a possible opportunity for economical means to the country in the future, the government is committed to socio-economic development through increased gold mining, timber harvesting and extraction of natural resources. Existing plans include to develop more hydroelectricity, to turn Suriname into a main food producer for the Caribbean through intensive new agriculture, and to build additional infrastructure and roads that would connect the country with Brazil and open up the interior.

Logging has increased substantially over the last few years and is expected to increase in the future. Despite the very high percentage of forest cover, the contribution of the forestry sector to the national income of Suriname is only about 1,3% of the gross domestic product (GDP). The government believes that the forest has much higher potential to generate long-term income for the country and aims to increase economical gains from forestry, through sustainable logging and management.

In November 2013, an international expert in REDD+ Measurement, Reporting and Verification (MRV) visited Paramaribo for targeted technical discussions on how to design an MRV system suitable for Suriname. The invited expert was Jenny Hewson from Conservation International (CI) in the United States. The three days of discussion were held with technical managers in SBB, a remote sensing specialist from CELOS and a representative of CI-Suriname. Parts of the discussion focused on the national conditions in terms of drivers of deforestation, expectations regarding the dynamics in forest cover and technical feasibility of monitoring each driver. Refering to the conceptual model presented in section 1.4 above, the following table was elaborated concerning the national circumstances. Since the situation and dynamics of drivers are changing, the content of this table needs to be reviewed and updated annually in collaboration with multiple stakeholders in Suriname, so that it remains useful as a guiding tool when prioritizing what phenomena to monitor:

Activity	Sub-categories	Spatial footprint	Temporal footprint	Early detection fine scale	Wall-to-wall sampling
Mining	Gold	Small scale gold mining	Need to evaluate progress in pattern distribution	Yes, would be useful for rapid response	Not useful – visible too late
		Large scale gold mining		No need	Yes
	Bauxite	Large scale bauxite mining		No need	Yes
Logging	Community forest	Selective logging	Monitoring is sufficient with current methods, but future monitoring could be required for illegal logging		
	Incidental cutting license	Clearcut			
	Concession forest	Selective logging			
Agriculture	Multiple variations, including traditional and modern types, different crops	Needs further discussion			
Housing Development	Mangrove deforestation	Research question		Potential	Potential
Infrastructure	Planned roads (3) Potential for roads to concessions granted in inaccessible areas	Large scale		No need	Yes
Energy	Hydrodams (3 planned)	Large scale		No need	Yes

Figure 9. Drivers of deforestation in Suriname and technical consideration for monitoring them.

3. POLICY MEASURES AND INSTRUMENTS

This section describes existing laws and policies that may be of relevance for the FCM plan. The first part provides an overview of national legislation as well as multilateral environmental agreements that Suriname has ratified. REDD+ commitments and the ACTO project are also introduced as existing instruments for forest cover monitoring.

3.1 Legal framework

The Constitution of the Republic of Suriname (1987) provides the overall legal framework for the country. It is also the legal basis for policies related to environmental sustainability. Article 6G of the Constitution reads *"The social objective of the State is focused towards the establishment and stimulation of conditions required for the preservation of nature and the safeguarding of the ecological balance."*[2] The constitution establishes that all forests, unless proven to be located on privately owned land, belong to the State. Article 41 reads: *"Natural riches and resources are property of the nation and shall be used to promote economic, social and cultural development. The nation shall have the inalienable right to take complete possession of the natural resources in order to apply them to the needs of the economic, social and cultural development of Suriname."*

In response to Article 40 of the Constitution, the Government of Suriname releases a National Development Plan of Suriname for the duration of its term. The National Development Plan of Suriname for 2012-2016 (referred to in section 2.3 above) was adopted by the National Assembly in

[2] http://www.constitution.org/cons/suriname.htm

December 2011. A new governmental election will be held in Suriname in 2015 and the new government is expected to release a new National Development Plan of Suriname in 2016.

In addition to the Constitution, several laws exist that relate to the environment, drivers of deforestation or for other reasons are relevant to the monitoring of forests. The ones directly focused on the forestry sector are the Forest Management Act (Wet Bosbeheer - SB 1992 no 80), the National Forest Policy (2006) and the Strategic Action Plan for the Forest Sector. The website milieuwetten.com is a platform where updated legal information is compiled and made available for the environmental sector to use. It provides a comprehensive overview of existing environmental legislation in Suriname, including national laws, regulations and policy, international treaties that Suriname has committed to, and institutional arrangements for law enforcement that exist within the country and on the international level. The website is a result of the project *"National Environmental Legislation - Legal Framework for Nature Management"* conducted by the Schurman Lawyers in the period 2009-2013 and financed by the Suriname Conservation Foundation (SCF). Digital versions of almost all laws and documents related to the environment in Suriname are available for immediate download from the website. Government institutions and other actors responsible for implementation of the policy responses are mapped on the website according to the distribution of responsibilities and tasks.[3]

In addition to creating its own legislation, Suriname is a member of the United Nations (UN) and has signed several Multilateral Environmental Agreements (MEA)s. The list below provides an overview of some of the most relevant international conventions and treaties that Suriname has committed to follow in the framework of the UN or through other international organizations or collaboration structures:

International agreements on forest, environment and other relevant topics	Ratified
Amazon Cooperation Treaty, ACT[4]	1978
Convention on International Trade in Endangered Species of Wild Fauna and Flora, CITES[5]	1981
Ramsar Convention (sustainable use and protection of wetlands)[6]	1985
Convention on Biological Diversity, CBD[7]	1996
Vienna Convention (ozone layer)[8]	1997
Montreal Protocol (ozone layer)[9]	1997
United Nations Framework Convention on Climate Change, UNFCCC[10]	1998
World Heritage Convention (preserving cultural and natural heritage)[11]	1998
Rotterdam Convention (chemicals and waste management)[12]	2000
United Nations Convention to Combat Desertification, UNCCD[13]	2000

[3] http://www.milieuwetten.com/index.php/welcome/index/8
[4] http://otca.info/portal/admin/_upload/tratado/The_Amazon_Cooperation_Treaty.pdf
[5] http://www.cites.org/
[6] http://www.ramsar.org/
[7] http://www.cbd.int/
[8] http://ozone.unep.org/new_site/en/vienna_convention.php
[9] http://ozone.unep.org/new_site/en/Treaties/treaties_decisions-hb.php?sec_id=5
[10] http://unfccc.int/
[11] http://whc.unesco.org/en/convention/
[12] http://www.pic.int/
[13] http://www.unccd.int/

Kyoto Protocol (climate change)[14]	2006
United Nations Declaration on the Rights of Indigenous Peoples[15]	2007
Cartagena Protocol on Biosafety[16]	2008
Stockholm Convention (persistent organic pollutants)[17]	2011
International Tropical Timber Agreement, ITTA of the ITTO[18]	2013

3.2 Forest cover monitoring required for the REDD+ mechanism

Forested developing countries are qualified to participate in REDD+ which is the United Nations mechanism for combating climate change by Reducing Emissions from Deforestation and forest Degradation. REDD+ eligible activities also include conservation of forest carbon stocks, enhancement of forest carbon stocks and the sustainable management of forest. A series of decisions concerning REDD+ have been negotiated and adopted in sessions of the United Nations Framework Convention on Climate Change (UNFCCC). The REDD+ mechanism is intended to eventually provide financial compensation to developing countries that can demonstrate forest related reduction and removal of greenhouse gas emissions. How this compensation will be enabled in detail is subject to further deliberation, though it is clear that payments will be performance-based and that participating countries need to put in place several measures to track and prove their achievements. Developing countries that wish to participate in REDD+ can seek assistance for their readiness process in terms of funding from the Forest Carbon Partnership Facility (FCPF) or the UN-REDD programme. The implementation framework and tools that need to be created in each participating country, based on international requirements and national circumstances, include a national Forest Reference Emissions Level / Reference Level (REL/RL) and a system for Measurement & Monitoring, Reporting and Verification (MRV). The MRV system should be part of a robust and transparent National Forest Monitoring System (NFMS).

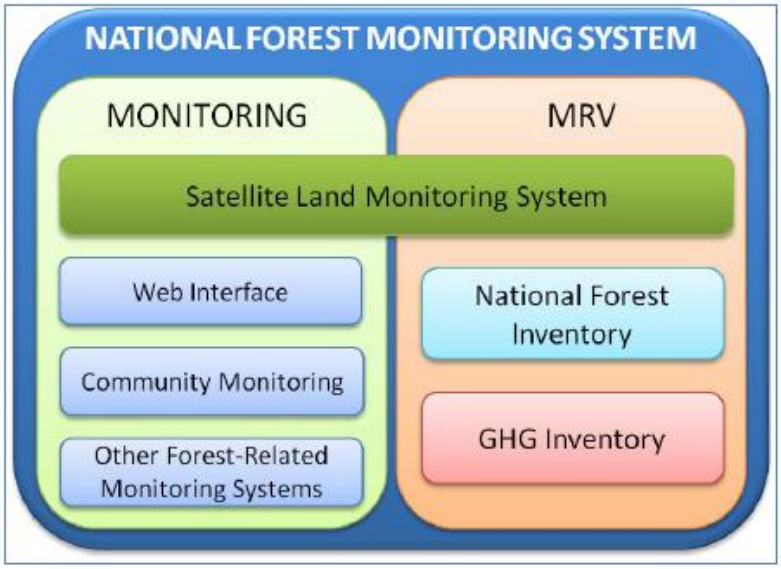


Figure 10. Diagram from the UN-REDD programme showing the components of an NFMS.

[14] http://unfccc.int/kyoto_protocol/items/2830.php
[15] http://www.un.org/esa/socdev/unpfii/documents/DRIPS_en.pdf
[16] http://bch.cbd.int/protocol/
[17] http://pops.int/
[18] http://www.itto.int/itta/

UNFCCC decisions establish that countries must follow the most recent methodological recommendations issued by the Intergovernmental Panel on Climate Change (IPCC) in their MRV system. The basic IPCC equation for reporting on greenhouse gas emissions and removals from the forest sector is to multiply activity data with emission factors. Activity data is generated by monitoring land use changes and comparing the size of forest cover at different points in time using satellite imagery and remote sensing methodologies. Data on emission factors can be generated through a National Forest Inventory (NFI) in the field.

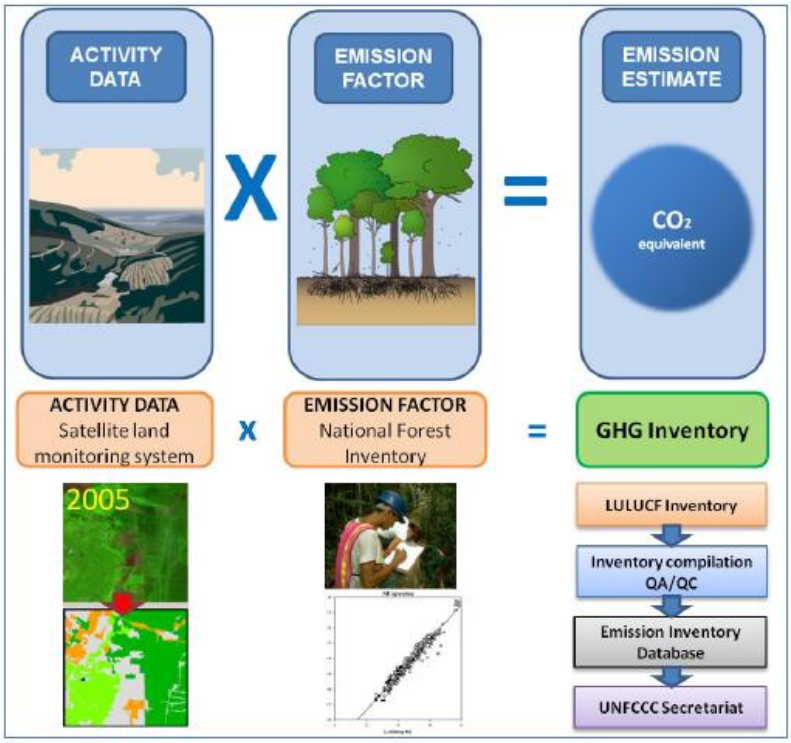


Figure 11. REDD+ MRV applies the IPCC's methodological approach to GHG emission estimates.

REDD+ readiness process and commitments in Suriname

As a high forest cover and low deforestation (HFLD) country, Suriname is interested in REDD+ as a tool for sustainable development and sustainable forest management. After some initial preparations for REDD+ in 2009-2010 followed by a break, Suriname re-engaged into a national REDD+ readiness process in 2012 and submitted a Readiness Preparation Proposal (R-PP) to the Forest Carbon Partnership Facility (FCPF) that was approved by the World Bank on 21 March 2013. The decision announced that Suriname would receive a REDD+ readiness grant of 3.8 million USD from the FCPF given that seven weak points of the R-PP were sufficiently addressed in an improved version. A final draft was submitted, completeness checked and accepted.[19]

Suriname has invited the United Nations Development Programme (UNDP) to act as Delivery Partner for the FCPF grant. In this capacity the UNDP has prepared a Project Document (PRODOC) that allocates the 3.8 million USD and divides responsibilities between institutions for the implementation of activities in the REDD+ readiness process. The PRODOC will guide the process of

[19] https://www.forestcarbonpartnership.org/suriname

"Strengthening national capacities of Suriname for the elaboration of the national REDD+ strategy and the design of its implementation framework" through the implementation of three pillars:

Pillar 1) Human capacities and stakeholders engagement

Pillar 2) REDD+ national strategy

Pillar 3) Implementation framework and tools.

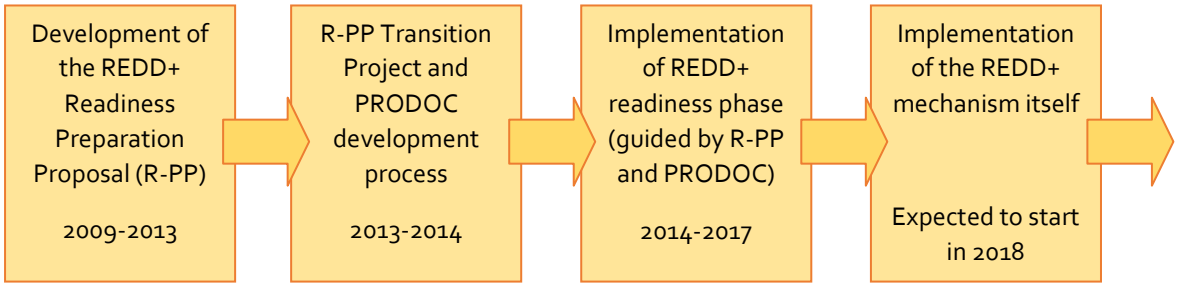


Figure 12. Timeline for Suriname's introduction of REDD+.

The National Institute for Environment and Development in Suriname (NIMOS) is the overall coordinating partner in Suriname for REDD+ readiness and implementation. Other institutions are assigned responsibilities for selected outputs and activities. Among those are the Foundation for Forest Management and Production Control (SBB), appointed to be in charge of establishing the national Forest Reference Emissions Level / Reference Level (REL/RL), setting up a Measurement & Monitoring, Reporting and Verification (MRV) system as part of a National Forest Monitoring System (NFMS) and building national consensus on the analysis of drivers of deforestation and forest degradation. The ACTO funded Forest Cover Monitoring Unit (FCMU) located in SBB will play a key role by delivering historical and updated activity data needed for those outputs and activities.

The following table lists the PRODOC responsibilities entrusted to the SBB in the left column. The right column explains if and how those activities are addressed through the FCM plan:

REDD+ R-PP Project Document (PRODOC)	FCM plan
2b4. Building national consensus on the analysis of drivers of deforestation and forest degradation *SBB, Indigenous Peoples / Maroon representative bodies and the Major Groups Collective (MGC) 2014-2015*	Included as part of Output 2.5 "Tools for REDD+ and land use planning are available" - specifically activities 2.5.1 to 2.5.5.
3a. Technical and human conditions to set up the implementation framework and tools are built	
3a1. Setting up institutional capacities *SBB and NIMOS 2014-2017*	Staff needs to be hired for Output 2.6 (NFI) and for the NFMS / MRV coordination structure.
3a2. Developing human capacities *SBB, NIMOS and UNDP 2014-2017*	Training needs for the FCMU are listed in Output 1.1 and for NFI in Output 2.6.
3b. A national forest REL/RL is developed	
3b1. Updating the national forest definition *SBB 2014-2015*	Included as part of Output 2.1 "Classification scheme for forest cover monitoring is formulated and approved".

3b2. Gathering and analysing historical activity data *SBB 2014-2015*	Output 2.2 and 2.4 contribute to this collection of historical data that can be used for REL/RL.
3b3. Gathering and analysing available emission factors data *SBB 2014-2015*	Activity 2.6.5 "Compile and analyse all available field information on forest and non-forest classes" and 2.6.6 "Publish an intermediary report on available carbon stock data"
3b4. Assessment of national circumstances *SBB and NIMOS 2014-2015*	While not directly included as a separate activity in the FCM plan, several activities will contribute.
3b5. Preparing and submitting a first national forest REL/RL *SBB 2015-2016*	Activity 3.3.1 " Prepare and submit a first national forest REL/RL for REDD+".
3b6. Preparing and submitting an improved national forest REL/RL *SBB 2017*	Activity 3.3.2 " Prepare and submit an improved national forest REL/RL for REDD+".
3c. A National Forest Monitoring System (NFMS) including an MRV function is developed	
3c1. Measuring and monitoring forest area change and activity data for REDD+ *SBB 2014-2017*	Output 2.4 establishes systematic activity data monitoring: "Deforestation, forest degradation and regeneration are monitored"
3c2. Measuring and monitoring forest carbon stocks and emission factors for REDD+ *SBB 2014-2017*	Output 2.6 "Multi-purpose National Forest Inventory (NFI) is carried out" includes emission factor measurements for carbon stock data.
3c3. Estimating and reporting on forest related greenhouse gas emissions and removals *SBB 2017*	Reporting is covered in Output 3.3 and data collection in Program 2.
3c4. Identify the type of information to be included in the NFMS *SBB and NIMOS 2015*	The FCM plan conceptualizes the NFMS and the annual workshop and other activities can be used for elaborating this.
3c5. Development of the REDD+ National Registry *SBB 2016*	In the FCM plan this is merged with 3c7 below, in activity 3.2.3 " Develop a REDD+ National Registry and monitor the outcomes of REDD+ activities".
3c6. Establish and maintain an online NFMS platform for data sharing and transparency *SBB 2015-2017*	Activity 3.2.1 " Establish, maintain and coordinate an NFMS platform online to share data generated by the FCMU with institutions and the public".
3c7. Monitor the outcomes of REDD+ activities *SBB and NIMOS 2017*	In the FCM plan this is merged with 3c5 above, in activity 3.2.3.

3.3 Projects specific to forest cover monitoring

As mentioned in the introduction to the FCM plan, Suriname has initiated its forest cover monitoring efforts through participation in regional projects. This section provides more details on the ACTO project *"Monitoring of Forest Cover in the Amazon Region"* and the regional technical collaboration project *"REDD+ for the Guiana Shield"* coordinated by ONF International.

Participation in the ACTO project

Suriname is a member country of the Amazon Cooperation Treaty Organization (ACTO), an international organization with the aim to promote sustainable development in the Amazon Basin. The other member countries are Bolivia, Brazil, Colombia, Ecuador, Guyana, Peru, and Venezuela. The Amazon Cooperation Treaty (ACT) was signed on 3 July 1978 and amended in 1998. ACTO was created in 1995 to strengthen the implementation of the treaty, and the ACTO Permanent Secretariat was established in Brasilia in 2002.

The strategic objectives of ACTO are to:

- Facilitate exchange and cooperation among the Member Countries, promoting strategic sustainable development and sustainable livelihoods in the region to improve the quality of life of its inhabitants, with emphasis on vulnerable populations, indigenous peoples, and other tribal communities.
- Ensure that the interests and sovereignty of the Member Countries are respected and promoted.
- Facilitate and foster actions to preserve, protect, conserve and sustainably use the forest, biodiversity and water resources of the Amazon.
- Promote management of Amazonian resources in a context of respect and harmony with nature and the environment.
- Promote and disseminate the cultures of the Amazon, and foster respect and protection of ancestral and current knowledge and wisdom.
- Promote coordination of plans and programs of Member Countries for the development of Amazonian populations, paying particular attention to vulnerable populations, indigenous peoples, and other tribal communities.

Source: Amazon Strategic Cooperation Agenda, approved at the X Meeting of the TCA's Ministers of Foreign Affairs, November 2010.

The ACTO project *"Monitoring Deforestation, Logging and Land Use Change in the Pan-Amazonian Forest"* has been implemented since 2011 with funding from ITTO, BMZ/GIZ and DGIS. The second project phase with funding from the Brazilian Development Bank (BNDES) will be implemented 2013-2017 under the new name *"Monitoring of Forest Cover in the Amazon Region".* The Brazilian National Institute for Space Research (INPE) is ACTO's technical implementing partner for the project.

The ACTO countries participate in the project through one political and one technical focal point each. For Suriname, the political focal point is the Ministry of Foreign Affairs (BUZA) and the technical focal point is the Ministry of Physical Planning, Land and Forest Management (RGB). The Ministry of RGB has delegated the direct engagement in the project to its technical implementing arm, the Foundation for Forest Management and Production Control (SBB). The project funded Forest Cover Monitoring Unit (FCMU) is thereby hosted by SBB.

The project has three components contributing to the overall objective of supporting the ACTO member countries in the development of national forest monitoring systems, with the purpose to improve forest governance in the Amazon region:

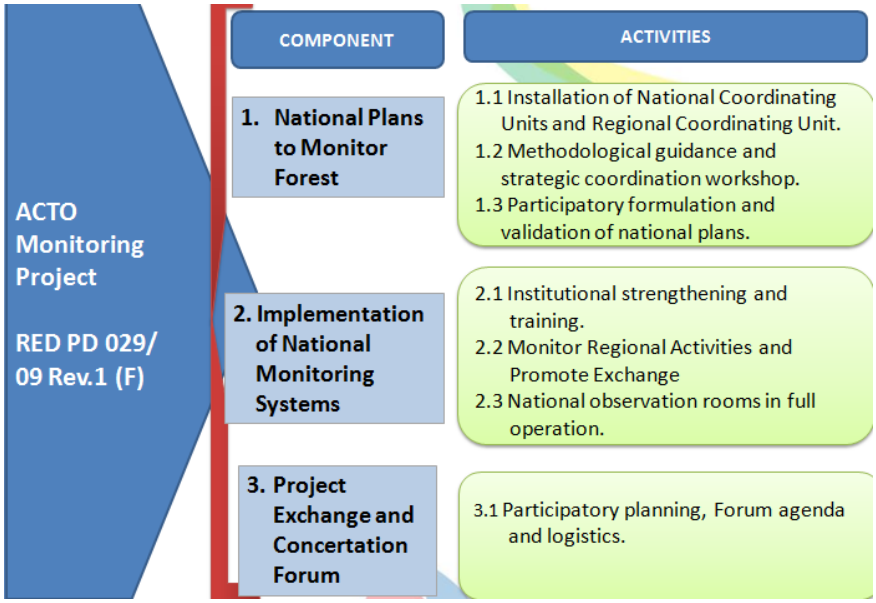


Figure 13. Overview of the ACTO project components and activities

Participating countries have agreed to each formulate a National Plan for Forest Cover Monitoring, which will guide their process to develop and implement forest cover monitoring systems as part of the project. It has been jointly agreed that these national systems should be designed to strengthen existing regional coordination platforms for forest management.

The project will directly attend to the following indicators:

a) area extension by forest type,
b) forest conversion rate,
c) proportion of environmental protection areas compared with permanent production areas,
d) contribution to the biological diversity conservation.

These indicators do not mention forest carbon sequestration and emission estimates as a reason for monitoring forest cover, which is the main focus of REDD+. The Amazon Strategic Cooperation Agenda does mention, however, that in the long term ACTO shall *"support Member Countries, that so request, in identifying international financial mechanisms based on the reduction of emissions by deforestation and degradation of forests REDD+ that might facilitate payments to the countries that preserve their forests".*

Participation in the REDD+ for the Guiana Shield project

"REDD+ for the Guiana Shield"[20] is another regional project that involves Suriname, Guyana, French Guiana and the Brazilian state of Amapá in technical collaboration focused on experience sharing and capacity-building related to three components: 1) Improving technical methodologies for forest cover monitoring and carbon stock assessment, 2) Improving the understanding of dynamics

[20] http://reddguianashield.com/

related to drivers of deforestation and forest degradation, and 3) Creating future scenarios by modelling deforestation and forest degradation.

The project is coordinated by the French Forest Office (ONF) and ONF International. It is funded by the European Regional Development Fund (FEDER) through the Interreg IV Caraïbes program, the French Global Environment Facility (FFEM), the French Guiana Region as well as by the project partners own contributions. Preparations for the project were initiated through discussions between Guyana, Suriname and France at the UNFCCC 14th Conference of the Parties held in Poznan, Poland in 2008. Financing agreements with donors were signed in late 2012, the project officially started in January 2013 and it will continue until December 2015.

The forestry service institutions in Suriname, Guyana, Amapá and French Guiana are the direct beneficiaries and participants in the project. In Suriname this is the Foundation for Forest Management and Production Control (SBB). The National Institute for Environment and Development in Suriname (NIMOS) is part of the project Steering Committee together with SBB. The Forest Cover Monitoring Unit (FCMU) has participated in some regional Working Group meetings and country support activities, which is the case also for the Center for Agricultural Research in Suriname (CELOS). WWF Guianas, Conservation International and the Guiana Shield Facility are invited as observers to the Steering Committee to enhance opportunities for synergies.

The project has a focal point (international volunteer) based in Suriname, employed by ONF International and hosted by the SBB since August 2013. She is working closely with the FCMU and has been in charge of drafting this National Plan for Forest Cover Monitoring (FCM plan).

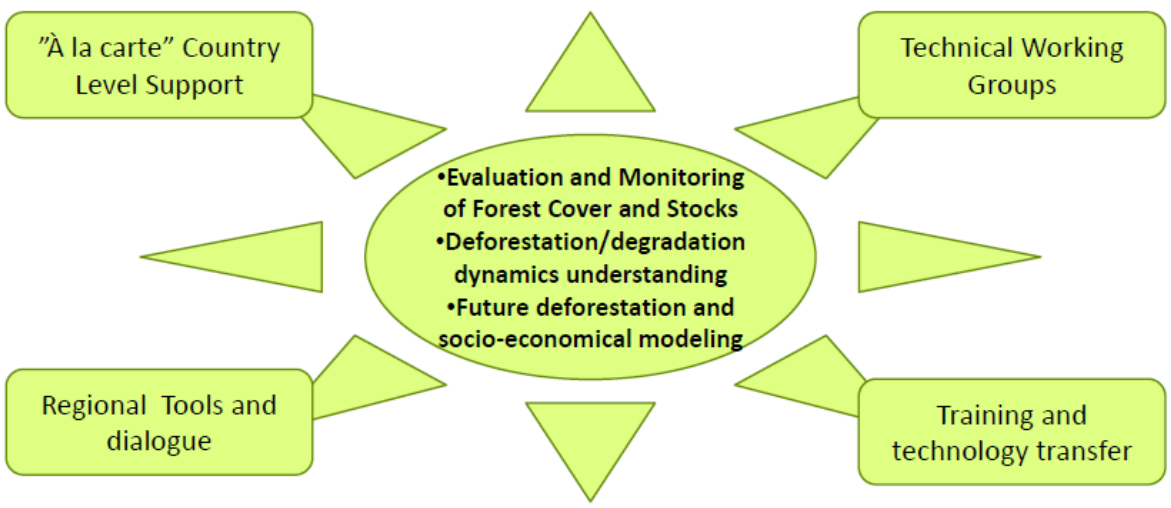


Figure 14. Thematic components and implementation channels for the project REDD+ for the Guiana Shield.

4. STRATEGIC FRAMEWORK

This is where the planning itself starts in light of the background and context provided in previous sections. The strategic framework motivates the rationale and need for a National Plan for Forest Cover Monitoring in Suriname. It discusses the vision, mission, goals and objectives, implementation guidelines, problem tree, logical framework and expected impacts of the National Plan.

4.1 Vision

A vision is a positive imagination of the future that inspires and taps into people's hopes for a positive future. It provides purpose, meaning and motivation by illustrating what the work and efforts may contribute to in the long-term.

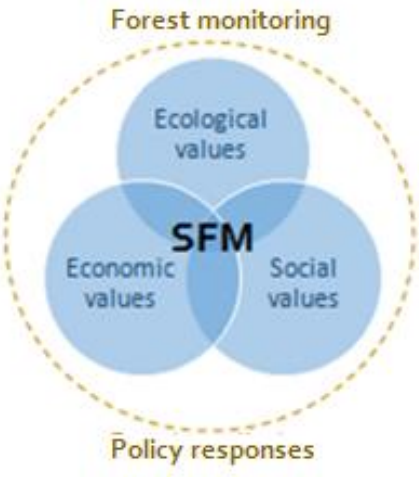


Figure 15. Vision for sustainable forest management (SFM)

This National Plan for Forest Cover Monitoring has been developed to serve the general vision of sustainable development and sustainable forest management in Suriname. This vision includes ecological, economic and social values that are to be balanced through good governance.

Forest cover monitoring can contribute to this by providing a trusted knowledge base linked to policy responses that are willing, wise and able to ensure the sustainable management of Suriname's forests. In the process of developing the FCM plan, the vision was formulated as follows:

"Suriname monitors forest cover changes in the whole country in close collaboration with multiple stakeholders, using modern technologies and local community participation in a system that provides the national and international community with the most updated and reliable information about forest cover, which is used to enforce governance on deforestation, forest degradation, land tenure and land use (changes), to sustainably manage the forest resources while maintaining resilience of forest ecosystems."

4.2 Problem tree with causes and effects

The first step before starting the planning is to formulate a core problem that the plan will address and identify its causes and effects. This negative story should uncover existing weaknesses and gaps that need to be overcome and turned around in order to get closer to the vision.

The core problem that this FCM plan aims to address is that in Suriname there is *"No national forest (cover) monitoring system in place to deliver up-to-date, documented, validated and accessible data"*. There are larger problems linked to unplanned deforestation, but as explained in Section 1.2, the mandate of the Forest Cover Monitoring Unit (FCMU) is to produce factual data.

Causes and effects of this problem are shown as roots and branches in a problem tree provided in Annex 1.

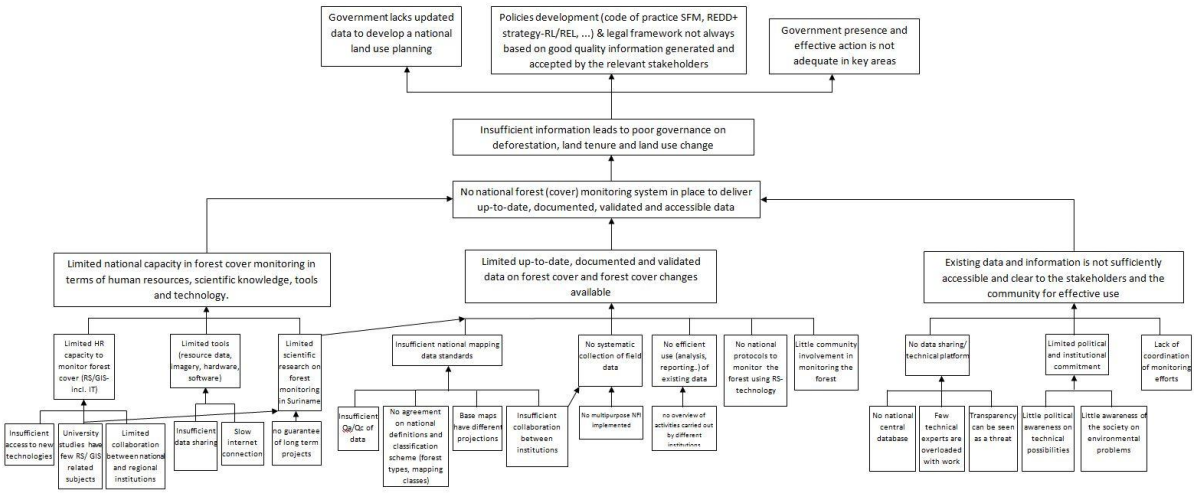


Figure 16. Problem tree of the FCM plan (see annex for better readability).

4.3 Goal and strategic objectives

The figure below shows how the problems can be turned around and translated into solutions through a process of planning:

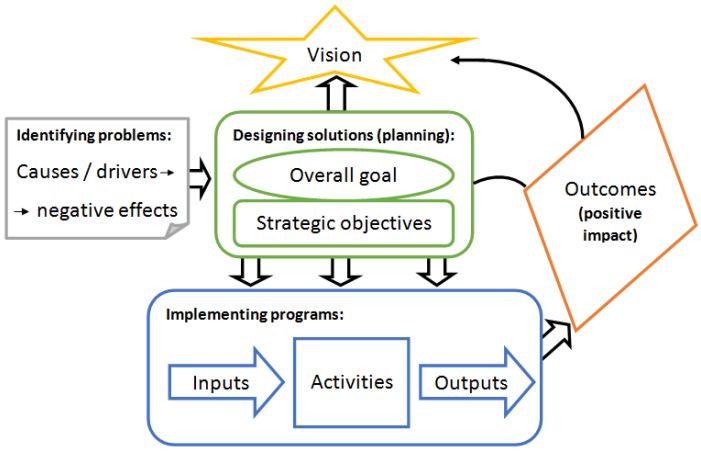


Figure 17. Elements of the strategic framework

Solutions are designed by formulating a goal and strategic objectives that articulate how the plan will contribute to bridging the gap between the core problem and the vision. As already mentioned in the introduction to this document, the overall goal of the FCM plan is:

"To contribute to the strengthening of the National Forest Monitoring System (NFMS) by generating information about changes in forest cover for Suriname that is reliable, up-to-date, accessible, understandable and transparent, serving multiple purposes amongst others optimized policy, policy implementation (e.g. national land use planning, sustainable management of the forest, REDD+) and law enforcement in the field (e.g. gold mining, mangrove forest)."

The conceptual framework in section 1 explained that a highly functional system is resilient, self-organizing and adaptive. The FCM plan needs to design and establish the elements and flows of the NFMS and keep track of its success in generating data that may be used for serving multiple purposes.

In order to ensure that all the roots and branches in the problem tree are addressed, and equally for making it easier to evaluate the plan's progress in providing real solutions, the goal is broken down into strategic objectives that express the planned achievements in more specific terms.

Three objectives lay out the strategy for what the FCM plan will focus on to accomplish.

Objectives of the Suriname National Plan for Forest Cover Monitoring:

1.	*To strengthen national capacity on forest cover monitoring, in terms of human resources, scientific and traditional knowledge, tools and technology.*
2.	*To generate documented, updated and validated data on forest cover and forest cover changes, ready to be used for multiple purposes.*
3.	*To make data and information about changes in forest cover understandable and accessible to policy-makers, communities and other stakeholders.*

4.4 Programs and their expected outcomes

In this section, each objective is formulated as a desired outcome. The outcomes summarize the positive impact that the FCM plan is expected to achieve, or in other words the difference that the National Forest Monitoring System (NFMS) will make.

Outcome linked to objective 1:
"National capacity on forest cover monitoring is strengthened and sustained in terms of human resources, scientific and traditional knowledge, tools and technology."
Outcome linked to objective 2:
"Up-to-date data on forest cover and forest cover changes are generated, documented and validated, ready to be used for multiple purposes such as policy implementation, law enforcement, land use planning, sustainable forest management, biodiversity conservation and REDD+."
Outcome linked to objective 3:
"Information and data about changes in forest cover is made understandable and accessible to policy-makers, other stakeholders and the general community."

The FCM plan will be implemented through three programs, each designed to address one of the outcomes:

Program 1	**National capacity-building on forest cover monitoring**
Program 2	**Data generation on forest cover and its changes**
Program 3	**Information and data sharing about forest cover and monitoring efforts**

As shown in the blue box in figure 11 above, each program is implemented through a series of activities. When systems-thinking and adaptive planning are applied (see section 1.4), activity-design is seen as a flow from inputs to outputs through a system with the purpose to result in positive change.

Outputs are the more specific tangible results or products that the project team should be able to guarantee through implementing the plan. The outputs of a program should all together respond to the objective and result in the outcome linked to the program. The outputs are achieved step-by-

step through the implementation of a series of specified activities. In order to make sure that the activities are realistic to achieve, the planning should include a list of inputs that are needed for each activity and explain how those inputs will granted. Depending on the nature of each activity, the necessary input may be resources such as funding, staff time, data and/or expertise.

See section 5 for a detailed description of the three programs of the FCM plan and their respective outputs and activities. An overview is also provided in the Logical Framework in Annex 2.

4.3 Strategic guidelines for implementation

The FCM plan is not static but may be adjusted over time to ensure that it stays relevant in a changing world. The figure below explains how the plan will follow a dynamic planning cycle for adaptive management:

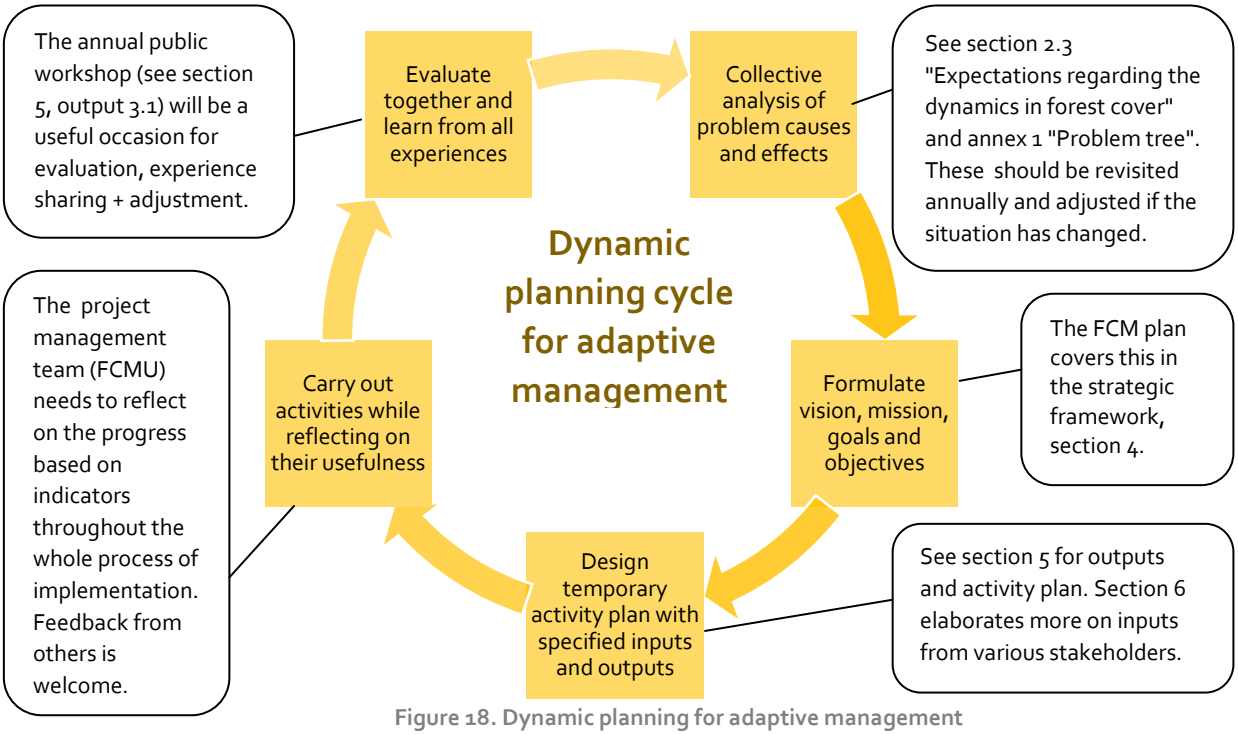


Figure 18. Dynamic planning for adaptive management

Throughout the process of implementation, it is important to constantly reflect upon the work, document the process and take note of what is going well and what is not. The project management team will evaluate internally and also invite feedback from stakeholders.

The Logical Framework in Annex 2 lists a number of indicators and means of verification for each output. These will be revisited regularly and used for evaluation of performance in line with the FCM plan. The Logical Framework also lists assumptions about the larger systems that the NFMS exists within. If conditions would change in the outside world so that the assumptions are no longer valid, it may affect the feasibility of the FCM plan so that it must be adjusted. It is often the project activities that need to be adapted, but it could also be the problem formulation, the outputs, objectives, outcomes, overall goal or even the vision.

Changes in the external factors may be positive or negative. A negative change would be for example if the inputs needed for activities are not available, due to for example lack of funding flows, data flows or human resources. In such cases the plan may need to be adapted to be less

ambitious than before. When reporting on performance it will then be clearly and transparently explained why the planned activities could not be achieved and what is planned instead.

On the other hand, external factors may instead make it easier than anticipated to implement the plan. If for example a hierarchical system would provide free high resolution satellite images on a daily basis, the FCMU might start to use them and adapt the outputs to be more ambitious. The FCMU will strive to seek partnerships and collaborations to take full advantage of supporting environments and new developments, constantly trying to steer the NFMS toward higher levels of performance and positive impact.

Each time adjustments are made to the FCM plan, the dynamic implementation cycle starts again with a higher level of experience built into the system.

Figure 19. Adaptive planning as a learning spiral

Critical question for measuring performance:

How effectively do we deliver in line with our objectives and make a distinctive impact relative to our resources?

5. PROGRAMS

This section contains the operational part of the FCM plan. It describes the planned activities, outputs and anticipated outcomes of three programs that will be implemented: Program 1) National capacity-building on forest cover monitoring, Program 2) Data generation on forest cover and its changes, and Program 3) Information and data sharing about forest cover and monitoring efforts.

5.1 National capacity-building on forest cover monitoring (Program 1)

Capacity-building lays the foundation for successful implementation of the FCM plan. This program has the objective ***"to strengthen national capacity on forest cover monitoring, in terms of human resources, scientific and traditional knowledge, tools and technology".***

Capacity in this context refers to human resources and their knowledge and skills as well as infrastructure and equipment such as hardware, software, imagery and data.

The following four outputs are planned to be achieved and together result in outcome 1:

Output 1.1	The Forest Cover Monitoring Unit (FCMU) is reinforced and consolidated
Output 1.2	The existing FCMU is sustained beyond 2017
Output 1.3	Collaboration with technical institutions and other stakeholders is reinforced and their capacities are built
Output 1.4	Research on forest cover monitoring is stimulated and carried out closely related to the technical program on FCM (program/outcome 2)
Outcome 1: National capacity on forest cover monitoring is strengthened and sustained in terms of human resources, scientific and traditional knowledge, tools and technology.	

Output 1.1 The Forest Cover Monitoring Unit (FCMU) is reinforced and consolidated

Through its participation in the ACTO forest monitoring project, Suriname has received resources to establish a Forest Cover Monitoring Unit (FCMU), tasked to coordinate the remote sensing component of a National Forest Monitoring System (NFMS) serving multiple purposes as described in this plan.

Suriname did not have any systematic monitoring of forest cover changes in place when the ACTO project started, and only a handful of individuals in the country had some degree of experience working with remote sensing. While most of the other ACTO member countries used the project funding to strengthen an existing remote sensing office in their respective country, this possibility did not exist for Suriname. Instead the decision was made to start up a new remote sensing unit in 2012 located in the Foundation for Forest Management and Production Control (SBB), which is the implementing technical arm of the Ministry of Physical Planning, Land and Forest Management (RGB) in Suriname. The new unit is part of the SBB Department of Research and Development, which also hosts the Geographical Information Systems (GIS) Unit existing since the creation of SBB in 1998 and a National Forest Inventory (NFI) Unit coordinating the NFI pilot project since 2012. The remote sensing unit became operational in October 2012 under the name 'Observation Room' (to correspond with the Spanish term 'sala de observación'). In November 2013 it was formally inaugurated as the Forest Cover Monitoring Unit (FCMU) by Minister Steven S. Relyveld LLM of RGB during the 2nd technical encounter of 'salas de observación' organized by ACTO in Paramaribo.

Figure 20. FCMU embedded in SBB and RGB

ACTO has provided the FCMU with hardware, software, training and human resources. SBB provides the office space, IT support, financial administration and logistical assistance to the FCMU. Since 2012 the ACTO project provides the full-time salary of a national technical coordinator and an experienced GIS analyst. In agreement with ACTO, the funding available for a third full-time position was redistributed for making it possible to involve university students and recent graduates in the FCMU on a part-time basis, with the goal to build increasing national capacities on forest cover monitoring. Several students from the education programmes Sustainable Management of

Natural Resources (MSc), Environmental Science (BSc) and Forestry (BSc) of Anton de Kom University (AdeKUS) have been engaged in the unit's activities at different times.

Through the second phase of the ACTO project *"Monitoring of Forest Cover in the Amazon Region"*, additional financial resources are guaranteed for staffing the FCMU until 2017, through a grant from the Amazon Fund managed by the Brazilian Development Bank (BNDES). It is estimated that the FCMU needs to compose five full-time staff members given the planned outputs and activities that the unit will carry out according to this plan. The full-time staff of the FCMU will be three GIS analysts, one database manager/programmer and one coordinator. The funding makes it possible to hire seven staff per ACTO member country, but Suriname has chosen to continue the practice of strengthening national capacity by reserving the remaining resources for part-time employment of students. Attempting to ensure the long term availability of skilled staff in the FCMU, processes are documented so that newcomers can access the institutional memory. Measures are taken to spread the capacity across the team so that many people learn the same skills, in order to avoid the vulnerability of becoming too dependent on specialized experts who may leave the organization. Efforts will be made to create interesting career opportunities for trained students to encourage them to stay in the FCMU.

Training of the FCMU core team

The growing FCMU needs to be reinforced with strong capacities in remote sensing and GIS, which are the most important technical tools for forest cover monitoring. A non-exclusive list of specific training needs has been identified that can hopefully be met through activity 1.1.2. Multiple possibilities for gaining these competencies will be explored, including partnerships with different training institutions, international experts and funding agencies. Potential delivery partners have already been identified for some of the trainings, while for other topics opportunities are still being sought. (*) below indicates that the training must be organized in Suriname to enable involvement of the full team:

- Basic remote sensing (every year) *
- Advanced GIS (every year) *
- Accuracy assessment of maps (5 days, provided in March 2014 by ONF REDD+)
- Terra Amazon software (planned to be provided by ACTO)
- PostgreSQL database programming
- Radar remote sensing principles
- Advanced remote sensing
- Forest cover monitoring methodologies (10 days, linked to activities 2.2.4 and 2.4.5 below)
- Land use and land cover mapping methodology (5 days + additional expert time, see 2.3.4)
- Forest degradation monitoring (10 days, see 2.4.12)
- Future deforestation modelling methodologies (10 days, see 2.5.7)
- Forest fire monitoring (planned to be provided by ACTO)
- Extracting parameters from aerial images (planned to be provided by Austria for 2.6)*
- Basic greenhouse gas (GHG) inventory reporting (whole team, see 3.2.4) *
- Advanced GHG reporting (1-2 people, see 3.2.4)

In order to achieve the most with the trainings, it is recommendable to create an enabling environment for practical implementation of the tools learnt during the training upon return to the office. In addition to specific trainings, it will be important for the FCMU to stay up-to-date with new developments in the evolving field of remote sensing and forest cover monitoring (1.1.5). This can be achieved through joining mailing lists and webinars, reading articles and attending workshops, conferences and symposiums on related topics when opportunities occur. Capacity-building will also be needed for the team in SBB that will carry out the National Forest Inventory, see Output 2.6 for more details.

Technology structure

The technology structure needed for forest cover monitoring includes infrastructure and equipment such as hardware and software. ACTO with funding from ITTO and GIZ/DGIS has provided most of the tools currently used by the FCMU including three state-of-the-art work stations, a data server, a plotter and high speed internet connection (4MB). Video conference equipment has been purchased and is expected to be delivered for collaboration between ACTO member countries from a distance (activity 1.1.6). SBB as the institution hosting the FCMU has provided office space, IT support and complementary equipment. Funding is now available from the Amazon Fund via ACTO for improving the technology structure of the FCMU until 2017 with hardware including additional work stations for the expanding team of staff and students (activity 1.1.3). Machines need maintenance and depreciation for wear and tear to increase the durability of the technology structure. Precautions will be taken such as installation of antivirus programs and plans will be made for what to do if computers would stop working. With the help from IT technicians of SBB, the FCMU continues to build a healthy IT environment and to create and share data based on the needs for forest cover monitoring.

In terms of software, the FCMU has followed ACTO's recommendation to use a methodology based on the free TerraAmazon[21] software developed by the Brazilian Foundation for Science, Technology and Space Applications (FUNCATE) and used by the National Institute for Space Research (INPE) in the Monitoring of the Brazilian Amazon by Satellite (PRODES) project. The methodology also makes use of the open source database PostgreSQL[22] and the free Brazilian software Spring[23] for segmentation of images. ACTO has provided training for the FCMU in the TerraAmazon system at several occasions, both in the INPE Amazon Regional Center (CRA) in Belém and by sending technical consultants to Suriname. The continuous technical support from INPE is a good reason for Suriname to use TerraAmazon.

GIS software is needed for parts of the mapping process and SBB has made an ArcGIS license available to the FCMU. ArcGIS is expensive but the FCMU is also experimenting with the free and open source software QGIS. The whole team received two days of internal training in QGIS in March 2014 through the ONF REDD+ project. In April-May the same year, two GIS analysts of the FCMU followed an extensive QGIS training at Anton de Kom University of Suriname (AdeKUS), by joining a two weeks course primarily targeted at students of the MSc program Sustainable Management of Natural Resources (SMNR). The FCMU is currently using both ArcGIS and QGIS in parallel. Software is not included in the ACTO budget and the FCMU envisions to continue using free and open source software as far as possible.

[21] http://www3.funcate.org.br/geo//available/wiki-v01-TerraAmazon/pmwiki.php/TerraAmazon/TerraAmazon
[22] http://www.postgresql.org/
[23] http://www.dpi.inpe.br/spring/english/

Imagery and data

Forest cover monitoring with remote sensing cannot be done without relevant imagery and data. So far the FCMU has been using Landsat imagery with an image archive since 1972, including many available to download for free from the internet.[24] Landsat imagery are taken with optical sensors with 30 x 30 m resolution and new images are made available every 16 days. A disadvantage is that clouds are visible on optical images. Since Suriname has a very high cloud coverage, only a small percentage of the available Landsat images are useful for forest cover monitoring. For the maps produced so far, the FCMU had to use a combination of several images from multiple dates for each part of the country (scene) to see most of the land area below the clouds. Still the maps include some areas that were always covered by clouds and had to be classified as "no data".

For the future it is planned to continue using freely available imagery as far as possible. Landsat 8, with 11 bands (7 multispectral, 1 panchromatic and two captured with a thermal infrared sensor), was recently launched and other satellites are expected to soon start to provide freely available imagery. Sentinel-1A (Radar C-band) was launched in April 2014, the launch of Sentinel-2A (optical 10 x 10 m resolution) is expected in April 2015 and CBERS-4B in 2016. Already processed datasets on forest cover are freely available from sources such as the Global Forest Watch[25], the University of Maryland[26] and JAXA[27] and may also be used.

Activity 1.1.4 will identify imagery and data needed to for implementation of the technical program (program 2) of the FCM plan. Depending on the design of methodologies that will be used for different outputs in program 2, it seems likely that it will become necessary to also acquire some satellite imagery from commercial sensors (optical or radar). This could be imagery with specific characteristics suitable for cloud gap filling, near real-time monitoring for specific areas or purposes, forest degradation monitoring, detailed land use and land cover mapping or accuracy assessment of produced maps. The ACTO project does not provide budget for imagery, which means that funding and partnerships will need to be sought. When images are acquired, efforts will be sought to obtain multiple licenses when possible so that not only the FCMU but also other institutions can get access to them, including ministries and governmental partners as well as the private sector and others with the need for imagery. The FCMU and ONF International have compiled a preliminary indicative overview of existing satellites with details about optical and radar sensors, number of bands, image size and frequency, costs, etc.[28]

Activity 1.1.7 will establish and maintain an internal database with a transparent structure for storing data and imagery, in order to make it easy for users to locate and access available resources. Relevant data that other institutions are willing to share will be included in this database. Improved network and database management will be achieved through reliable IT support tailored to GIS and remote sensing users and a routine for backup of data including clear responsibility assignment and control procedures.

[24] Landsat imagery can be downloaded from http://glovis.usgs.gov/, http://earthexplorer.usgs.gov/, http://glcf.umd.edu/data/gls/index.shtml/ or http://www.inpe.br/.
[25] http://www.globalforestwatch.org/
[26] http://earthenginepartners.appspot.com/science-2013-global-forest
[27] http://www.eorc.jaxa.jp/ALOS/en/palsar_fnf/fnf_index.htm
[28] Available here: http://reddguianashield.files.wordpress.com/2014/03/inventory-satellite-images-20140224.pdf

Activities leading to output 1.1:		2014		2015		2016		2017		2018	
1.1.1	Develop and manage the human resources										
1.1.2	Train the FCMU core team										
1.1.3	Strengthen the technology structure with technical capacities such as hardware and software										
1.1.4	Identify imagery and other data needed to carry out the FCM plan										
1.1.5	Keep track of new developments (gain knowledge and understanding about available methodologies, national processes etc)										
1.1.6	Learn from other ACTO member countries and other countries experiences related to forest cover monitoring										
1.1.7	Establish and maintain a transparent and documented database (for internal use)										

Output 1.2 The existing FCMU is sustained beyond 2017

After 2017 there is no guarantee that the ACTO project will continue to fund the FCMU. Leading up to this year while there is still funding, it is recommendable to use the opportunity to explore multiple possible products, services and tools that the FCMU can deliver to the Surinamese society within the multi-purpose National Forest Monitoring System (NFMS) of Suriname. The significance of keeping the FCMU beyond 2017 can be evaluated based on the usefulness of these products and tools for different ministries and institutions to optimize their land use decisions. If the ACTO project would not be extended after 2017 but the society still has a need for the services, it will be crucial to find alternative ways of sustaining the FCMU.

The most promising opportunity for sustaining the FCMU is through the process of preparing REDD+ implementation in Suriname (see section 3.2 above). REDD+ requires a technical system for Measurement/Monitoring, Reporting and Verification (MRV) that the SBB will be responsible for. The FCMU is getting ready for MRV implementation through its current activities and trainings. This process can be built further upon and the REDD+ preparatory process provides a framework for fundraising. See further section 6.2 'Budget flows and financing plan' on synergies between the FCM plan and the REDD+ readiness project.

In case no financing for REDD+ readiness would be available, the FCMU could be incorporated within the SBB budget and continue to provide the following information as a minimum: updated forest/ non-forest maps and figures, updated data on drivers of deforestation (infrastructure, mining etc), forest degradation estimates, near-real-time deforestation alerts for areas under special consideration (such as mangrove forest and nature reserves). This information will be used for national reporting related to forest statistics, environmental statistics and analyses of the forestry sector, as well as international reporting such as for the Forest Resource Assessment carried out by the FAO. It will also be useful for enforcing policy measures in the field, for predicting the spatial effects of land use options (such as construction of new roads, conversion of forest land to oil palm plantations etc) and as a tool for sustainable forest management (by producing a

suitability map for sustainable timber harvesting, conducting forest field inventories and support the planning of SFM).

Activities leading to output 1.2:		2014		2015		2016		2017		2018	
1.2.1	Continue to develop and manage the human resources										
1.2.2	Continue to train the FCMU core team										
1.2.3	Continue to strengthen the technology structure with technical capacities such as hardware and software										
1.2.4	Continue to identify data and imagery needed to carry out the FCM plan										
1.2.5	Continue to keep track of new developments (gain knowledge and understanding about available methodologies, national processes etc)										
1.2.6	Continue to learn from other ACTO member countries and other countries experiences related to forest cover monitoring										
1.2.7	Continue to maintain and coordinate a transparent and documented database (for internal use)										

Output 1.3 Collaboration with technical institutions and other stakeholders is reinforced and their capacities are built

Good collaboration between institutions reduces the risk of overlapping activities and optimizes the use of resources. The FCM plan includes several activities that are in line with the expertise of other institutions in Suriname. Reinforced collaboration between the FCMU and these institutions will improve the efficiency and effectiveness of the multi-purpose National Forest Monitoring System and enable successful implementation of the plan. This will increase the possibilities to attain a multidisciplinary platform for data sharing, exchange of expertise, joint spatial analysis and trainings.

Institutions outside the FCMU may be commissioned to implement some of the activities included in the FCM plan independently while other activities will be jointly performed. A Memorandum of Understanding (MoU) will be formulated and signed between SBB (as the institution hosting the FCMU) and each of those institutions. Funding can be sought through joint project proposals (activity 1.3.3) and publications can be co-authored when relevant (1.3.2).

Capacity-building of other institutions

The FCMU will seek to as far as possible invite targeted institutions to be technically trained simultaneously with its own core team (see output 1.1). Targeted institutions are those who can be expected to practically use the skills obtained through the training, which can be different at different occasions. For example, staff members of the Center for Agricultural Research in Suriname (CELOS), working in the GIS and remote sensing unit (NARENA), have already participated in

trainings on remote sensing in November 2013 and in QGIS and accuracy assessment of produced maps in March 2014 offered to the FCMU by external experts.

While some trainings may need to be kept small in order to maintain technical quality and focus, other workshops and training opportunities can be opened up to larger groups given that the required infrastructure is available. In addition to trainings provided by external experts, the FCMU is also planning to conduct trainings for other institutions themselves, to share tools that will be developed by the unit as part of program 2 as well as methodological insights from trainings followed abroad.

The FCMU room is small and can only host a limited number of external participants, especially if each participant needs a computer which is often the case for remote sensing and GIS related trainings. Discussions are ongoing with the Anton de Kom University of Suriname for exploring possibilities of hosting future trainings in their UCC computer lab, which would allow computer access for up to 20-30 participants at a time. AdeKUS can be involved in both providing and receiving capacity building and partnership may be established with their library for access to scientific literature on FCM.

In the consultation rounds carried out for preparation of the FCM plan, some other institutions also expressed strong interest to be involved in forest cover monitoring and to be engaged in capacity-building and partnership for this purpose through the FCM plan. Section 6 includes a table on the role of national stakeholders where more details are provided on how they want to be involved. For example, NIMOS and SBB need to collaborate closely because of shared responsibilities to implement REDD+ readiness. Stichting Planbureau Suriname and the Ministry of RGB play a central role because of their responsibilities for national land use planning.

Capacity-building of forest based communities

Forest based communities can play an explicit role in monitoring the forest. Therefore the FCMU will seek partnership with their representative bodies and villages to strengthen the capacity within these communities regarding forest monitoring skills. Existing structures for collaboration with these communities will be engaged, such as the REDD+ Assistants Collective, to identify good ways to interact with the communities. International good practices will also be explored to build the capacity of the FCMU and SBB in this type of collaboration, to ensure that forest based communities are not just consulted but that true partnership is developed and skills and tools shared. Capacity-building topics may include GPS use, national forest inventory, participatory mapping and GIS. Direct partnerships between communities can also be fostered so that they can share results with each other of forest cover monitoring in their vicinity.

Activities leading to output 1.3:		2014		2015		2016		2017		2018	
1.3.1	Build capacities of other institutions in forest cover monitoring (NIMOS, CELOS, University, Planbureau…)										
1.3.2	Build capacities of forest based communities to participate in forest monitoring										
1.3.3	Involve other institutions in relevant joint publications										
1.3.4	Sign MoUs and develop joint project proposals										

Output 1.4 Research on forest cover monitoring is stimulated and carried out closely related to the technical program on FCM (program/outcome 2)

Universities are integrators of research, innovation, education and practice. The global academic community has access to cutting-edge information about new technologies and methodologies that can be used for forest cover monitoring. Academic research has potential to directly feed technical institutions with relevant findings that may improve their work procedures as well as the scientific reliability of data they produce. For universities and research institutions it is also beneficial to collaborate closely with practitioners to gain understanding of problems faced on the ground and to increase the impact of research through better usability and visibility of results.

ACTO support for collaboration with academia

ACTO encourages collaboration between the forest cover monitoring units ('salas de observación') and academia. During the new ACTO project phase funding will be available for establishing a research room linked to the FCMU. In Suriname these resources could be used for strengthening the Center for Agricultural Research (CELOS), which is one of five research centers linked to the only university in the country, Anton de Kom University of Suriname (AdeKUS). CELOS focuses on scientific agricultural and forestry research and education at the Faculty of Technological Sciences. As mentioned in 1.3 above, CELOS has a department called NARENA working with GIS and remote sensing. The ACTO project will support research institutions to become better equipped for contributing to FCM plan activities. For example a training course in TerraAmazon specifically targeted for academic scholars is included in the ACTO budget for 2014. Through activity 1.4.1 the FCMU will seek to strengthen its collaboration with AdeKUS and CELOS as well as with research institutions in the Amazon region and further abroad.

Research needs identified by the FCMU

The FCMU has faced many challenges throughout its monitoring efforts so far. Complex questions have been raised that cannot be resolved to satisfaction with simple answers. More time and attention is needed in terms of academic research to objectively identify different possible options and systematically investigate applicable solutions. Research topics linked to existing needs include for example the spatial and temporal patterns of deforestation, behaviour and monitoring options for different drivers, whether shifting cultivation is forest or non-forest, monitoring options for mangrove and forest degradation. A more detailed list of research needs linked to implementation of the FCM plan will be identified through activity 1.4.2.

In 2014 Suriname has a very limited number of experts in FCM using remote sensing. One of them, Virginia Kent-Atmopawiro is currently pursuing her PhD at CELOS on *"Application of spaceborne radar remote sensing for tropical rainforest inventory and attribute estimation"*. Her job includes tutoring of Master and Bachelor students writing their thesis, including some students with links to the FCMU. Currently one of her MSc students is focused on detection of small-scale gold mining with high-resolution imageries, one BSc is dealing with clouds and one MSc will be looking into shifting cultivation.

Another PhD student who is conducting research in Suriname relevant for the FCM plan is Sara Ramirez Gomez. The title of her PhD is *"Participatory spatial information management and*

communication for modelling trade-offs among land use scenarios and ecosystem services in the upper Suriname River Area". Her work is expected to engage relevant stakeholders in the assessment of land use scenarios in order to model probabilities of future land cover change and their impacts on forest cover. She also has a MSc student who is modelling land use cover change in the upper Suriname river area using the software IDRISI.

In order to carry out all the research necessary for moving forward with the FCM plan, additional PhD students would be needed. Shifting cultivation and mangrove monitoring are complex enough to each be a PhD topic in themselves, but if that is not possible they could be addressed by several MSc and BSc students targeting different aspects of the topics. Priority right now would be to have one PhD focusing on the broad problematic related to drivers of deforestation and a second PhD on monitoring forest degradation in Suriname.

All opportunities to strengthen the science base of the FCMU will be seized, including exploring the possibility of establishing partnership with foreign universities and hosting one or two PhD students in the FCMU. This would bring benefits not only in terms of research but also team dynamic and daily access to remote sensing expertise.

Traditional knowledge

Indigenous peoples and Maroons that are based in the forest and apply traditional lifestyles have different worldviews compared to academic scientists. Scientific findings need to be merged with more traditional knowledge for better understanding of changes in the forest and in order to be used and endorsed to a fuller extent by forest based communities. Broad collaboration of actors with different perspectives tends to result in a more complete view of reality since contradictory perceptions can be jointly analyzed and merged into co-produced knowledge with consensus.

Research should be carried out with the aim to improve the understanding of what traditional knowledge is in the context of Suriname and how it best can be incorporated in forest cover monitoring. This must be in the spirit of mutual partnership, asking how FCM can be useful for forest based communities with traditional knowledge. It should be considered that this could vary between genders. Traditional perceptions and classifications for identifying forest can then be used to design the methodology for many different activities included in this plan.

Improving future advanced education opportunities

Activity 1.4.5 aims to address the problem that there are limited possibilities to study forest cover monitoring and remote sensing in higher-level institutions in Suriname. Students who come to work for the FCMU are currently trained on the job, but a more advanced education base of the staff force would be useful. One approach for addressing this could be to explore scholarship opportunities and establish partnerships for sending people to study abroad and hopefully come back with the skills after some years. Another parallel approach is to strengthen existing Bachelor and Master programmes in AdeKUS to foster students in skill sets related to forest cover monitoring, remote sensing and advanced GIS. ACTO supports this vision by suggesting in its project description that forest cover monitoring may be institutionalized as a subject in the academic curriculum of universities in its member countries.

Activities leading to output 1.4:		2014		2015		2016		2017		2018	
1.4.1	Establish collaboration with research institutions										
1.4.2	Identify research needs linked to implementation of the FCM plan										
1.4.3	Carry out research based on the results of activity 1.4.2										
1.4.4	Implement the research results in the technical program on forest cover monitoring										
1.4.5	Strengthen local study programmes on remote sensing and explore scholarship opportunities for studies related to forest cover monitoring, including through exchanges with universities and research centers abroad										

5.2 Data generation on forest cover and its changes (Program 2)

The second program of the FCM plan has the objective ***"to generate documented, updated and validated data on forest cover and forest cover changes, ready to be used for multiple purposes"***. Solid and reliable data generation is the core task of the FCMU and the backbone of forest cover monitoring.

Implementation of seven technical outputs are planned to support outcome 2:

Output 2.1	Classification scheme for forest cover monitoring is formulated and approved
Output 2.2	Forest/non-forest benchmark map is improved and published
Output 2.3	Land use/land cover (LULC) map is produced
Output 2.4	Deforestation, forest degradation and regeneration are monitored
Output 2.5	Tools for REDD+ and land use planning are available
Output 2.6	Multi-purpose National Forest Inventory (NFI) is carried out
Output 2.7	Alert system for near-real-time monitoring of forest cover is in place
Outcome 2: Up-to-date data on forest cover and forest cover changes are generated, documented and validated, ready to be used for multiple purposes such as policy implementation, law enforcement, land use planning, sustainable forest management, biodiversity conservation and REDD+.	

Output 2.1 Classification scheme for forest cover monitoring is formulated and approved

A classification scheme for forest cover monitoring defines the different land use and land cover classes that can be monitored, including forest, non-forest and subclasses on different levels. Forest and other classes can be defined in many different ways and it is up to each country to design their own classification scheme compatible with national needs and international reporting requirements. As a starting point for this process, the six broad categories forest land, cropland, grassland, wetland, settlements and other land will be used. Those are the categories defined by the Intergovernmental Panel on Climate Change (IPCC) for international reporting on land use, land use change and forestry (LULUCF) and agriculture, forestry and other land use (AFOLU). Suriname is already using these categories for reporting under the United Nations Framework Convention on

Climate Change (UNFCCC) and they are relatively easy to use for reporting also to the FAO and other international forestry related programs.

When producing 'Base map 2000' the FCMU applied the five classes forest, non-forest, hydrology, shifting cultivation and no data (clouds and shadows). For 'Deforestation map 2000-2009' the two additional classes deforestation and land acquisition were also included. The definitions used for these classes will be clarified through activity 2.1.1 as an input to coming discussions and may be adjusted through activity 2.1.2 based on further research, technical feasibility, stakeholder feedback and other factors.

National definition of forest

Suriname has a national definition of forest included in the Forest Management Act (1992) but this definition has an administrative character focusing on production forest. Therefore it cannot be used for mapping and monitoring forest cover and forest cover changes. The REDD+ readiness process requires that Suriname approves a new national forest definition in line with international guidelines-. Surinamese stakeholders have identified the need for an updated forest definition also for other purposes. It is expected that a new definition might take a long time to be legally recognized through formal inclusion in national law, but in any case it will be used for mapping and monitoring.

International agreements made within the UNFCCC provide flexibility to countries to choose their own definition of forest, as long as three parameters are included and motivated: minimum tree crown cover (10-30%), minimum land area (mapping unit of 0.5-1 ha) and potential in situ minimum tree height at maturity (2-5 m).

The Food and Agricultural Organization of the United Nations (FAO) definition of forest states the following: *"Land with tree crown cover (or equivalent stocking level) of more than 10 percent and area of more than 0.5 hectares (ha). The trees should be able to reach a minimum height of 5 meters (m) at maturity in situ. May consist either of closed forest formations where trees of various storeys and undergrowth cover a high proportion of the ground; or open forest formations with a continuous vegetation cover in which tree crown cover exceeds 10 percent. Young natural stands and all plantations established for forestry purposes which have yet to reach a crown density of 10 percent or tree height of 5 m are included under forest, as are areas normally forming part of the forest area which are temporarily unstocked as a result of human intervention or natural causes but which are expected to revert to forest".* For national purposes Suriname may seek inspiration from this and other international definitions of forest, but the national definition needs to be adapted to the circumstances that are relevant here.

The preliminary definition used by the FCMU for maps produced so far were minimum 30% of crown cover, 1ha minimum mapping unit and 5m minimum tree height at maturity. Technical and political consequences of keeping or adjusting this definition will need to be analyzed before the choice is made. It is advisable to take into account the technical characteristics of freely available imagery already when defining frequently mapped classes to make sure that is possible to discriminate them at a low cost. The FCMU is planning to at least discriminate mangrove forest and planted forest as separate subclasses within the forest class. Both are clearly visible on Landsat imagery and will be relevant to keep track of.

Shifting cultivation (fallow forest land) is a topic of debate since national stakeholders (indigenous and maroons) argue that it is a traditional and sustainable use of the forest and should be mapped

as such. When submitting 'Base map 2000' and 'Deforestation map 2000-2009' to ACTO, shifting cultivation was merged with the forest class for this reason. International organizations on the other hand usually see it as non-forest, but it also depends on national circumstances since there are many types of shifting cultivation that can be more or less sustainable. CELOS has conducted research on shifting cultivation systems in Suriname and as mentioned in output 1.4 more research is needed. Depending on technical feasibility it may be possible to map some types of shifting cultivation as forest and other types as non-forest or use different classes for different stages in the rotation cycle. This is one of the issues that will be addressed in the proposal to be developed as activity 2.1.2.

Definitions of other classes

The forest class can be further subcategorized, for example into primary forest, secondary forest, mangrove forest and planted forest and in a further stage according to a more detailed forest typology. The national classification scheme may include many levels of defined subclasses and sub-subclasses. The level of detail in terms of which classes to discriminate for which map can then be decided on a case-by-case basis, depending on which satellite imagery will be used and the technical feasibility of discriminating classes on those images, as well as government and community needs. In order to strengthen sustainable forest management, it could be recommendable to discriminate different types of production forest, since this would allow the concessionaires to improve their planning and the efficiency of pre-harvest inventories.

Different types of non-forest will also be distinguished and defined in the proposed classification scheme based on land use and drivers of deforestation. For the purpose of REDD+ there must be a distinction between deforestation with anthropogenic versus natural causes. Regeneration of forest and other types of forest gain will also be included. Activity 2.1.2 includes desk research on national and international classification criteria, existing case studies and technical restrictions of imagery. Technical support in terms of expert input will be sought both for developing the proposal and for providing external input to the workshop and consultations in activity 2.1.3 for reaching national agreement. The classification scheme may be improved over the coming years (activity 2.1.4) based on new emerging needs or new knowledge gained through other technical outputs. To develop the classification scheme, international methodologies such as the Land Cover Classification System (LCCS) will be considered. LCCS was developed by FAO and UNEP in response to a need for standardized and harmonized land cover data.

Activities leading to output 2.1:		2014		2015		2016		2017		2018	
2.1.1	Clarify the definitions that were used to produce 'Base map 2000'										
2.1.2	Formulate a proposal for a national classification scheme for the monitoring of forest cover, in line with international guidelines and considering the national forest typology and conditions										
2.1.3	Reach national approval on the classification scheme through consultations										
2.1.4	Improve the classification scheme based on the results of the other outputs										

Output 2.2 Forest/non-forest benchmark map is improved and published

A benchmark map is a tool to facilitate forest cover monitoring. The map shows the extent of forest, non-forest and other relevant classes for a particular historical year, which is used as the reference point in time against which future changes in forest cover are compared and measured. When mapping deforestation for later years, remote sensing imagery is used to identify pixels or objects that differ compared to the benchmark map. If only gross deforestation is monitored, an updated forest/non-forest map can be created by subtracting the areas where deforestation has occurred. When regeneration of forest is monitored as well, the new map also shows land areas that were non-forest in the benchmark year that have changed to forest. According to international guidelines, each country is free to choose for themselves what reference year they want to use for the national benchmark map.

Choice of reference year for the benchmark map

The FCMU has created a preliminary benchmark map for Suriname for the year 2000 referred to as 'Base map 2000'. The reason for having produced the map for this year is that ACTO member countries agreed together to use 2000 as the reference for regional deforestation mapping of the Amazon. After consultations with other institutions in the country and with international experts, it was decided to use year 2000 also for the national forest/non-forest benchmark map.

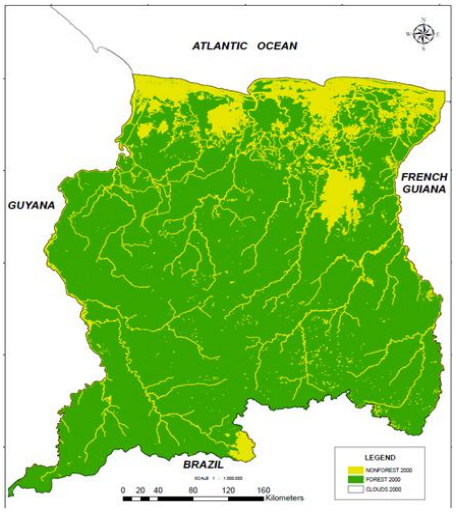


Figure 21. Base map 2000

Accuracy assessment

The next step is to carry out an accuracy assessment to check the quality of 'Base map 2000'. An accuracy assessment attempts to identify and measure remote sensing-based map error, by comparing points on the map with other data sources and checking to what extent classification has been done correctly. In March 2014, the FCMU team was trained in accuracy assessment through the 'REDD+ for the Guiana Shield' project and received technical support from ONF International to develop a protocol for accuracy assessment of 'Base map 2000'. The FCMU is currently performing the accuracy assessment in line with the protocol and the results will be published in early 2015.

Choice of methodology

'Base map 2000' was developed with a remote sensing methodology used for the PRODES project in Brazil slightly adapted to national circumstances (see 1.1 above). The technical support from INPE and the user-friendliness of the TerraAmazon software are good arguments for continued use of this methodology, but other options will also be explored depending on the results of the accuracy assessment and other factors.

The FCMU will develop an official national protocol to map forest cover (activity 2.2.5) and it is important to invest time and energy in making a careful and conscious choice of methodology in terms of software, satellite imagery and design of all steps in the interpretation and mapping process. In activity 2.2.4 the FCMU will identify other methodologies that could potentially be appropriate for forest cover monitoring in Suriname, get trained in these methodologies, test them

for a pilot area and compare different methodologies. Furthermore, research carried out nationally can be a direct input to the formulation of the national protocol and will be stimulated when possible.

The final choice needs to be synchronized with the decision on the classification scheme (output 2.1) to ensure technical feasibility of discriminating the desired classes. A benchmark map should not include any areas of "no data", so gap filling options will be explored for areas with clouds. In order to improve the comparability of results, it is recommended to create the benchmark map using the same technical methodology that will be used for mapping change (output 2.4) and to keep applying the same technique for many years. When the protocol has been written it will be reviewed by an external expert, followed by consultations with other technical experts to validate the protocol.

Finalization of the benchmark map

Scheduled for the second half of 2015, the benchmark map will be produced according to the agreed protocol. This may entail improving 'Base map 2000' or developing a new map from scratch depending on what has been decided. The map will be accuracy assessed and published in the first half of 2016.

Activities leading to output 2.2:		2014		2015		2016		2017		2018	
2.2.1	Clarify the area of interest to be used for the benchmark map										
2.2.2	Carry out accuracy assessment of the preliminary benchmark map (Base map 2000)										
2.2.3	Publish the provisional benchmark map and accuracy assessment results										
2.2.4	Study alternatives to the current methodology used										
2.2.5	Develop the official national protocol to map forest cover										
2.2.6	Improve the benchmark map according to the new protocol										
2.2.7	Carry out accuracy assessment of the improved map										
2.2.8	Publish the forest area benchmark map, the protocols used for mapping and accuracy assessment, and official numbers on the extent of all mapped classes in the benchmark year										

Output 2.3 Land use/land cover (LULC) map is produced

While output 2.2 will produce a map of forest/non-forest, both these classes can be divided into several more detailed land cover and land use classes. Remote sensing imagery allows land cover (LC) information to be obtained while local expert knowledge and field information is needed to estimate land use (LU).

In terms of the forest class, the LULC map will improve the knowledge about stratification of different forest types across the country by dividing the forest cover into detailed sub-classes as agreed in output 2.1. This information can be used for multiple purposes such as sustainable forest management, biodiversity research, ecosystem management and spatial planning. It can also make reporting on carbon stocks and carbon stock changes more accurate since forest types with different biomass store different amounts of carbon. The LULC map will also increase the knowledge about different types of non-forest and geographically overlapping classes of land use.

The preparatory work for developing the map will start in the second half of 2014 by compiling all available field data (synchronized with activity 2.6.5 below) and existing thematic maps showing ecosystems, forest types, agriculture, soil, minerals, elevation, land rights, concessions, etc. This includes desk research and GIS processing. In early 2015 the FCMU will start to visit other institutions for consultations (activity 2.3.2) in order to collect stakeholder expectations for the map, identify other eventual plans of developing similar maps and explore synergies. An international consultant will be engaged for 15 days to work in close collaboration with the FCMU, CELOS and other relevant partners to develop the methodology that will be used for producing the map (2.3.3). This activity includes identification of available and usable data based on the results of 2.3.1 and adjustment of the methodology to correspond with current capacities and equipment of the FCMU. Commercial imagery will most likely need to be bought and should be synchronized with activity 2.4.12 so that they can also be used for monitoring forest degradation.

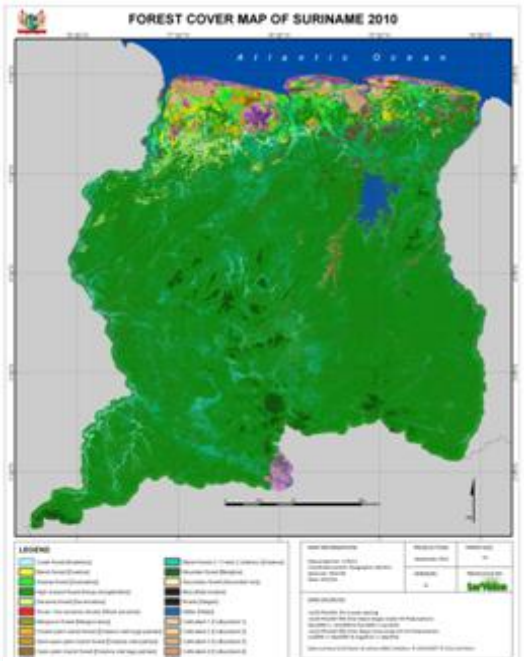


Figure 22. The forest type map by SarVision will be one of many inputs to the LULC map.

The work to produce the map itself will be carried out in 2015-2016 (activity 2.3.5). The year projected on the map could be 2015 or another date depending on the methodology and available data. Since the process for making of a LULC map is time consuming and complicated, it is estimated that the map could be used for 10 years before it is updated. Accuracy assessment will be needed and technical support is envisioned for adapting and finalizing a protocol for that (2.3.6). It is expected that the map will be ready for official publication in the end of 2016.

Activities leading to output 2.3:		2014		2015		2016		2017		2018	
2.3.1	Asses, collect and analyse all available maps (SarVision, ecosystem map, agriculture map, soil map, elevation, ABC project, etc), as well as the field information collected and compiled through activity 2.6.5										
2.3.2	Facilitate consultation on the LULC map development										
2.3.3	Develop the methodology to be used for producing the LULC map										
2.3.4	Conduct training on the new methodology										

2.3.5	Process the map for 2015 or another year to be confirmed											
2.3.6	Carry out accuracy assessment of the LULC map											
2.3.7	Hold a workshop to present the map and results											
2.3.8	Publish the map and report on the process and results											

Output 2.4 Deforestation, forest degradation and regeneration are monitored

Consistent and periodic monitoring of forest cover change is a cornerstone of a National Forest Monitoring System (NFMS). This output will produce a series of wall-to-wall maps showing changes in terms of deforestation, forest degradation and/or regeneration of forest for different intervals, resulting in official numbers on deforestation rate and area extents of classes.

In 2012-2013 the FCMU produced its first change map, the 'Deforestation map 2000-2009'. Accuracy assessment of this map will be carried out through activity 2.4.1 in accordance with the protocol developed with expert input from ONF International. In parallel with this activity, the FCMU will produce an updated deforestation map for the period 2009-2013 since the ACTO countries agreed together to update the regional deforestation map for that period. Suriname will prepare its national submission for the end of 2014 (activity 2.4.2) applying the same TerraAmazon based remote sensing methodology as for 'Base map 2000' and 'Deforestation map 2000-2009'. The map will be officially published on the national level after an accuracy assessment has been carried out in 2015 (2.4.3 and 2.4.4).

Choice of methodology

Synchronized with the process of developing an official methodology for the forest/non forest benchmark map (output 2.1), alternative methodologies for monitoring changes will be studied (activity 2.4.5). This will include the identification of possible options to interpret, distinguish and map post-deforestation classes (drivers), which has not been done so far in Suriname. Training opportunities may be provided through the ACTO project. Additional technical support will be sought for comparing different methodologies by learning how to use them and testing them on pilot areas. The procedure for developing the official national protocol to monitor changes in forest cover (activity 2.4.6) will be the same as for the benchmark map protocol (see output 2.1). The existing maps will be improved following the protocol (2.4.7) and an updated deforestation map for the period 2013-2015 will be produced based on the new protocol (2.4.8). Regeneration of forest may be included for some years but with lower frequency depending on decisions still to be made. The new and improved maps and numbers will be officially published in 2016.

Monitoring of forest degradation

In 2017 the FCMU will begin to develop a methodology for including forest degradation in the change monitoring (activity 2.4.12).

Forest degradation is the gradual destruction of forest areas that remain classified as forest, but with reduced capacity to provide ecosystem services such as carbon storage, timber, biodiversity habitats etc. It is only broadly defined since it can have different causes, implications and meaning in different contexts. Consensus is hard to reach because of different perceptions and priorities, linked to the interests of different actors in particular services or goods. International guidance on the topic is still unclear. Technical restrictions make it difficult to monitor forest degradation with remote sensing, since it is difficult on most types of satellite imagery to determine whether a forest is degraded or not.

Methodologies for monitoring forest degradation may improve with research that is ongoing around the world. Exchanges with ACTO countries may be useful for learning more and by 2017 international guidance will hopefully be clearer on how to address the topic. Imagery with special characteristics may need to be purchased and could be used also for the LULC map (see output 2.2). The change map for the 2015-2017 period is envisioned to include forest degradation for the first time in Suriname and results may be published in late 2018 (2.4.15). Additionally as pointed out in output 1.4, a PhD study on forest degradation could help to accelerate the national process to monitor forest degradation.

Using remote sensing for detection of logging remains very difficult. Nevertheless it has potential to support the field control procedures of the SBB. Technical possibilities will be assessed and some research based pilot studies on the topic could eventually be carried out within this output.

Activities leading to output 2.4:		2014		2015		2016		2017		2018	
2.4.1	Carry out accuracy assessment of the 2000-2009 deforestation map										
2.4.2	Update the deforestation map (2009-2013)										
2.4.3	Carry out accuracy assessment of the 2009-2013 deforestation map										
2.4.4	Publish provisional results for the 2000-2013 period										
2.4.5	Study alternatives to the currently used methodology										
2.4.6	Develop the official national protocol to monitor changes in forest cover (excluding degradation)										
2.4.7	Improve the existing forest cover change maps in line with the new protocol										
2.4.8	Perform the 2013-2015 forest cover change map										
2.4.9	Carry out accuracy assessment of the improved maps										
2.4.10	Hold a workshop to present results and official figures										
2.4.11	Publish the forest cover change maps, the protocols used for mapping and accuracy assessment, and official figures on the deforestation between 2000 and 2015 (3 subperiods)										
2.4.12	Develop a methodology to include forest degradation										

2.4.13	Perform the 2015-2017 forest change map, including degradation										
2.4.14	Carry out accuracy assessment of the 2015-2017 map										
2.4.15	Publish results for the 2015-2017 period										

Output 2.5 Tools for REDD+and land use planning are available

National land use planning in Suriname is currently ad-hoc. It needs to become more strategic and systematic in order to address several challenges such as preventing uncontrolled deforestation and forest degradation. Currently there are often overlapping land use rights granted for activities that may be conflicting, such as mining and logging, or logging and agriculture on the same piece of land. A roadmap for enhanced land use planning is under development through a project coordinated by the Ministry of Physical Planning, Land and Forestry (RGB) with funding from WWF. Furthermore the Stichting Planbureau Suriname (SPS) is planning to carry out a national agro-ecological zonation with technical support of the Brazilian organization Embrapa. The FCMU can provide tools for supporting these processes, such as baseline information about changes in land use due to drivers of deforestation, modelling future scenarios and providing suitability maps for sustainable timber harvesting. Products derived through earlier outputs will be useful for this, including the forest/non-forest maps (output 2.1 and 2.3) and the LULC map (output 2.2).

Assessment of drivers of deforestation

As part of the process for preparing the REDD+ strategy for Suriname, a number of background studies will be produced for strategic analysis and planning. One of those is a study for assessing and building consensus on drivers of deforestation, described in the PRODOC activity 2b4. SBB will be responsible for this study in collaboration with indigenous peoples and Maroon representative bodies and the REDD+ Major Groups Collective. It will be carried out in 2014-2015 through robust technical work embedded in a highly consultative process. A qualified consultant or consultancy firm will be hired by SBB to carry out an interdisciplinary analytic assessment using a mix of quantitative and qualitative research methods. The FCMU may support the consultant as needed by exploring the spatial footprint and monitoring options for various drivers, analysing satellite imagery and experiment in GIS with different approaches. The consultant may visit forest based communities to interview them about their perceptions of activities in the forest and carry out empirical ground observation.

The process should build upon the work that has already been carried out in Suriname regarding drivers of deforestation and forest degradation, notably the research report *"Spatial drivers of deforestation in Suriname"*[29] from 2011 by Sara Olga Ramirez-Gomez and the preliminary analysis of drivers included in the R-PP for REDD+. Qualitative and quantitative data on land use and related drivers will need to be collected from different institutions and ministries for statistical analysis in a way that is synchronized with the data collection mentioned in output 2.3 and 2.6. The same process needs to put extra focus on collecting geographical data for the specific time points 2000, 2009 and 2013, since this will be needed by the FCMU a year later when implementing activity 2.5.6. The result of the consultant's work will be a study analysing the systematic relation between direct

[29] http://www.csr.ufmg.br/dinamica/publications/sara_suriname.pdf

and underlying drivers of deforestation and forest degradation on the one hand and different REDD+ options on the other hand. Once the first draft is available, the SBB will facilitate a consultation process to review the expert report. This should include technical and public workshops in 2015 as well as a consultation process for indigenous peoples and Maroons organized in collaboration with their representative bodies. Feedback will be compiled and incorporated until national consensus is reached.

Preparing driver maps and modelling future deforestation

In 2015-2016 the FCMU will make use of geographical data for producing driver maps showing the causes of deforestation that took place between the years 2000, 2009 and 2013 (activity 2.5.6). This will be done through digitization or adaptation of existing data. The historical driver maps may later be used for predicting future deforestation through the development of a modelling tool (activity 2.5.7 to 2.5.10).

The REDD+ readiness process includes the development of a national forest reference level (REL/RL) to predict future deforestation in Suriname. In the coming years, the actual greenhouse gas emissions or removals will be compared to this reference when reporting on REDD+ performance. As mentioned in the PRODOC (see section 3.2), the REL/RL will be developed by a consultant to be hired in SBB (outside the FCMU and therefore not included in the budget of the FCM plan). The FCMU will collaborate with this consultant throughout the process of creating the modelling tool. The first step is a training session in which different existing methodologies for predicting future deforestation are compared and the ones that may be used in Suriname are selected (activity 2.5.7). The different steps involved in developing the model itself are to study the correlation between different drivers and deforestation, to estimate statistical significance, to prepare a risk map of deforestation and to select the most appropriate model based on comparison with observed deforestation (activity 2.5.8). A workshop and publication for presenting the results of the modelling exercise are expected by the end of 2016.

Monitoring drivers of deforestation

In 2017 the FCMU will develop a methodology to monitor drivers of deforestation and reassess the REL/RL localization (2.5.11). This will be based on the remote sensing activities that will already be performed for the LULC map preparation (output 2.3). The activity includes the creation of a database in which spatial data will be hosted, to be provided by different ministries upon request by NIMOS. The activity will be implemented by the FCMU team in collaboration with other institutions, the REDD+ technical MRV committee (if such a committee exists), and external technical support will be sought for reviewing and improving the protocol.

Suitability map for sustainable timber harvesting

Suitability mapping identifies areas where certain land use related activities can be implemented with better result than in other areas. A suitability map for sustainable timber harvesting can be a tool for maximizing income while limiting forest exploitation impacts. This map can be used within the application process for logging rights (concessions, community forest etc.) A draft suitability map for sustainable timber harvesting was developed after a training in spatial planning and suitability mapping that two current FCMU staff participated in 2009-2012, organized by

Conservation International (CI) Suriname. It was created in the software IDRISI. Activity 2.5.12 will improve the suitability map to make it a useful tool for the forestry sector and it will be published in 2017.

Activities leading to output 2.5:		2014		2015		2016		2017		2018	
2.5.1	Identify drivers of deforestation and forest degradation in Suriname										
2.5.2	Collect qualitative/quantitative data on land use from different ministries, institutions and organizations (linked to 2.3.1 and 2.6.5), especially geographical data for the 2000, 2009 and 2013 time points										
2.5.3	Prepare a qualitative/quantitative assessment of drivers of deforestation and forest degradation based on existing data										
2.5.4	Carry out a consultation process on the drivers of deforestation until national consensus is reached, involving IPs, Maroons and other stakeholders										
2.5.5	Publish the assessment study of drivers of deforestation										
2.5.6	Prepare driver maps for 2000, 2009 and 2013 (digitization or adaptation of existing data)										
2.5.7	Compare different existing methodologies for predicting future deforestation and decide which one(s) could be used										
2.5.8	Develop a spatial model to predict future deforestation locations										
2.5.9	Hold a workshop to present results of future deforestation modelling										
2.5.10	Publish the results of future deforestation modelling										
2.5.11	Develop a methodology to monitor drivers of deforestation and reassess the REL/RL localization										
2.5.12	Produce a suitability map for sustainable timber harvesting										

Output 2.6 Multi-purpose National Forest Inventory (NFI) is carried out

Remote sensing provides a wide range of information, but when establishing a forest monitoring system, it will remain necessary to continue collecting field data to complement the information collected by remote sensing sensors. A National Forest Inventory (NFI) is the systematic collection of field data from different forest types represented in a country. It can be designed to serve multiple purposes simultaneously depending on the parameters for which field data is collected. Purposes may include ecosystem monitoring, biodiversity research, carbon stock assessment and many others. For the REDD+ purpose, the NFI can collect data on carbon pools in the forest in terms

of above ground biomass, below ground biomass, soil organic matter, dead wood and litter. As an accepted alternative the Intergovernmental Panel on Climate Change (IPCC) has identified default values that may be used for estimating emission factors, but the carbon stock assessment becomes much more precise and reliable if field data from a NFI is used.

NFI pilot project 2012-2014

The execution of a National Forest Inventory (NFI), in a country like Suriname with a forest cover higher than 90% of its land area, is crucial for land use planning, and was already formulated within the Forest Management Act (1992) as one of the activities to enable sustainable forest management (SFM). An NFI requires strong institutional collaboration, commitment and a thorough expertise in forest inventory. A pilot project for a National Forest Inventory (NFI) was initiated in 2012 within the framework of a partnership between SBB and the Austrian Agency for Natural Resources Management and International Cooperation (ANRICA), focusing primarily on the purpose of timber stock assessment for SFM and carbon stock assessment for REDD+. Within this pilot project, ANRICA provides technical expertise to process forest inventory data, and additionally a novel approach is being tested to acquire inventory data, through seeking correlation between aerial photos and fieldwork. During the NFI pilot project 29 Sampling Units (SU) have been established in the field and data on timber and carbon stock was collected for these SU's. These field expeditions were co-financed by SBB, the World Wildlife Fund (WWF), Conservation International (CI) and the Coastal Management Project (SCPAM) of the Ministry of Physical Planning, Land and Forest Management (RGB) in Suriname. While the pilot project was initially meant to collect preliminary field data, lots of valuable experience necessary to carry out the complete NFI was acquired in amongst others the following subjects:

1) Training two field teams from SBB and one field team from CELOS (the CELOS carried out the fieldwork for four SU's financed by the SPCAM project) on applying the plot establishment and field data collection protocol
2) On-the-job training of junior tree spotters by senior tree spotters to determine vernacular tree species names
3) Identifying forest types on aerial imagery
4) Institutional strengthening (logistics and financial, prospection, and planning activities) of the SBB to prepare the fieldwork, also for very inaccessible field plots
5) Forest carbon calculations (needs to be further developed)
6) Community consultation and involvement
7) Formulation and updating field manuals
8) Estimation of costs to carry out field sampling

After completion of the field work in April 2014, the data needs to be processed and a report on the NFI pilot project will be compiled (2.6.1). The analysis involves interpretation of the aerial photos by comparing them with data and information from the field, as well as extracting parameters from the photos automatically, such as Normalized Difference Vegetation Index (NDVI), crown cover, texture etc. In order to extend the data set, aerial photos were also captured for a number of additional carbon plots established in 2010-2011 within the Forest Carbon Assessment and Monitoring project carried out by multiple institutions. If the novel approach to use aerial images for

the NFI proves to be successful, it will be possible to establish a correlation so that timber and carbon stocks can be reliably estimated also for the sampling units where field data has not been collected. The results of the NFI pilot project will be presented to the stakeholders during a workshop (2.6.2).

Designing a full-scale multi-purpose NFI

Following the pilot project there are plans to implement a full-scale National Forest Inventory for Suriname. Since this is a significant effort, the NFI will be designed to serve multiple purposes simultaneously. Which ones and how is still to be determined through activity 2.6.4, and stakeholders input can be collected through bilateral consultation, within an ad-hoc multidisciplinary working team and also during the workshop where the results of the pilot NFI will be presented (2.6.2).

Because of the complexity and the high costs of an NFI, enough time should be spent designing and planning this full-scale NFI. One of the crucial activities that will increase the chance of success is to build more capacity to plan and design an NFI, to carry out all different aspects of the NFI and to process the information (activity 2.6.3). Capacity will be built through trainings, but also by strengthening the NFI team by recruiting at least one forest inventory expert to coordinate the large NFI, and by collaborating with international organizations on specific activities. Currently some international collaborations are already identified including the possibility to get country support from ONF International within the *"REDD+ for the Guiana Shield"* project, and the support of UN-REDD within the framework of the PRODOC for REDD+, because the NFI is an inherent component of the NFMS and MRV system that will be established. The ONF REDD+ project will also provide training to NFI staff in forest inventory, carbon stock assessment and related topics through regional working group meetings and training sessions.

While mentioned within the FCM plan as the principle component to collect field data, the NFI is an extensive project, touching multiple disciplines and providing a range of outputs. Additionally, financial support needs to be provided to carry out this NFI. A detailed description of the NFI therefore needs to be written in a project proposal for a full-scale multi-purpose NFI (activity 2.6.4). Within this project proposal, the design of the NFI will be further elaborated upon, but also parallel project activities will be presented, including:

- Terms of Reference for recruiting a botanist within the NFI team responsible for the establishment of a protocol and/or field manual to determine tree species in the field, strengthening the collaboration with the National Herbarium of Suriname, seeking for collaboration with international (e.g. regional) partners to exchange information, building capacity of the NFI team in applying the field manual, collecting plant material for determination of species and encouraging a dynamic structure to keep the tree species list and field manual updated.
- Establishment of new allometric equations and/ or verification of existing regional or pantropical allometric equations. This can be done during the execution of the large NFI but also in close collaboration with the SBB and the private sector, by weighing trees and collecting samples from trees, logged for commercial purposes.

- Engagement of forest based communities to establish field plots in the vicinity of villages, but also to include the existing traditional knowledge regarding the forest resource within the NFI design where possible. In order to enhance the awareness and improve the collaboration and involvement in these often very remote villages, existing communication structures and networks will be used (e.g. REDD+ assistants and Indigenous Park Guards).

Throughout the project proposal formulation and implementation process it is recommended to use a stepwise approach, breaking up the full-scale NFI in sub-units that may geographically determined and that can be funded, finalized, evaluated and reported upon separately.

Reporting on timber stocks and carbon stocks

Before embarking on a full-scale NFI project, all the data and field information already existing from different sources on forest and non-forest classes will be compiled analysed (2.6.5). This will be synchronized with the process to compile data for the LULC map (output 2.3) and classification scheme (output 2.1). An intermediary report on available carbon stock data will be published in 2015 (2.6.6). Throughout the implementation of the full-scale multi-purpose NFI, intermediary reports on the estimated carbon stocks and timber stocks in Suriname will be published regularly (activity 2.6.9). These reports will be crucial input to the greenhouse gas inventory reports for REDD+ (see output 3.2) and are also relevant for sustainable forest management.

Activities leading to output 2.6:		2014		2015		2016		2017		2018	
2.6.1	Publish report on the National Forest Inventory (NFI) pilot project										
2.6.2	Hold a workshop to present results of the NFI pilot phase										
2.6.3	Training in forest inventory, carbon stock assessment and related topics including forest inventory statistics, botanical tree species determination, socio-economic assessment and involvement, etc										
2.6.4	Formulate a project proposal for a full-scale multi-purpose NFI (carbon stock assessment, sustainable forest management, biodiversity assessment, social use of forest, NTFP, etc)										
2.6.5	Compile and analyse all available field information on forest and non-forest classes										
2.6.6	Publish an intermediary report on available carbon stock data										
2.6.7	Prepare the full NFI implementation										
2.6.8	Carry out a multi-purpose NFI										
2.6.9	Report on the results of the multi-purpose NFI, including estimated carbon stocks and timber stocks in Suriname										

Output 2.7 Alert system for near-real-time monitoring of forest cover is in place

Near-real-time monitoring (NRTM) is helpful for discovering new deforestation earlier than what is possible with wall-to-wall mapping of change as in output 2.4. The purpose of such a system can be to provide early warning to institutions in charge of policy enforcement, so that they can respond quickly and put a halt to unplanned deforestation through interventions in the field. NRTM in Suriname will be designed to meet the needs of institutions responsible for controlling the sectors and activities linked to different drivers of deforestation.

Monitoring of forest fires

One possible cause of deforestation is natural or anthropogenic forest fires. This has not been a big problem in Suriname so far, but fires are becoming more frequent in parts of the Amazon mainly due to increasing drought. For some ACTO countries the problem is already acute and it could possibly become an issue also in Suriname in the future. For that reason it is relevant to stay informed about fire occurrence and analyse whether the frequency seems to increase.

The US National Aeronautics and Space Administration (NASA) provides a free information tool for near-real-time monitoring of forest fires, the Fire Information for Resource Management System (FIRMS). FIRMS provides global fire maps and active fire location alerts using MODIS 250m x 250m resolution satellite data. It is possible to sign up to receive free e-mail alerts when fires are detected in the area of interest.[30] The FCMU will follow up develop a procedure to monitor forest fires in Suriname using FIRMS (activity 2.7.1) and prepare an annual report on forest fire statistics including graphs and a map of fire spots in Suriname (2.7.2).

Collaboration with other institutions can provide useful information regarding forest fires in Suriname. For example the Amazon Cooperation Team (ACT) has good contact with people in Kwamalasamutu where anthropogenic forest fires occur for achieving food security, accessibility etc. The FCMU will stay updated on evolving trends regarding forest fires in Suriname and international methodologies for monitoring forest fires. Training on forest fire monitoring is also scheduled through the ACTO project.

Tool to compile deforestation alerts

Activity 2.7.3 to 2.7.5 aim to develop a tool that enables crowd-sourcing of information about what is going on in the forest. For the time being there is no centralized channel for people to inform the authorities when discovering unplanned deforestation activities in the forest. Several institutions receive such alerts orally now and then but a formal structure is missing. The information might not always reach the responsible organization properly and follow-up is often not adequate. The FCMU will take the lead in exploring options for an alert tool and design how it could work. In other countries there are different ways to submit alerts via smartphone, sms, GPS, the internet, phone calls or mail to a central point. Alerts may be made publicly visible through a web interface online or kept more discrete. After developing the tool it may be more relevant if it is coordinated by another institution that is mandated to take action. Possible options could be NIMOS, OGS, GMD or NCCR but this is still to be discussed. The FCMU would provide training to this institution on how to use

[30] FIRMS alerts signup page: https://earthdata.nasa.gov/data/near-real-time-data/firms/fire-email-alerts

the tool (activity 2.7.4). Besides the general public, also government officials operating in the field (forest guards, soldiers etc) can register deforestation alerts to such a system. Every six months from 2017 the FCMU could receive all the alerts from the past six-months period and display them as points on a map to show how the tool has been used (2.7.5). A global initiative to provide such a system is the "Global Forest Watch".[31] It might be recommendable to evaluate how this system could also be applied on a national scale.

Community-based monitoring

Forest dependent communities and people who go often to the field (certain NGOs, logging companies etc) can collect information on changes that are not easy to detect through remote sensing. It may be particularly important in areas of forest degradation and where there are opportunities for forest carbon stock enhancement. Activity 2.7.6 aims to study options for a community-based monitoring system based on the Surinamese REDD+ strategy, technical feasibility and relevance of such a system. Community-based or participatory forest monitoring recognizes the role of communities in keeping track of activities in the forest and contributing data to the National Forest Monitoring System (NFMS). This is not only part of output 2.7, but the aim with these activities are to involve communities in several technical outputs (Program 2) as well as information sharing (Program 3). Capacity building for this purpose was addressed in output 1.3.

Recognition of the role of local actors in forest monitoring is an important element of REDD+. Depending on how it is applied it may provide green jobs that contribute to the livelihoods of rural poor communities and improves the long term success of policy responses. Different kinds of community-based monitoring systems are tried out in different locations with varying results. This activity will compare existing options and case studies to gain methodological insights. Options could be identified through desk research and exchange with other countries in the Amazon region and beyond.

After collecting input from elsewhere and assessing existing national initiatives from government, NGOs and the private sector that can contribute to data collection and communication, stakeholders in Suriname will be consulted to develop a strategy suitable for the national context. It is important to recognize different aspects of this system. One important aspect is community engagement. This entails collaborating on the methodology, specifying what will be measured, how and why. It also includes the necessary capacity building. Another important aspect is the data and information flow. This includes data collection in the field, data transmission, data analysing and data and information communication.

Community-based monitoring is already tried out in Suriname so there is no need to start from scratch with this activity. It is important to recognize existing initiatives and structures from the government, civil society and private sector that can contribute to a community based monitoring system. One example is the Amazon Cooperation Team (ACT) that has trained indigenous park rangers in different indigenous villages in the interior through a project that could be continued and scaled up. The rangers are recruited to provide mainly ecological field data from their respective areas and could be asked to collect different information if needed and report to relevant institutions. Another example is the administrative structures for information and communication flows that are set-up through the Ministry of RO. Also, the communication infrastructure set up within the Civil Aviation (Luchtvaart dienst) to collect and transmit information about the airstrips.

[31] http://www.globalforestwatch.org/

Tropenbos is active in upper Suriname and partnership might be created for including this initiative as a pilot project for forest cover monitoring. The REDD+ Assistants Collective could be engaged in designing and supporting the implementation of community-based monitoring.

Within this mechanism it is also important that there is a systematic way to provide feedback to the communities. Products created by the FCMU are shared with the communities and information exchange for improving monitoring efforts could also be the other way around. When the FCMU discovers something strange on satellite images and want to know what it looks like in the field, they can request a check-up from rangers or local people in the area concerned.

Remote sensing based NRTM

Activity 2.7.7 will study options for remote sensing based near-real-time monitoring to see if it can be implemented by the FCMU, which methodology could be used and which areas to focus on. Basic NRTM may be carried out with freely available tools, such as downloading Landsat images as soon as they become available online (every 16 days) and checking whether new areas of non-forest can be detected. This could be limited to certain hotspots that are predicted to be more vulnerable to deforestation, such as for example mangrove forests, forest in nature reserves or forest in the greenstone belt. To explore this option a bit more, it is recommendable to start with the execution of one or several pilot studies in relevant pilot areas (such as mangrove forest around Paramaribo). Depending on needs and available resources it may become necessary to invest in high resolution imagery for certain areas, such as Rapid Eye with 5m x 5m resolution or Sentinel 2 with 10m x 10m resolution. The financial feasibility for this will be checked and might require additional budget to be estimated in 2018. Different methodologies for NRTM have been developed around the world and their technical feasibility and applicability to Suriname will be tested.

Activities leading to output 2.7:		2014		2015		2016		2017		2018	
2.7.1	Develop a procedure to monitor forest fires using FIRMS										
2.7.2	Prepare an annual report on forest fire statistics (including a map of fire spots in Suriname)										
2.7.3	Develop a tool to compile alerts on deforestation/degradation										
2.7.4	Provide training in how to use the tool and identify coordinating institution to take actions										
2.7.5	Prepare maps for the coordinator of the alert tool										
2.7.6	Study options for a community-based monitoring system based on the Surinamese REDD+ strategy, technical feasibility and relevance of such a system										
2.7.7	Study options for remote sensing based near-real-time monitoring to see if it can be implemented, which methodology could be used and which areas to focus on										

Figure 23. Example of what NRTM might look like.

5.3 Information and data sharing about forest cover and monitoring efforts (Program 3)

When data has been generated through program 2, it needs to be spread for potential use by different actors for multiple purposes such as policy enforcement, land use planning, sustainable forest management, biodiversity conservation and REDD+. In that regard the objective of program 3 is ***"to make data and information about changes in forest cover understandable and accessible to policy-makers, communities and other stakeholders"***.

The following three outputs are planned to together result in outcome 3:

Output 3.1	Mechanisms for regular involvement of stakeholders including policy makers and forest based communities are created and maintained
Output 3.2	Functional online tools and technical platform for data and information sharing are available
Output 3.3	International reporting is carried out, providing data from forest cover monitoring when required from Suriname or for voluntary submissions
Output 3.4	Outreach materials and awareness activities for informing the national community are in place
Outcome 3: Information and data about changes in forest cover is made understandable and accessible to policy-makers, other stakeholders and the general community.	

Output 3.1 Mechanisms for regular involvement of stakeholders including policy makers and forest based communities are created and maintained

While most of the FCM plan will be implemented by the FCMU, several other institutions will be involved or take the lead in the delivery of certain outputs. In order to make sure that forest cover monitoring is carried out in ways that bring the maximum benefits to the country as a whole, it is important to create forums where interested actors can come together and exchange experiences, establish collaboration, take stock at what has been achieved so far and make suggestions for the future.

Annual public workshop on forest cover monitoring

Once every year a public workshop will be organized to inform a broader audience about forest cover monitoring efforts and to share the latest information about status in forest cover (3.1.2). This occasion will be used for collecting feedback from the community on adjustments needed to the FCM plan based on expectations for the coming period and a collective analysis of problem causes and effects can be carried out. The table of national drivers of deforestation presented in Section 2.3 on "Expectations regarding the dynamics in forest cover" will be reviewed to see if the situation has changed and if new drivers need more attention than before. The annual progress reports formulated by the FCMU will be presented and the strategic and logical frameworks of the FCM plan may be updated in the workshop.

There is currently no funding available for these annual workshops. For this reason the events may need to keep a low profile and be held in Paramaribo. However, if possible to raise funds the workshops could be scaled up so that forest based community representatives from other parts of the country could be invited and supported to come. Translation to local languages would then be provided.

Technical working group on forest cover monitoring

The annual workshops are good for providing an overview of the situation and status of the FCM plan. However, successful implementation throughout the year requires more frequent exchanges between institutions and people involved in implementation. In that regard, activity 3.1.2 suggests to establish a "technical working group on forest cover monitoring" as a mechanism for regular involvement of stakeholder institutions and decision makers. The working group will be open to technically interested stakeholders who wish to stay up to date with the implementation of the FCM plan, which is dynamic and needs regular review in line with the principles of adaptive management. A mailing list will be created for communication and exchange between working group members. Draft reports and protocols will be circulated on the mailing list for consultation and comments will be welcomed. Existing initiatives for technical exchange will also be supported or engaged, for example the Spatial Planning Group that was established to strengthen the Green Suriname vision in 2009.

Ad-hoc working groups on specific topics

Throughout the implementation of various activities in the technical program, the need may be identified for small groups to come together from different institutions for targeted discussions, project design or problem-solving of specific topics. An ad-hoc working group could be then be formed to address the issue, so that experts with different perspectives can come together in a multidisciplinary context to brainstorm and join forces. In some cases the ad-hoc working group could be called a research team, depending on the purpose of the in-depth working sessions. As a first example, it is mentioned in Output 2.6 that an ad-hoc working group is needed for designing the multi-purpose National Forest Inventory.

Activities leading to output 3.1:		2014		2015		2016		2017		2018	
3.1.1	Carry out an annual workshop for all stakeholders to present the results of the past year and the plan for the coming year										

3.1.2	Establish and facilitate a "technical working group on FCM" (discussion, submission of reports and protocols, etc)											
3.1.3	Establish ad-hoc working groups on specific topics included in the FCM plan when needed											

Output 3.2 Functional online tools and technical platform for data and information sharing are available

Functional tools are needed for sharing the data produced by the FCMU with all potential users, including other institutions and the public in Suriname, in the region and internationally. When data is available and transparent it can be recycled by others and processed to benefit multiple purposes and Suriname as a whole. Suriname has also committed to report internationally on changes in land use and forest cover including for the purpose of REDD+.

NFMS platform online for data sharing and transparency

According to the PRODOC for REDD+, SBB will be tasked to establish and maintain an online NFMS platform for data sharing and transparency. This is addressed in the FCM plan by activity 3.2.1. The platform will be for the whole multi-purpose NFMS and not only for REDD+ purposes. It will mainly be a channel for the FCMU to make their data publicly available through a GIS platform through a central point online where data can be uploaded and become freely accessible to others. It can include GIS layers as well as remote sensing data and mapping products. Activity alerts received through participatory monitoring (see output 2.7) could potentially be added to the same web interface. The platform could be inspired by existing NFMS platforms that have been developed in other countries with support of the UN-REDD programme.[32] Technical and IT assistance will be mobilized as needed for the establishment of the online platform.

Data sharing on online platforms administered by others

The need for enhanced data sharing between all institutions in Suriname was stressed in most of the consultation meetings held in preparation for the FCM plan. This concern relates not only to forest cover monitoring but is a need experienced for multiple purposes in the different institutions consulted. Several initiatives were identified to already be underway in other institutions for creating joint online platforms for data sharing, both in the field of GIS and remote sensing and beyond. While the creation of a broad multidisciplinary data sharing platform falls outside the scope of the FCM plan, such an initiative would be welcomed if spearheaded by other actors. The FCMU is fully prepared to contribute to one or more collaborative online platforms by sharing data, providing the GIS/RS knowledge matrix[33] and participate actively in related discussions on data sharing protocol, standards and procedures for quality check (activity 3.2.2).

The platform initiatives mentioned in the consultation rounds are the following:

[32] http://nfms4redd.org/

[33] The knowledge matrix tool is available here: https://docs.google.com/a/onfinternational.org/spreadsheet/ccc?key=0Aldbc6yNK-g4dHd5dm9oRVMxNEVkTXBKeEJoVVUta2c&usp=drive_web#gid=0

- Caribbean Knowledge and Learning Platform (referred to by AdeKUS)
- Platform to be set up by the Stichting Planbureau Suriname in line with their national mandate
- Guiana Shield Facility Platform
- Environmental information and knowledge platform to be established within project *"Mainstreaming global environment commitments for effective national environmental management"* by the Ministry of ATM, UNDP and GEF.

On the regional level, the REDD+ for the Guiana Shield project[34] is planning to create an online platform for exchange between forestry services in Suriname, Guyana, French Guiana and Amapá in Brazil. This platform will include for example a discussion forum and an online library on topics related to forest cover monitoring, drivers of deforestation and forest degradation and modelling of future deforestation.

The FCMU will also contribute to the Global Forest Watch, a worldwide platform on forest cover monitoring.[35]

National Registry for monitoring of REDD+ outcomes

The need to develop a National Registry of REDD+ finance and activity was recognized in the R-PP and tasked to SBB in the PRODOC. The registry will comprise the registration process, data collection and monitoring of REDD+ policies and measures. A desk review will be carried out for identifying the scope needed and formulating Terms of Reference (ToR) for the activity. Technical assistance will then be hired to thoroughly review relevant national and international experiences and to formulate ToR for the registry itself. A technical workshop will gather experts to identify options and evaluate their pros and cons. After additional consultations to harmonize the registry design with other elements of the NFMS, the registry will be set up with technical and IT assistance. A guidebook of processes and procedures for accreditation as well as training material will help to engage REDD+ developers and entrepreneurs in preparing activities to be registered.

Activities leading to output 3.2:		2014		2015		2016		2017		2018	
3.2.1	Establish, maintain and coordinate an NFMS platform online to share data generated by the FCMU with institutions and the public										
3.2.2	Contribute to the establishment of multidisciplinary data sharing platforms (knowledge matrix, discussions on data sharing protocol, standards/quality check…)										
3.2.3	Develop a REDD+ National Registry and monitor the outcomes of REDD+ activities										

[34] http://reddguianashield.com/
[35] http://www.globalforestwatch.org/

Output 3.3 International reporting is carried out, providing data from forest cover monitoring when required from Suriname or for voluntary submissions

The FCMU has to report to ACTO and deliver products that are agreed on the regional level between the member countries. In addition, like other member countries of the United Nations and other international collaboration structures, Suriname has agreed to report national data in different formats to various processes. Some of those relate to forest cover, land use and land use change and are therefore addressed through the FCM plan.

Forest Reference Emissions Level / Reference Level (REL/RL) for REDD+

Countries that wish to participate in REDD+ need to submit a Forest Reference Emissions Level/Reference Level (REL/RL). The UNFCCC Conference of the Parties has issued three decisions that provide guidance on the development of a REL/RL in line with international requirements and national circumstances. The PRODOC establishes that SBB is responsible for the REL/RL preparation and submission for Suriname and that it will be done in a step-wise approach. Some of the steps are covered in Programme 2, namely the updating of the national forest definition and the gathering and analysing of historical activity data and available emission factors data. In order to guide the preparation of a suitable REL/RL, an assessment of national circumstances for Suriname as a country with high forest cover and low deforestation (HFLD) will be carried out jointly by SBB and NIMOS in 2014-2015. A first REL/RL for Suriname is expected to be ready for submission in 2016 (activity 3.3.1) and an updated and improved one in 2018 (3.3.2). Activity 3.3.1 and 3.3.2 in the FCM plan are fully synchronized with 3b5 and 3b6 in the PRODOC and more details can be read there.

Greenhouse gas inventory for the UNFCCC including REDD+

For the United Nations Framework Convention on Climate Change (UNFCCC), Suriname has submitted a first National Communication including a greenhouse gas inventory. A second National Communication has been prepared but not yet submitted to the UNFCCC. The greenhouse gas inventories have a broader scope but include forest cover changes and emissions from land use change, so the FCMU will be involved in providing data to future National Communications as needed. Biennial Update Reports (BUR) for the UNFCCC also include GHG emissions and removals from the forestry sector.

Greenhouse gas inventories focused on the forestry sector are also part of REDD+. The FCM plan contributes to the establishment of a Measurement, Reporting and Verification (MRV) system for REDD+ that tracks performance in terms of reduced emissions from deforestation and forest degradation. Programme 2 of this plan contributes to the 'M' in MRV by measuring changes in forest cover and carbon stocks. Activity 3.3.3 will develop a system for reporting and verification, 'R' and 'V' in MRV.

Reporting is the compilation/publication of data resulting from measurement and of information used for estimations. Specific requirements and guidelines need to be followed to ensure that data are reported uniformly over time and between countries. Information submitted through the National Registry mentioned above will be used for the reporting. Verification is the process of checking the accuracy/reliability of reported information, including the quality of the procedures or methodologies used to produce the information. Programme 2 of the FCM plan establishes that the FCMU will carry out accuracy assessments of the maps it produces to ensure the quality of the

reported data. Verification of submitted information is not only a self-check but is also done on the international level in line with UNFCCC decisions.

Activity 3.3.4 will convey the findings to the international public through a greenhouse gas (GHG) inventory for the REDD+ purpose. The basic equation for estimating GHG emissions from land use related activities is to multiply activity data (AD) with emission factors (EF). Activity data on land use change is acquired through satellite image interpretation and production of change maps. Emission factors are numbers related to carbon pools in above ground biomass, below ground biomass, soil organic matter, dead wood and litter as collected through the National Forest Inventory (see output 2.6). The first comprehensive GHG inventory report of Suriname for the REDD+ purpose will be performed in 2018.

Global Forest Resources Assessment (FRA) of the FAO

The Committee on Forestry of the Food and Agriculture Organization (FAO) has adopted a long-term strategy for *"supporting sustainable forest management through the global forest resources assessment"* 2012-2030.[36] The strategy includes to carry out an assessment of forest resources (including information on the goods and services provided by forests) on a global basis every five years and to estimate the changes in forests and their uses that have taken place since the previous assessment. The FAO has been working on worldwide assessments of forest since the 1940s with increasing quality over time. The methodology for the Global Forest Resources Assessment (FRA) includes that each country is responsible for submitting data and information about their own forest resources by responding to a standardized questionnaire provided and explained by the FAO. Suriname has participated in previous FRAs and most recently the SBB submitted data in 2013 for the FRA 2015. The FCMU was closely involved in this activity and provided data for most of the tables in the questionnaire. Preparations for the FRA 2020 are expected to start in 2018 as indicated by activity 3.3.5.

Activities leading to output 3.3:		2014		2015		2016		2017		2018	
3.3.1	Prepare and submit a first national forest Reference Emissions Level / Reference Level (REL/RL) for REDD+										
3.3.2	Prepare and submit an improved national forest Reference Emissions Level / Reference Level (REL/RL)										
3.3.3	Develop a reporting and verification system for the REDD+ purpose (including consultation, technical support, etc.)										
3.3.4	Perform the first comprehensive GHG inventory report for the REDD+ purpose										
3.3.5	Prepare the national submission from Suriname for the Global Forest Resources Assessment (FRA 2020)										

[36] http://foris.fao.org/static/data/fra2010/FRALongTermStrategy_En.pdf

Output 3.4 Outreach materials and awareness activities for informing the national community are in place

Outreach is important for making sure that the general public is aware of efforts to monitor forest cover, appreciate the rationale behind and get the right explanations for understanding the data that is presented. Output 3.4 includes the creation of outreach materials such as visual posters, story maps, brochures and websites with layout that convey messages about the status of forest cover in ways that are understood by the public. Communication materials will be translated into different local languages and tailored to audiences such as local communities, youth, indigenous peoples, policy-makers, NGOs or the private sector.

In addition to written materials, this output also includes awareness activities such as presentations and open door events. The FCMU is willing to welcome those who want to learn more about forest cover monitoring to come for a study visit to the office and gain some hands-on experience. It will also be possible to book FCMU staff to give lectures or workshops, for example at the University. This might also inspire students to specialize in forest monitoring related subjects. SBB has a weekly radio programme in which the FCMU will keep sharing regular updates. Making a film, short video clips or get active in social media are other possibilities. Also forest based communities should be informed about the project and this could be done by visiting remote areas to show video material in the villages.

Activities leading to output 3.3:		2014		2015		2016		2017		2018	
3.4.1	Share general information regularly about the project status (on SBB website, brochures, posters, forestry sector analysis…)										
3.4.2	Carry out awareness activities to inform the public about forest cover monitoring (open door events by the FCMU, info to students, presentations, radio, film, etc)										

6. MANAGEMENT TOOLS

This section establishes tools and mechanisms that will be useful for management of the programs towards a highly functional multi-purpose National Forest Monitoring System.

6.1 Structure and institutional coordination

This section describes the structure of the multi-purpose National Forest Monitoring System (NFMS) of Suriname that will be created and sustained through the implementation of this plan.

The diagram on the following page shows the NFMS of Suriname (black square) in terms of institutional arrangements. All the boxes inside the square are the elements of the NFMS. The dashed lines show the larger systems that the NFMS is embedded in, is affected by and needs to relate to.

This diagram shows only the system elements and not the interconnections between them, flows through the system or the function/purpose of the NFMS. Those components of the system are

addressed in other sections, see for example section 4 on purpose, 6.2 on budget flows and 6.3 on information flows.

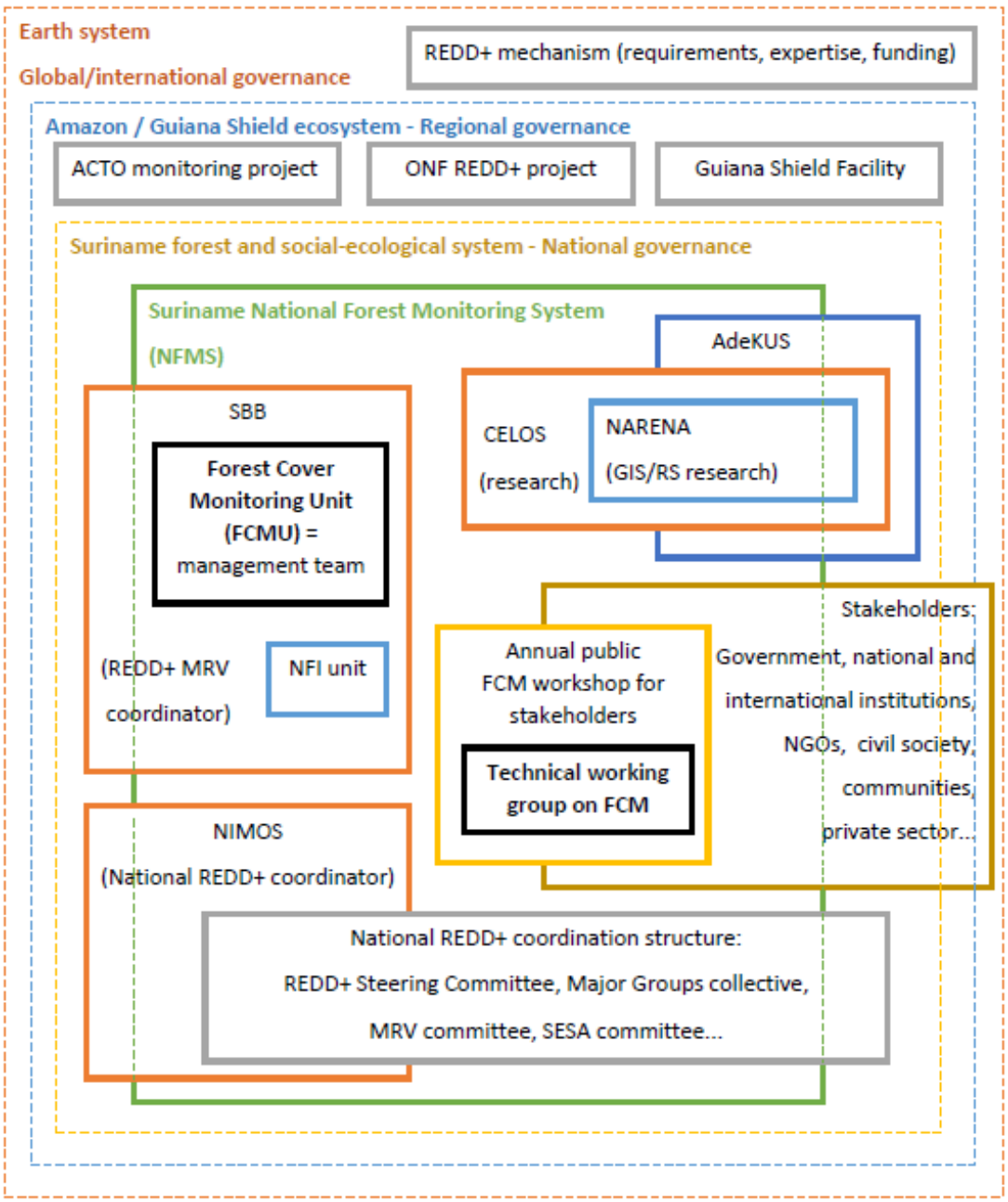


Figure 24. Diagram showing the NFMS institutional framework, with emphasize on the satellite forest cover monitoring component

Technical coordination of the implementation of the FCM plan

The Foundation for Forest Management and Production Control (SBB), as the implementing technical arm of the Ministry of Physical Planning, Land and Forest Management (RGB), envisions sustainable use of the national forest resource. Within the REDD+ Readiness Preparation Proposal (R-PP), the SBB was proposed to be the institution responsible for the implementation and technical coordination of the Measurement, Reporting and Verification (MRV) component as well as monitoring for other purposes within a National Forest Monitoring System (NFMS). Even though no financing mechanism for REDD+ is in place yet, SBB has taken this responsibility very seriously by

taking the lead over the last years in preparing for these new tasks. In this context, in collaboration with multiple other institutions, the SBB coordinated the Forest Carbon Assessment and Monitoring Project and initiated the pilot project for a National Forest Inventory (NFI). Consequently, within the ACTO project the SBB was appointed as the focal institution to embed the FCMU in the existing structure, overview and coordinate the activities carried out by the FCMU. As a unit working in close collaboration with the Directorate Research and Development of the SBB (one of the red squares in the diagram), the FCMU receives technical guidance and administrative, logistical, financial, infrastructural and IT support from the SBB.

The Forest Cover Monitoring Unit (FCMU) (see section 5 output 1.1 and 1.2) will be the main implementer of the FCM plan. The project management team is composed of the FCMU coordinator and staff and supported by the Directorate of Research and Development. As project manager, the FCMU will coordinate the actions related to forest cover change monitoring. The FCMU will provide internal reports every six months to the CEO of SBB as well as annual progress reports that will be publicly available.

As described in output 3.1, other institutions are involved in the technical coordination of the plan by participating in Technical Working Group on Forest Cover Monitoring and the Annual public Workshop. The FCMU will serve as the secretariat for this Working Group and organize the Annual Public Workshop on FCM.

Through the annual meeting of observatory rooms, the countries agree on a common technical agenda. As other observatory rooms, the FCMU will report to the Regional Coordinator of the ACTO project on the progress made towards the achievement of these regionally determined activities.

Linkages with research institutions

As explained in section 5 output 1.4, academic research is a crucial part of the NFMS. AdeKUS is the only university in Suriname, involved in several topics and partly included inside the box that represents the NFMS in the diagram. Its research center CELOS has a mandate more closely aligned with the NFMS and will play a more central role. The unit within CELOS called NARENA is working with GIS and remote sensing and the same kind of technical tools as the FCMU. CELOS and NARENA will support many of the activities included in the FCM plan and will add value to the NFMS by active involvement in knowledge production related to FCM. See section 5 output 1.4 for more details.

Linkages with the REDD+coordination structure

Special relations need to be established between the NFMS and the institutional structure for REDD+ implementation in Suriname. The NFMS will serve multiple purposes in addition to REDD+, but the fact remains that much of what the NFMS will deliver is required for REDD+ Measurement, Reporting and Verification (MRV). The FCM plan responds only to a part of the NFMS/MRV needed for REDD+ but all opportunities for synergies will be used. SBB and the FCMU will collaborate closely with NIMOS and the REDD+ Steering Committee, the Major Groups Collective and the REDD+ Assistants Collective. SBB will be MRV coordinator for REDD+ and part of this responsibility is delegated to the FCMU, as well as to the NFI unit that will be hired (when output 2.6 is implemented). Depending on how the REDD+ process evolves, the dynamic FCM plan will become more and more aligned as a direct contribution serving the REDD+ strategy of Suriname. If

fragmentation and overlap in activities would be discovered it will be replaced by full synchronization and mutual support.

Roles of national stakeholders

The following table attempts to describe the role that different national stakeholder institutions will play in the implementation of the FCM plan. The information in the table is based on discussions held with the institutions in the consultation rounds and national workshop organized as part of the formulation process of the FCM plan. The list is not exclusive and the information provided is not formally approved and set in stone so the list should be seen as an indicative tool that is fully dynamic and flexible. Institutions that wish to update their role are welcome to contact the FCMU.

Description of the institution's possible role in FCM plan implementation	Related outputs
Anton de Kom Universiteit of Suriname (AdeKUS)	
The University of Suriname is a knowledge and resource base that houses among others the faculty of Technological Sciences and the Institute for Graduate Studies and Research. Also the different research centers like CELOS, Herbarium and NZCS are linked to the AdeKUS. The university can play a role in providing capacity building and infrastructure for capacity building and by encouraging scientific research. Furthermore they could play a leading role in establishing an information sharing platform. FCMU will also involve students in their activities. An MoU is recommended.	All
Dienst Bodem Kartering (DBK)	
DBK can share the tremendous amount of historical soil maps and aerial pictures with the community.	2.3
Foundation for Forest Management and Production Control (SBB)	
SBB's role has been discussed extensively throughout the FCM plan, because it is the national focal institution responsible for the execution of the FCM plan and the establishment of the NFMS/MRV system. SBB is hosting the FCMU established by ACTO. The institution promotes sustainable forest management in Suriname and implements several tools for good forest governance.	All
General Office of Statistics (ABS)	
ABS collects different types of data that could be shared serving multiple activities. They were also identified as one of the potential leaders of a data sharing platform. The data collected within the plan could be used for the Environmental Statistics they need to produce, or to get a better understanding of different land uses. MoU or other agreement is needed.	1.3 2.1 2.3 2.4 2.6
Geological Mining Service (GMD)	
The GMD would like to be included in all capacity building activities related to GIS/RS. They have lots of information available (topography, mining rights, mining activities, mineral occurrences…) but solid agreements would be needed to share this information. GMD would need an updated mineral map for Suriname. Currently they are responsible for the execution of the ABC project where a new geological map for area close to the border with Brazil is developed in collaboration with Brazilian institutions. GMD indicated to be interested in a pilot project for NRTM with a frequency of 2-3 months in the greenstone belt, specifically in newly mined areas. Field measurements (NFI) could be carried out in close collaboration.	1.1 1.2 1.3 2.1 2.3 2.4 2.5 2.6 2.7, Program 3

GIS Software Application & Training N.V. GISsat	
GISsat N.V. is the international distributor for ESRI software in Suriname and reseller for the Mapping & GIS and the Survey product line of Trimble. They could play a role in the execution of the plan by providing training, GIS/RS software and software support and satellite imagery (e.g. Rapid Eye). Furthermore they use drones for mapping services. If there is funding available, images captured by drones could be used for the accuracy assessment and for NRTM. An example of a mapping project they have carried out is a community mapping project in Goensi. As a provider of ESRI software they could support a data sharing platform using ArcGis Online.	1.1 1.2 1.3 2.2 2.3 2.4 2.5 2.7 Program 3
Grassalco N.V. (private mining company)	
As a private mining company Grassalco could provide information on their mining rights and areas that have been mined (output 2.3). They indicated that they can provide information on abandoned mining areas which are regenerating. The data provided by FCMU could support them to get an overview of areas that have been mined before.	2.3 2.4 2.5 Program 3
Association of Indigenous Village Leaders in Suriname (VIDS)	
Collaboration could be established to enhance community based monitoring and to establish an infrastructure to strengthen data sharing with the communities.	1.3; 2.6; 2.7; Pr. 3
Maroon communities representatives - Association of Saramaka Authorities (VSG)	
Collaboration could be established to enhance community based monitoring and to establish an infrastructure to strengthen data sharing with the communities.	1.3; 2.6; 2.7; Pr. 3
Indigenous communities representatives - Sanomaro Esa Foundation	
Collaboration could be established to enhance community based monitoring and strengthen data sharing.	1.3; 2.6; 2.7; Pr. 3
Management Institute Land Registration and Land Information System (MI-GLIS)	
MI-GLIS could contribute to the execution of the plan in the following specific areas: enabling capacity building, providing cartographic standards and official layers, collaboration to carry out field measurements and facilitate data sharing among institutions. MI-GLIS proposed the possibility to jointly acquire RS-images (aerial pictures or high resolution images).	All
Maritime Authority Suriname (MAS)	
The MAS has bathymetric, nautical and coastal maps available. They indicated to be interested in various data outputs of the FCMU, such as topographic data along the river bank for points of recognition, industrial development of shipping and islands in the river.	
Meteorological Service	
The meteorological service could provide climatological data and maps to be used for the LULC map. The information generated by the FCMU related to land use change could help them to get a better understanding of changes in the micro and macro climate.	2.3 2.4 Pr. 3
Ministry of Agriculture, Livestock and Fisheries (LVV)	
Provide information about agricultural and livestock areas. Provide long term development plan and projects showing where deforestation and/or forest degradation might take place. Can use the information from the FCM plan to update or formulate their long term development plans.	2.3
Ministry of Defence	
Can provide support to enforce law where illegal mining (deforestation) takes place. Prevent or respond to forest fires and natural disasters. Support field monitoring.	

Ministry of Education and Community Development	
They can provide information about Human Capacity. They can also support scholarships and scientific research regarding forest monitoring and remote sensing.	1.1
Ministry of Finance	
May provide funds or support fundraising for implementation of the FCM plan.	
Ministry of Foreign Affairs (BUZA)	
Support FCMU through its participation in regional projects such as the Multilateral Environmental Agreements. Political focal point of the ACTO project "Monitoring of the forest cover in the Amazon Region". Promote the FCMU and facilitate fundraising.	All
Ministry of Internal Affairs	
Support awareness raising within forest based communities. Support field activities to gather necessary field data.	
Ministry of Justice and Police	
Enforcement of law. React to and deal with forest fires and other natural disasters.	
Ministry of Labor,Technological development and Environment	
Support in education and awareness activities regarding deforestation in Suriname. Provide environment data and data about implementation of environment related conventions.	Pr. 3
Ministry of National Health	
Provide health information about forest based communities and about possible threats (Malaria) that might occur in the Interior.	
Ministry of Natural resources (Ministry NH)	
The ministry of NH could foresee information on long term planned developments and projects. The information created by the FCMU could be a way to verify the implementation of the planned activities in the field and to detect unplanned deforestation.	2.2 2.3 2.4 2.5; 2.7; Pr. 3
Ministry of Physical Planning, Land and Forestry (RGB)	
Directorate Forest Management: As described previously in this document, the FCMU carries out a role in the ACTO project delegated by the Ministry of RGB to SBB. A regular update of the project status is required. Awareness activities could be developed jointly and all information created by the FCMU should be shared with the Ministry. This Ministry is also responsible for producing land use and land use planning maps. The FCM plan can provide important information to produce those maps. **Directorate Nature Management:** For this department of the Ministry it is very important to do NRTM of the protected areas and the mangrove forest in the MUMA's. This would allow them to act more efficiently in the field when unplanned (or illegal) activities take place. Also the establishment of small recreational camps within the protected area needs to be traced, but this might be difficult with the available imagery. They could provide input to the determination of the definition of forest. Additionally they would like to involve their GIS experts within the capacity building activities of the FCMU. A collaboration between the FCMU and the SCPAM coordinating unit should be established.	All 1.3 2.1 2.7
Ministry of Regional Development (Min. RO)	
The Ministry of RO disposes of an infrastructure to communicate with all the villages	Program 2

and forest based communities. Therefore they will play a crucial role in the engagement of the communities within the execution of the FCM plan, including the community based monitoring and the NFI. The data on deforestation, land use and land cover delivered by the FCMU could help the Ministry to plan their projects and activities.	Program 3
Ministry of Social Affairs and Public Housing	
They can provide information about land use planning regarding housing.	2.3
Ministry of Trade and Industry	
Support to give FCMU information about economic activities taking place in specific areas. We can analyze or have a better view on the effects of industry and trade on the environment.	2.3 2.4
Ministry of Transport, Communications and Tourism (TCT)	
To give the FCMU actual information and future development regarding communication on accessibility and reachability of communities; To give information about further expansion and modernization of infrastructure regarding telecommunications, transport and tourism.	2.3 2.4
National Herbarium Suriname (BBS)	
The BBS plays a very important role in the execution of the National Forest Inventory as they are responsible for the official list of tree species, the national plant collection and the identification of tree species. The data produced by the FCMU can be used by the BBS to plan their research activities. The trees species identified in collaboration with the BBS will extend the national herbarium and the knowledge of tree species biodiversity.	2.3 2.4 2.6 Pr. 3
National Institute for Environment and Development in Suriname (NIMOS)	
NIMOS is responsible for the overall coordination REDD+ in Suriname and of many REDD+ related acitivies, while the SBB is coordinating the establishment of the NFMS/MRV system and the REL/RL for REDD+. Therefore close and frequent communication on these topics will be necessary throughout the harmonized implementation of the FCM plan and the PRODOC.	All
National Planning Office Foundation (Stichting Planbureau Suriname - SPS)	
Capacity could be built jointly within the Agro-ecological zonation projection carried out by SPS with support of the Brazilian research institution Embrapa. SPS could establish a data sharing platform, bringing together multidisciplinary GIS/RS data. They could also be involved within capacity building activities carried out within the FCM plan. They also dispose of an archive of historical maps.	1.1 1.3 2.1 2.2 2.3; 2.4; 2.5
National Zoological Collection in Suriname (NZCS)	
The NZCS is currently mapping the mercury pollution in the interior. They are willing to share the collected GPS data on the location of small scale gold mining. Furthermore the plots established by Ms. G. Landburg in the framework of her PhD research could be incorporated in the NFI design. They could also provide QGIS training.	Program 1 2.3 2.4 2.5; 2.6 Program 3
NGO - Conservation International (CI) Suriname	
CI Suriname has previously been involved in providing technical support and capacity building in forest monitoring. They also did research on participatory community mapping in the south of Suriname. Within the current South Suriname Conservation Corridor project, data sharing, infrastructure for community engagement. CI can continue to provide technical and financial support.	
NGO - Amazon Conservation Team (ACT)	
Amazon Conservation Team Suriname (Suriname ACT) is working in partnership	1.2

with indigenous and maroon communities to protect and preserve biodiversity, culture and traditional health care in Suriname. Because of their existing collaboration with the indigenous and maroon communities and their experience working in the south of Suriname, the role of ACT can be in line of providing support to ensuring community engagement / involvement and they could provide an infrastructure to enable data and information sharing with the communities. Community based monitoring involving the Indigenous Park Guards (IPGs) for on the ground measurements. Other areas that ACT could play a role in are fire monitoring and tree species list. They also like to take part in trainings.	1.3 2.1 2.3 2.4 2.6 2.7 3.2
NGO - Tropenbos International Suriname (TBI)	
TBI could support capacity building activities, provide detailed (field) information on specific areas, enable community-based monitoring systems in Upper Suriname. Within TBI, a PhD is being carried out related to participatory monitoring of ecosystem services. FCMU could learn from this example. Furthermore TBI could provide input on the classification scheme that will be determined. TBI indicated the importance of the created data by the FCMU also to develop their activities and hopes to be able to participate to specific capacity building activities organized by the FCMU.	1.1 1.3 1.4 2.1 2.2 2.3 2.4 2.6; 2.7; Pr. 3
NGO - World Wildlife Fund (WWF)	
WWF is creating a roadmap towards a national land use planning in close collaboration with the Min. of RGB. They will include the FCM plan within this roadmap. Furthermore they want to make an update of a regional map for the Guiana Shield on gold mining. Where possible they will do this in close collaboration with the SBB/FCMU. Four PhD students will collaborate with Suriname, and eventually one of them could be outsourced to the FCMU to help resolving FCM related research questions (ToR needs to be formulated). Furthermore, after the successful finalization of the NFI pilot project supported by WWF, the multipurpose NFI could also be supported by them. NRTM in mangrove forest and protected areas is a tool of high importance for WWF Guianas. WWF can provide technical and financial support through its international network.	All
Ordening Goud Sector (OGS)	
OGS could provide GPS data on the location where gold mining activities take place to improve the understanding of the drivers of deforestation. The NRTM could, in collaboration with OGS, provide more frequent and detailed information on deforestation caused by gold mining, facilitating more efficient field controls. OGS will be involved in relevant capacity building activities.	2.3 2.7 Pr. 3
Private logging company - E-Timber Industry Suriname (Logging company)	
E-Timber industry is a private logging company with a FSC label. To help them to plan their logging activities, a map showing the location of deforested areas caused by mining could be useful for them. Furthermore they proposed that the private companies could establish PSPs using the same methodology as the one used for the NFI, their presence in the field could also contribute to a NRTM system.	2.3 2.4 2.6 2.7 Program 3
Private mining companies - IAMGOLD	
No input received from them, but they could provide information on their ongoing and planned mining activities.	2.2 2.3;2.4; Pr. 3
Private mining companies - Suriname Aluminium Company (SURALCO)	
SURALCO indicated that they dispose of areal pictures, and data showing the location of their mining activity. They can provide information about areas that will be (potentially) mined.	2.2 2.3; 2.4; 2.5

Research - Center for Agricultural Research in Suriname (CELOS)	
CELOS fosters applied scientific research in the Agricultural and Forestry sector in Suriname and the region. In addition to conduct research, CELOS also makes its services and facilities available to University Scientists and students to enable research, namely those faculty members and students affiliated with the Department of Agriculture of the Faculty of Technology. CELOS will play a key role to carry out applied research as input to the FCM plan. The PhD research on Forest typology currently done by NARENA is of crucial importance for outcome 2.1. Also research and data on Biodiversity, agriculture, forestry, PSPs, production and non-commercial forest. CELOS indicated to be interested in information that supports tailor made maps for clients and research on land-use planning with national GIS. They have also indicated to be interested to be involved in deciding the reference year for the forest/non-forest benchmark map. Furthermore, they have indicated to be interested in an MoU between CELOS and SBB.	All
Small Grants Programme Suriname (implemented by UNDP)	
The SGPS could provide support to carry out pilot projects for community based monitoring (including capacity building) and to strengthen data sharing and awareness between the FCMU and the communities.	1.3 2.6 2.7; Pr. 3
United Nations Development Programme (UNDP)	
UNDP is involved in two big projects closely related to the work as defined in the FCM plan: Implementation of the REDD+ Readiness Project Proposal (R-PP) through the PRODOC and the project "Mainstreaming global environment commitments for effective national environmental management". Therefore the good collaboration and communication needs to be continued because it will create an enabling environment for a harmonized implementation of all projects.	All
NGO - Suriname Conservation Foundation (SCF)	
Support conservation of forest instead of deforestation and degradation.	
National Coordination Center for Disaster Relief (NCCR)	
Provide information about natural and anthropogenic disasters. Coordinate activities in the fight against disasters.	

Potential for regional and international collaboration

The table below includes some current as well as possible future partner organizations abroad, indicating the type of collaboration that is established or may be explored.

(Possible) partners	Type of collaboration
ACTO and its member countries	
The Amazon Cooperation Treaty Organization has eight member countries: Suriname, Bolivia, Brazil, Colombia, Ecuador, Guyana, Peru, Venezuela. The ACTO project "Monitoring of Forest Cover in the Amazon Region" will enable collaboration between the countries on FCM related topics until 2017. Suriname may also establish bilateral collaboration with other ACTO countries.	Exchange of experiences in the Amazon region, technical expertise, stay updated about new technology development, share research results because of similar problems and conditions.
Office National des Forets (ONF), ONF International and forestry services in the Guiana Shield	
ONF and ONF International are French organizations that coordinate the REDD+ for the Guiana Shield[37] regional technical	Exchange of experiences in the Guiana Shield region, capacity

[37] http://reddguianashield.com/

collaboration project. The project offers a platform for exchange of REDD+ MRV experiences between Suriname, Guyana, French Guiana and the state of Amapá in Brazil. SBB has strengthened its contacts with the Guyana Forestry Commission (GFC) and the Amapá State Forest Institute (IEF) through the project. Training and capacity building opportunities and external technical support is available at least until the end of 2015.	building, working group meetings, technical expertise as country support, funding of activities.
Guiana Shield Facility (GSF)	
The GSF is a multi-donor funding facility for the long-term financing of national and regional activities in the Guiana Shield. Activities focus on conservation of ecosystems, protection of biodiversity, and sustaining human livelihoods. UNDP Guyana is directly implementing the GSF until December 2014 and it is then expected that a suitable regional institution will take over. This could be a way to establish long term collaboration between the Guiana Shield countries.	Jointly find solutions for technical problems (e.g. allometric biomass equations, coastal dynamic, monitoring drivers of deforestation), data sharing, share research results, joint capacity building, etc.
United Nations entities such as UN-REDD, UNEP, UNDP, FAO	
Suriname is a partner country to UN-REDD, UNEP, UNDP and other international organizations in the UN system. As a partner there might be possibilities to receive technical and financial support to implement the REDD+ Readiness Preparation Proposal and other FCM priorities. Suriname is a member of LACFC (Spanish acronym COFLAC) which is the Latin American and Caribbean Forestry Commission of the FAO.	Explore additional funding to fill the financial gaps, get technical support and technical expertise (for example the FAO might be able to provide support to develop a NFI in line with output 2.6).
Group of Earth Observations (GEO)[38]	
GEO was launched in response to the World Summit on Sustainable Development (WSSD) and by the industrialized G8 countries in 2002. The rationale was that in an increasingly complex and environmentally stressed world, international collaboration is crucial for making full use of the growing potential of Earth observations to support decision making. It is a voluntary partnership of governments and international organizations, which provides a framework within which these partners can develop new projects and coordinate their strategies and investments. Membership is open to all United Nations member organizations, and as of 2013, GEO's members include 89 Governments and the European Commission. In addition, 67 intergovernmental, international and regional organizations with a mandate in Earth observation or related issues have been recognized as Participating Organizations. Out of the ACTO member countries, Brazil, Peru and Colombia are also members of GEO. GEO coordinates efforts to build a Global Earth Observation System of Systems (GEOSS).	Suriname is not a member of GEO, but could explore this opportunity in the future.
SilvaCarbon[39]	
SilvaCarbon is the contribution of the United States government to the GEO Forest Carbon Tracking task, a component of the GEOSS. They organize training courses and workshops on important topics.	Suriname might be able to join workshops and online discussions.

[38] http://earthobservations.org/index.shtml
[39] http://swp.gmu.edu/silvacarbon/node/30

Sociedad Latinoamericana de Percepción Remota y Sistemas de Información Espacial (SELPER)	
SELPER may be associated with other scientific and technical societies, involved directly or indirectly with the technology of remote sensing, looking for a mutually beneficial relationship. It aims to promote all activities related to remote sensing in the broadest sense and foster the professional development of its members, so as to contribute positively to benefit the Latino community and its institutions. SELPER wants to bring together all persons and entities engaged in the research, development, applications and operations in remote sensing, always looking for the closest cooperation between the various sectors of activities and exchange of information, data and knowledge more effective.	Stay updated about new technology developments, exchange technical expertise, share research results that are relevant because of the similar problems and conditions in the region. SELPER involvement might potentially facilitate access to imagery and other relevant data.
Providers of data sets (Global Forest Watch - GFW, University of Maryland, ASTRIUM, JAXA, etc)	
Currently there is a new trend to provide up-to-date global information on deforestation and other relevant layers. For example, the University of Maryland provided a global forest cover layer for 2000 and a forest loss layer for the period 2000-2012. Global Forest Watch announced to update this layer annually.	Follow up global trends and available information. Use these data when relevant and avoid to do too many overlapping activities on national level in order to reach maximum result.
Providers of satellite images (ESA, NASA, INPE etc)	
Satellite images are crucial to carry out the planned activities. It might be wise to investigate how to obtain them in the most optimal way through partnerships and collaboration.	Apply for free use of imagery etc.
Providers of software (ESRI, Clark Labs etc)	
ESRI is an international supplier of the ArcGIS Geographic Information System software, web GIS and geo-database management applications. The company was founded in 1969 and is headquartered in California, USA. Clark Labs is the provider of the IDRISI software for raster-based GIS and image processing software.	Expertise, software at lower costs, support to participate in conferences etc.
Non-governmental organizations (NGOs) such as WWF, CI, GFC, etc	
The World Wildlife Fund (WWF) and Conservation International (CI) have co-funded projects related to setting up an NFMS in Suriname, including field work for the NFI pilot project. These and other NGOs might be interested in future collaboration. The Global Forest Coalition (GFC) can provide relevant international on-the-ground expertise on how to work successfully with promoting the rights of forest based peoples in forest policy.	Join forces to implement FCM related projects for good causes. Joint fundraising and provision of financial resources.
Foreign universities	
A solid capacity on GIS/RS is needed especially for forest monitoring. It might be recommended to help motivated BSc students to find a scholarship program allowing them to do their MSc study abroad (e.g. at a university in one of the ACTO member countries). Collaboration with foreign universities and facilitating scientific research could be further explored, considering that local students should also be involved. (Example: existing collaboration between SBB and the University of Hamburg)	Long term capacity and research.
Research institutes such as the International Union of Forest Research Organizations (IUFRO)	
IUFRO is a global network for forest science cooperation that unites more than 15,000 scientists in almost 700 member organizations in over 110 countries. Scientists cooperate in IUFRO	Provide access to the latest research and expertise on good forest governance and related

on a voluntary basis. Their mission is "to promote global cooperation in forest-related research and to enhance the understanding of the ecological, economic and social aspects of forests and trees; as well as to disseminate scientific knowledge to stakeholders and decision-makers and to contribute to forest policy and on-the-ground forest management."	topics.
Bilateral partnerships and collaboration	
The Government of Suriname has a bilateral partnership with the Government of Austria. Currently they are supporting the National Forest Inventory (NFI) pilot project. There might be possibilities to extend the support for the complete NFI (while jointly looking for funding).	Technical support, filling funding gaps.
Financial institutions such as IDB, FCPF, World Bank	
Implementation of the FCM plan and the wider REDD+ readiness preparation proposal (R-PP) will require additional funding. Some of this could be covered by the existing grant from the FCPF (World Bank). Additionally, a delegation from Suriname visited the IDB headquarters in Washington and discussed the possibilities of IDB financing Suriname's NFI together with the Austrian organisation ANRICA.	Filling funding gaps, including funding for the complete NFI.
Online forums and discussion groups	
The internet provides opportunities to link up with other people, experts and institutions all around the world working on forest cover monitoring. Examples of useful hubs to join are REDD+ community[40], different LinkedIn groups on relevant topics, etc.	Capacity building through webinars, articles, exchanges with experts etc.
Platforms such as Google Earth Engine, Open Street Maps	
Google Earth Engine is a cloud computing platform for processing satellite imagery and other Earth observation data. It provides access to a large warehouse of satellite imagery and the computational power needed to analyze those images. OpenStreetMap (OSM) is a collaborative project to create a free editable map of the world. Two major driving forces behind the establishment and growth of OSM have been restrictions on use or availability of map information across much of the world and the advent of inexpensive portable satellite navigation devices.	Technical collaboration on data sharing and analysing.
Research institutes such as Imazon	
Imazon is a non-profit research institution classified as a Civil Society Public Interest Organization (OSCIP). It was founded in 1990 and its mission is to promote sustainable development in the Amazon through studies, support for public policy formulation, broad dissemination of information and capacity building. Imazon research activities include: socioeconomic diagnosis of land uses in the Amazon; development of methods for evaluating and monitoring those uses; carrying out demonstration projects; analysis of public policies for land use; and development of sustainable development scenarios and models for those economic activities.	Collaborate on monitoring methodologies and pilot projects.

[40] http://reddcommunity.org/

6.2 Budget flows and financing plan

For the implementation of the FCM plan in the period 2014-2018, it is estimated that a budget of USD 4.684.730 is needed. The total funding available from ACTO so far is USD 958.707. This is covering most of the operational costs until 2017, including salaries of the FCMU team, IT equipment and furniture, miscellaneous costs, several capacity building activities, technical assistance and field verification activities. Additionally, the SBB will continue to provide infrastructure, logistical support, technical expertise, administrative and financial support to the FCMU and implementation of the FCM plan. Also, ONF International has committed to provide training and technical expertise, covering an estimated total of USD 160.000 provided through the REDD+ for the Guiana Shield project.

For implementing the FCM plan there is a remaining funding gap of USD 3.566.023. This gap includes mainly the execution of a multipurpose NFI, operational costs of the FCMU after 2017, workshops, trainings, technical expertise, publications, and satellite imagery. A multi-purpose National Forest Inventory (NFI) (output 2.6) is an expensive undertaking that would cost more than all the other outputs in all three programs together. It is therefore kept separate in the table below.

Because the NFI and the work done within the FCMU are the main elements of a NFMS/MRV system, the funding gap will be filled with the resources designated for the implementation of the R-PP and in particular setting up and operationalize the NFMS/ MRV-system. After the execution of the R-PP, Suriname will be REDD+ ready, meaning that financial resources will be available for sustaining the FCMU.

Because of the importance of the products to be delivered by the FCMU to strengthen good governance and sustainable utilization of the forest, in case of delays towards this REDD+ readiness process, the SBB could include the operational costs of the FCMU after 2017 in its budgets.

Fundraising will be carried out to fill budget gaps, potentially jointly with other institutions.

FCM Plan BUDGET	**TOTAL estimated (USD)**	Covered by ACTO project (until 2017)	Covered by ONF REDD+ (until 2015)	Covered by Government / SBB / REDD+ readiness / other (**)	**Funding gap**
Program 1	1.500.000	908.000	112.000	To be confirmed	480.000
Program 2 (*)	480.000	52.000	48.000	To be confirmed	380.000
Program 3	230.000	0	0	To be confirmed	230.000
TOTAL:	**2.210.000**	960.000	160.000	To be confirmed	**1.090.000**

(*) The Multi-purpose National Forest Inventory (NFI) that is included in Program 2 (output 2.6) is not included in the budget above since a separate project proposal will be formulated for this comprehensive activity. The estimated cost of an NFI, depending on its design, is 2.500.000 to 5.000.000 USD.

(**) Suriname has been granted 3.8 million USD from the Forest Carbon Partnership Facility (FCPF) for REDD+ preparations. Those funds will be used for much more than what is included in the FCM plan, but a sum still to be confirmed will be available for implementation of this plan (hiring of personnel, support to the establishment of an MRV system and REL/RL etc). For more details see the PRODOC.

6.3 Information flows and communication strategy

As mentioned in section 1, systems tend to work better when data, information and communication are moving freely through them. The FCM plan will produce information and data about changes in forest cover that need to be understandable and accessible to policy-makers, communities and other stakeholders. It is of key importance that maps, reports and other information products communicate clear messages. Sources and processes for creating the information must be shared transparently so that users themselves are free to judge the reliability of the messages received. The different outputs of program 3 are designed to improve data sharing between stakeholder institutions and will enable interested actors to translate the data into action.

An important part of the strategy to convey information in all relevant languages. Dutch is the official language of Suriname and other languages such as Sranan Tongo and many different local languages are used by the population. The official languages used within the ACTO project are Spanish, Portuguese and English. Suriname is using English in the ACTO context so far, but it is part of the communication strategy that the FCMU will increase its abilities to communicate and read technical documents in Spanish and in Portuguese. This will greatly improve the opportunities to collaborate and build upon the many good practices developed by other countries in the region.

The internet provides opportunities for communication that could not have been imagined only a few decades ago. The FCMU will tap into this global information flow by joining mailing lists, social media groups and discussion forums online that can be a good opportunity to get aware of opportunities. It can be expected that active and responsible online presence will enhance data flows and access to resources for implementation of the FCM plan. As outlined in section 5 (see output 3.2 and 3.3), it is also part of the communication strategy that the FCMU will make its own data, maps and information products available in innovative and interactive formats online.

Multiple different channels will be used for spreading and obtaining information since different audiences and potential collaborators are more familiar with different tools. In order to constantly improve its ways of communicating and producing useful information, the FCMU will be asking its different audiences regularly what information they need that they are currently not supplied with, how often they want to receive communications from the FCMU and which channels they have a preference for.

6.4 Evaluation

Within the framework of this plan, the newly established FCMU will be further strengthened and sustained, research will be carried out, new data sets will be created, and new ways for data and information sharing will be explored. Furthermore the activities will involve a wide range of stakeholders. Because of the complexity to achieve a successful implementation of the project, it is important to evaluate the progress made on a regular basis. Therefore several reports will be provided:

Report	Context	Content
Monthly report (internal)	Written by each FCMU team member and sent to the ACTO project Regional Coordinator with a copy to the CEO of SBB in order to get the monthly salary.	- Activities planned and executed during the month.
6-months report (internal)	Written by the FCMU team and sent to the CEO of SBB with a copy to the regional coordinator of the ACTO project.	- Overview of the activities carried out with all specifications. - Evaluation based on the indicators and means of verification.

Annual progress report and annual plan (external)	Written by the FCMU team and sent to the Technical Working Group of Forest Cover Monitoring. This will also be published on the internet and shared with the Regional Coordinator of the ACTO project.	- Overview of the activities carried out with all specifications. - Evaluation based on the indicators and means of verification. - Adjustment of the FCM plan if necessary (related to the assumptions).

CONCLUSION

Sustainable forest management is made possible through the performance of good governance, which in practice means that effective policy responses are designed and implemented. The FCM plan will keep policy-makers and other actors informed by providing scientifically sound knowledge about the state of the forests, including current and predicted future deforestation and forest degradation. In the long run this will hopefully lead to the vision coming true:

"Suriname monitors forest cover changes in the whole country in close collaboration with multiple stakeholders, using modern technologies and local community participation in a system that provides the national and international community with the most updated and reliable information about forest cover, which is used to enforce governance on deforestation, forest degradation, land tenure and land use (changes), to sustainably manage the forest resources while maintaining resilience of forest ecosystems."

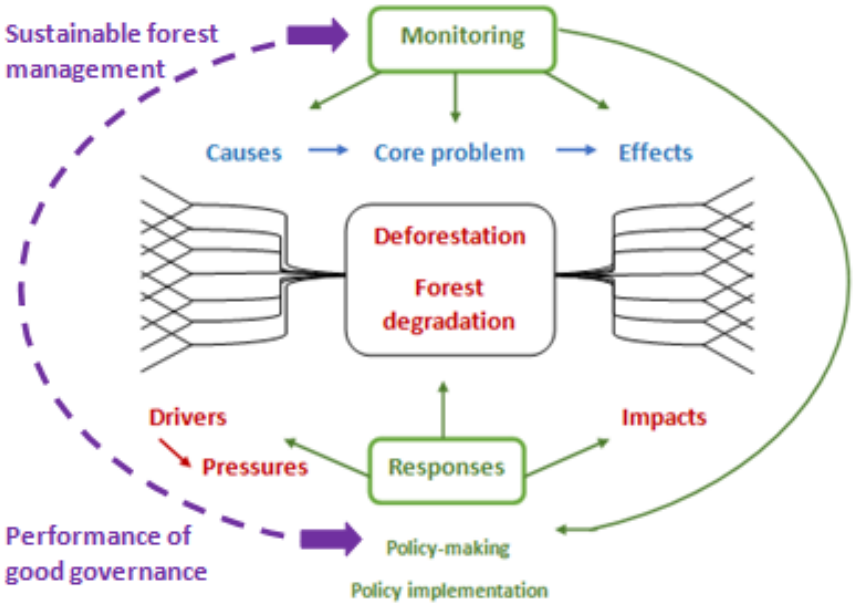


Figure 25. Monitoring the full problem chain to enable good policy responses for forest cover.

ANNEXES

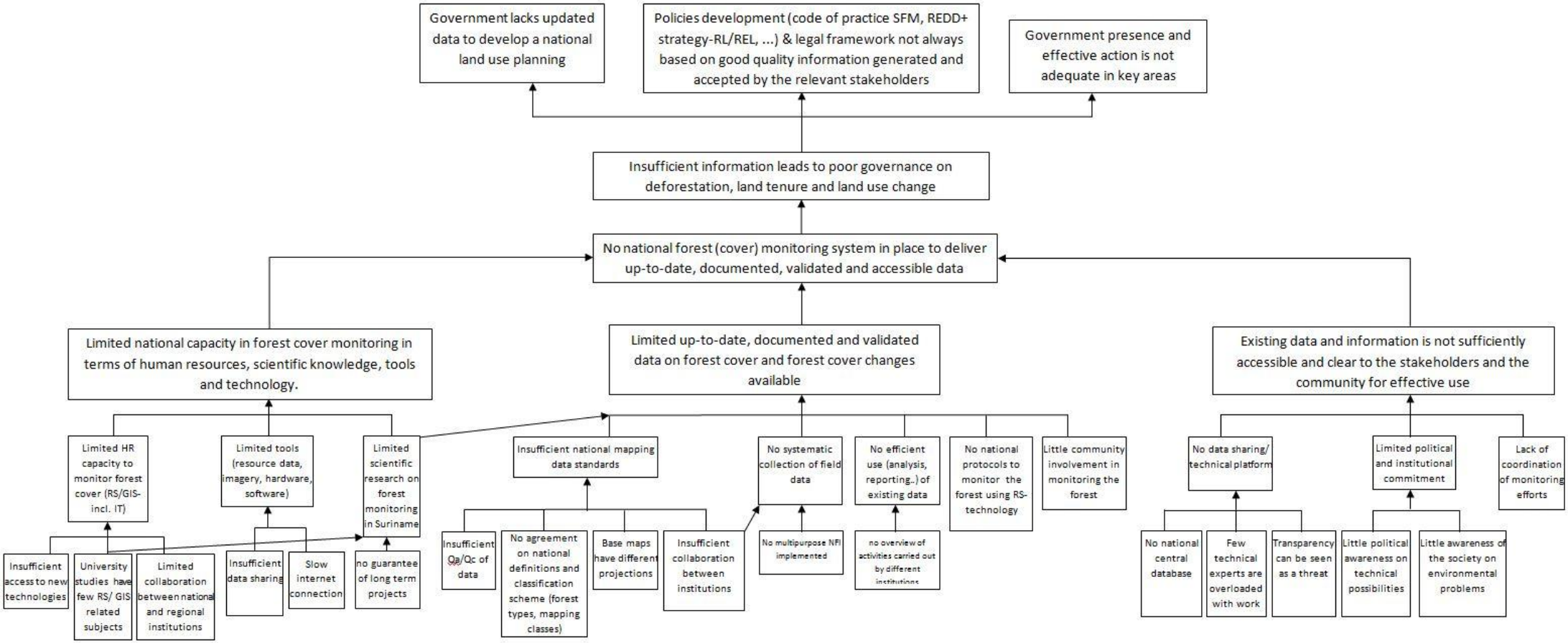
Annex 1. Problem Tree for the Suriname National Plan for Forest Cover Monitoring

Annex 2. Logical Framework for the Suriname National Plan for Forest Cover Monitoring

Submitted in June 2014

The Suriname National Plan for Forest Cover Monitoring was adopted in 2014 as requested by the Amazon Cooperation Treaty Organization (ACTO). The plan was developed by the consultant ONF International (ONFI) in close collaboration with Suriname's Foundation for Forest Management and Production Control (SBB) and its ACTO funded Forest Cover Monitoring Unit (FCMU). Subject to multi-stakeholder consultation, a National Workshop was held in Paramaribo on 20 May 2014 to validate this plan as a recognized national strategy for the period 2014-2018. Written comments from stakeholders were incorporated after the workshop. The plan in its current version was submitted to ACTO on 30 June 2014.

Annex 1. Problem Tree for the Suriname National Plan for Forest Cover Monitoring



Logical Framework for the Suriname National Plan for Forest Cover Monitoring

Vision: *Suriname monitors forest cover changes in the whole country in close collaboration with multiple stakeholders, using modern technologies and local community participation in a system that provides the national and international community with the most updated and reliable information about forest cover, which is used to enforce governance on deforestation, forest degradation, land tenure and land use (changes), to sustainably manage the forest resources while maintaining resilience of forest ecosystems.*

Overall Goal: *To contribute to the strengthening of the National Forest Monitoring System (NFMS) by generating information about changes in forest cover for Suriname that is reliable, up-to-date, accessible, understandable and transparent, serving multiple purposes amongst others optimized policy, policy implementation (e.g. national land use planning, sustainable management of the forest, REDD+) and law enforcement in the field (e.g. gold mining, mangrove forest).*

OBJECTIVES (planned achievements)	**ACTIVITIES** (steps to meet objectives)	**INDICATORS** (how to measure change)	**MEANS OF VERIFICATION** (how collect indicator info)	**ASSUMPTIONS** (what else to be aware of)
<u>Outcome 1</u> **National capacity on forest cover monitoring is strengthened and sustained in terms of human resources, scientific and traditional knowledge, tools and technology**				
Output 1.1 The Forest Cover Monitoring Unit (FCMU) is reinforced and consolidated	Activity 1.1.1 Develop and manage the human resources Activity 1.1.2 Train the FCMU core team Activity 1.1.3 Strengthen the technology structure with technical capacities such as hardware and software Activity 1.1.4 Identify imagery and other data needed to carry out the FCM plan Activity 1.1.5 Keep track of new developments (gain knowledge and understanding about available methodologies, national processes etc) Activity 1.1.6 Learn from other ACTO member countries and other countries experiences related to forest cover monitoring Activity 1.1.7 Establish and maintain a transparent and documented database (for internal use)	1) Minimally five trained staff working full time in the FCMU 2) Technology platform established and operational including hard- and software, internet connection, videoconferencing system, network 3) FCMU team is informed about the newest developments with reference to FCMU 4) Use of images and data to monitor the	1) List of personnel working in the FCMU 2) Optimal collection, generation and publication of data 3) List of webinars, conferences, workshops the FCMU team attended 4) Documented images database GIS (vector & raster) database	1) Core team stays working for FCMU 2) Experts are available to provide training 3) Technical (including IT) support available to design, establish the platform 4) Sensors continue to provide free or low cost satellite imagery 5) Other institutions are willing to share data

		forest cover		
Output 1.2 The existing FCMU is sustained beyond 2017	Activity 1.2.1 Continue to develop and manage the human resources Activity 1.2.2 Continue to train the FCMU core team Activity 1.2.3 Continue to strengthen the technology structure with technical capacities such as hardware and software Activity 1.2.4 Continue to identify data and imagery needed to carry out the FCM plan Activity 1.2.5 Continue to keep track of new developments (gain knowledge and understanding about available methodologies, national processes etc) Activity 1.2.6 Continue to learn from other ACTO member countries and other countries experiences related to forest cover monitoring Activity 1.2.7 Continue to maintain and coordinate a transparent and documented database (for internal use)	1) Minimally five trained staff working full time in the FCMU after 2017 2) Technology platform operational including hard- and software, internet connection, videoconferencing system, network after 2017 3) FCMU team continues to be informed about the newest developments with reference to FCM 4) Use of images and data to monitor the forest cover	1) List of personnel working in the FCMU 2) Optimal collection, generation and publication of data 3) List of webinars, conferences, workshops the FCMU team attended after 2017 4) Documented images database GIS (vector & raster) database	1) Core team stays working for FCMU 2) Experts are available to provide training 3) Technical (including IT) support available to maintain the platform after 2017 4) Sensors continue to provide free or low cost satellite imagery 5) Other institutions are willing to share data
Output 1.3 Collaboration with technical institutions and other stakeholders is reinforced and their capacities are built	Activity 1.3.1 Build capacities of other institutions in forest cover monitoring (NIMOS, CELOS, University, Stichting Planbureau Suriname…) Activity 1.3.2 Build capacities of forest based communities to participate in forest monitoring Activity 1.3.3 Involve other institutions in relevant joint publications Activity 1.3.4 Sign MoUs and develop joint project proposals	1) Staff of other institutions are trained in RS/FCM 2) Indigenous peoples and Maroons are trained in monitoring 3) Relevant publications are published in collaboration with other institutions 4) MoUs are signed 5) Project proposals are developed jointly	1) List of participants to trainings 2) Author list of publications by FCMU 3) Signed MoUs 4) Copies of jointly developed and submitted project proposals	1) People to be trained are available 2) Capacity to provide trainings for different target groups 3) Computer lab available to hold RS/GIS trainings for approx. 20 people 4) Experts from other institutions are available to publish in collaboration with the FCMU
Output 1.4 Research on forest cover monitoring is stimulated and carried out closely related to the technical program on FCM (program/outcome 2)	Activity 1.4.1 Establish collaboration with research institutions Activity 1.4.2 Identify research needs linked to implementation of the FCM plan Activity 1.4.3 Carry out research based on the results of activity 1.4.2 Activity 1.4.4 Implement the research results in the	1) Methods developed to monitor the forest cover are closely linked with research 2) Scientific research is carried out 3) Relevant study	1) Scientific references 2) List of researches carried out and students graduated on FCM related topics 3) Published research results	1) Students are available 2) Research institutions can provide guidance

	technical program on forest cover monitoring Activity 1.4.5 Strengthen local study programmes on remote sensing and explore scholarship opportunities for studies related to forest cover monitoring, including through exchanges with universities and research centers abroad	programs / courses in AdeKUS 4) Surinamese students with scholarships for relevant studies abroad		
<u>Outcome 2</u> **Up-to-date data on forest cover and forest cover changes are generated, documented and validated, ready to be used for multiple purposes such as policy implementation, law enforcement, land use planning, sustainable forest management, biodiversity conservation and REDD+**				
Output 2.1 Classification scheme for forest cover monitoring is formulated and approved	Activity 2.1.1 Clarify the definitions that were used to produce 'Base map 2000' Activity 2.1.2 Formulate a proposal for a national classification scheme for the monitoring of forest cover, in line with international guidelines and considering the national forest typology and conditions Activity 2.1.3 Reach national approval on the classification scheme through consultations Activity 2.1.4 Improve the classification scheme based on the results of the other outputs	1) Clear definition of all classes to be mapped	1) Document describing all classes to be mapped 2) Report of discussions	1) Expert available for review
Output 2.2 Forest/non-forest benchmark map is improved and published	Activity 2.2.1 Clarify the area of interest to be used for the benchmark map Activity 2.2.2 Carry out accuracy assessment of the preliminary benchmark map (Base map 2000) Activity 2.2.3 Publish the provisional benchmark map and accuracy assessment results Activity 2.2.4 Study alternatives to the current methodology used Activity 2.2.5 Develop the official national protocol to map forest cover Activity 2.2.6 Improve the benchmark map according to the new protocol Activity 2.2.7 Carry out accuracy assessment of the improved map Activity 2.2.8 Publish the forest area benchmark map, the protocols used for mapping and accuracy assessment, and official numbers on the extent of all mapped classes in the benchmark year	1) Validated forest cover benchmark map	1) Published forest cover benchmark map and documents indicating the method, results and accuracy assessment	1) Output 2.1 is finalized 2) Training in other methodologies is available 3) External expert is available
Output 2.3 Land use/land cover (LULC) map is	Activity 2.3.1 Asses, collect and analyse all available maps (SarVision, ecosystem map, agriculture map, soil map,	1) Workshop and training organized	1) Reports of workshop and training	1) Output 2.1 is finalized 2) Training in methodology

produced	elevation, ABC project, etc), as well as the field information collected and compiled through activity 2.6.5 Activity 2.3.2 Facilitate consultation on the LULC map development Activity 2.3.3 Develop the methodology to be used for producing the LULC map Activity 2.3.4 Conduct training on the new methodology Activity 2.3.5 Process the map for 2015 or another year to be confirmed Activity 2.3.6 Carry out accuracy assessment of the LULC map Activity 2.3.7 Hold a workshop to present the map and results Activity 2.3.8 Publish the map and report on the process and results	2) Validated LULC map	2) Published LULC map and documents indicating the method, results and accuracy assessment	is available 3) External expert is available 4) Other institutions are willing to share data
Output 2.4 Deforestation, forest degradation and regeneration are monitored	Activity 2.4.1 Carry out accuracy assessment of the 2000-2009 deforestation map Activity 2.4.2 Update the deforestation map (2009-2013) Activity 2.4.3 Carry out accuracy assessment of the 2009-2013 deforestation map Activity 2.4.4 Publish provisional results for the 2000-2013 period Activity 2.4.5 Study alternatives to the currently used methodology Activity 2.4.6 Develop the official national protocol to monitor changes in forest cover (excluding degradation) Activity 2.4.7 Improve the existing forest cover change maps in line with the new protocol Activity 2.4.8 Perform the 2013-2015 forest cover change map Activity 2.4.9 Carry out accuracy assessment of the improved maps Activity 2.4.10 Hold a workshop to present results and official figures Activity 2.4.11 Publish the forest cover change maps, the protocols used for mapping and accuracy assessment, and official figures on the deforestation between 2000 and 2015 (3 subperiods) Activity 2.4.12 Develop a methodology to include forest degradation	1) Published deforestation maps 2) Published forest cover change maps 3) Workshops and trainings organized	1) Published deforestation 2000-2009, 2009-2013 , 2013-2015 maps and documents indicating the method, figures and accuracy assessment 2) Report of the workshop 3) Published forest cover change (incl. Degradation and regeneration) 2015-2017 map and documents indicating the method, figures and accuracy assessment	1) Output 2.1 is finalized 2) External expert is available 3) Research on forest degradation is carried out 4) Satellite images suitable for monitoring forest degradation are available

	Activity 2.4.13 Perform the 2015-2017 forest change map, including degradation Activity 2.4.14 Carry out accuracy assessment of the 2015-2017 map Activity 2.4.15 Publish results for the 2015-2017 period			
Output 2.5 Tools for REDD+ and land use planning are available	Activity 2.5.1 Identify drivers of deforestation and forest degradation in Suriname Activity 2.5.2 Collect qualitative/quantitative data on land use from different ministries, institutions and organizations (linked to 2.3.1 and 2.6.5), especially geographical data for the 2000, 2009 and 2013 time points Activity 2.5.3 Prepare a qualitative/quantitative assessment of drivers of deforestation and forest degradation based on existing data Activity 2.5.4 Carry out a consultation process on the drivers of deforestation until national consensus is reached, involving IPs, Maroons and other stakeholders Activity 2.5.5 Publish the assessment study of drivers of deforestation Activity 2.5.6 Prepare driver maps for 2000, 2009 and 2013 (digitization or adaptation of existing data) Activity 2.5.7 Compare different existing methodologies for predicting future deforestation and decide which one(s) could be used Activity 2.5.8 Develop a spatial model to predict future deforestation locations Activity 2.5.9 Hold a workshop to present results of future deforestation modelling Activity 2.5.10 Publish the results of future deforestation modelling Activity 2.5.11 Develop a methodology to monitor drivers of deforestation and reassess the REL/RL localization Activity 2.5.12 Produce a suitability map for sustainable timber harvesting	1) Study on national drivers is published 2) Consultations are carried out on drivers of deforestation 3) Consensus reached on national drivers of deforestation 4) Driver maps are published 5) Model to localize the future deforestation is developed 6) Suitability map for sustainable timber harvesting is developed	1) Published report of the assessment of drivers of deforestation 2) Document describing the model to predict future deforestation 3) Results (maps) of the implementation of the model 4) Published methodology to monitor drivers of deforestation 5) Published suitability map for sustainable timber harvesting indicating the method and results	1) Other institutions are willing to share data 2) Research is carried out 3) REL/RL is established within the R-PP
Output 2.6 Multi-purpose National Forest Inventory (NFI) is carried out	Activity 2.6.1 Publish report on the National Forest Inventory (NFI) pilot project Activity 2.6.2 Hold a workshop to present results of the NFI pilot phase Activity 2.6.3 Training in forest inventory, carbon stock assessment and related topics including forest inventory	1) NFI pilot project is analysed and evaluated 2) Multi-purpose NFI is designed 3) Capacity built to carry	1) Document describing results (timber, carbon stocks, biodiversity…) and method of the NFI 2) Number of people that have been trained and	1) R-PP is implemented to make funding available to hire NFI staff 2) Other institutions are willing to play an active role in the multipurpose

	statistics, botanical tree species determination, socio-economic assessment and involvement, etc Activity 2.6.4 Formulate a project proposal for a full-scale multi-purpose NFI (carbon stock assessment, sustainable forest management, biodiversity assessment, social use of forest, NTFP, etc) Activity 2.6.5 Compile and analyse all available field information on forest and non-forest classes Activity 2.6.6 Publish an intermediary report on available carbon stock data Activity 2.6.7 Prepare the full NFI implementation Activity 2.6.8 Carry out a multi-purpose NFI Activity 2.6.9 Report on the results of the multi-purpose NFI, including estimated carbon stocks and timber stocks in Suriname	out NFI 4) NFI field work has been carried out	effectively involved in the NFI	NFI
Output 2.7 Alert system for near-real-time monitoring of forest cover is in place	Activity 2.7.1 Develop a procedure to monitor forest fires using FIRMS Activity 2.7.2 Prepare an annual report on forest fire statistics (including a map of fire spots in Suriname) Activity 2.7.3 Develop a tool to compile alerts on deforestation/degradation Activity 2.7.4 Provide training in how to use the tool and identify coordinating institution to take actions Activity 2.7.5 Prepare maps for the coordinator of the alert tool Activity 2.7.6 Study options for a community-based monitoring system based on the Surinamese REDD+ strategy, technical feasibility and relevance of such a system Activity 2.7.7 Study options for remote sensing based near-real-time monitoring to see if it can be implemented, which methodology could be used and which areas to focus on	1) Annual fire map is produced 2) Central point to provide alerts on deforestation established 3) Forest based communities exchange information about the forest cover with FCMU 4) Near real time RS monitoring system is in place	1) Documented maps and tables indicating the number, area and location of fires 2) Number of alerts (incl. Information provide by forest base communities) received by the central point 3) Number of maps showing recent deforestation sent to relevant institutions	1) FIRMS continues to work 2) Fire remains to be a low threat in Suriname 3) Community interacts to the alert tool 4) Institutions need near real time RS solutions
<u>Outcome 3</u> Information and data about changes in forest cover is made understandable and accessible to policy-makers, other stakeholders and the general community				
Output 3.1 Mechanisms for regular involvement of stakeholders including policy makers and forest based communities are created	Activity 3.1.1 Carry out an annual workshop for all stakeholders to present the results of the past year and the plan for the coming year Activity 3.1.2 Establish and facilitate a "technical working group on FCM" (discussion, submission of reports and	1) Public workshop on FCM held annually 2) FCM working groups (permanent and ad-hoc) are in existence	1) Number of participants in annual workshop 2) Stakeholders use the data to enforce their policies and plans	1) Decision makers and stakeholders participate actively

and maintained	protocols, etc) Activity 3.1.3 Establish ad-hoc working groups on specific topics included in the FCM plan when needed	3) Produced data are relevant for the stakeholders	3) Reports of the workshops	
Output 3.2 Functional online tools and technical platform for data and information sharing are available	Activity 3.2.1 Establish, maintain and coordinate an NFMS platform online to share data generated by the FCMU with institutions and the public Activity 3.2.2 Contribute to the establishment of multidisciplinary data sharing platforms (knowledge matrix, discussions on data sharing protocol, standards/quality check…) Activity 3.2.3 Develop a REDD+ National Registry and monitor the outcomes of REDD+ activities	1) Operational platforms providing relevant accessible data	1) FCMU data used by other institutions 2) Multidisciplinary data used by FCMU 3) Participation to meetings 4) Knowledge matrix	1) Institutions are willing to share their data 2) Multi-disciplinary data sharing platform is created
Output 3.3 International reporting is carried out, providing data from forest cover monitoring when required from Suriname or for voluntary submissions	Activity 3.3.1 Prepare and submit a first national forest Reference Emissions Level / Reference Level (REL/RL) for REDD+ Activity 3.3.2 Prepare and submit an improved national forest Reference Emissions Level / Reference Level (REL/RL) Activity 3.3.3 Develop a reporting and verification system for the REDD+ purpose (including consultation, technical support, etc.) Activity 3.3.4 Perform the first comprehensive GHG inventory report for the REDD+ purpose Activity 3.3.5 Prepare the national submission from Suriname for the Global Forest Resources Assessment (FRA 2020)	1) REL/RLs are submitted 2) Reporting and verification system for REDD+ purposes established 3) GHG report is submitted 4) National data to the FRA 2020 is submitted	1) REL/RL submission documents 2) Documents describing the reporting and verification system 3) GHG report for REDD+ 4) FRA 2020	1) International community keeps expecting REL/RL, GHG reports 2) FRA 2020 is carried out internationally as expected
Output 3.4 Outreach materials and awareness activities for informing the national community are in place	Activity 3.4.1 Share general information regularly about the project status (on SBB website, brochures, posters, forestry sector analysis…) Activity 3.4.2 Carry out awareness activities to inform the public about forest cover monitoring (open door events by the FCMU, info to students, presentations, radio, film, etc)	1) Information is available for the public about the project and the generated data	1) Number of reports available; 2) Number of awareness activities 3) Number of feedbacks	1) People are willing to participate in awareness activities