

INTERNATIONAL CLIMATE INITIATIVE

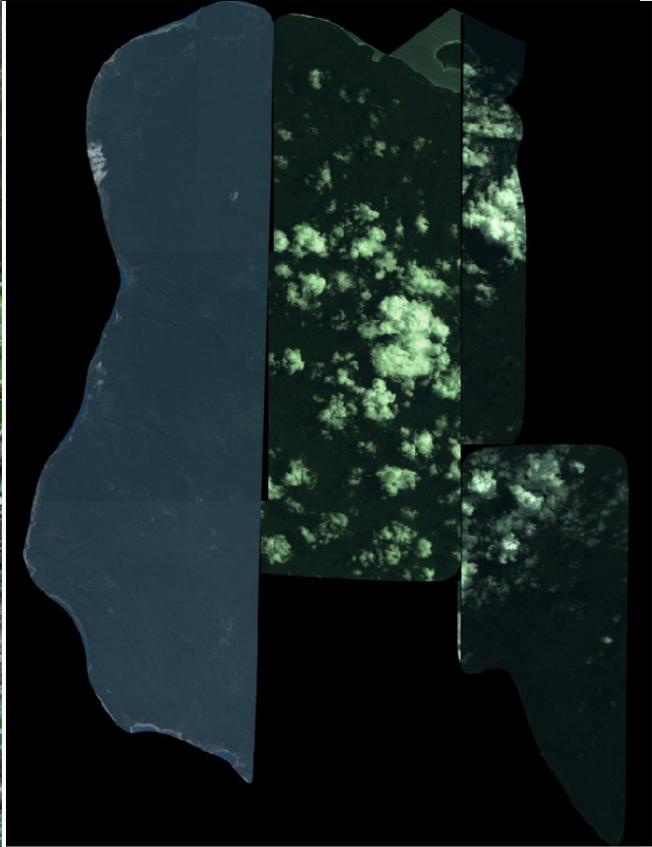
Regional project Climate Protection through Forest Conservation in Pacific Island Countries

On behalf of



Federal Ministry for the
Environment, Nature Conserv
and Nuclear Safety

of the Federal Republic of Germany



Methodology development for MRV and Reference Level for REDD+ in Vanuatu

April 2012



SPC
Secretariat
of the Pacific
Community



SPC Land Resources Division



Deutsche Gesellschaft
für Internationale
Zusammenarbeit (GIZ) GmbH

Report prepared by Jörg Seifert-Granzin

Email: jseifert@mesa-consult.com

and Björn Hecht

Email: bjorn.hecht@giz.de

**On behalf of SPC/GIZ Regional Project
“Climate Protection through Forest
Conservation in Pacific Island Countries”**

P.O. Box 14041, SUVA, Fiji

e-mail: karl-peter.kirsch-jung@giz.de

Contents

Contents.....	3
Glossary.....	4
1. Introduction.....	6
2. Defining REL/MRV.....	7
3. Methodology for developing a national Reference Emission Level/Reference Level.....	8
4. Measuring, Reporting, Verifying Carbon Emissions.....	10
References.....	12
Annex 1 – R-PP Component 3: Develop a Reference Level.....	15
Annex 2 – R-PP Component 4 a: Emissions and Removals.....	22

Glossary

A/R	Afforestation and reforestation
AWG-KP	Ad-hoc Working Group on Further Commitments of Annex I Parties under the Kyoto-Protocol
AWG-LCA	Ad-hoc Working Group on Long-term Cooperative Action
BACI	'Before-After-Control-Intervention' model
BAU	Business as Usual
BMU	German Federal Ministry of the Environment, Nature Conservation and Nuclear Safety
CCBA	Climate, Community and Biodiversity Alliance
CCBS	Climate, Community and Biodiversity Standards
CDM	Clean Development Mechanism
COP	Conference of Parties
DoL	Department of Lands
DARD	Department of Agriculture and Rural Development
DEPC	Department of Environmental Protection and Conservation
DoF	Vanuatu Department of Forestry
EFCS	Enhancement of Forest Carbon Stocks
EO	Earth Observation
FAO	United Nations Food and Agricultural Organization
FCPF	Forest Carbon Partnership Facility
FRA	Forest Resources Assessment
FPIC	Free, prior, and informed consent
GHG	Greenhouse Gas
GIZ	Deutsche Gesellschaft für Internationale Zusammenarbeit GmbH
GOFC-GOLD	Global Observation of Forest and Land Cover Dynamics
HOFS	Heads of Forestry Services
IPCC	Intergovernmental Panel on Climate Change
JNRI	Jurisdictional and Nested REDD Initiative
LULUCF	Land Use, Land-Use Change, and Forestry
MAQFF	Ministry of Agriculture, Quarantine, Forestry and Fisheries
MAR-SFM	Monitoring, Assessment and Reporting for Sustainable Forest Management
MMU	Minimum mapping unit

MRV	Measuring, Reporting and Verifying greenhouse gas emissions
NACCC	Vanuatu National Advisory Council on Climate Change
NAMA	National Appropriate Mitigation Action
NTFPs	Non-timber forest products
ORI	Orthorectified radar image
PIC	Pacific Island Countries
PNG	Papua New Guinea
REDD+	Reducing emissions from deforestation, forest degradation, conservation, sustainable management of forests and enhancement of carbon stocks
REL	Reference Emission Level
REL	Reference Emission Level
RIL	Reduced Impact Logging
RL	Forest Reference Level
RMU	Resources Management Units
R-PIN	Readiness Plan Idea Note
R-PP	Readiness Preparation Proposal
RS	Remote sensing
SAR	Synthetic Aperture Radar
SBSTA	Subsidiary Body for Scientific and Technical Advice (to UNFCCC)
SOPAC	Applied Geoscience and Technology Division of SPC
SPC	Secretariat of the Pacific Community
UNFCCC	United Nations Framework Convention on Climate Change
VANRIS	Vanuatu Resource Information System
VCS	Verified Carbon Standard
VDoF	Vanuatu Department of Forests
VNSO	Vanuatu National Statistics Office

1. Introduction

Greenhouse gas (GHG) emissions from ongoing deforestation and forest degradation are responsible for 17% of global warming. While the Pacific Islands Countries (PIC) contribute marginally to the global emissions, the larger forested PICs can significantly reduce carbon emissions from forestry. This opens up opportunities for these countries to benefit financially from maintaining and establishing forest areas to mitigate climate change through a carbon financing mechanism under the United Nations Framework Convention in Climate Change (UNFCCC), the so-called REDD+ (Reducing emissions from deforestation and forest degradation). Sustainable management, associated with forest conservation will have beneficial ecological, social, cultural and economical impact while contributing to climate change mitigation.

In response to the recommendations from the 2009 meeting of the Pacific Regional Heads of Forestry Services (HOFS), the German Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (BMU) approved funding of 4.9 million Euros for the project titled "Climate protection through forest conservation in the Pacific Island Countries". The Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) implements the project in partnership with the Secretariat of the Pacific Community (SPC) from November 2010 to March 2015.

The regional implementation covers all SPC member countries, but the four countries with the largest forest cover have been selected for support of their national readiness processes; Fiji, Papua New Guinea, Solomon Islands and Vanuatu.

In Vanuatu, a Readiness Programme Idea Note (R-PIN) has been developed to apply for World Bank support under the multi-lateral Forest Carbon Partnership Facility (FCPF). Currently, the country works on developing its Readiness Preparation Proposal (R-PP), which will serve as national implementation strategy for REDD+. In an effort of coordination, SPC/GIZ staff has joined the World Bank representative on their scoping mission. The organizations came to an understanding that SPC/GIZ will focus on supporting the development of a system for measuring, reporting and verifying (MRV) carbon emissions and the Reference Emission Level (REL), while World Bank will support the policy process.

As a first step towards the establishment of the national REL and the MRV System, the methodologies have to be designed. In a next step, those methodologies will have to be tested in the field, reviewed and adapted according to results in accuracy and efficiency, and finally rolled out nationwide.

A mission to Vanuatu was carried out in October 2011. Interviews were conducted with a broad number of stakeholders, the available data was reviewed and in the end, a framework for the methodologies on REL development and MRV was discussed in a stakeholder workshop and presented to the National Advisory Committee on Climate Change (NACCC). This report describes the proposed methodologies for REL/RL and MRV for Vanuatu in detail and how national circumstances will be taken into account. The annexes contain the proposed contributions to Vanuatu's Readiness Preparation Proposal (R-PP) document.

2. Defining REL/RL and MRV

According to the decisions of COP 17 in Durban, Forest Reference Emission Levels and Forest Reference Levels (REL/RLs) are considered as benchmarks for assessing a country's performance in reducing total emissions and increasing removals associated with eligible REDD+ activities. Here, Forest Reference Emission Level (REL) refers to the amount of gross emissions from deforestation and degradation, and forest management from a defined geographical area and within an agreed period under an approved business-as-usual (BAU) scenario against which actual emissions are compared. The BAU scenario refers to the development path which a system would follow if it were not influenced by any external program or policy intervention; that is, it is the scenario in which historical and current practices continue.

While the REL includes gross emissions only, the Forest Reference Level (RL) includes additionally the removals from sustainable management of forest and enhancement of forest carbon stocks.

A country has to assess carefully and in a transparent manner, how much carbon emission was saved due to REDD+ activities. The actual annual emissions have to be measured, reported and verified (MRV). The measurements are compared to the REL/RL. Any emission reduction in comparison to this will be compensated.

The measuring and reporting of the carbon stock changes has to follow a standard in order to be comparable: under the United Framework Convention on Climate Change (UNFCCC), the Intergovernmental Panel on Climate Change (IPCC) has elaborated guidelines for greenhouse gas (GHG) inventories. The Subsidiary Body for Scientific and Technical Advice (SBSTA) to the UNFCCC has decided, that these are going to be standard for an internationally agreed REDD+ mechanism. In practice, this defines what data has to be collected, how it should be collected and how it should be analyzed.

The compliance with the standards and the calculated emission savings has to be verified by a third party auditor before carbon reduction units can be sold. The widest spread certification company for the voluntary carbon markets today is the Verified Carbon Standard (VCS), which adheres to the IPCC requirements. It can be beneficial for a country to prepare for both, the voluntary and the compliance market, hence complying with VCS and IPCC standards at the same time.

3. Methodology for developing a national Reference Emission Level/Reference Level (REL/RL)

The REL/RL for GHG emission reductions under REDD+ is based on the past, current and anticipated future development trends in forestry. The historic and future trends without REDD+ policy interventions have to be assessed as accurately as possible to draw up a “business as usual” scenario (BAU). The actually occurring emissions in future will be compared to the scenario and the difference will be the amount of carbon emissions for which compensation will be paid.

It’s accepted by UNFCCC to submit a conservative estimate and refine the REL/RL later on, especially because the UNFCCC itself hasn’t produced final detailed guidelines yet. In the R-PP, a proposal for the development of a national REL/RL is required, taking into account the national circumstances that will shape this methodology, such as infrastructure, data availability, capacities, relevant drivers of deforestation, etc. The actual implementation work will be done after the FCPF has approved the R-PP.

The methodology for developing the REL/RL is a technical issue, but relies on political decisions. For the endorsement of the methodology, the national level government has to approve the proposed reference time period, which will be based on scientific data review, the national forest definition and the aforementioned future development trends.

The sections of a national REL/RL development methodology for Vanuatu are proposed as follows:

Modalities:

The decisions of the Conference of Parties 17 (COP 17 – decisive meeting of all parties to the UNFCCC in Durban, 2011) provide limited guidance on REL/RL modalities. Beyond, Vanuatu’s REDD+ REL/RL will respect the following modalities:

- Activity specific REL/RL approach
- Piloting on 5 islands and bundling the results for one single reporting
- Activity specific temporal boundaries: different time periods for different activity types, reflected in the REL/RL
- Anticipating national circumstances
- Stepwise development of activity-specific RELs
- Modeling
- Spatiotemporal integration
- Factoring out non-anthropogenic emissions, as recognized by UNFCCC: how can the influence of natural events (i.e. cyclones) be factored out?

Methodological framework:

The following tools and methods will be applied to collect data for the development of activity specific RELs:

- Focal groups and scenario development
- Surveys
- Statistical regression and trend analysis
- Spatial modeling

- Projecting removal by enhancing forest carbon stocks

Data requirements and availability:

This section maps out which data is required, which sources can be used and how this will be analyzed.

Key activities and work plan:

A proposal for the activities and a sequenced schedule for the implementation is described.

Institutional Framework:

The development of activity specific subnational REL/RLs integrated into a national RL requires support and backstopping from different governmental agencies as well as local stakeholders.

Summary budget:

All activities proposed in the work plan are marked with a preliminary budget. The funding for the implementation will be requested from donors. The FCPF will provide 3.4 million USD after approval of the R-PP for the implementation.

4. Measuring, Reporting, Verifying forest carbon emissions (MRV)

For the measuring, reporting and verifying of GHG emissions from the forestry sector there are much more advanced methodologies than for developing the REL/RL. These have to be complied with in order to receive international recognition of the accuracy of measurements of carbon emissions and removals.

The proposed National Forest Monitoring System is based on the latest decisions of COP 17 and the Cancun Agreements. It will also anticipate future decisions of the advisory groups to UNFCCC on REDD+.

Being a small island state composed of 83 islands and island groups, Vanuatu is showing a comparatively low deforestation rate (Herold et al. 2007). Besides, governmental agencies and ministries count with very limited human, technical, and financial resources to manage natural resources. Currently, no forest concessions are operating in Vanuatu and timber harvesting is operating at a small scale level (Vanuatu Forest Policy 2011 - 2020). Consequently, Vanuatu has to aim at a cost-effective forest monitoring system focusing on core greenhouse gas (GHG) measurement, reporting and verification (MRV) activities. It will build existing imagery and mapping products focusing its efforts on closing information gaps minimizing the MRV implementation costs without sacrificing its accuracy. Just as for the REL/RL development, such an information system can be extended over time to serve multiple purposes in managing lands, forests, and property rights.

While activity data will be generated in a wall-to-wall mode, Vanuatu should focus its GHG inventory efforts during the first and second phase on the 4 bigger islands Santo, Malekula, Efate and Erromango. However, a sampling scheme will be developed that supports the processing of emission factors which can be attributed to land use and land use change on all islands. In the third phase, the sampling scheme can be intensified to cover all relevant geographical entities. Along this line, Vanuatu's REDD MRV framework is integrating building blocks developed at the regional level to reduce the national implementation costs. Particularly, it will anticipate MAR-SFM, the Monitoring, Assessment and Reporting for Sustainable Forest Management Framework (Thiele et al. 2010), a forest inventory approach adjusting FAO's inventory framework to the specific conditions of small islands in the South Pacific.

While the country will focus its REDD efforts during the readiness phase on developing its capacities in the managing geodata, the Applied Geoscience and Technology Division (SOPAC) of the Secretariat of the Pacific Community (SPC) will generate relevant activity data to account for forest related GHG emission and removals.

Although the UNFCCC Parties haven't yet agreed to what extent the IPCC guidance and guidelines will be used in accounting for emissions and removals in REDD+, Vanuatu is committed to base its REDD+ MRV on the 2006 IPCC Guidelines for National Greenhouse Gas Inventories (IPCC 2006).

While Vanuatu aims at implementing a comprehensive national REDD+ approach covering all the 5 eligible activities, it will focus its efforts on geographic areas, policy approaches, and eligible activities which show the highest potential to achieve emission reductions and GHG removals on short to medium term. Besides monitoring deforestation and forest degradation, the MRV system shall be capable of tracking GHG removals enhancing forest carbon stocks at different scales (e.g. community forestry, ecosystem restoration) and in different ways (e.g. reforestation using timber species, agroforestry).

The methodology defines in more detail how to address these eligible activities under REDD+. Due to the current lack of capacities for certain tasks, SPC should play a major support role to the Department of Forestry (DoF) in implementing the forest inventory and the remote sensing tasks. The lack of capacities will be addressed through intense on-the-job training and other training measures along the way.

References

- Achard F., et al. 2007: Accounting for avoided conversion of intact and non-intact forests
Technical options and a proposal for a policy tool Institute for Environment and
Sustainability, Joint Research Centre of the European Commission.
- Almeida-Filho, R. et al. 2009: Using dual-polarized ALOS PALSAR data for detecting new fronts of
deforestation in the Brazilian Amazonia, *International Journal of Remote Sensing* Vol. 30,
No. 14, 20 July 2009, 3735–3743.
- Asner, G. et al. 2010: High-resolution forest carbon stocks and emissions in the Amazon, *PNAS*
September 21, 2010 vol. 107 no. 38, p. 16738-16742
- Bellamy, J.A. ed. 1993: Vanuatu Resource Information System. VANRIS Handbook. Prepared by
the CSIRO Brisbane and the Department of Primary Industries Forest Service for the
Australian International Development Assistance Bureau.
- Brown, S. 1997: Estimating Biomass and Biomass Change of Tropical Forests: a Primer. FAO
Forestry Paper - 134.
- Chagas, Thiago, Jacob Olander, Charlotte Streck, Robert O'Sullivan, and Joerg Seifert-Granzin
2011: Nested Approaches to REDD+: An Overview of Issues and Options. Washington,
DC: Forest Trends and Climate Focus.
- Chave, J. et al. 2005: Tree allometry and improved estimation of carbon stocks and balance in
tropical forests, *Oecologia* 145: 87–99
- Feldpausch, T.R. 2011: Height-diameter allometry of tropical forest trees, in: *Biogeosciences*, 8,
1081–1106, 2011.
- Geist, H. and Lambin E.F. 2002: Proximate causes and underlying driving forces of tropical
deforestation, *Bioscience*; Feb 2002; 52, 2; ProQuest Biology Journals, pg. 143
- GOFC-GOLD 2011: A sourcebook of methods and procedures for monitoring and reporting
anthropogenic greenhouse gas emissions and removals caused by deforestation, gains
and losses of carbon stocks in forests remaining forests, and forestation. GOFC-GOLD
Report version COP17-1, (GOFC-GOLD Project Office, Natural Resources Canada, Alberta,
Canada)
- Herold, M., Sambale, J. , Lindner, M., Urban, M. and Weaver, S. 2007: Satellite based monitoring
of the national forest resources in the pacific island state of Vanuatu, DGPF Tagungsband
16 / 2007 – Dreiländertagung SGPBF, DGPF und OVG.
- IPCC 2003: Report on Definitions and Methodological Options to Inventory Emissions from Direct
Human-induced Degradation of Forests and Devegetation of Other Vegetation Types.
- IPCC 2006: 2006 IPCC Guidelines for National Greenhouse Gas Inventories, Prepared by the
National Greenhouse Gas Inventories Programme, Eggleston H.S., Buendia L., Miwa K.,
Ngara T. and Tanabe K. (eds). Published: IGES, Japan.

IPCC GPG LULUCF 2003: Good Practice Guidance on Land Use, Land-Use Change and Forestry.

Laforteza, R. et al. 2010: Assessing the impacts of fragmentation on plant communities in New Zealand: scaling from survey plots to landscapes, *Global Ecology and Biogeography*, 19, 741–754.

Meridian Institute 2011: Modalities for REDD+ Reference Levels: Technical and Procedural Issues. Prepared for the Government of Norway, by Arild Angelsen, Doug Boucher, Sandra Brown, Valérie Merckx, Charlotte Streck, and Daniel Zarin.

Ministry of Agriculture, Quarantine, Forestry and Fisheries 2011: Elaboration of a Vegetation and Land Cover Map of Vanuatu” under the FAO Program “Strengthening of the Monitoring, Assessment and Reporting (MAR) on Sustainable Forest Management (SFM)”, elaborated by Martin Schweter.

Mitchard, E.T.A. et al. 2011: Measuring biomass changes due to woody encroachment and deforestation/degradation in a forest–savanna boundary region of central Africa using multi-temporal L-band radar backscatter, *Remote Sensing of Environment* (2011), doi:10.1016/j.rse.2010.02.022

Olander, J. and Ebeling, J. 2011: Building Forest Carbon Projects: Step-by-Step Overview and Guide. In *Building Forest Carbon Projects*, Johannes Ebeling and Jacob Olander (eds.). Washington, DC: Forest Trends.

Pearson, T., Walker, S. and Brown, S. 2005: Sourcebook for Land Use, Land-Use Change and Forestry Projects, BioCarbon Fund /Winrock International.

Potapov, P. et al. 2008: Mapping the World's Intact Forest Landscapes by Remote Sensing. *Ecology and Society*, 13

Saatchi, S. et al. 2011: Benchmark map of forest carbon stocks in tropical regions across three continents, *PNAS* May 2011, www.pnas.org/cgi/doi/10.1073/pnas.1019576108.

Seifert-Granzin, J. 2011: REDD Guidance: Technical Project Design. In *Building Forest Carbon Projects*, Johannes Ebeling and Jacob Olander (eds.). Washington, DC: Forest Trends.

Smith, E.P. 2002: BACI Design, in: El-Shaarawi, A.H. and Piegorisch, W.W. 2002: *Encyclopedia of Environmetrics*, Chichester: Wiley & Sons.

The Climate, Community & Biodiversity Alliance (CCBA) 2008: *Climate, Community and Biodiversity Project Design Standards, Second Edition – December 2008*

The Climate, Community & Biodiversity Alliance and CARE International (CCBA and CARE international) 2010: *REDD Social & Environmental Standards Version 1 June 2010*

Thiele, T., Mussong, M. and Mateboto, J. 2010: *MAR-SFM. Monitoring, Assessment and Reporting for Sustainable Forest Management in Pacific Island Countries*, SPC.

The Vanuatu National Statistics Office (VNSO) 2008: *Census of Agriculture 2007—Vanuatu*

The Vanuatu National Statistics Office (VNSO) 2009a: Vanuatu Household Income and Expenditure Survey 2006

The Vanuatu National Statistics Office (VNSO) 2009b: 2009 National Census of Population and Housing, Summary Release.

The Vanuatu National Statistics Office (VNSO) 2010: 2010 Household Income and Expenditure Survey (HIES) Survey Operations Report.

Government of the Republic of Vanuatu 2011: Vanuatu Forest Policy 2011 – 2020, June 2011.

VCS 2012a: VCS Standard. VCS Version 3.2 Requirements Document, Washington, DC: Verified Carbon Standard.

VCS2012b: Agriculture, Forestry and Other Land Use (AFOLU) Requirements. VCS Version 3.2 Requirements Document, Washington, DC: Verified Carbon Standard.

VCS 2012c: Jurisdictional and Nested REDD Initiative: Summary of Technical Recommendations – Version 2.0, February, 22 2012, Washington, DC: Verified Carbon Standard.

Annex 1

Component 3: Develop a National Forest Reference Emission Level and/or a Forest Reference Level

Definitions

According to the decisions of COP 17 in Durban Forest Reference Emission Levels and Forest Reference Levels (REL/RLs) are considered as benchmarks for assessing a country's performance in reducing total emissions and increasing removals associated with eligible REDD+ activities (see Component 4a and Annex 4 for further details) . Here, Forest Reference Emission Level (REL) refers to the amount of gross emissions from deforestation and degradation, and forest management from a defined geographical area and within an agreed period under an approved business-as-usual (BAU) scenario against which actual emissions are compared. The BAU scenario refers to the development path a system would follow if it were not subject to any external program or policy intervention; that is, it is the scenario in which historical and current practices continue. While the REL includes gross emissions only, the Forest Reference Level includes additionally the removals from sustainable management of forest and enhancement of forest carbon stocks.

1. Modalities

The decisions of COP 17 provide limited guidance on REL/RL modalities. Beyond, Vanuatu's REDD+ REL/RL will anticipate the following modalities:

Activity specific REL/RL approach: Due to different drivers, agents, underlying causes (Comp 2a) specific REL/RLs approaches and will be developed for each of the 5 eligible REDD+ activities. The choice of the approach depends on data availability, resources requirements, and the technical capacities available. While some approaches might be simple in terms of data requirements and can be easily implemented, others might require additional efforts. Defining a REL for degradation might require determining and combining different BAUs for illegal logging, charcoal production, and fuel wood collection. Approved methodological elements of the VCS will be screened and tested to assess their potential to be used at different levels.

Piloting on 5 islands and nesting: As the emission and removal dynamics of Vanuatu's bigger islands¹ depends on specific sets of drivers, agents, and underlying causes, the REL approaches will be fit and calibrated to these specific conditions. Each REL approach will be tested within a given domain. The rest of the national territory will be treated as one region, as the islands show similar deforestation rates and patterns.

¹ The regional GIZ-SPC program has selected Efate, Erromango, Malekula, and Santo as pilot islands. Tanna should be included as a particular domain, as it shows one of the highest deforestation rates in the past (Herzog et al. 2007).

National activity specific R(E)Ls will be build following the Technical Recommendations Version 2 of VCS's Jurisdictional and Nested REDD Initiative.

Activity specific temporal boundaries: While Vanuatu's historic deforestation patterns can be reconstructed for the past 30 years to calibrate the BAU scenario; it is difficult to generate similar activity data for historic degradation or enhancement of carbon stock activities. Thus, activity based R(E)Ls will be developed using different temporal boundaries concepts. While a reference year might be selected for the partial RL for enhancement or conservation of forest carbon stocks, the deforestation and degradation RELs will be based on historic periods.

Anticipating national circumstances: The development of future deforestation and degradation patterns will depend on the dynamics drivers, underlying causes, and agents. In case of Vanuatu, the demand for land use change is particularly driven agricultural production which has to meet the demand driven by demographic change, urbanization, and growth of the tourism sector. Vanuatu approved certain sector strategies to achieve the Millennium Development Goals (cf. Comp 2a) which will be anticipated in developing activity specific RELs for 5 pilot islands.

Stepwise development of activity-specific RELs: The development of the deforestation REL will be start with a construction and projection of the historic deforestation pattern evolving over the last 30 years. At a second stage, the historic change patters (activity data and emission factors) and their relation to explanatory parameters representing the dynamics of drivers, causes, and agents will be assessed. Within a third step, alternative sector specific policy and development scenarios will be tested to analyze corresponding emission and removal pathways.

Modeling: The potential of spatial and non-spatial models for certain activities will be explored and all relevant parameters, assumptions, methods, and procedures will be comprehensively documented. Common scientific standards (sensitivity analysis, verification and validation of models) and good practices will be followed in developing models.

Spatiotemporal integration: A national RL will be constructed by spatially and temporally integrating activity specific RELs and RLs. The national RL will be based on an approved macroeconomic development scenario.

Factoring out non-anthropogenic emissions: According to the Decision of COP 17 in Durban consistency shall be achieved with anthropogenic forest-related greenhouse gas emissions by sources and removals by sinks as contained in each country's greenhouse gas inventories. This requirement implies that parties have to factor out non-anthropogenic emissions and removals, e.g. caused by natural disturbances.

2. Methodological framework

Different tools and methods will be applied to establish and integrate activity specific RELs:

Focal groups and scenario development: To identify and explore Vanuatu's sector specific development pathways (e.g. for tourism, forestry, and agriculture) focal groups interviews involving different stakeholders and experts will be conducted at the national level and on 5 pilot islands. These interviews will be based on national sector policies and development plans and will lead to the development of the BAU case and alternative land-use change scenarios. Complementary, the potential of Delphi-methods can be explored to balance the view of policy leaders with expert opinions from academe and other stakeholders.

Surveys will play a crucial role in assessing the dynamics and impacts of particular degradation activities. VCS provides modules to quantify fuel wood extraction and charcoal making (VCS VMD0008). Apart, they will be used to understand the behavior of deforestation and degradation agents in a changing policy environment. Vanuatu will explore the potential of these methodological elements on selected pilot sites.

Statistical regression and trend analysis: Vanuatu has comprehensive demographic and agricultural census data (see next section), which has to be explored to assess the statistical correlation between certain trends (e.g. demographics, agricultural production, timber extraction) and historic deforestation and degradation patterns.

Spatial modeling: The DinamicaEGO 1.8.9 will be used to assess the explanatory power of certain drivers (e.g. access to forest, site specific environmental conditions, settlement patterns) and to project the historic deforestation pattern into the future under different scenario assumptions. Spatial models will be linked to quantitative assumptions about the future deforestation, and if feasible degradation rates. A spatial deforestation model will be developed and specifically calibrated for each of the 5 pilot islands.

Projecting removal by enhancing forest carbon stocks will use methodological tools developed under the CDM such as TARAM 1.4. It is expected that similar tools will be developed for NAMAs, soon and shall be tested as soon as they become available.

Different approaches exist to anticipate national circumstances in developing the national REL/RL. Within a direct approach the results of a BAU based on appropriate data, approved policy scenarios, and sound modeling² approaches, for example a projected deforestation pattern for the period 2014-2017 can be directly combined with strata specific emission factors to determine the REL. Within an indirect approach a derived BAU can be adjusted to factor in future development needs, resources policies, or other factors considered relevant. While parties haven't yet agreed on specific modalities how to determine or adjust the REL/RL, Vanuatu will stepwise develop and test different modeling options within both approaches.

The explanatory power and quality of higher-order modeling approaches such as optimization in agricultural modeling and System Dynamics shall be tested in cooperation with national and

² Here, modeling is used as a generic term covering simple statistical models (averages, trends), uni- or multivariate statistics, linear or non-linear dynamic models.

international research institutions. However, these tests shall be used as opportunities to enhance national REDD+ research opportunities.

3. Data requirements and availability

The REL/RL development will build on inputs from several other components to be implemented during the Readiness phase:

Component 2a: The assessment of land use, land-use change drivers, forest law, policy and governance has to provide quantitative inputs to assess the weight of different drivers in developing the BAU and alternative scenarios.

Component 4a: The forest monitoring system has to provide the spatial deforestation and forest degradation patterns as well as rates to estimate emissions and removal over time.

Component 2b: The methodological REL/RL framework can be used to assess the performance of selected REDD-plus strategy options.

Within its efforts to implement a national forest monitoring system Vanuatu will process historic deforestation patterns and rates for the periods 1990-2000-2007-2011 (cf. Annex 4a).

Degradation reporting will be based on the stratification of the new vegetation map (MAQFF 2011) reflecting the state of 2011 – 2014 and eventually 2007-2011. The high-resolution topographic derived from NEXTMap® 2003 TopoSAR orthorectified radar images serves as a comprehensive and highly accurate spatial data source for roads, settlements, hydrography, and mining, and other infrastructure features.

Besides the spatial MRV data the Government of Vanuatu is conducting different surveys on a regular basis, of which the following are of high relevance for the REL/RL development:

Table 1: Available statistical data for REL/RL development

Type	Year(s)	Coverage	Source
Census of Agriculture	2007	<ul style="list-style-type: none"> Structure and characteristics of agricultural activities of households; Number and distribution of household engaged; Data on the farm/holding/sub-holding area, quantity of the crops grown/sold, number of cattle and other livestock kept, quantity of fisheries species gathered/caught, etc. 	VNSO 2008
5 th National Census of Population and Housing 2009	2009 (1967, 1979, 1989, 1999)	<ul style="list-style-type: none"> Population size and growth 1999 – 2009 by province and island Various demographic indicators 	VNSO 2009b
Household Income and Expenditure Survey	2006, 2010	<ul style="list-style-type: none"> Demographic, income and expenditure data at the household level as well as relative standard errors for the data 	VNSO 2009a, 2010
Tourism statistics	Monthly	<ul style="list-style-type: none"> Origin, visitor arrivals, purpose of visit, length of stay, means of transport 	VNSO

Current data availability and structure can be considered satisfactory for REL/RL development. Combining available statistical and forest monitoring data robust spatially explicit model can be

constructed and calibrated which will link the performance of key drivers and underlying causes to the evolving historic deforestation pattern. The correlation between the degradation pattern 2007-2011 (if detectable) and certain agricultural, demographic, and socioeconomic parameters has to be investigated further. Additional data needs might arise when higher-order modeling approaches will be tested. These needs would have to be addressed by complementary funding sources.

4. Key activities and work plan

BAU and policy scenarios development: An international consultant (natural resources economist or policy analyst) will elaborate the BAU and alternative development scenarios. The consultant will develop a policy survey design which has to be approved by the National REDD+ Steering Committee (Cf. Component 1a. National Readiness Management Arrangements). Based on the design the consultant will scope relevant sector policies to derive alternative development scenarios and their impacts in terms of land-use change. Once the Steering Committee has reviewed and approved these scenarios, the international consultant will conduct a 3-step Delphi questionnaire sent to a panel of national and international experts to identify the BAU to validate the approved scenarios. The preselected policy scenarios will be adjusted based on the Delphi survey results and presented to the Steering Committee. Together with the spatial projections of the BAU (see below), they will be validated by local stakeholders in 5 regional outreach workshops on the five pilot islands. The Workshop results will be documented, the BAU and alternative scenarios adjusted and submitted to the Steering Committee for final approval.

Spatiotemporal deforestation modeling: Spatiotemporal deforestation models will be developed and calibrated for 5 pilot islands. An international consultant (GIS specialist) will compile a Geodatabase using available spatial (Component 4a) and statistical data. The consultant will conduct a spatial regression analysis to identify statistical correlations between spatial deforestation patterns, deforestation rates, key parameters and proxies capturing the drivers', causes', and agents' dynamics. Based on the results of the statistical analysis the consultant will develop and calibrate a spatiotemporal model in DinamicaEgo using historical data to project the future deforestation pattern for each pilot island based on the past trend. Once the policy scenarios have been developed, their land-use change impacts will be simulated and assessed using the calibrated model. Together with the policy scenarios the spatial simulations will be presented to the National Steering Committee. Having been analyzed during the 5 regional outreach workshops they will be adjusted for final approval and documented.

EFCS Database development: Enhancement of forest carbon stocks (EFCS) activities will be implemented within the national forest plantation program focusing on site-specific forest plantation concepts, in particular for degraded areas, and compensatory tree planting (Government of the Republic of Vanuatu 2011). These activities will have to be registered (location, stand characteristics), monitored, and measured. Thus, an IPCC 2006 approach 3 compliant database will have to be developed which maintains spatial consistency in reporting emissions and removals across the national domain. A geodatabase has to be developed which support the national EFCS registry reporting tasks. The geodatabase has to be designed in consistency with the reporting requirement established by the IPCC 2006 inventory guidelines

and reporting formats, the forest monitoring system (Component 4a) as well as with future COP decisions.

REL/RL integration: The spatiotemporal deforestation model, the forest monitoring system and the EFCS database will be integrated within a common GIS framework. This framework will support IPCC 2006 approach 3 compliant reporting on emissions and removals. The integration of subnational REL/RLs will follow the Technical Recommendations version 2 and the forthcoming Technical Requirements of the VCS Jurisdictional and Nested REDD Initiative (JNRI). JNRI compliance will be validated by an UNFCCC and VCS accredited certifier.

Stakeholder coordination and outreach: The National REDD+ Steering Committee will accompany the process, review and approve milestone products (policy survey design, policy survey, BAU and policy scenarios, and integrated national REL/RL framework). Local stakeholders will validate the subnational REL/RLs components (BAU, policy scenarios, and spatiotemporal modeling results) at regional outreach workshops to be held on the 5 pilot islands.

Annex 3a presents the work plan and the tentative schedule.

5. Institutional Framework

The development of activity specific subnational REL/RLs integrated into a national RL requires support and backstopping from different governmental agencies as well as local stakeholders. The following governmental institutions will be requested to actively participate in backstopping, data sharing and framing at the level of the REDD+ Steering Committee:

- Ministry of Agriculture, Quarantine, Forestry and Fisheries
- Vanuatu National Statistics Office
- Departments of Agriculture
- Department of Forest
- Department of Land Surveys
- Department of Provincial Affairs

The national REDD+ coordinator will manage the REL development, supervise the work of the consultants and liaise with provincial offices. Complementary research in the field of REL development will be coordinated and approved by the Steering Committee.

6. Summary budget

Main Activity	Sub-Activity	Estimated Cost (in thousands)				
		2011	2012	2013	2014	Total
BAU and policy scenarios development	Policy survey design			3.0		3.0
	Policy survey			18.0		18.0
	Delphi survey			24.0		24.0
	Policy scenario development			12.0		12.0
	Documentation			6.0		6.0
Spatial deforestation modeling	Geodatabase compilation			10.0		10.0
	Statistical analysis			10.0		10.0
	Model calibration			12.5		12.5
	Scenario tests			12.5		12.5
	Scenario adjustment			7.5		7.5
	Documentation			5.0		5.0
EFCS Database development	GeoDatabase design			10.0		10.0
	Geodatabase implementation and training			17.2		17.2
	Documentation			5.0		5.0
REL/RL integration	Accounting framework design			11.0		11.0
	Spatial REL/RL integration			5.0		5.0
	Reporting				8.0	8.0
Stakeholder coordination and outreach	Steering Committee			2.5		2.5
	Regional outreach workshops			87.3		87.3
External REL/RL validation				61.0	61.0	
Total				258.5	69.0	327.5
Government						
FCPF						
Other Development Partner 1 (name))						

Annex 2

Component 4: Design Systems for National Forest Monitoring and Information on Safeguards

4a. National Forest Monitoring System

Guiding principles

The proposed National Forest Monitoring Systems is based on the latest decisions of the 17. Conference of the Parties (COP) of the United Nations Framework Convention on Climate Change (UNFCCC) held in Durban in 2011 and the Cancun Agreements (FCCC/CP/2010/7/Add.1). It will also anticipate the forthcoming decisions of the Subsidiary Body of Scientific and Technological Advice (SBSTA) and of the Ad-hoc Working Group on Long-term Cooperative Action (AWG-LCA) on REDD+.

Being a small island state composed of 83 islands and island groups, Vanuatu is showing a comparatively low deforestation rate (Herold et al. 2007). Besides, governmental agencies and ministries count with very limited human, technical, and financial resources to manage natural resources. Currently, no forest concessions are operating in Vanuatu and timber harvesting is operating at a small scale level (Vanuatu Forest Policy 2011 - 2020). Consequently, Vanuatu has to aim at a cost-effective forest monitoring system focusing on core greenhouse gas (GHG) measurement, reporting and verification (MRV) activities. It will build existing imagery and mapping products focusing its efforts on closing information gaps minimizing the MRV implementation costs without scarifying its accuracy. Such an information system can be extended over time to serve multiple purposes in managing lands, forests, and property rights.

While activity data will be generated in a wall-to-wall mode, , Vanuatu will focus its GHG inventory efforts during the first and second phase on the 4 bigger islands Santo, Malekula, Efate and Erromango. However, a sampling scheme will be developed that supports the processing of emission factors which can be attributed to land use and land use change on all islands. In the third phase, the sampling scheme can be intensified to cover all relevant geographical entities.

Along this line, Vanuatu's REDD MRV framework is integrating building blocks developed at the regional level to reduce the national implementation costs. Particularly, it will anticipate MAR-SFM, the Monitoring, Assessment and Reporting for Sustainable Forest Management Framework (Thiele et al. 2010), a forest inventory approach adjusting FAO's inventory framework to the specific conditions of small islands in the South Pacific. While the country will focus its REDD

efforts during the readiness phase on developing its capacities in the managing geodata, the Applied Geoscience and Technology Division (SOPAC) of the Secretariat of the Pacific Community (SPC) will generate relevant activity data to account for forest related GHG emission and removals.

Although the UNFCCC Parties haven't yet agreed to what extent the IPCC guidance and guidelines will be used in accounting for emissions and removals in REDD+, Vanuatu is committed to base its REDD+ MRV on the 2006 IPCC Guidelines for National Greenhouse Gas Inventories (IPCC 2006). In its initial phase, it is aiming at a tier 2 compliant GHG inventory approach gradually improving the accuracy of emission factors over time to reach tier 3 for selected carbon pools. In the same way, the spatial resolution, accuracy, and precision of forest cover monitoring shall improve over time. While the detection of historic land use land use change has to be based on medium resolution optical (Landsat, Aster, Spot) and radar imagery (ALOS Palsar), the design of the future system will anticipate new improved sensor technologies (e.g. ESA's Sentinel 2 sensor) and new processing methodologies.

While Vanuatu aims at implementing a comprehensive national REDD+ approach covering all the 5 eligible activities, it will focus its efforts on geographic areas, policy approaches, and eligible activities which show the highest potential to achieve emission reductions and GHG removals on short to medium term. Besides monitoring deforestation and forest degradation, the MRV system shall be capable of tracking GHG removals enhancing forest carbon stocks at different scales (e.g. community forestry, ecosystem restoration) and in different ways (e.g. reforestation using timber species, agroforestry).

Eligible REDD+ activities

Vanuatu is committed develop a cost-effective MRV System, which will be implemented step by step. It will build on available terrestrial inventory and remote sensing data and anticipate new emerging technologies to be provided by different space agencies during the Readiness phase. At its mature stature this system will cover all the 5 eligible REDD+ activities. Table 1 summarizes the initial scope of the MRV system to be implemented during the Readiness phase. Annex 4.A describes the available and required data sources, processing methodologies, and scope for each of the 5 eligible activities.

Table 1: Key systems characteristics of Vanuatu's initial REDD+ MRV system

REDD+ activity	Activity data (AD) and Emission factors (ED)	Spatial domain	Temporal boundaries
Deforestation	AD: Optical and radar data ED: IPCC 2006 tier 2 compliant forest inventory	AD: wall-to-wall processing (83 islands) ED: terrestrial inventory on 4 biggest islands	AD: 1990-2000-2007-2011-2014 -2017 ED: 2012, 2017
Degradation	AD: detected managed/non-intact forest land remaining forest land ED: IPCC 2006 tier 2 compliant forest inventory	AD: hot spot monitoring on 4 biggest islands ED: Terrestrial inventory on 4 biggest islands	AD: (2007 –)2011 – 2014 – 2017 ED: 2012, 2017
Sustainable Management of forests	AD: Management plans ED: site specific inventories	Registered pilot sites	2012 - 2017
Enhancement of forest carbon stocks	AD: National registry of AR activities ED: species specific default values	Registered pilot sites	2012 - 2017
Conservation of forest carbon stocks	AD: residual areas (intact unmanaged forest land) ED: IPCC 2006 tier 2 compliant forest inventory	AD: wall-to-wall processing (83 islands) ED: terrestrial inventory on 4 biggest islands	AD: 1990-2000-2007-2011-2014 -2017 ED: 2012, 2017

The National Forest Inventory Approach

For REDD+ reporting purposes the following forest definition will be applied in accordance with the National Forest Policy 2011 - 2020:

Forest is a minimum area of land of 0.81 hectare with tree crown cover (or equivalent stocking level) of more than 10 percent with trees with the potential to reach a minimum height of 3 meters at maturity in situ.

The Stratification of the National Forest Inventory will be based on the Government of Vanuatu's recently released new vegetation and land cover map of Vanuatu (Ministry of Agriculture, Quarantine, Forestry and Fisheries MAQFF 2011). Eight forest classes open and closed high forests, low forests, thickets, mangroves as well as tree crops will be covered by the forest inventory, while GHG removals by forest plantations will be monitored for specific sites. The inventory design will follow the Protocols of the Monitoring, Assessment and Reporting for Sustainable Forest Management (MAR-SFM) developed by the Secretariat of the Pacific Community (SPC). Plots including subplots, units, and subunits will be established following a cross-shaped plot design (s. Annex 4.A). While aboveground biomass, deadwood, litter, and soil-carbon will be measured in the field, belowground biomass will be estimated using IPCC default values for root-to-shoot ratios.

Aiming at a precision of ± 10 per cent of the true value of the mean at the 95 per cent confidence level for aboveground biomass in each stratum, it is estimated that 180 plots will be required to cover the relevant strata. The final plot number will be calculated after a pre-test of the inventory approach on Efate Island in 2012. Aboveground biomass will be calculated using new pantropical allometric equations (Chave et al. 2005).

The Forest Inventory will be conducted under the lead of SPC and VDoF during 2012 - 2013. In accordance with the MAR-SFM protocol (Thiele et al. 2010) key biodiversity parameters will be assessed, too. All plots will be installed involving local communities and land owners. The results will be presented, discussed and validated by landowners and other stakeholders on each island during the Readiness phase.

Deforestation monitoring

Vanuatu will cover the periods 1990-2000-2007-2011-2014-2017 in reporting on emissions from deforestation and forest degradation. It will use the methodology developed by Herold et al. 2007 to the periods 2000 – 2007 and 2007 – 2011 complementing it applying radar-based methodologies to reduce the clouds coverage. Seven major tasks will be conducted during the Readiness phase:

- (1) Deforestation processing 2007 – 2011
- (2) Cloud correction 1990- 2000
- (3) Deforestation processing 2000 – 2007 – 2011
- (4) Deforestation processing 2011 – 2014
- (5) Deforestation processing 2014 – 2017
- (6) Vegetation map 2011 and 2017 updates

Annex 4.A identifies the data requirements, methods to be used, and resources required.

During an initial phase (2012 – 2015) all remote sensing tasks shall be conducted at the regional level with the support of the Applied Geoscience and Technology Division of the Secretariat of the Pacific Community (SOPAC). In this phase, relevant governmental units in Vanuatu will be trained to verify and use the products. Local stakeholders will be involved in all activities in validating the products of each task before completion. All products will be made available to Vanuatu's REDD+ stakeholders applying a disclosure policy to be elaborated.

Degradation monitoring

Vanuatu will test GOFC-GOLD's indirect approach in combination with IPCC 2006 reporting requirements. It will consider the strata open medium-high forest, open low forest, and open thicket as degraded. Other forest classes will be sub-stratified in intact and non-intact, and complementary in managed and unmanaged, if appropriate, applying GOFC-GOLD's 6 criteria to report emissions from degradation. Reporting will anticipate the periods 2011-2014-2017. Backward reporting for the period 2007-2011 will be tested within a research project to be funded complementarily.

Enhancement of forest carbon stocks

The Department of Forestry will establish a registry for enhancement of carbon stock activities eligible under a REDD+ compensation scheme. It will monitor removals on registered sites, account and report corresponding GHG removals using formats and rules to be agreed under UNFCCC for REDD+ reporting. . It will analyze the option to implement a national plantation and replanting program as a National Appropriate Mitigation Action (NAMA) and decide about an appropriate reporting period.

Conservation of forest carbon stocks

Vanuatu is committed to create and extend protected areas to be managed by communities and landowners. It will report on conservation of carbon stocks in those areas.

Sustainable management of forests

The Department of Forests will analyze the potential of promoting pilot activities reducing logging impacts. It considers the available VCS methodologies for Reduced Impact Logging (RIL) as an option for nested project-based approaches.

Common Geodata infrastructure and Standards in terrestrial monitoring

To improve consistency in data management, geo services, and ultimately the quality of the REDD+ monitoring and reporting the Department of Lands, Department of Agriculture and Rural Development, Department of Environmental Protection and Conservation, and the Department of Forests have to agree on common Geodata standards, formats, and official datasets.

Capacity building: GIS and Remote Sensing

During the Readiness phase GIS routines and geo-databases have to be consolidated first, before the remote sensing capacities can be improved. To facilitate the proliferation of common Geodata standards and procedures, GIS staff of different Departments dedicated to terrestrial monitoring shall be involved in GIS training and remote sensing technology transfer. A long-term capacity building concept will be developed during the initial Readiness phase to guide this process.

Independent review and certification

Vanuatu will follow the Technical Recommendations of the Jurisdictional and Nested REDD Initiative (JNRI) of the Verified Carbon Standard (VCS) version 3.2 (VCS 2012a-c). It aims at certifying its REDD+ MRV system by an UNFCCC accredited certifier. The validation can be initiated once the integrated REL/RL framework has been established (Component 3). Verification can be conducted as soon as the National Forest Inventory has been implemented and the activity data for the periods 1990-2014 have been processed.

Table 4-1: Summary of Monitoring Activities and Budget (USD)						
Main Activity	Sub-Activity	Estimated Cost (in thousands)				
		2012	2013	2014	2015	Total
National Forest Inventory	Inventory preparation	58.24				58.24
	Inventory pre-test	100.48				100.48
	Inventory roll-out	155.31	326.00	45.52		526.83
	Data processing and reporting			36.75		36.75
Deforestation monitoring	Deforestation processing 2000–2011	124.30	79.30			203.60
	Cloud correction 1990-2000		125.64	7.61		133.25
	Deforestation analysis 2000-2007-2011			43.40		43.40
	Deforestation analysis 2011 – 2014				119.51	119.51
	External verification				70.00	70.00
Geodata management		40.00	60.00		100.00	
GIS/RS Training		50.00	50.00	80.00	180.00	
Total		438.33	620.94	243.28	269.51	1,572.06
Government						
FCPF						
UN-REDD Programme (if applicable)						
GIZ						
Other Development Partner 2 (name)						
Other Development Partner 3 (name)						