Terms of Reference for Developing Capacities for a national Monitoring, Reporting and Verification System to support REDD+ participation of Guyana

Background, Capacity Assessment and Roadmap

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Acronyms

AFOLU	Agriculture, forestry and other land uses
CCI	Clinton Climate Initiative
CIFOR	Centre for International Forest Research
FAO	United Nations Food and Agriculture Organization
FCPF	Forest Carbon Partnership Facility of the World Bank
FIDS	Forest Industry Development Survey
GEO	Group of Earth Observation
GFC	Guyana Forestry Commission
GGMC	Guyana Geology and Mines Commission
GHG	Greenhouse gas
GINRIS	Guyana Integrated Natural Resources Information System
GL&SC	Guyana Geology and Mines Commission
GOFC-GOLD	Global Observations of Forest and Land Cover Dynamics
GPG	Good Practice Guidance
IFP	Interim Forestry Programme
INPE	National Institute for Space Research (Brazil)
IPCC	Intergovernmental Panel on Climate Change
LULUCF	Land Use, Land Use Change and Forestry
MLI	Management Level Inventory
MRV	Measurement, Reporting and Verification
NARI	National Agriculture Research Institute
NGO	Non-Governmental Organization
OCC	Office of Climate Change
REDD	Reducing Emissions from Deforestation and Forest Degradation
SBSTA	Subsidiary Body of Science and Technical Advice
ToR	Terms of Reference
UNFCCC	United Nations Framework Convention on Climate Change
USFS	United States Forest Service

SECTION 1: Scope and Objectives

1.1 Background

The Government of Guyana has embarked on a national programme that aims to protect and maintain its forests in an effort to reduce global carbon emissions and at the same time attract resources to foster growth and development along a low carbon emissions path. Guyana has over 80% of its land area covered by forests, approximately 16 million hectares. There has been a relatively low deforestation rate in Guyana estimated at 0.1% to 0.3% per annum; that is expected to increase in the future. Guyana is committed to provide a contribution to address the second most important source of carbon dioxide emissions world-wide coming from deforestation and forest degradation and is estimated at approximately 18% of global emissions.

The cooperation between the Governments of Norway and Guyana expresses a willingness to work together to provide the world with a relevant, replicable model for how REDD-plus can align the development objectives of forest countries with the world's need to combat climate change. The initiative will require the development of capacities for monitoring, reporting and verification (MRV) of forest carbon stocks and changes.

While policy and compensations mechanisms for implementing REDD are still under discussion within the UNFCCC, the draft text on methodology for REDD produced by SBSTA 30 in June 2009 makes it clear that not only reduced emissions from deforestation and degradation, but also forest conservation, sustainable forest management and forest enhancement are likely to be included in the agreement which will be finalized at the climate summit in Copenhagen in December 2009. These three elements are jointly referred to as 'REDD +'.

This creates some certainty about the contours of the agreement and what will be credited, as well as opportunities to use a variety of approaches to measuring and monitoring. One key measure to quantify the role of a forest for climate change mitigation is the sum of the carbon stored in its terrestrial pools (i.e. vegetation biomass and soil carbon). It can be assumed that any change in the forest carbon stocks from direct or indirect human activities has an impact on the climate with the overall goal to reduce the amount of emissions to the atmosphere and to maintain or increase the overall terrestrial carbon pool. Thus, climate change mitigation activities currently under discussion encourage:

- the long-term conservation of forests to maintain its current or natural carbon reservoir,
- to change the impact of human activities (i.e. causing carbon emissions from land use) in forests to stabilize or increase terrestrial carbon stocks in the long-term,

- a change in current human activities towards reforestation of land to increase the terrestrial carbon sink.

These generic and fundamental objectives are addressed in the REDD+ and the LULUCF discussions in a number of concepts, such as deforestation, forest degradation, forest conservation etc. These reflect the need to specify policies to alter human activities towards a more climate friendly way. This includes means to measure and report carbon impacts on the local, national and global level. Current international REDD+ discussions are dealing with carbon and emission-oriented approaches, the national implementation has to consider a cause- or driver oriented perspective to design and implement useful policies.

It is currently not practical nor efficient to measure and report the stocks and changes for the whole terrestrial carbon reservoir with the level of detail and certainty to address all drivers and processes that have a carbon impact on the land. REDD+ readiness activities in Guyana are encouraged to start right away and will need to include a priority setting given that:

- Countries, in general, start from a diverse set of backgrounds in terms of historical drivers and changes in forest carbon; expected future land use changes due to their development objectives; and current capabilities for measuring and monitoring forest carbon on the national and local level.

- current human land use impacts causing carbon emissions are focused in specific areas and regions and should, perhaps, be primarily addressed in the very near-term. However, it is the long-term stabilization or increase of the terrestrial carbon reservoir as a whole that will decide on the effectiveness of the activities initiated today and to eventually implement a low carbon development strategy for Guyana,

- resources to address REDD+ will be limited and not suitable to address all issues everywhere at the same time. While all requirements and forest change drivers and processes should be addressed from the beginning, their entry points will vary and priority setting and efficient implementation strategies will be needed at the international, national and sub-national level.

Thus, it is important to understand the use of concepts like deforestation, degradation and conservation as means to provide agreed international frameworks and to scope and define practical and efficient implementation strategies (policies and MRV) for countries and actors to start REDD+ actions. This should include the definition of long-term targets and the specification of near-term priorities. It should be aimed for starting efficient with some level of national monitoring with most detail and certainty in spatially limited areas of “REDD actions” that proves and verifies the positive effect of policies and implementation for the climate.

1.2 Objectives

As an initial step to the implementation of a MRVS for Guyana, a road map for the development of a MRV system for REDD+ participation for Guyana was designed following a stakeholder participation session. The development of such a road map considered several aspects that have been elaborated in the facilitation process and for preparing Terms of Reference for developing an REDD MRV system:

1. Requirements for the MRV system:
    - The accepted principles and procedures of estimation and reporting of carbon emissions and removals at the national level should meet criteria specified by the IPCC Good Practice Guidelines and Guidance for reporting on the international level;
    - The particulars of the national REDD implementation strategy that have been selected, since different activities have different MRV implications;
2. Bridging the capacity gap through a detailed plan to establish sustained MRV capacities within the country:
    - Capacity gap assessment based on the state of the existing national forest monitoring technical capabilities and the requirements for the MRV system;
    - Develop a road map and foster its implementation through a sustained and efficient institutional framework including competence in measuring and monitoring at different levels, support of national policies and REDD+ actions, international reporting and verification, and linking MRV of actions and MRV of transactions.

The outcomes of the initiative, as outlined in the MRV capacity development roadmap, are as follows:

- The overall goal is a capacity development process to establish a sustained MRV for implementing REDD policies and results-based compensation for such activities in the long-term as a contribution to Guyana's low carbon development pathway and support for the sustainable development of natural resources;
- The development of a national REDD+ MRV system uses a phased approach along a roadmap that specifies near-term priorities & long-term targets; builds upon existing capacities and data; and international requirements and national needs; and has the objective to support annual estimation; reporting and verification of forest-related carbon emissions and removals at the national level,
- The MRV system evolution is directly linked with REDD+ policy development and implementation and contains a systematic national monitoring, reporting and verification system and a sub-national program to support MRV for local REDD+ activities;
- A strong institutional base and the establishment and maintenance of partnership and cooperation at all levels as enabling framework.

Seven specific areas were identified where activities are recommended for the first phase and should start as soon as possible:

- Develop and implement a national mechanism and institutional framework
- Implement a comprehensive forest area change assessment for historical periods
- Build carbon stock measurement and monitoring capacities
- Develop MRV for a set of sub-national REDD demonstration activities
- Engagement with the international community
- Sustain an internal and national communication mechanisms
- Conduct and support research on key issues

SECTION 2: Principles for MRV Capacity Development

The current UNFCCC SBSTA negotiation text (June 2009[1]) refers to the need to establish monitoring systems that use an appropriate combination of remote sensing and ground-based forest carbon inventory approaches with a focus on estimating anthropogenic forest-related greenhouse gas emissions by sources, removals by sinks, forest carbon stocks and forest area changes. It is agreed that the IPCC Good Practice Guidelines on Land Use Land Use Change and Forestry (LULUCF) provide suitable and agreed methods and procedures to estimate and report on carbon stock changes for deforestation, forest degradation, forest conservation, reforestation, afforestation etc. All MRV activities and estimates should follow the five IPCC reporting principles and should particularly be transparent, comparable, consistent, as accurate and complete as possible, and should reduce uncertainties, as far as national capabilities and capacities permit). It is further indicated that these monitoring systems and their results will be open to independent review as agreed by the Conference of the Parties.

Table 1 lists some of the key information sources currently available to Guyana as international guidance. In that context, the UN REDD program has specified a set of key considerations for development of national MRV systems:

1 – Monitor What Matters
2 – Warrant Multi-stakeholder process
3 – Ensure Quality, Reporting and Verification compliance
4 – Guarantee Availability and Accessibility of data and Methods
5 – Support Investment and Sharing of Benefits
6 – Strengthen Institutional, Technical, Legal and Policy Development Capacities

These considerations clearly point at the need for country-specific and country-driven solutions for developing capacities and partnerships that certainly go beyond technical MRV considerations and include a participatory process and the exploration of co-benefits and synergies. CIFOR has been proposing the "3 E's concept" of efficiency, effectiveness and equity as guidance for both REDD related policies and MRV developments and their linkages in REDD readiness and implementation. The 3 E's

[1] UNFCCC SBSTA 30 decision and draft text for Copenhagen negotiated in June 2009 (should be available to workshop participants): http://unfccc.int/resource/docs/2009/sbsta/eng/l09.pdf

concept, for example, provides a framework to consider the diverse set of needs and requirements for both policy and MRV on the national and sub-national level:

Table 1. Overview of needs for guidance, analyses and advice on national MRV and key information available.

Need	Whose need	Key information provided by
International principles and guidance for measuring & reporting on carbon stock changes & emissions	Individual Parties	IPCC Good Practice Guidance for LULUCF[2]
Additional information on methods and procedures for MRV	Individual Parties	GOFC-GOLD Sourcebook[3]
Analysis of current national MRV capacities	Individual Parties; International community	Assessment of national forest monitoring capacities[4]
Analysis on costs of developing national MRV systems	Individual Parties International community	UNFCCC technical paper on costs for REDD MRV[5]
Concepts for national REDD architectures (incl. link of policy and MRV)	Individual Parties	CIFOR book on national REDD architecture and policies
Advice on how to develop national MRV system	Individual Parties	UN REDD program (framework, www.un-redd.org)

Efficiency: using transparent, consistent and cost-effective data sources and procedures, sets up an institutional infrastructure and establishes sustained capacities within the country that meet its national and international REDD+ requirements and enables to report forest carbon changes using the IPCC GPG in the long-term;

Effectiveness: supports and is driven by the development and implementation of a national REDD+ policy and its areas of priority area of actions;

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[2] *Guidelines (2003) on Land Use Land Use Change and Forestry (LULUCF), focus on chapters 2 and 3: http://www.ipcc-nggip.iges.or.jp/public/gpglulucf/gpglulucf.html, Guidance on Agriculture Forestry and other Land Uses (AFOLU), focus on chapters 1-4: http://www.ipcc-nggip.iges.or.jp/public/2006gl/vol4.html*

[3] *GOFC-GOLD REDD technical sourcebook, updated version published in July 2009: http://www.gofc-gold.uni-jena.de/redd/sourcebook/Sourcebook_Version_July_2009_cop14-2.pdf*

[4] *An assessment of national forest monitoring capabilities in tropical non-Annex I countries: http://princes.3cdn.net/8453c17981d0ae3cc8_q0m6vsqxd.pdf*

[5] *UNFCCC/SBSTA technical paper on costs of monitoring for REDD published in June 2009: http://unfccc.int/resource/docs/2009/tp/01.pdf*

Equity: integrates MRV actors and activities for local measurements and monitoring, national-level monitoring and estimation, and international guidance, and supports independent review, to ensure participation and transparency among different stakeholders involved.

These considerations currently provide the most comprehensive and up to date foundations to develop MRV systems as part of national readiness process. Building upon the existing guidance and principles, the workshop discussions did go deeper in assessing requirements and capacity needs, and providing suggestion for MRV capacity development strategies and actions that reflect Guyana's specific country circumstances. The process will follow the fundamental assumptions:

1. The overall goal is to establish a capacity development process to implement a sustained MRV system for implementing REDD policies and results-based compensation for such activities in the long-term as contribution to Guyana's low carbon development pathway. In general, any progress for REDD+ MRV fosters integrated decision making for resource management, and, thus, by itself, provides on important foundation for any future development.
2. The development of a national REDD+ MRV system uses a phased approach along a roadmap that specifies near-term priorities & long-term targets and is based on:
    a. Building upon existing capacities and data, international requirements and national needs for Guyana's REDD participation,
    b. the objective to support annual estimation, reporting and verification of forest-related carbon emissions and removals on the national level,
    c. the need to maintain some flexibility to adjust the activities in case the details of REDD compensation mechanisms are agreed internationally;
3. The MRV system evolution is directly linked with REDD+ policy development and implementation and contains a systematic national monitoring, reporting and verification system and a sub-national program to support MRV for local REDD+ activities;
4. An strong institutional set up and the establishment and maintenance of partnership and cooperation on all levels provides the framework:
    a. a steering body coordinating all REDD+ MRV activities and the implementation of the roadmap,
    b. the Guyana Forestry Commission as executive agency,
    c. a process for involving all relevant national stakeholders involved in MRV and REDD implementation and mechanisms to ensure transparent and open exchange and management of data,
    d. building partnerships and cooperation with key national and international organizations that help Guyana in implementing the road map.

SECTION 3: Capacity Gap Assessment

The evaluation of Guyana's capacities and REDD specific characteristics provide the basis to specify the recommendations and next steps for developing capacities for the implementation of an MRVS for Guyana. Starting with an assessment of current capacities, additional information on country-specific characteristics and requirements for REDD were analyzed and discussed. The capacity gap assessment was performed for both international requirements (IPCC GPG, Table 2) and national needs (through an assessment of current forest change processes, Table 3).

As synthesis of the capacity gap assessment, the national MRV development principles defined seven key action areas as immediate activities for starting the capacity development process for Guyana:

1. Develop and implement a national mechanism and institutional framework:
   - Steering body for the MRV system development (Office of climate change as coordinator of activities)
   - Coordination and integration of national datasets through a high-level national technical committee accompanied by a related legislative reform and development of a national data management system and infrastructure
   - Participation, scientific advice and international partnering, i.e. through the establishment of a technical and scientific advisory group
2. Conduct a comprehensive forest area change assessment for a historical period:
   - Processing and interpretation of historical archived satellite datasets at national level for forest area change, benchmark forest map and exploration of the monitoring of forest degradation
   - Capacity building component included from the beginning
3. Build carbon stock measurement capacities:
   - Design a national and sub-national stratification
   - Design protocols and implement measurements in all carbon pools
   - Targeted sampling and surveys to establish national conversions/expansion factors
4. Develop MRV for a set of REDD demonstration activities
   - Focus on key drivers/processes and engagement with implementation actors (i.e. land owners, communities)
   - Conduct detailed monitoring at demonstration sites
5. Engagement with international community:
   - Explore the possibility of the GEO Task to help in satellite data acquisition from 2009 onwards
   - Partner with international organizations and research partners
   - Seek further advise/coordination with international activities
6. Sustained internal communication mechanism on MRV:
   - Development communication plan and outreach materials
   - Conduct a series of regional workshops and consultation to inform about REDD and MRV

7. Conduct/support research on key issues
    - Scoping exercise for linking policy and MRV (actions, transactions)
    - Detailed national driver assessment and methods for reference level projection
    - Co-benefits of MRV (i.e. to support LCDS) and tools for decision-support in the context of integrated natural resources management

The execution of the work will be centralized at the Guyana Forestry Commission and this agency will be the focal agency for coordinating all aspects of data collection, analysis, research execution and assessments and for routine continuous monitoring of the system. This agency will work with all consultants, data providers and suppliers, and stakeholders of the MRVS.

Table 2: Capacity gap assessment for international requirements (following IPCC GPG for LULUCF)

Variable	Focus	Analysis of Existing observations and data records (i.e. satellite data, airphotos, surveys) and information (estimates, rates, factors etc.)	Proposed activities to fill data and capacity gaps for measurement and monitoring
Area changes (activity data)	Deforestation	• No consistent historical record of forest area changes • Preliminary assessment for 2007/08 using Landsat data • Some data of activities (processes) with governmental agencies - Data on areas affected (concessions, leases) need to be integrated on national level	• Implement a comprehensive forest area change assessment based on archived satellite data and using existing national datasets • Develop sustained capacities to conduct regular and consistent forest area change monitoring using remote sensing and GIS
	Reforestation	• No consistent historical record of forest area changes • Reforestation not major issue in Guyana	See above with emphasis to detect forest regrowth (note: not a significant process currently in Guyana)
Changes in carbon stocks / emission factors	Land use change (aboveground)	• No consistent national forest inventory • No data on actual carbon stocks, emission factors - current use of IPCC default data for carbon stocks and conversions • Suitable national forest stratification for forest carbon densities? • Some initial biomass monitoring permanent sample plots have been established recently	• Establish capacities and implement a systematic national forest carbon measurement and monitoring system, i.e. through permanent sample plots, including: o A suitable national carbon density stratification o Acquisition of key measurements in situ o Allometric data (for biomass conversion and expansion factors) o Carbon fraction values considering country-specific stratification • Subnational measurement program to monitor key activities
	Degradation & increases in C-stocks (aboveground)	• No consistent national forest inventory and information and forest degradation • Logging concession areas and harvest estimates • No data on actual carbon stocks and emission factors • Some initial permanent sample plots have been established recently	• Suitable carbon conversion procedures for existing data • Subnational measurement program to monitor key REDD activities • Long-term measurement efforts to quantify emission factors and net-carbon changes for different degradation processes • Regular monitoring of activities causing forest degradation

	Other pools (i.e. soils)	• Soil carbon may be key category (1/3 of current estimates of terrestrial carbon pool • Impacts from deforestation and degradation unknown • No consistent national data?	• Identification of national carbon stock key categories • Include all pools initially in fieldwork to understand key categories
Biomass burning	Emissions of several GHG	• No consistent national data on areas effected and carbon impact	• Understanding of natural fire regime and expected changes with climate change • Include fire satellite observations and in forest area change associated will fieldwork

Spatial data infrastructure	Drivers & factors of forest changes, Centralized database	• National coverage of GIS data is available for number of baseline datasets:
		  • SRTM 90m DEM
		  • Landsat 2006 – 2009 – national coverage
		  • PALSAR 2009 (hotspots coverage)
		  • CBERS 2009 (hotspot coverage)
		• Consistent national database and transparent data exchange for integrating relevant data is not in place
			• Establish national mechanism to gather relevant data on national level
			• Build a spatial data infrastructure integrating all IPCC relevant data for reporting

Table 3: Capacity gap assessment for national needs (forest change processes)

Processes that effect forest carbon stocks	Who is responsible for the execution of the activity?	Effects on the forest (carbon effect per ha): sink or source	How important is the process nationally (area affected)?	Importance (carbon impact)	Current responsibilities & data/monitoring activities and capacities	Suggested activity to fill data gap in the near term
Forest land conversion for agriculture (Livestocks, crops, and aquaculture	Investors	Source - Large	Large	Very high	GL&SC GFC – in the case of the quick assessment report Some data on area change and non on carbon emissions	1. Gather/integrate existing data on the national level 2. Remote sensing based, area / land use change assessment 3. In situ carbon stock measurements & conversion of inventory data
Forest land conversion for mining	Local miners and companies	Source – large, low to medium if rehabilitation to improve carbon stock in the future	Large	High	GGMC GFC - in the case of the quick assessment report Some data on area change and non on carbon emissions	1. Gather/integrate existing data on the national level 2. Remote sensing based area / land use change assessment 3. In situ carbon stock measurements & conversion of inventory data
Logging activities	Holders of Forest Leases	Source – medium to low (depending on level of sustainability and long term regeneration)	Large	High	GFC-concessions Some data on area affected and harvest estimates (non on carbon emissions and long term effects)	1. Gather data on national level and evaluate data with remote sensing assessment 2. Conversion of existing harvest estimates into carbon 3. Additional field measurements 4. Study long-term effects
Forest land conversion for roads	Government agencies Forest Lease holders Miners Developers	Source - large	Large	Very high	Ministry of Public Works GFC EPA Some data on area change and non on carbon emissions	1. Gather/integrate existing data on the national level 2. Remote sensing based area / land use change assessment 3. In situ carbon stock measurements & conversion of inventory data
Forest land conversion for urban	Government agencies Forest Lease	Source - large	Medium	High	Ministry of Housing Forest Lease Holders Mine Lease Holders	1. Gather/integrate existing data on the national level 2. Remote sensing based area / land

development Forest land (housing) conversion for local agricultural economies in transition	holders Miners Local communities Developers Villages Investors	Source - large	Small	Medium	Ministry of Agriculture Ministry of Finance through GOINVEST Limited data on area change and non on carbon emissions	1. Gather/integrate existing data on land change assessment 2. Remote sensing based area / land use change assessment 3. In situ carbon stock measurements & conversion of inventory data
Forest land conversion for energy development	Multilateral institutions Government agencies	Source - large	Medium	High	EPA Sea Defence GFC Some data on area change and non on carbon emissions	1. Gather data on national level and evaluate data with remote sensing assessment 2. Targeted ground surveys and in situ for carbon sequestration
Mangrove development improvement for sea defence purposes	GFC Sea Defence EPA Local communities Villages Farmers Hunters	Sink - medium	Small	Low	EPA GFC Some data on area change and non on carbon sequestration Local communities Villages Limited data on area affected and non on carbon emissions	1. Gather data on national level and evaluate data with remote sensing assessment 2. Targeted ground surveys to assess carbon impact
Fires (agricultural fires and accidental burning of forest)		Source - medium	Small	Medium		
Issue of subsistence farming (incl. Fire)	Local communities Villages	Source - zero to medium (depending on fate of land, maybe carbon neutral in the long term	Small	Low	Local communities Villages Community based NGOs No data on area change and non on carbon impact	1. Engage communities/NGO in monitoring 2. Gather data on national level and evaluate data with remote sensing assessment 3. Targeted ground surveys to assess carbon impact
Forest Protection	NGOs GFC EPA Local communities Villages Large concessionaires	Overall carbon Neutral but large if counted as avoided source	Large	High	EPA NGOs(National and International) GFC National Parks Commission Ministry of Amerindian Affairs Some data on area change and limited on carbon stocks	1. Gather data on national level 2. In situ carbon stock measurements & conversion of inventory data

SECTION 4: Road Map for MRV System Development

The development of a road map for the establishment of a system for measurement, reporting, and verification (MRV) as an initial investment to participate in any REDD mechanism requires the consideration of a number of necessary steps and different types of gaps to be addressed in different phases. The road map lists expected outcomes and capacity improvements for these different phases (Table 4), as well as, a set of specific activities to fill four different types of gaps (Table 5).

Most importantly, REDD policy should drive MRV activities and vice versa, and this interaction needs to be established from the beginning. One of the fundamental questions initially is whether sufficient data are existing for the country to explore REDD opportunities and formulate a national REDD policy strategy and scope, and demonstrate implementation activities. This issue is targeted in the first phase and should be tackled right away, also considering opportunities for early REDD+ implementation and demonstrations. The seven priority action areas from the workshop discussions provided in the previous section will be used as baseline to specify efforts for the first phase.

Activities include the establishment of missing institutional arrangements and filling some existing gaps to first derive initial datasets (data gap filling). The results should provide a thorough understanding on the activities of drivers and processes and their forest carbon impact, and how policies can be defined and implemented to affect them. In this phase, Guyana will also be aiming to build basic capacities to report on a set of interim performance indicators that will respond to an international REDD mechanism, focused on area based changes.

The co-evolution of the MRV system and the national policy mechanisms to support the positive impact of REDD+ actions continues in the readiness phase where the development of technical capacities, institutional arrangements and policies will result in the establishment of the reference level. This process will help provide the foundations for the eligibility to participate in REDD results-based crediting mechanisms. In both the readiness and the implementation phase the large emphasis on measurements and monitoring will be extended to reporting and verification, i.e. through the establishment capacities to apply the IPCC GPG for international reporting.

The implementation process may also include an effort to fill a methodological gap. Initial measurement and monitoring activities will use readily available (historical) data and methods that may be limited in achieving, for example, accuracy and completeness in national forest carbon monitoring and the GHG inventory. Furthermore, a consolidated national REDD implementation strategy and an analysis of IPCC key categories will result in a prioritization of what needs to monitored, reported and verified in the long-term with the main objective being to contribute to efforts in the key areas and processes designated with respect to REDD implementation actions.

The current road map is associated with a timeline of 2010/11 for phase 1, 2011/12 for phase 2 and post 2012/13 for the implementation phase. This timing reflects the current planning and maybe accelerated if desired, i.e. the need to move towards a full Tier 3 system for participating in new REDD compensation instruments.

Table 4: MRV road map – objectives and expected key results for different phase

	National strategy (2010/11) ➔	Country readiness (2011/12) ➔	Implementation (post 2012)➔
Objectives	**Gather and integrate information & fill data gaps for national REDD opportunities, scoping and policy development**	**Develop capacities, conduct historical monitoring, and implement a (minimum) IPCC Tier 2 national forest carbon monitoring, establish the reference level and report on interim performance**	**Establish consistent and continuous MRV supporting national REDD+ actions and international IPCC GPG-based reporting and verification**
Key results and national capacities developed	1. Comprehensive MRV roadmap developed and national MRV steering body operational 2. Improved national capacities on LCDS, REDD, IPCC-LULUCF, and carbon dynamics 3. Framework and capacities to demonstrate REDD implementation and interim performance 4. All data available and accessible (including acquisition of new forest carbon data) on drivers and processes needed for developing a national REDD policy and interim implementation plan 5. Established communication and participation mechanism to involve relevant stakeholders nationally and internationally 6. Approaches for setting reference levels, linking MRV and policy, and MRV co-benefits and synergies are explored and defined	1. Capacities in place for consistent and continuous acquisition and analysis of key data for Tier 2 nationally and Tier 3 for demonstration/activity sites including international reporting using IPCC LULUCF; uncertainty assessment MRV improvement plan developed 2. Reference level established based on historical data, and future developments using internationally accepted methods 3. All data available and accessible for an updated national REDD implementation plan 4. Regular reporting on REDD demonstrations and interim performance 5. Continued engagement with key national stakeholders for REDD implementation and assuring long-term sustainability of MRV capacities (i.e. universities) 6. Monitoring system explored to cover key variables for other ecosystem services	1. IPCC key category analysis and assessment for Tier 3 approaches completed and implemented (if desired) 2. Independent international review of full MRV system completed 3. Capacity in place and implementation to deliver verification and compliance assessment for REDD results-based compensation 4. National data infrastructure of forest greenhouse gas inventory and assessment in place for regular reporting 5. Implementation plan to use new and proven technologies to reduce uncertainties and increase efficiency of MRV system 6. Framework developed that links REDD into LCDS monitoring, reporting and verification system

Table 5: MRV road map – specification of activities for gap filling

	National strategy ➔	Country readiness ➔	Implementation ➔
Objectives	**Gather and integrate information & fill data gaps for national REDD opportunities scoping and policy development**	**Develop capacities, conduct historical monitoring, and implement a (minimum) IPCC Tier 2 national forest carbon monitoring, establish the reference level and report on interim performance**	**Establish consistent and continuous MRV supporting national REDD+ actions and international IPCC GPG-based reporting and verification**
Data gap filling	• Gather, evaluate and integrate existing data sources on the national level • Acquire additional data (if needed) to analyze (the carbon impact) of all relevant historical forest change processes and drivers (i.e. using satellite data, initial carbon stock assessments and ancillary information) • Assessment of historical and current processes of forest carbon change for formulating national REDD policy strategy and related MRV priorities, and respond to an initial set of interim performance indicators	• Establish mechanisms and partnerships with relevant data sources (i.e. satellite data) to facilitate availability to Guyana in a consistent and continuous way • Data gathering and analysis of drivers and factors of forest carbon change to support an assessment of future driver activities and related/projected forest carbon changes • Collect data for a first comprehensive uncertainty assessment of the different measurement and monitoring components	• Conduct an IPCC key category analysis • Assess opportunities and data gaps to move towards Tier 3 on the national or sub-national (if desired) • Foster and support REDD activity-based monitoring by different actors as part of national framework
Eligibility gap filling	• Develop a national REDD strategy • Involvement of all relevant stakeholders at the national and sub-national level – set up a sustained two-way communication mechanism • Participation in international REDD and REDD readiness processes • Scope a framework for immediate demonstration actions and interim performance indicators that will respond to an international REDD mechanism	• Continued involvement of all relevant stakeholders at the national and sub-national level • Provide an assessment of carbon emissions (and removals) as historical reference level and expectations/forecasting future development • Develop a national implementation plan and related policies to encourage REDD actions by relevant stakeholders • Implement and evaluate REDD implementation activities, and report performance for interim indicators	• Implement an international review of the MRV system • Prepare regular interactions and reporting on REDD implementation activities and on the IPCC LULUCF inventory • Verification and compliance assessment comparing performance against the reference level

Capacity and institutional gap filling	• Complete an comprehensive assessment of existing data and capacities considering international and national MRV requirements • Set up a national MRV coordination mechanism to steer the capacity development and assign roles and responsibilities • Develop capacities to monitor given a set of interim performance indicators • Engage in general capacity building on REDD, IPCC-LULUCF, terrestrial carbon dynamics and key standard methods • Interaction with local actors and key implementation bodies on their role for MRV	• Build sustained capacities to conduct regular and consistent forest and forest area change monitoring using remote sensing and GIS • Establish capacities and implement a systematic national forest carbon measurement and monitoring system, i.e. through permanent sample plots. • Scope and evaluate a sub-national, activity-based measurement program, to monitor key REDD implementation actions • Training and implementation of reporting (IPCC LULUCF) including an institutional framework • Develop and implement an uncertainty assessment and a long-term improvement plan for the MRV system • Scope the involvement of national/regional higher-education institutions	• Continuous training and improvement for institutions and activities providing data and analysis for the REDD MRV system, • Build a national spatial data infrastructure for IPCC LULUCF reporting and REDD implementation • Develop additional monitoring capacities (if needed, to go for Tier 3) • Build a system for verifying REDD actions on the national level using MRV data and other information, link MRV of transactions • Develop and implement an uncertainty assessment and a long-term improvement plan for the MRV system • Implement capacities in higher-education institutions on REDD MRV for university curricula
Methodo-logical gap filling	• Interaction and partnership with national and international research organizations on key issues • Exploration of methods and approaches for establishing reference levels • Evaluate concepts for linking MRV, REDD policy and implementations • Explore potential co-benefits and synergies of the carbon measurements with other monitoring needs	• Interaction and partnership with national and international research organizations on key issues • Develop frameworks for interlinked implementing REDD policies and MRV and linking MRV of actions and MRV of transactions • Exploration of evolving technologies for REDD MRV • Assess the requirements of monitoring carbon variables and relevant information for other ecosystem services	• Foster activities to reduce uncertainties and increase efficiency of MRV system • Implement evolving technologies into regular REDD MRV activities • Finalize exploration of REDD MRV and implementation including broader ecosystem services and environmental accounting procedures and make recommendations.

SECTION 5: Status of Current Activities, Previous Work and Suggested Approaches

5.1 Definitions

Standard and definitions are important in developing an MRVS. Guyana currently has outlined a definition of forest in its Forest Act 2009.

In conducting such assessments and in the overall design of the MRVS, the following are required to be noted and considered: [6]

Anthropogenicity in the land sectors relates to how directly emissions and removals can be related to human activities. The UNFCCC only calls for action, and therefore inventory, of anthropogenic emissions. The MRV system needs to be able to separately estimate anthropogenic and natural emissions.

Natural disturbances are sources of emissions that are not anthropogenic in origin, and the accounting rules and methods to factor them out are ongoing. The MRV system will need to be developed consistent with developments in this area.

Interannual variability due to changes such as climate can cause significant time-series volatility in annual emissions estimates. Various policy approaches are being discussed, and an MRV system should be in a position to take account of this.

Leakage: the potential for a climate mitigation project in one area to displace emission generating activity to another area, rather than abate total emissions. Policy frameworks and monitoring systems need to guard against such effects. National wall-to-wall monitoring of changes in land cover and land use supports such policy measures.

Permanence: the persistence of emissions reductions made in forest carbon activities. This can be addressed in policy through crediting mechanisms. Permanence policies can be supported by continuous, time-series and spatially consistent forest monitoring.

Baselines: time-series consistent monitoring from archival data can provide a baseline of historical trends. Spatially explicit baselines also allow for insights into sub-national trends.

Additionality: where policy frameworks call for additionality, one or both of two key tests usually apply (1) that the activity will have effect beyond projections of business-as-usual baselines as described above, and/or (2) that it is an activity that would not be otherwise economically viable.

[6] CCI, Proposal for MRVS in Guyana.

5.2 Assessing Drivers of Deforestation

In Guyana, as part of its Readiness Preparation Proposal to the World Bank's Forest Carbon Partnership Facility, initial, national level quick assessments were done on the drivers of deforestation and forest degradation: a qualitative assessment based on national sectoral analysis, and a quantitative assessment based on GIS and Remote Sensing Data.

The current understanding of processes affecting forest carbon is not suitable for define and implement REDD+ actions (Table 3). An assessment is require to be conducted, using these initial assessments, on the drivers of deforestation and forest degradation and will include the following key areas:

- Assessing drivers of deforestation
- Identifying causes of forest degradation
- Identifying the likely impacts on carbon stocks from both deforestation and forest degradation
- Assessing areas of forest subject to logging
- Quantifying degradation of carbon stocks by forest fire

5.3 Monitoring Forests and Forest Area Change

Activity Data - Approaches

One of the areas identified as initial activities involve the assessment of forest area change. IPCC GPG suggested Approach 2 for reporting activity data involves tracking of land conversions between categories. Both approaches 1 and 2 provide "net" area changes. Approach 3 extends Approach 2 by using spatially explicit land conversion information; thus allowing for an estimation of both "gross" and "net" changes. Thus, Approach 3 allows the spatial tracking of land change trajectories is the suggested practical approach for REDD implementation.[7] The MRVS is expected to adopt an Approach 3 method, in assessing activity data.

Initial work on emission factors will commence in the first phase of the initiative. This will begin by utilizing existing and newly collected data on carbon stocks, and will be informed by processes of destructive sampling and targeted sampling. The emission factors are derived from assessments of the changes in carbon stocks in the various carbon pools of a forest. Carbon stock information can be obtained at different Tier levels: Tier 1 uses IPCC default values (i.e. biomass in different forest biomes, carbon fraction etc.); Tier 2 requires some country-specific carbon data (i.e. from field inventories, permanent plots), and Tier 3 national inventory-type data of carbon stocks in different pools and assessment of any change in pools through repeated measurements or modeling. Moving from Tier 1 to Tier 3 increases the accuracy and precision of the estimates, but also increases the complexity and the costs of monitoring.[8]

[7] GOFC-GOLD Sourcebook, p. 12
[8] Ibid. p. 12

The MRVS for Guyana will commence with a Tier 2 approach for the readiness phase with accuracy and precision assessments conducted, and cost of monitoring tabulated. Capacities will be built progressively in the system for movement to a Tier 3 approach.

Remote Sensing

The establishment of a Steering/Executive Body for the REDD+ MRVS will be required as an initial activity in the first phase of the Road Map. One of the aspects that this Body will oversee is the coordination of data and key inputs and the setting up of a national mechanism to feed into the LCDS framework. This data infrastructure will include a consolidation of existing remote sensing data and resources that are currently available.

Datasets and analysis a temporal coverage spanning two time periods 2005 and 2006-2008 are available for Guyana at both the Guyana Forestry Commission and the Guyana Geology and Mines Commission. This is a total of 34 Landsat scenes (17 for each time period). A combination of recent ASTER image over identified hotspots (marked by areas of major change) for 2008 and 2009 and ALOS data over identified hotspots for 2008 and 2009.

Capacity exists at the GFC, GGMC and GLSC in preprocessing images and in visual interpretation. Human capacity will need to be built in areas of automated interpretation for deforestation, as well as other areas related to processing and analysis of the results, and the monitoring of areas undergoing forest degradation.

GIS and RS capability reside at the Guyana Forest Commission, Guyana Lands and Surveys Commission and the Guyana Geology and Mines Commission. Guyana Integrated Natural Resources Information System (GINRIS) is an existing database that comprises land use data on the major land uses in Guyana. This database is housed at the GL&SC. This system was established to develop the GIS capacity in Guyana & to serve as repository for national GIS information. The objective was to have one central database where all of the information could be stored and accessed. GINRIS has mapping coverage of 1 - 50:000 mapping scale coverage of country and allows for data sharing by the regulatory natural resources agencies which in turn allows for better coordination amongst agencies. It also allows for the use of information that is standardized, a related legislative reform and development of a national data management system and infrastructure to foster transparency, efficiency and for national and international reporting. One of the initial activities will involve the establishment of a national coordination mechanism, and will include exploring the possible integration of GINRIS-system and revitalize, and will be used to upgrade to use a broader set of data types.

In order to allow for an integrated approach to executing Approach 3, it is required for a system to be developed and housed at the Guyana Forestry Commission, that will complement GINRIS, and that will allow for networking from key agencies that will record and report on individual sector data. The agencies that will be linked to this system

are the GFC, GLSC, GGMC, the Hydrometeorological Division, Ministry of Amerindian Affairs, and other relevant agencies that may be identified.

Algorithms are required to be developed to interpret and estimate emissions. Interpretation will commence with visual interpretation and will move towards automated methods, the latter of which may be done by supervised labeling and clustering, and will be accompanied by training and correction phases. Also required, is pre processing of images which needs to be accompanied by geometric correction, cloud and cloud shadow detection and removal, radiometric corrections and image segmentation.

Options/Considerations for Remote Sensing Assessments

In optical wavelengths (visible to near infra-red), LANDSAT imagery has been recommended by most sources as most suitable for monitoring purposes. The GOFC-GOLD (2009) sourcebook tabulates various platforms with availability and cost and concludes "*In summary, LANDSAT-type data around years 1990, 2000 and 2005 will most suitable to assess historical rates and patterns of deforestation.*". More temporal coverage maybe available for Guyana and should be explored in particular for the most recent years. Pöyry (2008) have provided a detailed report to GFC on the use of SRS to monitor logging activities, and provide detailed algorithms and procedures based on LANDSAT imagery, which they similarly conclude provides the best current option based on cost, coverage availability over Guyana, and resolution.

LANDSAT has a resolution of 30m. This is sufficient to register logging roads and log landings, as well as clearings for farms, power lines, roads, housing, etc if suitable temporal coverage is available. Optical data are affected by cloud cover, but the frequency of imagery means that selection of cloud free coverage has not proven to be an insurmountable problem. Together ASTER data, Landsat will be the primary source for the monitoring of historical forest changes on the national level.

However, other optical platforms offer different scale resolutions and may have strengths in appropriate contexts. CBERS, designed primarily for Brazil's needs has sensors at higher resolutions, down to 20 m. Alternatively, IKONOS resolves to 1-4 m, giving fine detail over smaller area, but is prohibitively expensive to use at Guyana's national scale. The Terra Amazon GIS-system of Brazil will be explored for use in executing Approach 3 and will be assessed for appropriateness and ease of integration. DMC satellite at 32m, currently used by Brazil to supplement CBERS will also be considered in this regard.

In the microwave spectrum, radar imagery is potentially useful in providing synoptic and high-temporal coverage and distinguishing broad biomass categories. Radar imagery has the advantage of not being inhibited by cloud cover, but interpretation beyond simple cover classes is difficult, as there is nothing equivalent to the differential spectral band responses that are available from optical sensors. JERS radar imagery was used as the basis for the Guyana 2001 National Vegetation Map, in combination with a variety of other sources. JERS is no longer functional, but the more advanced ALOS satellite with its PALSAR sensor provides a replacement. However, access to this imagery is much less

open than LANDSAT, and is probably restricted to specific project arrangements. Guyana will be exploring cooperation with the international community to explore the use of Radar data as contribution to the REDD MRV system.

One of the first activities required is the development of a **benchmark forest area map**. This map will represent the point from which each future area assessment will be made and the actual changes will be monitored. The benchmark year will have to be determined in the initial phase.

All products generate will be subject to independent accuracy assessments. The GOFC-GOLD Sourcebook provides some guidance in that regard and requires higher-quality reference data from in situ observations, ground truthing, and higher resolution satellite or airborne data.

Degradation

In assessing degradation, the intensity, extent of area and technique to be used are important considerations. Very high spatial resolution sensors will be required for mapping low intensity degradation. This will be informed by activity data. The spectral resolution and quality of the radiometric signal must be taken into account for monitoring forest degradation at high spatial resolution. The estimation of the abundance of the materials (i.e., end-members) found with the forested pixels, through SMA, requires at least four spectral bands placed in spectral regions that contrast the end members spectral signatures.[9] The Brazilian model will be assessed for possible extrapolation to Guyana, as outlined in GOFC-GOLD Source Book.Additionally, Brazil's DETEX system will be assessed for possible applicability to Guyana.

The Sample Design should also recommend a field based monitoring system that will allow for ground monitoring of degradation, again informed by activity data.

Resource and Capacity Requirement

In addition to the software outlined in the table below, capacity will also need to be built at the institutional level at the GFC to operate such a system as well as to utilize satellite images for forest degradation monitoring and assessment.

5.4 Monitoring Forest Carbon Stocks

Field Data

As outlined in the Roadmap, the activities that will be undertaken in the initial stage will include the design and implementation of a national carbon measurement system. This will involve the designing of national and sub-national stratification, the development of

[9] GOFC-GOLD p. 32

sample design and the conducting of required statistical analyses and the development of protocols for measurement of all carbon pools.

Initial work has commenced in designing field inventories as described below:

The GFC and the REDD Secretariat established to lead technical unit on REDD activities; have been trained in the establishment of plots and in destructive sampling for soil, necromass and to a lesser extent roots and bole destructive sampling. The GFC currently houses a basic set of equipment for this purpose, including an oven, scales, and other such equipment. Pilot activities has started in the setting up of a network of permanent plots, covering all forest types in Guyana including high forest, scrub forest, savannah margins and woodland mosaics, montane forests.

The plots established are circular, of 18 m radius (0.1 ha) with an inner subplot of 8 m radius (0.02 ha). Trees over 20 cm dbh were measured on the main plot, and over 5 cm dbh on the subplot. Plots were organized in clusters of 5, based on a cross design with a central plot, and four plots on 100 m arms at right angles. Clusters have been organised into transects of 3 clusters in a line, one km apart. Plots covered non-productive Muri and Dakama scrub forests, and sensitive savannah-hill forest mosaics, as these constitute important areas for biomass sequestration and potential forest loss, in addition to the sampling of productive forest.

It is proposed that 900 plots be set up as a maximum, grouped as 180 clusters and 60 transects be established nationally in all major forest types. At intervals of 300 plots, results will be assessed for accuracy and precision in estimates recording confidence interval of findings. At this stage, recommendation will be made for additional plots if so required to enhance precision and accuracy. These recommendations will be subject to the outline of the sample design to be done as an initial activity to the project.

Associated with this monitoring system will be data collection to establish coefficients and allometric functions for the major biomass pools: Tree boles, crowns and roots, lianas and epiphytes, understorey shrubs and herbaceous plants, standing and fallen deadwood, litter and soil carbon.

Soil and Necromass Sampling

This work has comprised of two types of sampling units and was done for three clusters of plots. Associated with monitoring plots has been 4 temporary 3 x 3 m quadrats which were destructively sampled by weight for fallen deadwood, litter, and small plant biomass. Soil samples were taken for organic carbon determination. An initial forest carbon stock assessment has been conducted using existing inventory data available to the GFC. The results are summarized as described in Table 6 and 7[10]:

The system will be aimed at generating accurate and precise estimates of carbon stocks. Sampling will be done in order to attain values that can be extrapolated to the population.

[10] Tables taken from Alder D. August, 2009, GFC.

The main concepts that will be considered in this exercise are: bias, accuracy and precision.

Table 6: Total sequestered carbon as tree biomass in Guyana

Vegetation Class	Area	Tonnes per hectare				Total, millions tonnes			
	km²	*Above ground biomass*	*Biomass incl. roots*	*Carbon*	*CO_2 equiv.*	*Above ground biomass*	*Biomass incl. roots*	*Carbon*	*CO_2 equiv.*
Lowland Mixed Forest	100,408	361	440	220	807	3,621	4,417	2,209	8,098
Hill/Montane Forest	45,190	342	418	209	766	1,547	1,888	944	3,461
Wallaba Forest	10,867	460	561	280	1,028	499	609	305	1,117
High forest subtotal	156,465	362	442	221	810	5,668	6,914	3,457	12,676
Dakama Forest	4,234	184	224	112	410	78	95	47	174
Scrub or Savannah	17,562	77	93	47	171	134	164	82	300
Swamp/Marsh Forest	26,899	192	235	117	431	518	632	316	1,158
Cultivated/urban/cleared	4,687					-	-	-	-
Total land area	209,847	305	372	186	682	6,397	7,805	3,902	14,309

Table 7: Biomass estimates by size class for the FIDS, IFP and MLI inventories

Interpolated figures are shown in blue italic

Above-ground tree biomass in tonnes/ha by 10 cm classes

Inventory/Veg. Class	0-9	10-19	20-29	30-39	40-49	50-59	60-69	70-79	80-89	90-99	100-109	110+	Total
FIDS 1968-73													
Lowland Mixed Forest	*20.0*	*31.4*	*48.7*	57.4	50.3	51.5	46.3	25.0	10.4	7.4	5.8	6.7	360.9
Hill or Montane Forest	*21.2*	*33.3*	*51.7*	59.1	51.4	45.0	32.3	16.0	14.4	9.2	8.0	41.1	382.7
Wallaba Forest	*19.5*	*30.5*	*47.4*	78.5	67.9	70.9	26.1	10.2					350.9
Swamp/Marsh	*11.2*	*17.5*	*27.2*	25.1	25.2	27.5	28.4	11.9	11.1	3.8	9.1	3.6	201.5
Mean FIDS	*19.7*	*30.9*	*48.0*	56.0	49.1	48.3	40.8	21.4	11.4	7.6	6.5	16.1	355.8
IFP 1990-94													
Lowland Mixed Forest	*20.4*	31.0	50.5	58.7	54.2	41.2	36.8	26.8	22.4	14.5	9.3	20.1	385.9
Wallaba Forest	*24.0*	35.0	60.9	74.4	81.6	73.4	47.1	33.4	21.8	12.6	7.5	11.8	483.3
Swamp/Marsh	*10.6*	15.8	26.7	28.2	28.2	21.5	17.6	10.8	11.1	10.7	6.9	11.5	199.7
Dakama Forest	*28.5*	60.8	53.0	28.1	14.3	8.4	4.3	2.2	0.7	0.4	0.3	0.3	201.2
Scrub or Savannah	*10.8*	28.1	15.0	12.2	5.3	4.3	1.3		1.5				78.6
Mean IFP	*21.0*	33.4	50.5	55.7	52.9	42.2	33.9	24.3	19.2	12.3	7.8	15.8	369.1
MLI 2002-2008													
Lowland Mixed Forest	*15.9*	23.4	40.2	48.5	40.3	36.5	30.3	20.9	16.8	12.5	7.0	11.2	303.6
Hill or Montane Forest	*13.3*	26.4	26.7	52.5	41.1	33.7	29.4	11.9	14.1	6.4	12.4	7.7	275.5
Wallaba Forest	*14.7*	24.5	34.3	59.3	55.1	47.2	36.6	17.9	10.0	5.7	4.8	1.1	311.3
Swamp/Marsh	*11.5*	19.9	26.1	29.6	17.6	12.0	7.9	2.0	1.2	1.3			129.1
Dakama Forest	*17.2*	32.4	36.3	22.1	5.3	3.4	0.8		0.2		0.5		118.2
Scrub or Savannah	*7.1*	13.7	14.7	20.2	8.6	1.5	3.0						68.8
Mean MLI	*15.6*	24.0	38.5	47.7	39.1	34.9	28.6	18.6	14.9	10.7	6.6	9.4	288.6
Mean, all inventories	*18.1*	28.7	43.8	53.7	49.3	40.8	33.1	22.7	17.6	11.6	7.4	14.3	341.1

The REDD readiness work will commence on a Tier 2 system and will employ static forest biomass information and will also used country specific data and is expected to also resolve forest biomass at finer scaled through delineation. For degradation, Tier 2 using the stock change method seems to be a suitable starting point. Tier 3 will however, be explored as a future step, and efforts will be required to allow for the system to progressively move into a Tier 3 system; starting initially to explore Tier 3- level monitoring in sub-national demonstration sites. Guyana has commenced work in assessing forest carbon stock.

Stratification

Stratification is required to be done by forest type and will measure carbon stocks of various geographic location and degrees of disturbances. A detailed forest type map exists (referred to as Vegetation Map and to be linked with the benchmark forest map) in Guyana and can be reviewed for accuracy and precision. A grouped/simplified map has also been generated and may be considered as well. Following assessment of these existing sources, the land cover maps can be improved to reflect acceptable levels of accuracy and precision. These maps are presented below (Figure 1 and 2). These areas are calculated from the GIS shape file used in the map. The map itself is was developed by ter Steege, 2001 from a variety of sources including satellite imagery, soil maps, research plots and forest inventory plots. Using this information, and informed by field data, a national carbon stocks map is required to be created. Guyana is seeking several types of stratification that reflect carbon densities of forests, specific areas of sub-national REDD implementation, and areas of rapid change. The stratifications should help to include both a systematic national monitoring and a sub-national measurement plan with areas of most change and REDD implementation activities.

Figure 1: Vegetation map of Guyana *(after ter Steege, 2001b)*

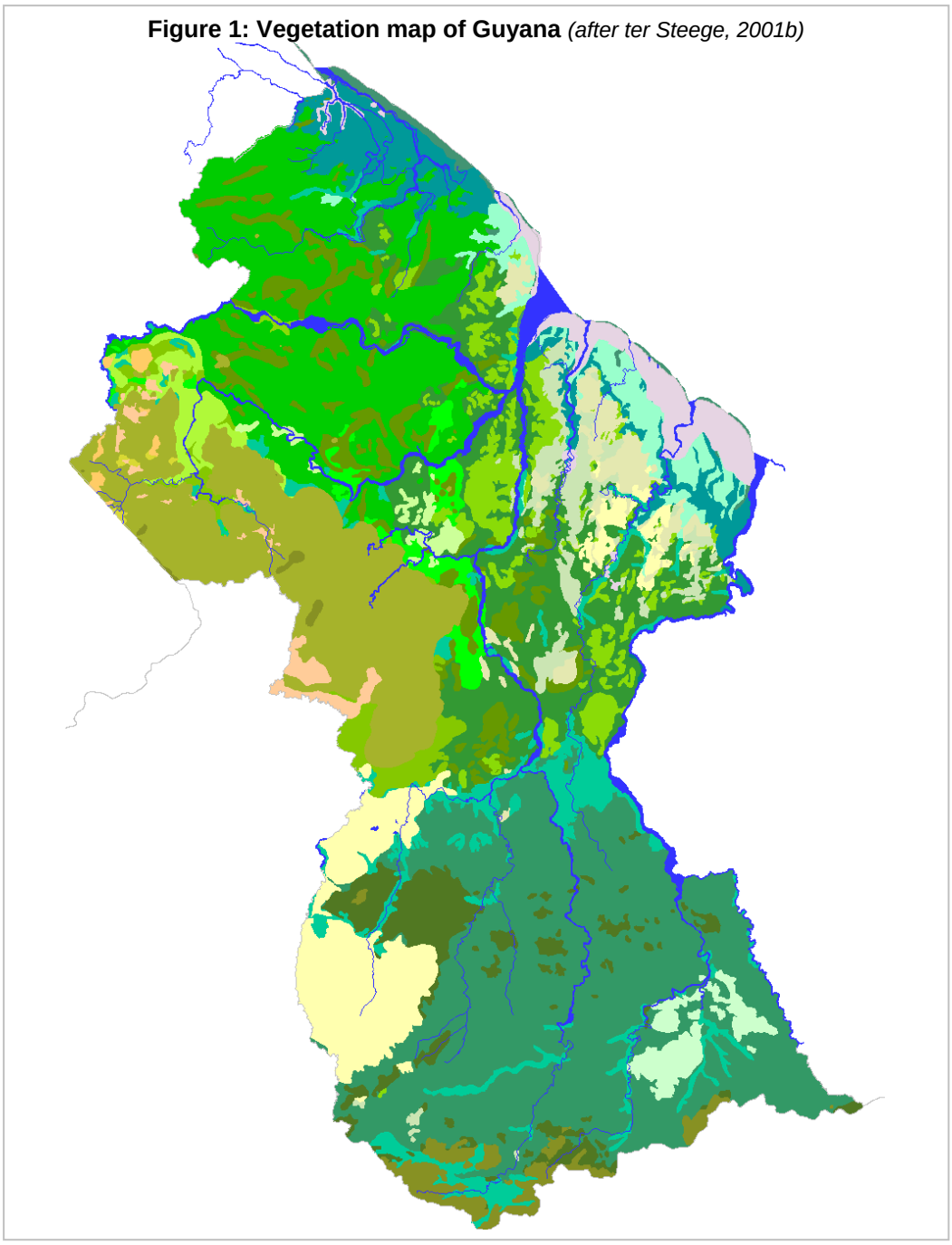
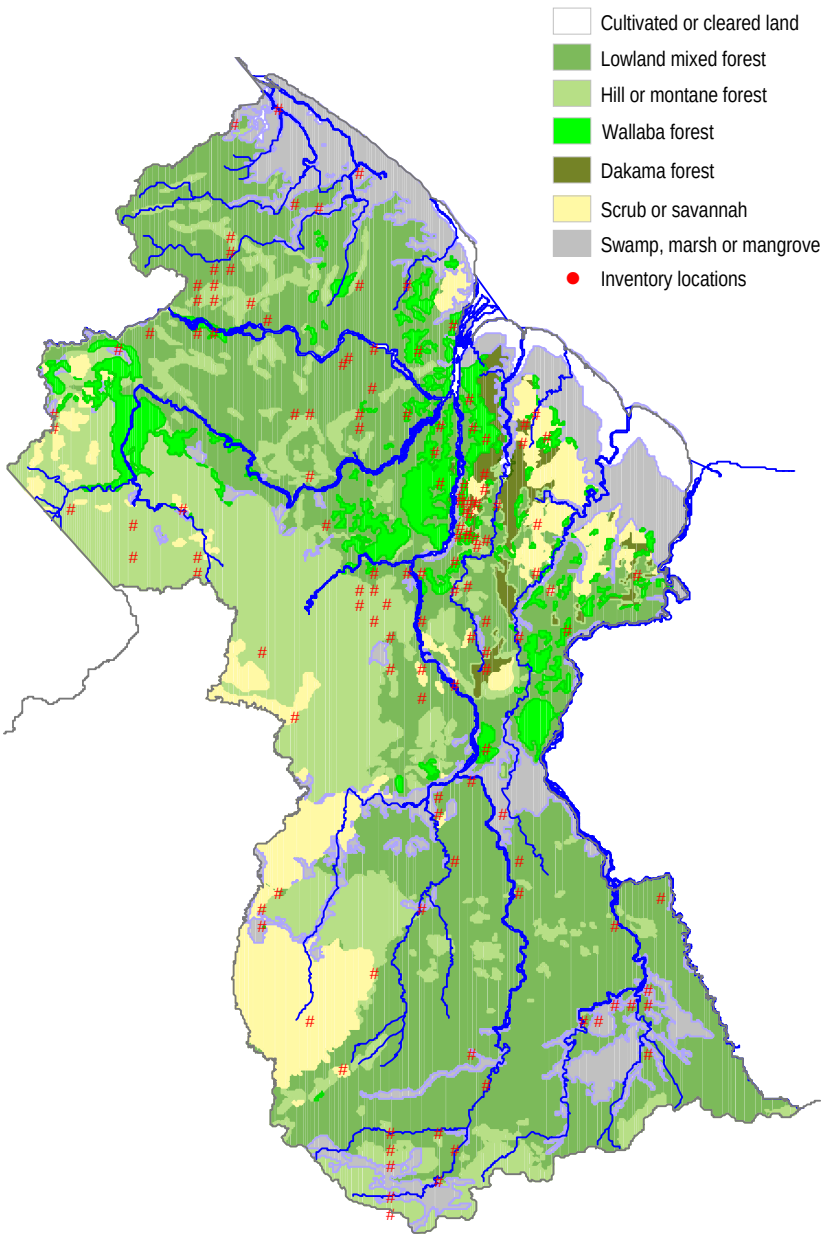


Table shows the related key to forest types and forest and other land use areas.

Code	Vegetation Types	Map	Area (km^2)
1.1	Mixed forest Central/NE Guyana		20,858
1.2	Mixed forest NW Distict		28,393
1.3	Mixed Forest Pakaraimas		3,233
1.4	Mixed Forest South Guyana		47,789
1.5	Mixed Forest on steep hills		7,817
1.6	Mixed Forest on steep hills Pakaraimas		3,339
1.7	Mixed Forest on steep hills South Guyana		6,922
1.8	Mixed Forest/Swamp complex		2,513
2.1	Clump Wallaba Forest		1,016
2.2	Clump Wallaba/Wallaba Forest		2,522
2.3	Wallaba Forest		7,329
2.4	White Sand Forest South Guyana		136
2.5	Dakama Forest		4,234
2.6	Muri scrub/white sand savannah		3,810
3.1	Open Swamp		4,604
3.2	Marsh Forest		9,891
3.3	Coastal Swamp Forest		7,865
3.4	Forested Islands in Rivers		765
4.1	Mangrove Forest		1,262
5.1	Lowland grass/shrub savannah		11,287
6.1	Upland scleromorphic scrub		525
6.2	Upland grass/shrub savannah		1,940
6.3	Broadleaf upland meadow		196
7.1	Submontaine Forest Pakaraimas		23,549
7.2	Montaine Forest Pakaraimas		275
8.1	Submontaine Forest Southern Guyana		3,090
9.0	Clearings, cultivated land, large mines		4,687
	Rivers, lakes, streams		5,123
TOTAL			214,970

Figure 2: Simplified vegetation classes and inventory areas



Estimation of Carbon Stocks of Forest Undergoing Change

The overarching principle of conservativeness is required to be complied with whereby decreases in emissions will not be overstated. Carbon measurements pools will be defined: this will include an assessment of above ground tree biomass, below ground tree biomass, and an assessment of the relative importance of additional carbon pools. Existing data collection by the GFC will be assessed in this regard. Certain pools such as soil carbon or even dead material tend to be quite variable and can be relatively time consuming and costly to measure. The decision to include these pools in the operational

monitoring would therefore be made based on whether they represent a key category and available financial resources. Soils will likely represent a key category in peat swamp forests and mangrove forests and carbon emissions are high when deforested. For forests on mineral soils with high organic carbon content and deforestation is to cropland, as much as 30% of the total soil organic matter stock will be lost in the top 30 cm or so during the first 5 years. Dead wood is a key category in old growth forest where it can represent more than 10% of total biomass.[11]

Currently, it is envisaged that investigation will be made into all sources and all pools through initial assessments and decisions taken following this, as to which pools to exclude. There is required to be consistency on the application of such inclusion/exclusion in reference case and monitoring of later emissions. In estimating carbon stocks, identification of the strata where carbon stock assessment is necessary, will be conducted. This will take focus on a sub classification of the key carbon pools. Some carbon pools may not need to be monitored routinely. However, some categories that are relevant to old growth forest will have to be included, such as deadwood which is a key category to monitor for forests with such characteristics as it reportedly represents more than 10% of total biomass.

The System will utilize Approach A (upfront stratification) whereby a forest carbon stock assessment will be done for every strata where there is a history or future likelihood of deforestation or forest degradation. Existing data will be identified and will include forest inventory data. A variety of both stock and stand tables are available for these inventory datasets. The results presented in this section will be used as a starting point for the assessment and are required to be subject to an assessment of suitability and relevance. The data gathered will be used to estimate growing stock volume and biomass conversion and expansion factors. Any missing data will be identified and assessed.

Soil sampling will be done to a depth of 30cm. Through an initial project executed by the GFC has completed assessments along 3 transects and staff have been fully trained to execute data collection. The work done comprised of two types of sampling units. Associated with monitoring plots will be 4 temporary 3 x 3 m quadrats. Soil samples will be taken for organic carbon determination. Sample was taken from only the center plots (12 quadrats) of each transect. Procedures have already been drafted and field tested for such sampling. Staff of the GFC and REDD Secretariat have been trained to undertake such work. Collaboration has been made with the National Agriculture Research Institute in analyzing soil data.

For all estimates taken, uncertainty analyses will be required to be conducted. The Tier 2 method is a Monte Carlo type analysis. Monte Carlo analyses model uncertainty through selecting random values from probability distributions for parameters and measuring the effect on total stocks. Either training in the use of software packages that automatically

[11] IBID. p. 56

provide Monte Carlo type analyses or contracting an expert in Monte Carlo analysis is required to implement this higher level method.[12]

5.5 Reference Levels

The estimate of emissions from deforestation and degradation requires assessing reference levels against which future emissions can be compared. These reference levels should represent the historical emissions from deforestation and forest degradation in "forested land" at national level.[13] Given the rather low rate of deforestation in Guyana, the method of reference level will likely use future projected emissions levels. As such, assessments will be made of future reference scenario based which will be influenced on the outcome of the international climate change negotiation. This will look at the deforestation drivers and processes, areas of projected growth, planned activities in natural resources utilization and other forms of development. In this regard, various scenarios will be considered. The reference levels that will be used will be dependent on the outcome of the negotiations.

5.6 Method of Estimating CO2 Emissions

Appropriate carbon pools will be assessed and emissions and net removals will also be determined. Land conversion by sub categories (if necessary) within various land uses will also be required to be defined and emissions and net removals will be assessed as per these sub categories. In conducting overall carbon estimating, carbon emissions into the atmosphere, transfer of carbon to other pools will also have to be considered, like in the case of biomass to deadwood during logging.

The LULUCF Guidelines recommend either a stock-difference method or a gain-loss method for estimating the annual carbon stock change in biomass and dead organic matter (DOM) in "Forests Remaining Forests" (the land-use subcategory that encompasses forest degradation). In general, the gain loss method is applicable for all tiers, while the stock-difference method is more suited to Tiers 2 and 3 assuming its application involves accurate and complete forest inventories based on sample plots. [14]

The stock based approach as well as the gain loss approach will be assessed for applicability. It is recognized that the sock based approach requires estimates in both mineral and organic soil. Whether this is assessed as possible during the carbon stock assessment process will determine the suitability of this process. The Gain Loss Method requires for biomass growth rates to be collected. In the Tier 2 method, a combination of methods can be used to assess some carbon pools, e.g soil. The method that is used however must be consistently and uniformed applied and will be IPCC compliant.

[12] GOFC-GOLD Sourcebook, p. 70
[13] Ibid. p. 13
[14] Ibid. p. 80

5.7 Reporting

The main principles of transparency, consistency, comparability, completeness and accuracy will be the key to an effective reporting framework. The reporting framework will be IPCC compliant. Although the reporting framework has not yet been decided at the level of the Conference of Parties, until such time that they are designed, the exiting GhG inventory reporting format will be referred to as a guide to this process.

Reporting tables include classification of initial and final land use categories, identification and measurement of activity data, emissions factors, total change on carbon stock and total CO2 emissions. Relevant explanations and notations should also be provided in reporting formats. An example of this table is presented in GOFC-GOLD Sourcebook. Reporting will also be done in the initial phases prior to the MRVS being completed, along the interim performance indicators (mainly area based indicators) that Guyana will be required to report on as part of a financing mechanism.

5.8 Verification

Quality assurance and quality control procedures will be required to be developed. Accuracy assessments will be used to provides a check for bias and of confidence in predictions through testing the system in a range of circumstances to check whether any inaccuracies in the results are biased toward over or underestimation in a national inventory.

MRV systems are a long-term proposition and should be allowed to evolve over time. There will therefore be a need for continuous improvement in the system. Using the verifications and accuracy assessments efforts can be made to progressively improve models over time.

Uncertainty assessment will also be required to assess the confidence that can be placed in the overall result of the model application at the reporting scale. Accuracy assessments are an important part of testing for any bias in inventory results. Validation and verification are also required and this is planned to be done by an independent 3rd Party expert.

5.9 Principal National Stakeholders

A high-level Steering Body is required to be set up to oversee the MRV roadmap development and implementation and to monitor progress along the Road Map; also with respect to national policies. A technical committee will be led by the Guyana Forestry Commission, with a mandate of overseeing the technical MRVS activity implementation.

Guyana is also seeking to build national and international partnerships that help the implementation of the MRV roadmap.

It is tentatively foreseen that the following, will be the principal national and sub-national stakeholders in the process, some of whom will be members of the Steering Body:

Ministry/Agency	**Tentative Role in MRVS**
Office of the President	Strategic guidance and directives
National Climate Committee	Networking, coordination and technical support
Ministry of Agriculture	Data on agriculture activities, scale, scope, occurrences, plans and projections
Ministry of Amerindian Affairs	Amerindian Lands date: scale, number of titles, coverage, etc
Ministry of Finance	Strategic Guidance on policy and planning
Guyana Forestry Commission.	Key coordinating agency, support field work for MRVS and RS activities, consultation and networking among relevant agencies and stakeholders.
Guyana Geology and Mines Commission	Key support agency for mining sector information including RS and GIS capabilities and resources.
Guyana Lands and Surveys Commission	Key support agency for land use planning sector information including RS and GIS capabilities and resources.
Environmental Protection Agency	Support to aspect relating to environmental monitoring and management
REDD Secretariat	Support the execution of MRVS activities
Hydrometeorological Service	Assist in provision of weather data
University of Guyana	Support to research and assessments

Other Entities/Groups/ Bodies	**Tentative Role in MRVS**
Amerindian Communities	Support the implementation of MRVS activities especially in areas of consultation and information sharing/gathering exercises.
Community-based NGOs	Support to process in technical and research aspects of monitoring.
International NGOs and multi-lateral institutions	Support to process in technical and research aspects of monitoring.
Private Sector	Support to overall implementation
Other Forest based Communities	Support the process and advice on impact on communities. Assist in consultation and information sharing.
Civil Society	Support to overall implementation

Summary of Joint Capacity of the main Land Management Agencies in Guyana:

Guyana Forestry Commission, Guyana Geology and Mines Commission and the Guyana Lands and Guyana Lands and Surveys Commission

Information System Capability	Human and Physical Capacity	Data Availability	Gaps that Institutions have identified based on current mandate
1. Integrated GIS	Computed resources, integrated server, trained persons in geo referencing, geo rectifying, masking, identification of areas subject to change, identify of driver of change by visual inspection, digitizing of area of change, merging of assessment at national level and generation of final national level data. GPS mapping	1. Land area monitoring of large and medium size mining claims. 2. Water quality data on suspended sediments (turbidity and TSS) for a five year period for Guyana, and 10 -15 years for various rivers. 3. Dredge locations August 2009. 4. Tidal water quality data for Essequibo river. 5. Forest Roads and Rivers Map 6. Soil Map (NARI) 1:1,000,000 scale 7. Vegetation Map 1:1,000,000 scale 8. Topographic Mao 1:50,000 9. Gazetteer of Guyana 10. 1:50,000 level river networks are available for Administrative Regions 1, 3, 6, 8 and 10. Work is currently done for Regions 7 and 9.	Management of small claims needs further integration into land management system Time series of Dredge location data/real time position logging. Integrated data management system Improved quality control in land tenure information assessments through GIS needs (maps) being updated. Baseline mapping is required to be updated on the majority of land titles in Guyana's interior since previous work would have been based on natural features. Updated mapping of coastal region to allow for establishing of urban spread and title management.
2. Remote Sensing Assessments	Remote sensing image analysis software, trained persons in conducting remote sensing assessments including: geo referencing, digitizing of area of change,	1. Landsat medium resolution images (20m) for entire land cover of Guyana for 2005 and 2006. 2. Aeromagnetic data at 200m line spacing. 3. Scanned 1: 50,000 topographic base maps 4. JERS 30m resolution imagery 5. SRTM 90m DEM 6. JERS 1999 – 500M 7. Landsat 2006 – 2009 – national coverage 8. PALSAR 2009 (hotspots coverage) 9. CBERS 2009 (hotspot coverage)	High resolution images for mining hotspots Aeromag does not cover the pakaraima mountains Automated detection of forest land area change needed Cataloguing of existing satellite imagery data.
3. Geological	Trained Geologists and technicians Geo-chem Lab	1. Geological data. 2. Geochemical assay data for 42 elements. (selected project areas and company data) 3. Structural data (faults, lineament interpretation) 4. Mineral occurrence in Guyana 5. SN Barron library	Geo-chemical samples for areas out of project areas Structural data is based on previous work and does not cover the entire country one equal scale Mineral Potential map needed for Guy.
4. Forest Concession Management and Legality Assessment	Trained staff in visual detection of occurrences of illegality based on a decision tree framework, forest area allocation and planning.	1. Forest concession allocation map 2. Change detection system	Integrated planning and management with other natural resources agencies
5. Field Data on forest inventory, and initial work on forest carbon stock assessment	Staff trained in executing forest inventory and in establishing forest biomass monitoring plots, destructive sampling of soil and necromass, some training in roots and tree destructive sampling, and in ground truthing and some training in verifying data via aerial surveys	1. Report on carbon storage capacity by soil type (Hans ter Steege, 2001) 2. Biomass Monitoring System reports and Baseline Assessment 3. 135 Biomass monitoring plots established 4. Management level inventory for various areas in Guyana.	Additional training in tree and roots sampling. Training and creation of framework in the integration of this work into an MRVS.

SECTION 6: Immediate Activities and Implementation Framework

In the first phase of the Road Map which is estimated to take 12 months to 24 months (variable for the different actions, scheduled largely for 2010), a series of steps and activities are intended to be completed. The outcomes of this phase will inform the second phase of the initiative. The activities imply that all efforts are coordinated and implemented with national agencies and partners. All activities listed provide a more or less technical description, however, it is assumed that all international partner involvement (i.e. through tenders) include an integrated capacity building component that helps to establish the capabilities within Guyana and its implementing agencies.

The set of immediate actions are designed to start the process with particular emphasis to respond to requirements of *Memorandum of Understanding between the Government of the Cooperative Republic of Guyana and the Government of the Kingdom of Norway regarding Cooperation on Issues related to the Fight against Climate Change, the Protection of Biodiversity and the Enhancement of Sustainable Development.* There is flexibility to include additional activities or speed up the capacity development process if desired by Guyana and based on the outcomes of the international negotiations on REDD+ and associated mechanisms.

Overview of Immediate Activities

1. ***Develop and implement a national MRV coordination mechanism***:

1.1 Establish Steering Body for the MRV system development:

- (Office of Climate Change, Office of the President will be responsible for strategic and policy coordination of activities and the Guyana Forestry Commission for Technical Coordination and Implementation)
- Issue tender and coordinate and oversee implementation of activities
- Establish Executive body for REDD+ MRV system and international reporting on forest carbon issues
- Provide central body for linking MRV and policy

1.2 Coordinate and integrate of national datasets (Technical subcommittee):

- Establish joint database at national level, compatible, involvement of key agencies: Guyana Lands and Surveys Commission, Guyana Geology and Mines Commission, Guyana Forestry Commission.
- Set up national coordination mechanism, explore the possible integration of GINRIS-system and revitalize, use and feed into LCDS framework, upgrade to use a broader set of data types
- Establish a central national data infrastructure and management system for integration, transparency and support national and international reporting

- Coordinate and collate tracking (shape files) data and track actual forest change on agriculture/lease, forestry, mining and other processes through remote sensing imagery analyses
- Utilize Common geo reference systems for REDD+ MRV

1.3 Participation, scientific advice and international coordination

- Identify suitable technical partners through the establishment of a technical and scientific advisory group
- Coordinate the sharing of technical information including seeking advice and support, through meetings, conferences, dialogue, and other forms of interaction
- Steer the efforts of an annual verification by neutral expert(s) of MRV activities and according to the indicators for REDD-plus performance

2. Conduct a comprehensive forest area change assessment for the historical period:

2.1 Build Capacity and Partnerships

- Collaborate with international partner (s) to assist in processing and interpretation of data
- Conduct capacity building sessions on processing and interpretation of data, partial interpretation and accuracy assessment. This is required to be done within the country.

2.2 Finalize definitions

- Assess national definition of *forest* currently use in Guyana
- Determine national definition of forest land and forest land change, to capture human-induced changes

2.3 Consolidate and make available archive and existing Data

- Acquire satellite data (to be done by Guyana), with specific attention to using a variety of sources
- Make available all relevant national datasets, definitions, spatial reference system etc.

2.4 Conduct Assessment on forest degradation

- Include an assessment of monitoring forest degradation from selective logging for more recent years using Landsat-type data or for selected areas with higher-resolution data (study of feasibility to see whether areas affected can be detected accurately)

2.5 Conduct Stratification, mapping and implement monitoring and Assessment of (historical) change in forest area

- Develop Benchmark forest map for 2009 (also to be used for national stratification)
- Using historical data in archives (Landsat), map deforestation (and reforestation) starting 1990 if historical data permit

- Conduct assessment using Minimum 3 (bi-annual) time steps since 2000 using guidance for methods given by GOFC-GOLD sourcebook (to be completed by Oct. 2010)
- Conduct assessment for the inclusion of the option to use optical in synergy with Radar data for 2007-2009
- Identification of mapped forest change processes at second step
- Assess available software for forest change assessment (Spring from Brazil will be explored. Sources in Guyana will be analyzed for suitability)
- Develop framework to report under interim performance indicators, capacity building for the implementation of the MRVS

2.6 Conduct independent accuracy assessment for forest maps and change estimates,

- Following international guidance (i.e. IPCC GPG and GOFC-GOLD Sourcebook)

2.7 Prepare for reporting on interim, area-based performance indicators

- Assess monitoring requirements for performance indicators
- Generate annual satellite data coverage intended with satellite data for future periods (cooperation GEO task and regional partners), and consider the issue of seasonality, maybe not all data analyzed wall to wall annually right away – key is the need to build satellite data archive
- Build required capacities to report on interim indicators starting 2010 latest

3. Build carbon stock measurement capacities (1.5 - 2 years) which will undertake a phased approach, improve carbon data and estimations over time.

3.1 Design and Implement a national Carbon Measurement System

- Design a national and sub-national stratification
- Develop sample design and conduct statistical analysis for national systematic monitoring: national carbon density stratification and determination of plots establishment requirements (permanent and temporary plots aimed at measuring carbon capacities as well as monitoring change in carbon pools)
- Develop protocols and implement measurements in all carbon pools
- Engage with relevant national stakeholders, including the Guyana Forestry Commission and conduct capacity building sessions.

3.2 Establish Carbon Conversion, Expansion Factors, Wood Density and Root/Shoot Ratio

- Utilize current existing inventory data and timber harvesting - data to be converted into carbon (stocks and emissions),
- Implement efforts for:

    - Generate national factors through a process of destructive sampling
    - Implement targeted sampling and surveys to establish national factors
    - Develop Factors for: carbon conversion, expansion factors, wood density for key species, root/shoot ratio based through destructive sampling program
- Conduct IPCC uncertainty assessment from the beginning, error propagation conducted
- Convert existing forest and forestry data into carbon

3.3 Assess Drivers/Processes of change and their carbon impact

- Link a national and sub-national stratification
- Address a variety of drivers and activities – which may require the setting up of temporary and/or permanent plots:
    - General changes (random temporary based area change and monitoring) – implemented by land agencies
    - REDD activity-based measurements (involve REDD implementers)
- Decide on carbon pools, with an aim to measuring all pools initially. In this process selected locations, where are the high-carbon soils, will be explored for possible priority in assessment and may be the main pool measured following determination of significance.

3.4 Develop long-term carbon measurement and monitoring plan to implement REDD

- Assess monitoring requirements for interim performance indicators and results-based compensation mechanisms developing under UNFCCC and elsewhere
- Develop options to implement a more detailed and improved measurement, and verification system that meets those requirements, starting with the interim performance indicators, and preliminary key category analysis

4. Develop MRV for a set of REDD demonstration activities

4.1 Determination of Drivers/Processes for Deforestation and Forest Degradation

- Identify key national drivers/processes and engagement with implementation actors (i.e. land owners, communities).
- Assess the interaction and impact of national drivers/processes on local stakeholders

4.2 Identify Possible REDD Candidate Activity and Monitor Impact

- Scope for possible REDD candidate activities for three locations addressing different drivers and associated national policy options (at

least one should involve community owned forests), capacity building to be done at each stage of the implementation of the initiative

- Develop monitoring and implementation framework and conduct detailed monitoring at demonstration sites using Tier 3 (integrated with national monitoring) (for selected sub-national demonstration), and execute capacity building sessions with national and local stakeholders.

5. Engagement with international community:

5.1 Seek assistance from relevant international partners, including GEO task, to help satellite data acquisition from 2009 onwards

5.2 Establish a focal point and with technical subcommittee

5.3 Work with international partner and verification sites

5.4 Partner with regional organizations and international research partners (i.e. South-South cooperation and student/staff exchange etc.)

- *Bilateral agreements, INPE, CIFOR, research partners, …*

5.5 Seek further advise/coordination with international activities

- *UN REDD, Worldbank FCPF, IPCC, CCI, GOFC-GOLD …*

6. Sustained internal and national communication mechanism

6.1 Conduct a series of regional workshops to inform about REDD+ and MRV among national actors

6.2 Produce communication plan, outreach materials

6.3 Execute workshops and consultation on REDD, MRV and LCDS at sub-national and local levels, involving local NGO's

7. Conduct/support research on key issues

7.1 Conduct scoping exercise for linking policy and MRV (actions, transactions, carbon registry issues)

7.2 Produce detailed national forest change driver assessment and methods for reference level projection

7.3 Co-benefits of MRV (i.e. to support LCDS) and tools for decision-support in the context of integrated natural resources management

Summary for Phase 1 of MRVS (Year 2010 and 2011)				
List of Activities	**Responsible Agency**	**Potential international Partner(s)**	**To be implemented by Guyana**	**To be implemented by Tender**
1. Develop and implement a national MRV coordination mechanism (1 year)				
1.1 Establish Steering Body for the MRV system development	OCC		√	
1.2 Coordinate and integrate national datasets (Technical subcommittee)	GFC, GGMC, GLSC	FAO/UN-REDD, GIS-SDI experts	√	√
1.3 Participation, scientific advice and international coordination	GFC	UNFCCC, IPCC, UN REDD, World bank FCPF, CCI, GOFC-GOLD, INPE, GEO, NGO's, research organizations, …	√	√
2. Conduct a comprehensive forest area change assessment for historical period (1-1,5 years)				
2.1 Build Capacity and Partnerships	GFC	INPE, GOFC-GOLD, GEO, IPCC, CCI	√	√
2.2 Finalize definitions	OCC and GFC	IPCC, FAO	√	
2.3 Consolidate archive and existing data	GFC, GGMC, GLSC	INPE, Space Agencies	√	√
2.4 Conduct Assessment on forest degradation	GFC	UN REDD, IPCC, CIFOR, GOFC-GOLD	√	√
2.5 Conduct stratification, mapping and implement monitoring and assessment of (historical) change in forest area	GFC, GGMC, GLSC	GEO, GOFC-GOLD, INPE, IPCC, WUR, CCI, Woods Hole	√	√
2.6 Conduct independent accuracy assessment for forest maps	GFC	IPCC, GOFC-GOLD		
2.7 Prepare for reporting on interim, area-based performance indicators	GFC, GGMC, GLSC	Government of Norway, UN-REDD, GOFC-GOLD	√	√
3. Build carbon stock measurement capacities (1.5 - 2 years)				
3.1 Design and Implement Carbon Measurement System	GFC	FAO/UN-REDD, USFS, WINROCK	√	√
3.2 Establish Carbon Conversion, Expansion Factors, Wood Density and Root/Shoot Ratio	GFC	FAO/UN REDD, WINROCK	√	√
3.3 Assess Drivers/Processes of change and their carbon impact	GFC	IPCC, UN REDD, FCPF	√	√
3.4 Develop long-term carbon measurement and monitoring plan to implement REDD	GFC	UNFCCC, IPCC, UN REDD,	√	√
4. Develop MRV for a set of REDD demonstration activities (1.5 - 2 years)				
4.1 Determination of Drivers/Processes for Deforestation and Forest Degradation	GFC	IPCC, UN REDD, FCPF	√	√

4.2 Identify Possible REDD Candidate Activity and Monitor Impact	GFC, Land Holder, Communities	FCPF, UN REDD, WINROCK	√	√
5. Engagement with international community (1.5 - 2 years)				
5.1 Seek assistance from relevant international partners to help satellite data acquisition	GFC	GEO, INPE, ESA ...	√	
5.2 Establish a focal point with technical subcommittee	OCC		√	
5.3 Work with international partner and verification sites	GFC	GEO, FCPF, UN REDD, INPE, WUR, CI, WWF	√	
5.4 Partner with regional organizations, bilateral agreements and international research partners	GFC	Bilateral agreements, INPE, CIFOR, CCI,WUR, CI, WWF,	√	
5.5 Seek further advise/coordination with international activities	GFC	FAO, GOFC-GOLD, FCPF, UN REDD, INPE, CCI, CI, WWF, CIFOR,	√	
6. Sustained communication mechanism (1 year)				
6.1 Conduct a series of regional workshops to inform about REDD+ and MRV	GFC and OCC	CI, WWF	√	
6.2 Produce Communication plan, outreach materials	GFC	CI, WWF	√	√
6.3 Execute workshops and consultation on REDD, MRV and LCDS at national and local levels	OCC and GFC	CI, WWF	√	
7. Conduct/support research on key issues (1.5 - 2 years)				
7.1 Conduct scoping exercise for linking policy and MRV	GFC	CIFOR, IPCC, WUR	√	√
7.2 Produce detailed national Driver assessment and methods for reference level projection	GFC	Research partners, CIFOR, UNFCCC	√	√
7.3 Co-benefits of MRV (i.e. to support LCDS) and tools for decision-support in the context of integrated natural resources management	GFC, GGMC, GLSC	IPCC, Research partners, NGO's	√	√