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On behalf of
Federal Ministry for the Environment, Nature Conservation and Nuclear Safety
of the Federal Republic of Germany

REDD Feasibility Study for Tetepare Island, Solomon Islands

SPC
Secretariat of the Pacific Community

giz Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH

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ACRONYMS AND ABREVIATIONS

AFOLU	Agriculture, Forestry, And Other Land Uses
AGLB	Aboveground Live Biomass
CAR	Climate Action Reserve
CCB	Carbon Community Biodiversity Standard
CER	Certified Emission Reductions
GHG	Greenhouse Gases
IFM	Improved Forest Management
LtPF	Logged To Protected Forest
NGO	Non-Governmental Organization
NPA	National Protected Area
PD	Project Document
PNG	Papua New Guinea
REDD	Reduced Emissions from Deforestation and Degradation
SIG	Solomon Islands Government
SPC	Secretariat of the Pacific Community
tCO_2e	Metric Tons Of Carbon Dioxide Equivalent
TDA	Tetepare Descendants Association
UNFCCC	United Nations Framework Convention on Climate Change
VCM	Voluntary Carbon Market
VCS	Verified Carbon Standard
VCU	Verified Carbon Units = 1 ton CO_2e

EXECUTIVE SUMMARY

The REDD feasibility study for Tetepare Island in the Western Province of the Solomon Islands assessed eligibility, potential revenues, benefits, costs, and constraints to implement a forest carbon project that reduces emissions caused by deforestation and forest degradation. Specific factors assessed were the likelihood that emissions from the forest would occur in the near future (additionality), legal aspects, potential carbon credits that would be accrued under a REDD project, and a cost/benefit analysis that compares revenue from REDD versus that from logging.

Tetepare is the largest uninhabited island in the Pacific and harbours abundant marine and terrestrial biodiversity, including the Tetepare White-eye (*Zosterops kulambangrae tetiparius*) and a population of horseshoe bats found nowhere else on Earth. The fringing reefs near Tetepare support one of the highest diversities of fish and coral in the world, second only to Raja Ampat in Indonesia. A variety of non-tangible benefits can be derived from REDD logged-to-protected projects such as flood and erosion control, the provision of clean drinking water, maintenance of the forest itself, freshwater, and protection of near-shore marine habitats that provide protein sources in the form of fish, marine invertebrates and game animals. Since Tetepare is uninhabited some of these environmental services aren't directly enjoyed by members of the Tetepare Descendants Association (TDA), who are living on nearby islands. The TDA is comprised of 3,500 members that can show a genealogical link to the Solomon Islanders that inhabited the island before it was abandoned in the mid-1800s. However, TDA members do hunt feral pigs on Tetepare, and fish on the near-shore reefs. In addition, the island provides a source of logs used for making dugout canoes.

From the rapid forest survey that was carried out on Tetepare, a basal area of 32.5 m^2/ha was estimated, which is indicative of undisturbed primary lowland forest. The sheer number of trees over two meters in diameter is highly unusual to find in almost any lowland tropical forest today. Studies on similar sites in the Solomon Islands show that in unlogged forest total tree biomass could range from 500 to 700 t/ha.

The study shows that a REDD project for Tetepare could financially compete with logging revenue allocated to customary landowners. A forest carbon project including all 12,041 ha of forest on Tetepare is conservatively estimated to generate a total of **18 million tons CO2e avoided emissions** over a period of 10 years. Table 1 below shows that the potential revenue from this activity is estimated to be higher than of a logging operation:

Comparison of the estimated average income per ha from a forest carbon project, assuming a low, medium and high price scenario, and from logging.

Mean Gross Revenue/Ha over 9 Years From REDD			Logging Scenario (USD/ha)
Low $US3	Med $US6	High $US9	
$279.78	$559.57	$839.35	$230.00

For a carbon project on forest conservation, under the assumptions made in this study, three different revenue scenarios anticipating low (US$ 3 per carbon unit), medium (US$ 6 per carbon unit), and high (US$ 9 per carbon unit) carbon prices were created. Landowners can therefore expect an annual revenue of about US$ 280 per ha in the low price scenario, US$ 560 per ha in the medium price scenario, and up to US$ 840 in the high price scenario, compared to an estimated US$ 230 per ha from logging. It should be noted that REDD revenues are gross estimates. Potential taxes charged by the government have not been factored in. Even if the government would decide to tax carbon credits similarly to export timber (25%), both the medium and high price REDD scenarios still substantially exceed the revenue generated from logging. It is also assumed that transaction costs to bring this REDD project to market would be covered through grants.

Apart from valuing climate change mitigation services provided by the forest ecosystems, there are numerous co-benefits in conserving the forest ecosystem in Tetepare. The majority of TDA members would like to conserve Tetepare's natural and cultural values for future generations.

To participate on the voluntary carbon market, a project must comply with the principles and criteria of a chosen carbon standard. The Verified Carbon Standard (VCS) is the most widely applied standard for REDD projects, with the most appropriate methodology for Tetepare's situation being the "Methodology for Calculating GHG Benefits from Preventing Planned Degradation" (VM0011).

This study also briefly examined costs and benefits from a community perspective, which included seafood harvests along with hunting of feral pigs by TDA members. While Tetepare has been managed by the Tetepare Descendants Association (TDA) for the last eight years as a community-based protected area, it does not have national protected area status; and thus, the decision to continue conserving the island or to log it, is entirely in the hands of the TDA members. Over the last four years, several proposals to log Tetepare have been brought to TDA meetings, with some members favouring that choice, while others have continued to support conservation. This report contends that without a REDD project, given declines in agricultural production and fish catches, the members will most likely eventually turn towards logging on Tetepare to gain revenue for food and other staples.

Currently, there is no legislation, regulation, or policy that provides clarity regarding carbon rights, especially on customary lands. A statutory restriction under existing law could prevent customary landowners from entering into a contract to sell emission reduction credits, creating an additional challenge for potential REDD projects. Additionally, the primary legislation that governs timber concessions is the Forest Resources and Timber Utilization Act, which has been amended many times over the last 30 years and is now widely seen as one of the causes for a lack of governance in the forestry sector.

There are marked differences in how logging revenue is distributed compared to REDD funds. The principles of transparency and equitability embedded in REDD do not apply for the distribution of logging revenue, which is the responsibility of the licensee.

The study concludes that a carbon project is a favourable management option for Tetepare and its landowners, also because of the co-benefits provided by such an activity. The main challenges that will have to be overcome are the legal uncertainty of REDD projects in the Solomon Islands, as well as the required legally binding commitment of the whole TDA to permanent conservation of the island over the period of carbon credit issuance.

1 INTRODUCTION

The German Agency for International Cooperation (GIZ) and the Secretariat of the Pacific Community (SPC) have been supporting the Solomon Islands' REDD efforts through its regional project "Climate Protection through Forest Conservation in Pacific Island Countries". The regional SPC/GIZ REDD+ project is funded by the International Climate Initiative of the German Federal Environment Ministry. As part of this support, GIZ engaged the author to conduct a REDD feasibility study on Tetepare. The island was selected since it has long-running under-funded conservation initiatives that could benefit from the potential financial resources generated through a REDD project. Typically, the first step in developing a REDD project is to conduct a feasibility study to assess whether there are technical, social, and/or financial constraints that could significantly impede the implementation of a forest carbon project.

Tetepare is unique based on the fact that it is the largest uninhabited island in the Pacific (120km^2) and harbours abundant marine and terrestrial biodiversity, including the Tetepare White-eye (*Zosterops kulambangrae tetiparius*) and a population of horseshoe bats found no where else on Earth (Read et al. 2010). The fringing reefs near Tetepare support one of the highest diversities of fish and coral in the world, second only to Raja Ampat in Indonesia (Read and Moseby 2010). The Island provides refuge for the 'Big Five' species – those that hold the crown for being the largest in their respective genera; and include the leatherback turtle, saltwater crocodile, prehensile-tailed skink, coconut crab, and the Dugong (Read 2011).

From April 16 to May 5 2012 a field visit to the Solomon Islands was conducted to assess the feasibility for a REDD project, starting first in Honiara, and followed by field work on Tetepare Island. The main tasks of the author are outlined below.

1. Provide recommendations on whether an existing GHG methodology approved by the VCS is compatible with circumstances at the project site.
2. Assess aspects related to whether the project would be eligible under VCS criteria with a focus on additionality, leakage, and permanence in the project.
3. Determine the most likely land use scenario and provide a rough estimate of GHG emissions from those baseline activities.
4. Provide a first iteration rough estimate of the 'with project' GHG emissions and assess the financial feasibility of the potential revenue generated by carbon credit sales on the voluntary market.
5. Even in the event that the project would not be feasible under the stringent criteria of the VCS, it may still have significant merit for climate change mitigation and conservation reasons. The consultant was therefore tasked to consider suitable certification schemes and to determine whether bilateral support would be warranted.
6. Using freely available satellite imagery and imagery that the project partners have on hand, provide a first iteration of the forest stratification that would correspond to statistically significant differences in biomass between strata. Conduct rapid ground-truthing of the stratification.
7. Based on previous biomass surveys done in similar forest, provide a rough estimate of the number of sample plots needed to comply with VCS's criterion of +/-10% sample error with a 90% level of confidence.
8. A final report for Tetepare should be submitted that assesses the technical and financial feasibility of a REDD project applying VCS principles and criteria. In the annexes, it should include two summary socio-economic and biodiversity assessments on the basis of previous work done by third parties
9. Produce maps (JPEG, Google Earth (.kml) and ARCGIS format) that show the following:
    a. First iteration carbon accounting area of the project
    b. First iteration forest strata based on expanded IPCC categories.

This report is divided into the following sections: project site description, brief discussion on the current status of the voluntary carbon market, additionality analysis, eligibility analysis under the VCS guidelines and selection of a VCS-approved methodology, legal analysis, potential to generate verified carbon units (VCU), cost/benefit analysis, and recommendations.

Wherever possible, the author has applied conservative estimates of the potential carbon credits in accordance with the principles and criteria of the Verified Carbon Standard (VCS). Since a compliance market capable of accepting REDD credits is unlikely to be operational before 2020, accessing funds on the voluntary carbon markets is the emphasis of this feasibility study; and VCS is the world's most accepted standard. While no decision has been made to apply this particular standard in the potential REDD site, it is much easier to adapt a rigorous standard such as VCS to one less stringent, as opposed the other way around.

2 PROJECT SITE DESCRIPTION

2.1 Land Cover Types

In the Solomon Islands five forest types can be found, which are saline swamp, freshwater swamp, lowland, hill, and montane forests. Of these five, lowland forest is the dominant type, followed by hill forest with 400m altitude generally recognized as the elevational boundary between these two types. To a much lesser extent, freshwater swamp forest and beach forest are also found in the Solomon Islands, along with montane forest on two islands with elevations that exceed 1700m (Whitmore 1969). On Tetepare, by far the dominant forest type is lowland forest with a small amount of hill forest on ridgelines and mountaintops, and small areas of swamp forest close to the coast (see Annex 2).

LANDSAT imagery was downloaded and ortho-rectified for the years 1989, 2000, 2006, and 2012. No deforestation could be detected between any of the imagery years. While it should be noted that all four images had a high level of cloud cover, given that the island has not been inhabited for 150 years, it is not surprising that no detectable deforestation could be spotted. The 2012 land cover analysis did identify 3,700 ha of forest that were degraded (canopy cover between 30% - 70%), which is most likely due to an earthquake in 2009 that caused numerous landslides in the steeper parts of the island[1] (Figure 1). A small portion (24 ha) of beach forest forming a narrow belt on the coast was also identified.

Figure 1: Land cover analysis for Tetepare using LANDSAT 7 imagery for 2012

2.2 Land Use History

The descendants of the tribes that lived on Tetepare report that the island was abandoned in the mid-1800s, most likely due to diseases introduced by Westerners since that time period coincides with the first encounters with whalers. While much of the Pacific islands were visited early on; starting with Captain Cook's voyage in

[1] Personal communication 2012, Kennedy (head of forest patrolling for TDA)

the 1760s, given the fierce reputation for headhunting in the Solomon Islands, these islands were left fairly untouched until the mid to late 1800s.

After abandonment, the only settlement resulted from the establishment of a coconut plantation on the western side of the island. The plantation's lease dates back to1908, when an Australian trading company, Burns Philip, started clearing the forest for a coconut plantation to produce copra (Read 2011). Once fully established, the copra plantation occupied roughly 3% of the total land area. In 1942, with the war in the Pacific raging, the plantation was abandoned and subsequently occupied by the Japanese army. The domestic pigs that were held on the plantation were released and quickly went feral with their prodigy still on the island today. After the war the plantation lease was purchased by the British colonial government in order to resettle various ethnic groups, but the plan was met with substantial opposition from Tetepare descendants. For another thirty years, the coconut plantation was operated by various expatriate managers, ending in 1978 with the collapse of copra prices. Through much of the 1980s and 1990s, a succession of managers from the nearby islands of Lokuru and Ughele attempted to harvest copra but all ended in failure with the lease eventually reverting back to the Commissioner of Lands (Read 2011).

On other islands in the country, and mostly during the last two decades, log sales have been the primary driver of export earnings. The Western Province in particular has been the largest producer of logs by far (Table 1).

Table 1: Annual summary of log export production by province, 1994-2008

Year	Guadalcanal	Western	Isabel	Malaita	Choiseul	Makira	Central	Total
1994	15,400	403,100	50,100	41,300	50,900	26,900	0	617,700
1995	55,100	392,200	102,700	38,400	88,400	40,300	19,900	737,000
1996	76,500	457,800	51,200	37,900	87,500	31,000	34,000	805,900
1997	75,200	284,800	126,100	12,300	83,000	11,500	16,700	609,600
1998	99,900	234,500	130,200	4,500	89,100	11,600	17,000	586,800
1999	21,800	397,700	82,600	13,100	35,700	23,100	41,900	615,900
2000	14,100	322,900	101,300	17,700	44,100	16,100	5,100	521,300
2001	0	282,300	167,400	34,100	8,200	1,500	15,900	509,400
2002	0	337,300	171,800	17,400	21,000	7,200	9,500	554,200
2003	0	471,000	188,500	0	46,000	19,300	14,100	738,900
2004	0	625,000	144,300	20,000	113,200	35,200	30,600	968,300
2005	9,800	725,000	93,600	30,200	76,400	77,500	34,300	1,066,800
2006	9,756	807,867	94,478	50,159	76,382	77,511	34,318	1,150,501
2007	115,160	727,707	234,963	114,599	205,856	181,720	3000	1,583,005
2008	147,273	465,319	245,594	102,244	125,216	195,168	50,060	1,302,261
Total	*639,991*	*6,954,993*	*2,014,825*	*36928*	*1,189,954*	*758,599*	*326,378*	*12,397,567*
Average	***36,791***	***353,828***	***120,385***	***27,796***	***78,730***	***50,573***	***21,759***	***826,504***

Source: Brief Report On The Update Of Valid Logging Concession Areas And The Status Of The Remaining Loggable Forest National Facts & Estimates, July 2010

The high importance that log sales have had on export earnings combined with weak governance in regulating and monitoring compliance has resulted in the logging companies for all practical purposes enjoying '*carte blanche*' in the Solomon Islands. This status has manifested itself in several ways that would directly and indirectly affect REDD projects:

- By 2008, the total amount of log exports exceeded the sustainable production by six times. Timber demand is way out of proportion with sustainable production and has meant that unlogged lowland forest appropriate for REDD is practically non-existent.
- If a logged-to-protected REDD project were initiated, its risk rating would be high given the weak governance and lack of compliance by logging companies. High-risk ratings lower financial feasibility since a larger percentage of carbon credits would need to be set-aside in a non-permanence buffer. Of note is that among developing countries, the Solomon Islands rank high for income potential from REDD, but rank low for governance (Figure 2).

- Underpayment of timber royalties and duties totalling hundreds of millions of dollars has resulted in even weaker State regulatory agencies without the resources to effectively carry out their duties (Auditor General 2005). Furthermore, this foregone tax revenue could have funded development and infrastructure projects that would have benefitted a significant percentage of the population.

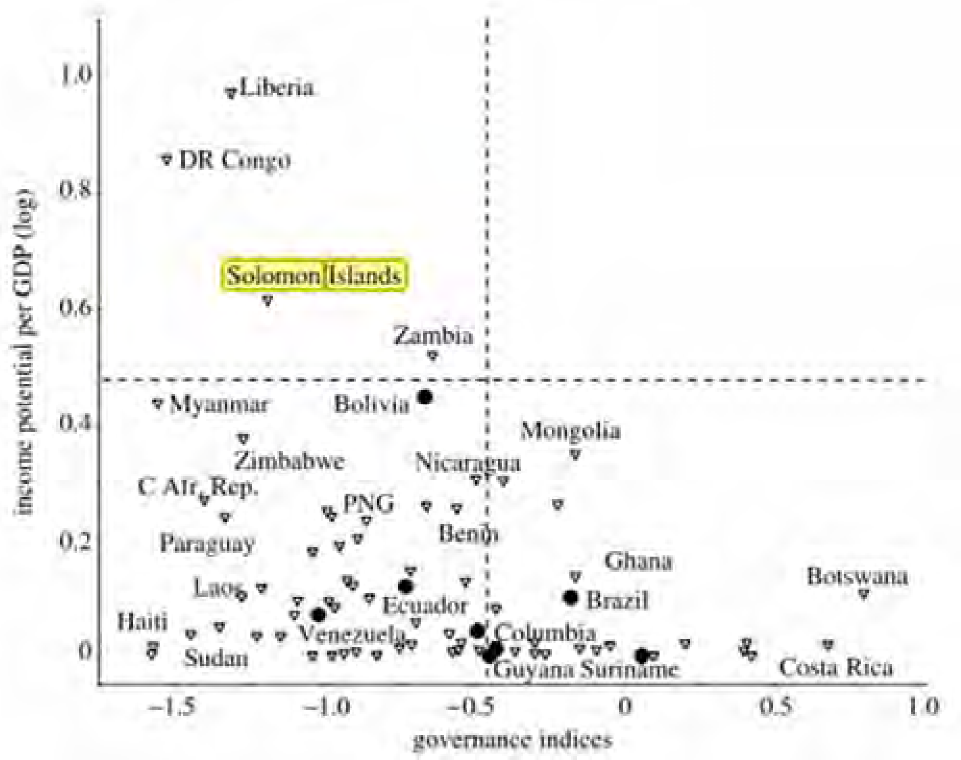

Figure 2: Relationship between income potential (expressed as percentage of GDP, log transformed) and governance.

The governance index used is the mean of two variables measuring law enforcement and corruption perception. Lower values indicate more severe governance problems (Kaufmann et al. 2005).

2.3 Current and Planned Land Use Dynamics in Project Area

Currently, Tetepare is being managed as a community-based protected area with an eco-tourism lodge capable of supporting approximately 12 tourists and another 12 to 15 staff comprising eco-tourism and environmental monitoring teams. TDA members primarily use the island to hunt feral pigs and cut the occasional tree to make dug out canoes. The island's coastal waters also are fished and at one time Bêche-de-mer was heavily extracted from the island's surrounding waters. A few forest gardens exist on the island but are quite limited in size and found slightly inland from the beach.

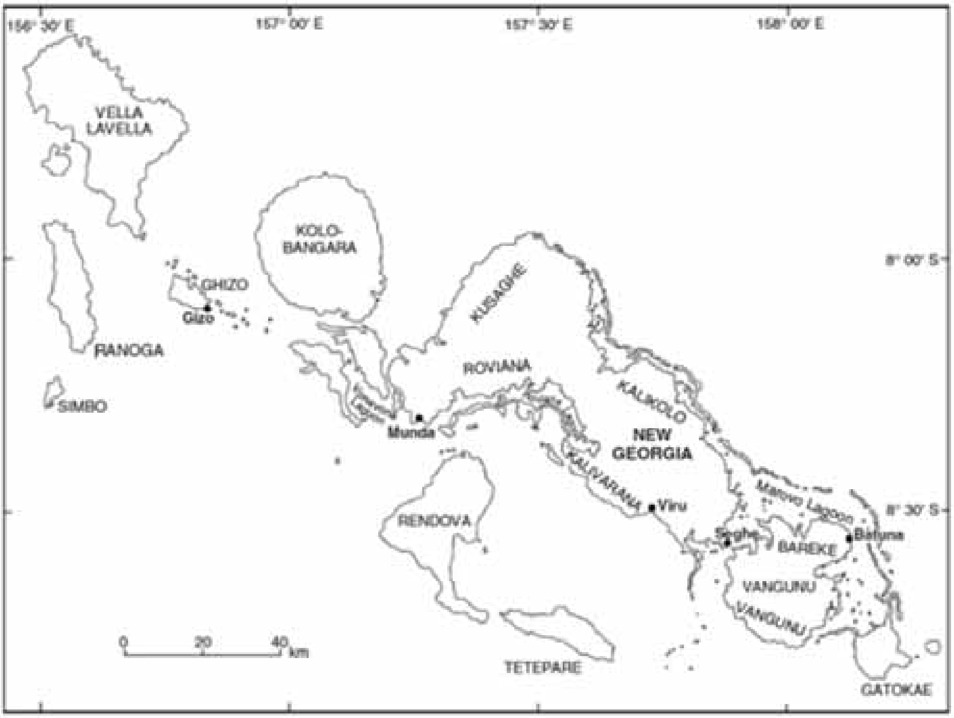

Figure 3: Map of Western Province showing Tetepare and other nearby islands

3 CURRENT STATUS OF THE VOLUNTARY CARBON MARKET

3.1 Trends In Demand And Price

The conceptual framework for how carbon credits are accrued, monitored, and eventually retired under many national REDD+ schemes is still evolving, and a compliance market for carbon credits will not come into existence before 2020. However, a voluntary carbon market (VCM) currently exists and could both provide financial benefit to impoverished rural communities and act as an incubator of ideas and a testing ground for monitoring and revenue distribution methods. Development of various national REDD components could be accelerated by applying the lessons learned from VCM projects, along with helping to inform policy enactment and reform.

In 2011 the voluntary carbon markets recorded the second highest number of carbon credit transactions, totalling US$ 576 million (Peters-Stanley and Hamilton 2012). It should be remembered that the world's worst recession since the Great Depression has occurred over the last five years, and has had an effect on the carbon markets, most notably the existing compliance markets, especially under the CDM that allows developed countries to offset their emissions by financing carbon projects in developing countries, and purchasing Certified Emission Reduction (CER) credits. Currently, CERs are trading at US$ 0.50 down from US$ 20 in 2008. However, REDD-derived credits continue to be in demand with a mean price at credit issuance of US$ 9/ton CO_2 (VCU), which is higher than energy-derived credits due mainly to the generation of social and ecological co-benefits and the charismatic nature of some projects (Figure 4). Future demand for REDD credits, while showing some effect from stalled UNFCCC negotiations and the economic crisis are still predicted to nearly double by 2020 (Figure 5).

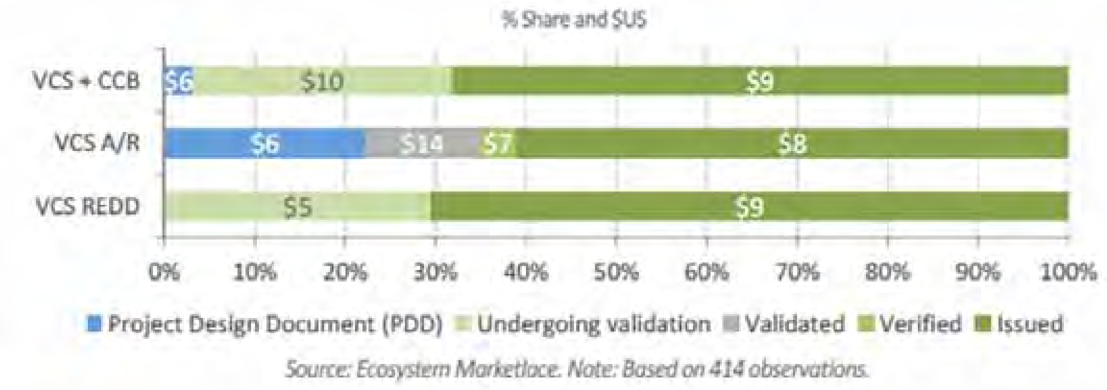

Figure 4: Mean prices received for REDD-related Verified Carbon Units (VCU) according to project development stage (Peters-Stanley et al. 2012).

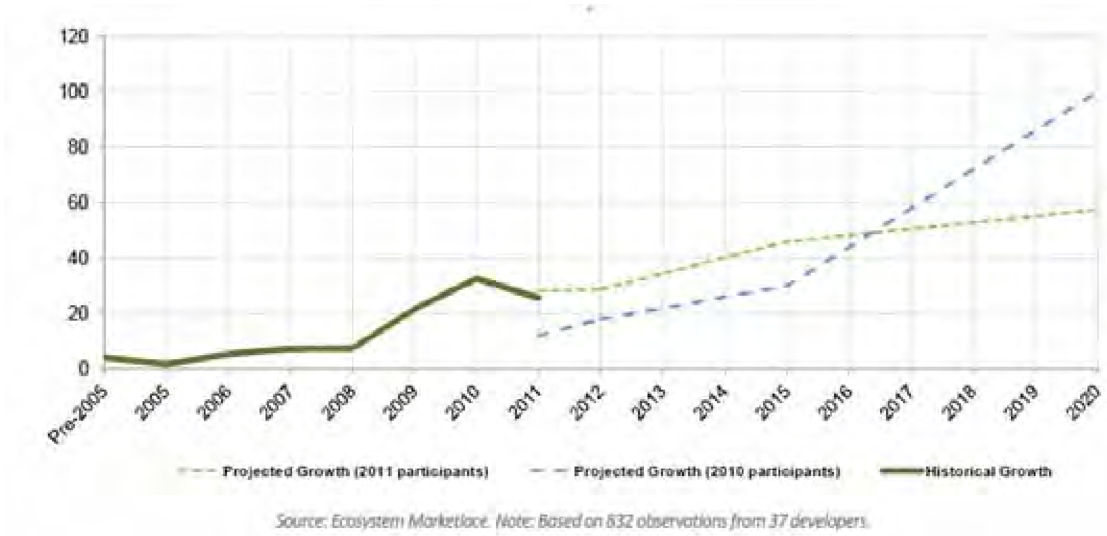

Figure 5: Figure 5 Future demand for forest carbon related VCU through 2020 (Stanley-Peters et al. 2012).

3.2 Selection Of A Third Party Standard

In 2011, of the total issued carbon credits on the voluntary market, 28% applied the Verified Carbon Standard (VCS); which over the last three years, has become the world's most commonly applied standard (Figure 6).

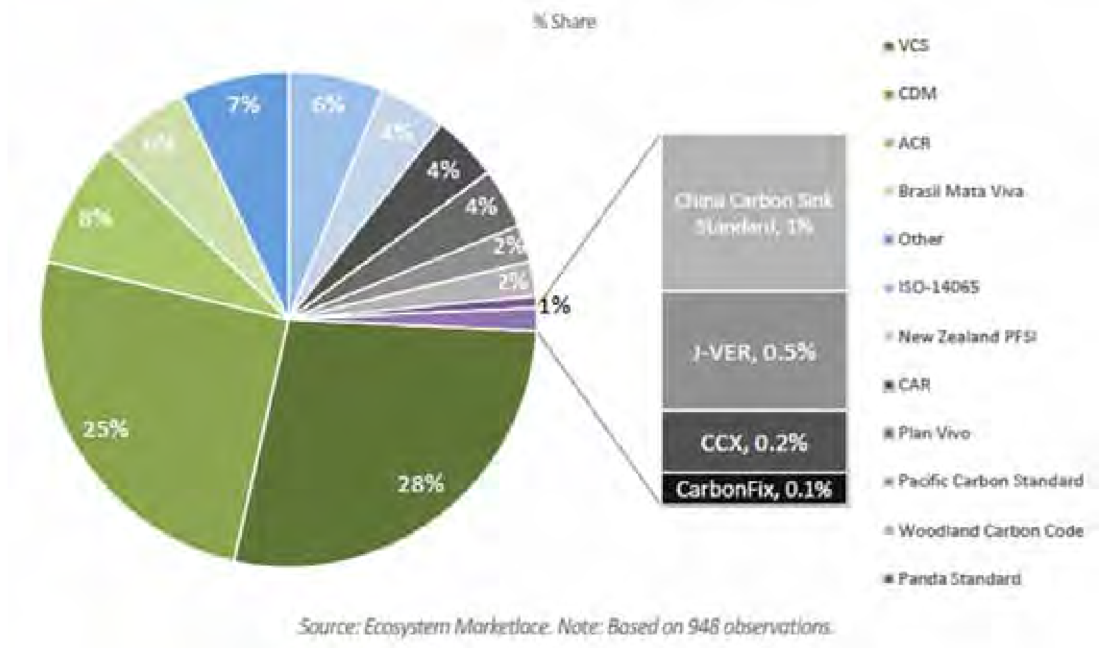

Figure 6: Market share for independent and US domestic standards.

While various other standards exist besides VCS, most of them are designed to meet the needs of specific domestic markets, with Plan Vivo as one exception. Plan Vivo was designed as a low-cost alternative for community-based initiatives, and the NGO Live and Learn has elected to apply this standard to two REDD community projects they are establishing on Choiseul Island. Its advantages are simplicity and relatively low costs; however, as shown in Figure 3 Plan Vivo projects represented only 2% of the market share in 2011, and for many institutional REDD credit buyers, this standard is not well known and would lack creditability. An additional standard is the Climate Action Reserve (CAR), while created for the US market, is now being applied in at least two projects outside of the US. However, there is a strong likelihood that the two CAR projects (both in Latin America) would like to participate in offsets generated through California's cap and trade initiative; which could partially explain why in these cases the CAR standard was chosen.

The majority of institutional investors and bilateral development agencies view a project's commitment to obtain VCS verification as a perquisite for their involvement because the standard ensures that rigorous scientific principles and methods are applied to quantify carbon pools and estimate future emissions. An additional point is that the Solomon Islands follow a Melanesian land tenure system whereby 88% of the forestland is owned by tribes or clans. Given the preceding and recognizing that logging has generated substantial social issues, going beyond VCS will most likely be necessary. The Climate, Community, and Biodiversity (CCB) Standard provides safeguards for social and ecological aspects of REDD projects. A REDD project would not necessarily need to undertake VCS and CCB activities simultaneously, but rather needs to ensure that the commitment is there and plans are made so that the project eventually complies with both standards. To facilitate joint implementation of VCS and CCB, both standards recently collaborated to create a Project Design (PD) template that accommodates both standards criteria; and thus would help to lower the project development costs[2].

The Solomon Islands Government (SIG) could ensure that social and biodiversity safeguards are embedded into REDD by requiring that projects are validated and verified under CCB or an equivalent standard. Nevertheless, since this feasibility study focuses primarily on the technical aspects and secondarily on identifying potential social and/or ecological constraints, VCS guidelines and VCS approved methodologies have been used in the analysis.

[2] http://v-c-s.org/sites/v-c-s.org/files/VCS%20CCB%20Guidance%20Project%20Development%20Process.pdf

4 ADDITIONALITY ANALYSIS

An analysis of additionality tests to see whether emissions would occur beyond a reasonable doubt in the absence of carbon financing. In essence, would this particular project generate emissions reductions that would not have happened otherwise? For projects in this VCS category, additionality must be shown using the "Tool for the Demonstration and Assessment of Additionality in IFM Project Activities". A three-step process is carried out to satisfy the above test, which are listed below:

Step 1: Identification of the alternative land use scenario to the IFM project activity

Step 2: Investment analysis to determine that the proposed project activity is not the most economically or financially attractive of the identified land use scenarios

Step 3: Barrier analysis

4.1 Step 1:Identification Of Alternative Land Use Scenarios

Examining topographic and edaphic characteristics of Tetepare Island indicates whether there are natural constraints that rule out certain land use options. The origin of the island is volcanic and as such possesses deep soils with relatively high fertility. The island does have several small mountains, but none exceed 400m in elevation with only a small percentage of area possessing steep slopes that would inhibit logging.

While the community-based protected status has kept commercial logging out of Tetepare for the time being, the national government has not legally gazetted the island under a National Protected Area status. Therefore, the fate of the island lies entirely in the hands of the Tetepare Descendants' Association. However, the constitution establishing the TDA specifically mentions that one of its aims is to prevent commercial extraction of the resources found on the island (see below, from Article 2 of the constitution):

Primary Aims of Tetepare's Constitution:

(1) Manage and own the entire Tetepare Island collectively by Tetepare Descendants.
(2) Conserve natural resources upon and under the land and in and under the sea around Tetepare for the benefit of present and future generations descended from Tetepare Island.
(3) Prevent commercial resource extraction from Tetepare Island and surrounding waters and prohibit poaching of resources by non-descendants of Tetepare.
(4) Research, locate and document natural resources (including tambu sites and traditional artefacts) on Tetepare Island in order to adopt and enforce resource management orders to ensure their adequate protection.
(5) Research and document the genealogy of individuals, families and tribal units descended from Tetepare and their history, traditions, stories, myths, legends, songs and art.
(6) Discourage the settlement of Tetepare Island by descendants and prevent the migration to or resettlement of Tetepare Island by non-descendants.

While an Executive Committee runs the daily operations of the TDA, Article 2 above appears to greatly constrain any potential of commercial logging. Thus, for a logging scenario to happen under the constitution, it would require an extraordinary meeting of the full TDA membership with the majority voting in favour of exploitation. Unless the economic and/or the environmental situation in the Western Province substantially changes, gaining a majority vote to modify the constitution is not easily imagined. Nevertheless, this report suggests that the effects of climate change, especially in regard to the low-lying islands will force community members to make decisions that they would not normally make. Already, there is mounting evidence that some effects from climate change have taken hold in the Solomon Islands, with increased surface temperature and a mean decrease in annual precipitation of 20 to 40% (Rasmussen et al. 2007).

Another logging scenario would entail ignoring Tetepare's constitution, and logging would be promoted and approved by a group of influential TDA leaders. This option is more in line with common practice in the Solomon Islands, and in fact several attempts have been made to attain a logging license for Tetepare but did not receive sufficient support from enough TDA leaders. Figure 7 indicates that the majority of the islands of the Western Province have been logged, which will put increasing pressure on the exploitation of Tetepare.

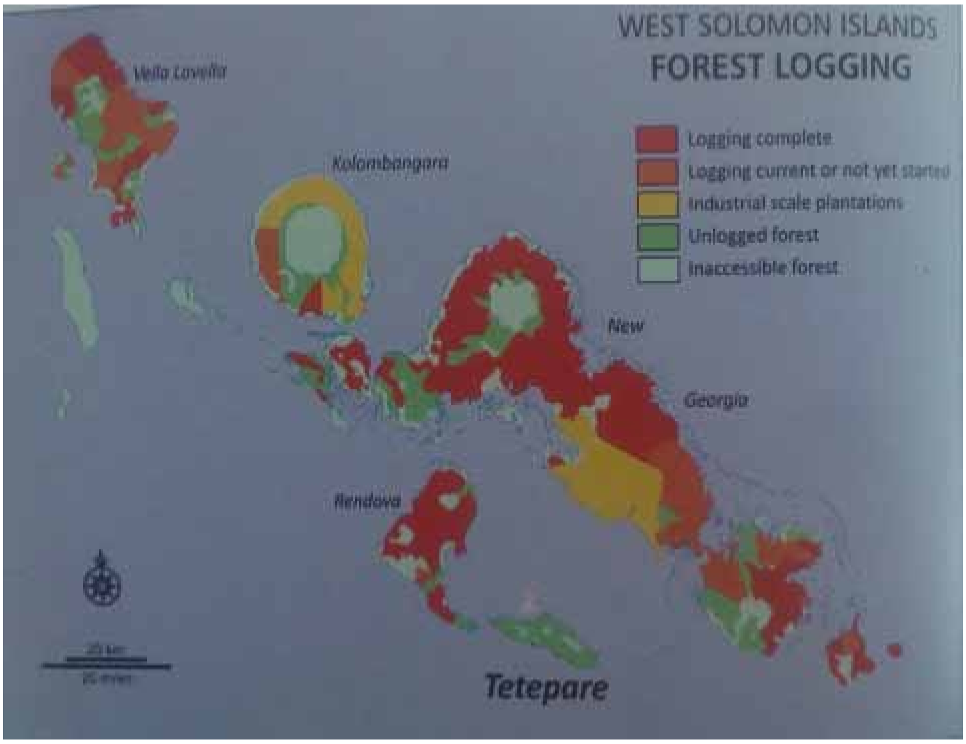

Figure 7: Map of the Western Province indicating logging status

4.2 Step 2: Investment Analysis

Carbon credits generated from REDD projects range in price depending on the stage of project development. The highest prices are generated after the VCUs have been issued and in 2011 the mean price reported was US$ 9.00 per VCU. For REDD projects that have only been validated, the price could range from US$ 3 – 6 per VCU. For carbon credits to financially compete with revenues generated from industrial logging, the VCU price would need to be at least US$ 25 – US$ 30 per VCU. The baseline scenario assumes that logging will happen, and as Figure 4 indicates, almost all the islands in the Western Province have been logged, which suggests that logging is indeed the norm.

Profitability in logging operations is determined by two main factors – commercial timber volumes that can be extracted and log haul distances. Table 3 summarizes the results of the rapid forest surveys conducted on Tetepare , which indicate that the sampled forest has not been logged with basal area values commonly associated with primary forest and that roughly 90% of the trees falling inside the sample points were of commercially acceptable species.

Table 2: Results of 3P point sampling conducted during the rapid forest survey on Tetepare Island

Site Name	Total Sample Points		Basal Area (m^2/ha)	Total Trees Sampled	Total Commercial Trees In Plot	Percentage of Commercial Species
Tetepare	40		32.5	650	594	91.4

4.3 Step 3: Barrier Analysis

Barriers could be technological, cultural or legal, while financial barriers are dealt with in Step (2). In Tetepare's case, while there are no cultural barriers that would limit a REDD project, there are legal barriers that highly discourage investment in REDD projects, especially regarding lack of legal clarity on carbon rights and taxation of carbon credits.

5 ELIGIBILITY ANALYSIS

5.1 Eligibility Criteria Under VCS Project Type

REDD projects are categorized by VCS according to their 'business-as-usual' scenario, or often termed the baseline case. In essence, determining the baseline case requires answering the question – what is the most likely land use activity that will happen in the project site? Applying VCS guidelines, this type of scenario fits into the Improved Forest Management (IFM) category. Improved forest management projects are somewhat unique in that there is no change in land use classes driven by deforestation, but rather the baseline and project scenarios assume that forest will stay as forest; thus the focus is on reducing forest degradation commonly caused by logging. Besides degradation and its associated emissions, eligible activities are those that increase sequestration and both activities must be on forestlands managed for wood products under a license granted by government.

To be eligible for an IFM project the following VCS criteria need to be met:

- Forest management in the baseline scenario must be planned timber harvest;
- Planned timber harvest must be estimated using forest inventory methods that determine allowable harvesting intensities ($m^3\ ha^{-1}$);
- The boundaries of the forest land must be clearly defined and documented;
- The baseline condition cannot include conversion to managed plantations.

The latest version of VCS's Forestry guidelines lists four major activities that can qualify under the IFM category:

1. **Reduced impact logging (RIL):** Encompasses a comprehensive suite of activities that range from improved planning of roads and skid trails, accurately mapping the location of trees to be felled, improved techniques in directional tree felling, and reducing the size of roads, skid trials, and log decks.
2. **Logged to protected forest (LtPF):** Applies to either logged over or virgin forests and could be partially implemented in a concession in conjunction with FSC certification or the entire HPH could be taken out of production. An example of the latter option is the Noel Kempt project in Bolivia.
3. **Extended rotation or cutting cycle (ERA):** Originally designed for even-age plantations this objective is also applicable to natural forest concessions under a selective harvesting regime. The two most common examples applicable to Indonesia are:
    a. Increasing the minimum cut diameter of harvestable trees
    b. Extending the re-entry period for selective harvesting
4. **Low productive to high productive (LtHP):** Applies to highly degraded forest where there is a paucity of commercial species or where the normal successional forest cycles have been arrested. The aim is to increase stocking of commercial species that leads to enhanced carbon sequestration and typically has been done through enrichment planting. Additionally, this objective could be employed where the normal successional stages have been arrested, examples being where intense wildfires devastate extensive forest stands and subsequently bamboo and/or vines dominate, thereby suppressing natural regeneration. Even though this objective is primarily for rehabilitating degraded forest, VCS does require that the area meet the country's definition of forest.

5.2 Relevant IFM Activities

Of the four major activities under the IFM category, only the Logged to Protected Forest (LtPF) option fits with the circumstances of Tetepare Island for several reasons, that include:

1. The forests of Tetepare are pristine, have never been logged on a commercial scale and are thought to harbour high biodiversity.

2. The four thousand member Tetepare Descendants Association was created to promote and facilitate conservation of the island's natural resources; and thus, LtPF is in line with the wishes of a large number of community members.

There are two applicable VCS-approved methodologies under the Logged to Protected (LtPF) option, listed below:

a. VM0010 Methodology for Improved Forest Management: Conversion from Logged to Protected Forest

b. VM0011 Methodology for Calculating GHG Benefits from Preventing Planned Degradation

Of the two above methodologies, VM0011 allows for emissions from logging damage and road and skid trail construction to be included in the baseline. The baseline scenario for forest management includes selected timber harvest practices. The quantification of avoided GHG emissions (the with project scenario) is determined based on a change in land use practice and an increase in carbon sequestration.

Key criteria of the VM0011 methodology are:

- The IFM project activity may contain more than one discrete area of land.
- The minimum duration of a monitoring period is one year and the maximum duration is 10 years.
- Project proponents are free to decide on the periodicity of verifications, however, under the VCS AFOLU Guidance Document, if verification does not occur within 5 years, 50% of the buffer account credits are cancelled.
- Carbon pools included: Aboveground trees, dead wood, and harvested wood products.
- Project emission source included: Burning of biomass.
- A Historical Baseline Scenario derived from the historical practices of the baseline agent of timber harvest must be used where data are available, otherwise a Common Practice Baseline Scenario determined from a timber harvest plan shall be used.
- A planned timber-harvesting schedule has to be submitted by project proponents as part of the VCS PD.
- Project proponents have to submit a detailed description of the vegetation stratification adopted for the project area ex ante.
- Baseline projections are calculated ex ante and are not adjusted throughout the project lifetime.
- In all cases, where wood is harvested for conversion to wood products, carbon stock in the long-lived wood products pool must be included in the baseline case.
- The potential for illegal extraction of trees from the project area shall be assessed ex ante and ex post through a participatory rural appraisal (PRA) of the communities in and surrounding the project area.

The eligibility criteria above can all be met in the Tetepare project site.

6 LEGAL ANALYSIS

6.1 Applicable Laws

While almost 90% of the forest land is owned by clans, as is typical in a Melanesian land tenure system, laws that deal with customary rights over land and the associated bundle of rights with owning land (e.g. timber, carbon, water, etc.) are not clearly defined in the Solomon Islands. Since the business-as-usual scenario is that logging will occur in the future, the most relevant law is the Forest Resources and Timber Utilization Act, last amended in 2000. This Act was designed to regulate forest management including logging and has been amended various times, starting with the original act known as the Forests Act of 1960, which was amended in 1969, 1977, 1982, 1984, 1990, 1991, and 2000. None of the amendments clearly differentiate landowner rights versus timber rights, and customary ownership is not clearly defined, even though 88% of the land is under that form of ownership. The Revised Solomon Islands Code of Logging Practice (2002) is an additional regulation that specifies particular practices that a timber concessionaire must follow to reduce environmental impacts. A new Forest Bill was drafted in 2004. Policy experts believe it may offer better guidance in relation to timber rights on customary lands, but it has yet to be voted on by the parliament.

Figure 8 illustrates the major steps involved in the issuance of a logging concession on customary lands.

Figure 8: Legal steps needed to acquire a timber concession (Public Solicitor's Office 2011)

While Figure 8 does suggest that customary landowners do have some say in the granting of timber rights, in practice the voices of dissenting groups are seldom heeded. Another issue is that often times there are overlapping claims on customary lands from different clans and no formal mediation process exists to help solve the problem, nor is there a functioning Lands Registration Office that can grant recognition and title to customary lands (Corrin 2012). Potentially problematic for REDD projects is that there may be a statutory restriction that prevents customary landowners from entering into a contract to sell emission reduction credits. This would need to be further clarified and may require an amendment to the Land and Titles Act that would exempt REDD contracts (Corrin 2012).

7 POTENTIAL TO GENERATE CARBON CREDITS

7.1 Project Boundaries And Scope

7.1.1 Spatial Boundaries

The spatial boundaries of this potential REDD site should include the forest types on Tetepare that would be logged under the baseline scenario, which encompasses the entire island except a narrow belt near the coast. The revised Solomon Islands Code of Logging Practice (2002) mandates a maximum allowable slope that can be logged of 30°. Figure 9 indicates slope classes on Tetepare with dark red representing slopes that exceed 30°.

Figure 9: Tetepare Island with slope classes in degrees calculated from 90m SRTM data. Dark red colour indicates very steep slopes (>= 30 degrees slope) to be excluded from logging.

From a total area of 12,735 ha, the logging exclusion for steep slopes equals 170 ha, while another 24 ha are classed as beach forest without commercial species. An additional 500 ha are believed to pertain to old village sites and ceremonial areas (tambu sites) that the TDA would ensure were set aside without logging. After deducting the abovementioned exclusions, the total effective logging area equals 12,041 ha.

7.1.2. Temporal Boundaries

Logged-to-protected REDD projects are typically for 30 years, and two logging cycles are foreseen during the project life cycle, with the second cycle starting in year 11 and follows common practice in the Solomon Islands. While two cycles are contemplated, it should be noted that the emission estimates have only examined the first ten years in the project cycle since VCS requires that a new baseline be developed after the project's first decade.

7.1.3. Carbon Pools

For logged to protected project types, the carbon pools to be measured are typically restricted to biomass in the aboveground tree component and do not include non-woody aboveground vegetation since its total contribution is normally insignificant. The selected methodology, VM0011, lists the following carbon pools shown in Table 4. Harvested wood products under a baseline scenario are included and the percentage of long-lived wood products needs to be estimated.

Table 3: List of carbon pools and which ones are to be included in the GHG methodology according to VM0011

Carbon pools	Included/Optional/Excluded	Justification / Explanation of choice
ABG trees	Included	The stock change in the ABG tree biomass shall be estimated
ABG non-trees	Excluded	Exclusion is always conservative when forests remain as forests
Belowground	Excluded	Unlikely to change significantly in forests remaining as forests and is difficult to measure – omission is conservative
Dead wood	Included	Required under VCS Tool for AFOLU Methodological issues
Harvested wood products	Included	Will be greater in baseline than project scenario and significant
Litter	Excluded	Insignificant and exclusion is conservative
Soil organic carbon	Excluded	Exclusion is always conservative when forests remains as forests

7.2 Modelling The Baseline And With-Project Scenarios

In order to model the business as usual or baseline scenario, reliable estimates of the following parameters are needed:

a. Total biomass in unlogged forest,
b. Biomass that would be extracted during logging and the percentage that would go toward long-lived wood products,
c. Biomass that would be killed due to road, skid trail construction, and felling damage, and
d. Regrowth rates post logging.

7.2.1 Total Biomass In Unlogged Forest

There is a total absence of published biomass studies for the Solomon Islands. Whitmore (1966, 1969, 1989a, 1989b) was one of the few authors that installed a systematic array of plots in the Solomon Islands, but his work focused on forest ecology and the silvics of various commercial species and did not measure biomass. While the Solomon Islands will have fewer tree species compared to PNG, biomass within the same forest types should be similar, and a decision was made to use published studies from PNG. Table 5 lists the studies that measured biomass throughout PNG.

Table 4: Summaries of aboveground live biomass plots across PNG (Bryan et al. 2010)

Name	Biomass (t/ha)	Annual mean temperature (°C)	Reference
Mt Hagen mixed 1	375	8.3	Powell, 1970
Mt Hagen mixed 2	411	10.2	Powell, 1970
Mt Hagen mixed 4	493	12	Powell, 1970
Mt Hagen *Nothofagus* 5	458	12	Powell, 1970
Chimbu mixed	350	13	Edwards and Grubb, 1977
Finschaffen	597	26.3	Abe et al., 2000
Madang Ramu	320	27.5	G. Weiblen (unpublished data)
Mt Bosavi	311	23.8	Shearman (unpublished data)
Mt Missim	428	19.1	Pratt, 1983
Nothofagus pulleii	333	12.2	Ash, 1988
Nothofagus grandis	296	14	Ash, 1988
Mixed forest	180	13.4	Ash, 1988
Montane conifer	118	10.4	Ash, 1988
Mixed (*Nothofagus*) Kutubu limestone	270	21.9	Ash, 1988
Mixed (*Nothofagus*) Kutubu volcanics	378	23.1	Ash, 1988
Vanimo 1	414	28.4	Cameron and Vigus, 1993
Vanimo 2	441	28.4	Cameron and Vigus, 1993
Kapiura 1	328	28.3	Cameron and Vigus, 1993
Kapiura 2	361	28.3	Cameron and Vigus, 1993
Kumusi 1	479	28.1	Cameron and Vigus, 1993
Makapa 1	305	25.5	Bryan et al. (submitted)
Makapa 2	230	25.5	Bryan et al. (submitted)

At least eight studies have measured biomass in various different forest types in PNG, however most of the research done to date has used a limited number of plots not representative of expansive forest types (Bryan et al. 2010). Two studies that attempted to address this issue are (Fox et al. 2011) and Bryan et al. (2010) with the former reporting a mean AGLB of 274 t/ha +/- 18 t/ha for primary lowland forest, while Bryan et al. (2010) recorded a mean AGLB of 386 t/ha[3]. For the Tetepare analysis, a decision was made to use the mean of 386 t/ha since the Fox et al. (2011) plots were established by the PNG Forest Research Institute and there may be some bias in relation to plot location, ease of access, and possible anthropogenic disturbance (Bryan et al 2010). Additionally, the slightly higher mean AGLB from Bryan et al. (2010) probably more closely coincides with that on Tetepare given that the island has been uninhabited for 150 years; and thus has not been subject to any anthropogenic disturbances.

7.2.2 Biomass Extracted During Logging And Percentage Toward Long-Lived Wood Products

The principal data source for this section are the National Forest Resource Assessment reports (URS 2003 and 2006) that examine log export volumes over 10 years (Table 5). The Western Province reported from 1994 – 2003 a mean export volume of 41 m^3/ha and provides the best evidence of the potential extractable biomass during logging for Tetepare.

[3] Mean AGLB excluded locations with mean annual temp of < 24° C, and infers that plots that were located in higher elevations were not included in the mean estimate.

Table 5: Summary of merchantable volumes for unlogged natural forests with export potential.

Province	2003 assessment[1]		2006 assessment[2]	
	(m^3/ha)	(m^3)	(m^3/ha)	(m^3)
Guadalcanal	14	623,000	12	481,200
Western	41	2,632,200	42	2,079,000
Isabel	23	1,796,300	21	1,190,700
Choiseul	41	3,653,100	31	2,573,000
Makira	35	735,000	28	487,200
Malaita	22	655,600	26	751,400
Central	43	288,100	49	279,300
National		10,383,300		*7,841,800*

Source: 1 URS (2003), note that Malaita and Central have been included to allow for a direct comparison with 2006 data
2 URS

Timber volume shown in Table 6 can be easily converted to biomass by multiplying the mean species-wide wood density for Southeast Asia, 0.57 t/m^3 (Reyes et al. 1992). A second step is to approximate the logs and branches left in the forest as waste. A Winrock study estimated that 48% of the total biomass is extracted with the remaining 52% left as waste, which equals 25.32 t/ha of biomass (Casarim et al. 2010).

For the biomass that is extracted as logs and eventually processed, VM0011 provides an equation to calculate the amount of carbon stock sequestered in long-lived wood products, and is shown in Equation 1 below.

Eq. 1: $$C_{WP,i|BSL} = \sum_k \left(C_{EX,i,k|BSL} * (1 - WW_k) * (1 - SLF_k) * (1 - OF_k)\right)$$

Where:

$C_{WP,i\|BSL}$	carbon stock sequestered in wood products in stratum i as a result of planned timber harvest in the baseline scenario, in tC·ha^{-1};
$C_{EX,i\|BSL}$	mean carbon stock of extracted timber per unit area in stratum i, tC·ha^{-1};
WW_k	fraction of biomass carbon from wood waste immediately emitted as a by product of milling operations for wood product k, dimensionless; [17]
SLF_k	fraction of biomass carbon for wood product k that will be emitted to the atmosphere within 5 years of timber harvest, dimensionless; [18]
OF_k	fraction of biomass carbon for wood product type k that will be emitted to the atmosphere between 5 and 100 years of timber harvest, dimensionless; [19]
i	1, 2, 3 …M strata; and
k	wood product classes (1. sawnwood, 2. wood-based panels, 3. other industrial roundwood, 4. paper and paper board, and 5. other).

The logs are exported mostly to Malaysia, China, and South Korea and the end products are assumed to be either boards or plywood. Given the preceding assumptions, Equation 1 indicates that about 16% of the carbon goes toward long-lived wood products, which is considered an emission sink in the carbon accounting.

The only biomass study that could be found for the Solomon Islands comes from Eric Katovai's on-going PhD dissertation, which examines biomass in unlogged versus logged forest (Table 6). Two plot sizes were installed (0.1 and 0.25ha) and the mean values for 0.25ha plots should better represent the true mean, although the sample size is not yet robust enough. At least 12 more plots are planned utilizing the larger plot size, which would provide the best estimates of biomass for the Western Province. Nevertheless, Table 7 does suggest the volcanic islands of the Western Province possess high biomass levels.

Table 6: Preliminary results of biomass sampling on Kolombangara Island, Western Province (Katovai, unpublished)

Plot Description	Mean (t/ha)	Std. Error (t/ha)	N	CV (%)	Sample Error (%)
Biomass Plot 0.1 (logged ~10yr ago)	345.60	51.56	16	59.68	31.8%
Biomass Plot 0.1 (logged ~30yr ago)	515.81	29.93	16	23.21	12.4%
Biomass Plot 0.1 (logged~50yr ago)	597.06	67.49	16	45.22	24.1%
Biomass Plot 0.1 (unlogged)	1037.80	76.98	20	33.17	15.5%
Biomass Plot 0.25 (logged~10yr ago)	191.64	52.23	4	54.51	86.7%
Biomass Plot 0.25 (logged~50yr ago)	560.70	12.04	2	3.04	-
Biomass Plot 0.25 (unlogged)	777.81	12.33	4	3.17	5.0%

7.2.3 Biomass Lost Due To Mortality, Road/Skid Trail, And Log Deck Construction

Data on mortality of residual trees was assessed from various studies in Malaysia and Indonesia and was conservatively set at 5% in the first year, declining to 2% by the second year, and then by year 5, the last year that includes logging-inducted mortality, was set to 1%[4] (Sist et al. 2002, Cassarim et al. 2010). The percentage area cleared for road/skid trails and log decks was set at 5 and 6% respectively (Cassarim 2010). One of the most comprehensive studies addressing biomass lost from selective logging in PNG is Bryan's PhD dissertation (2012) which indicated that logging reduced the total biomass on average by 33%, including the extracted timber, mortality, and road and skid trails. Applying the abovementioned percentages for mortality, road, and log deck percentages combined with the 50 t/ha of biomass from logs that would be extracted indicates that 30% of the total biomass would be eliminated; very similar to Bryan's estimate. That percentage is considered conservative since other studies calculated that 50% of the biomass was lost from logging (Fox et al. 2011, Tangki and Chappell 2008).

7.2.4 Biomass Regrowth Post-logging

Regrowth post-logging is one of the most variable parameters with some studies showing a 2.5 tC/ha/yr rate (Brown and Lugo 1990), while others indicate sequestration as high as 7.5 tC/ha/yr to 10 tC/ha/yr (Scatena et al. 1993, Hughes et al. 1999). Fox et al (2011) analysed a series of PNG forest plots and measured a sequestration rate of 1.12 ± 3.41 tC/ha/yr, which was chosen for the baseline sequestration rate for this study. The same study in unlogged primary forest indicated a rate of 0.23 ± 1.57 tC/ha/yr.

Based on the biomass parameters discussed in the above subsections, a spreadsheet model was constructed to estimate the potential emission reductions with the results shown on the following page.

[4] The percentages are in addition to the natural (background) mortality found in unlogged forest.

Table 8: Baseline emission sources and sinks per hectare for the first ten years under an industrial logging scenario

Baseline Activity	Project Yr.	Harvest Target m3/ha	Area Logged (ha)	Baseline biomass accounting (tons dry matter): AG Biomass (tons dry matter) Total	Commercial	Non-Commercial	Post-logging Biomass Components under Baseline: Removed as Timber	Dead logging debris	Accum. Mortality post-logging	Roads and skid trail	Landings	Sinks: LLWP Deduction	Accumulated Regrowth
	0			380.0	266.0	114.0	0.0	0.0	0.00	0.0	0.0	0.0	0.0
Logging	1	41	500	276.0	193.2	82.8	23.4	25.3	13.53	22.8	19	3.7	0.0
Logging	2	41	1000	275.5	192.9	82.7	23.4	25.4	18.84	22.8	19	3.7	1.12
Logging	3	41	1500	275.5	192.9	82.7	23.4	25.4	23.78	22.8	19	3.7	2.24
Logging	4	41	1500	275.5	192.9	82.7	23.4	25.4	26.38	22.8	19	3.7	3.25
Logging	5	41	1700	275.5	192.9	82.7	23.4	25.4	28.98	22.8	19	3.7	4.17
Logging	6	41	1780	275.5	192.9	82.7	23.4	25.4	28.98	22.8	19	3.7	5.10
Logging	7	41	2000	275.5	192.9	82.7	23.4	25.4	28.98	22.8	19	3.7	5.99
Logging	8	41	2000	275.5	192.9	82.7	23.4	25.4	28.98	22.8	19	3.7	6.84
No logging	9	41	0	275.5	192.9	82.7	0.0	0.0	0.00	0.0	0	0.0	0.00
No logging	10	41	0	275.5	192.9	82.7	0.0	0.0	0.00	0.0	0	0.0	0.00

Baseline Activity	Project Yr.	Yearly baseline CO_2 emissions (t/ha): Emissions Sources: Removed as Timber	Dead logging debris	Mortality to residual stand	Roads and skid trail	Landings	Total Sources	Emissions Sinks: LLWP Deduction	Sequestration	BASELINE Total Emissions w/out sequest.
	0	0.0	0.0	0.0	0.0	0.0	0.0	0.00	0.0	0.0
Logging	1	36.0	46.4	24.8	41.8	34.8	183.8	-6.86	0.00	177.0
Logging	2	36.0	46.5	34.5	41.8	34.8	193.7	-6.86	-2.06	184.8
Logging	3	36.0	46.5	43.6	41.8	34.8	202.7	-6.86	-4.11	191.8
Logging	4	36.0	46.5	48.4	41.8	34.8	207.5	-6.86	-5.95	194.7
Logging	5	36.0	46.5	53.1	41.8	34.8	212.3	-6.86	-7.64	197.8
Logging	6	36.0	46.5	53.1	41.8	34.8	212.3	-6.86	-9.35	196.1
Logging	7	36.0	46.5	53.1	41.8	34.8	212.3	-6.86	-10.98	194.4
Logging	8	36.0	46.5	53.1	41.8	34.8	212.3	-6.86	-12.55	192.9
No logging	9	0.0	0.0	0.0	0.0	0.0	0.0	0	0.00	0.0
No logging	10	0.0	0.0	0.0	0.0	0.0	0.0	0	0.00	0.0

Table 9: With-project emission sources and sinks per hectare for first ten years under a logged-to-protected scenario

	With project biomass accounting (tdm)				With project CO_2e Emissions			
	AG Biomass (tons dry matter)				Total Biomass Growth			Sink
	Total	Commercial	Non-Commercial	Annual Increment (tdm)	Total	Commercial	Non-Commercial	w_Project Sequestration
No activitiy	380.0	266.0	114.0		696.7	487.7	209.0	0.0
No activitiy	380.6	266.4	114.6	0.6	697.7	488.4	209.3	0.0
Monitoring	381.1	266.8	115.1	0.6	698.7	489.1	209.6	1.9
No activitiy	381.7	267.2	115.7	0.6	699.7	489.8	209.9	1.9
No activitiy	382.2	267.6	116.2	0.6	700.8	490.5	210.2	2.5
No activitiy	382.8	268.0	116.8	0.6	701.8	491.3	210.5	3.4
No activitiy	383.4	268.4	117.4	0.6	702.8	492.0	210.8	4.3
No activitiy	383.9	268.7	117.9	0.6	703.9	492.7	211.2	5.1
No activitiy	384.5	269.1	118.5	0.6	704.9	493.4	211.5	5.9
No activitiy	385.0	269.5	119.0	0.6	705.9	494.1	211.8	6.8
Monitoring	385.6	269.9	119.6	0.6	706.9	494.9	212.1	7.5

Table 7: Estimate of potential credits (VCU) per hectare that would be generated from emission reductions

VCS Credit Generation					
From logging	From sequestration	Subtotal Credits	Non-permanence Risk Withholdings	Leakage Deduction	Total Credits (VCU/ha)
0.00	0.0	0.00	0.00	0.00	0.00
176.98	0.0	176.98	(53.09)	(17.70)	106.19
184.77	1.9	186.67	(56.00)	(18.67)	112.00
191.77	1.9	193.67	(58.10)	(19.37)	116.20
194.69	2.5	197.19	(59.16)	(19.72)	118.31
197.78	3.4	201.18	(60.35)	(20.12)	120.71
196.06	4.3	200.36	(60.11)	(20.04)	120.22
194.44	5.1	199.54	(59.86)	(19.95)	119.72
192.87	5.9	198.77	(59.63)	(19.88)	119.26
0.00	0.0	0.00	0.00	0.00	0.00
0.00	0.0	0.00	0.00	0.00	0.00

7.3 Potential Carbon Credit Generation

Tables 8 – 10 provide estimates of emission sources and sinks for the first ten years of a VCS project and the total credits that could be generated. While VCS projects typically span 30 years, only the first ten years are used in this feasibility study since the standard requires a new baseline to be developed and validated after year 10. National policies can change over time and could therefore strongly influence the additionality and baseline. Predicting further into the future than a decade, given the changes that can rapidly occur, is not practical.

Table 11 provides detail on how the cumulative biomass losses from mortality shown in Table 7 were estimated. Percentage mortality due to logging declines over a five-year period (Sist et al. 2002). The initial pre-logging biomass of 380 t/ha is multiplied by the percentage mortality for each year shown in Table 11.

Table 10: Estimated biomass lost due to mortality post-logging for the baseline scenario.

Year of Project	Mortality (t/ha) by Logging Coupe								TOTAL Accumulative Mortality (t/ha)
	1	2	3	4	5	6	7	8	
1									
2	0								0
3	13.5								13.53
4	5.3	13.5							18.84
5	4.9	5.3	13.5						23.78
6	2.6	4.9	5.3	13.5					26.38
7	2.6	2.6	4.9	5.3	13.5				28.98
8	0.0	2.6	2.6	4.9	5.3	13.5			28.98
9	0.0		2.6	2.6	4.9	5.3	13.5		28.98
10	0.0			2.6	2.6	4.9	5.3	13.5	28.98

Table 11: Percentage mortality post-logging (Sist et al. 2002)

Mortality (Years after logging)				
1	2	3	4	5
5%	2%	1.3%	1%	1%

Biomass growth on a cumulative basis was estimated the same way as in Table 10 for both the baseline and with-project scenarios and shown in Table 13. Additionally, as with mortality, biomass growth accumulation is assumed to decline over time (Sist et al. 2002).

Table 12: Biomass accumulation from growth under the baseline (logging) scenario.

Year of Project	Biomass Accumulation by Logging Coupe										Growth rate
	1	2	3	4	5	6	7	8	9	t/ha	
1											
2	1.12									1.12	
3	1.12	1.12								2.24	0%
4	1.01	1.12	1.12							3.25	10%
5	0.92	1.01	1.12	1.12						4.17	20%
6	0.94	0.92	1.01	1.12	1.12					5.10	20%
7	0.89	0.94	0.92	1.01	1.12	1.12				5.99	25%
8	0.85	0.89	0.94	0.92	1.01	1.12	1.12			6.84	30%
9	0.86	0.85	0.89	0.94	0.92	1.01	1.12	1.12		7.71	30%
10	0.77	0.86	0.85	0.89	0.94	0.92	1.01	1.12	1.12	8.48	40%

7.3.1 Non-Permanence Withholding For Risks

Under VCS rules, REDD projects are required to evaluate the risks that affect the permanence of the carbon stocks and include natural, political, social, and management related risks. A percentage withholding of credits is estimated based on the identification of the assessment of the most serious identified risk, and can range from 10% to 30%, or can at times be higher for particularly risky projects. Table 8 applies a 30% risks withholding, which is due to low capacity to monitor and regulate the logging industry and low overall governance. The VCS tool is normally applied with the project proponents to accurately weigh the risks. At this stage its use is somewhat premature and provides only an indicative idea. After five years of project implementation without major incident, a release of these withheld credits can be requested.

7.3.2 Leakage

Leakage is the displacement of emissions from the project site to another site. Experience has shown that once increased funds are allocated and lead to improved management, some of the activities that produced deforestation and degradation simply move to an area that does not have the same level of scrutiny. For IFM projects, there are two components to leakage – market-based leakage and project leakage. Market-based leakage addresses the demand at a provincial or national level for wood as well as the effect that stopping logging will have on that demand. Since Tetepare has not yet become an active logging concession, market-based demand and associated leakage should not be a factor. An additional factor is that this project will be undertaken on behalf of the TDA members, with the hope of providing significant income for participating TDA communities. Given that there already is in place a monitoring team and that the island is uninhabited, a likely assumption is that leakage from illegal logging would be quite small. However, in order to ensure that the final emission reduction estimates are conservative, a 10% leakage deduction has been included.

The last column in Table 8 shows the verified carbon units (VCU) after the risk withholding and leakage deductions have been included. First year emission reductions are predicted to be 106 VCU/ha and range over ten years from 106 VCU/ha to 121 VCU/ha.

8 COSTS/BENEFITS ANALYSIS

8.1 Potential Revenue From VCU Sales

The financial viability analysis factored in three price scenarios for the sale of VCU, ranging from US$ 3 to US$ 6, and US$ 9 per VCU (tCO_2e). The price scenarios are pegged to what projects are currently receiving based on their stage of development. Projects that have completed a PDD but have not yet been validated are receiving on average US$ 3 per ton CO_2e for emission reductions. REDD projects that have been both validated and verified, with the credits ready to be issued received a mean price of US$ 9 per VCU in 2011 (Peters-Stanley and Hamilton 2012). Under the lowest price scenario, gross revenue ranges from US$ 160,000 to US$ 718,000, while the medium price scenario ranges from US$ 320,000 to US$ 1.43 million (Table 14).

Table 13: Potential gross revenue for the first ten years applying three price scenarios for carbon credits (VCU).

	Price Scenario VCU/ha			Gross Revenue/yr. (VCU/ha x No. ha logged)		
	Low	Med	High	Low	Med	High
Total Credits (VCU/ha)	$3	$6	$9	$3	$6	$9
0.00	0.00	0.00	0.00	$ -	0.00	0.00
106.19	318.57	637.14	955.71	$ 159,284	$ 318,569	$ 477,853
112.00	336.00	671.99	1,007.99	$ 335,997	$ 671,994	$ 1,007,991
116.20	348.60	697.21	1,045.81	$ 522,905	$ 1,045,809	$ 1,568,714
118.31	354.94	709.89	1,064.83	$ 532,415	$ 1,064,829	$ 1,597,244
120.71	362.12	724.24	1,086.36	$ 615,602	$ 1,231,204	$ 1,846,806
120.22	360.65	721.30	1,081.95	$ 641,955	$ 1,283,910	$ 1,925,865
119.72	359.17	718.33	1,077.50	$ 718,331	$ 1,436,662	$ 2,154,993
119.26	357.79	715.57	1,073.36	$ 715,573	$ 1,431,146	$ 2,146,719
0.00	0.00	0.00	0.00	$ -	0.00	0.00
0.00	0.00	0.00	0.00	$ -	0.00	0.00

If TDA as the project proponent could wait until the project has been validated and verified, then there is a likely chance that gross revenue could range from US$ 477,000 to US$ 2.15 million, based on actual REDD credit sales for 2011. The reader should keep in mind that the last two years of a ten-year cycle do not generate income from credit sales; and thus, it is best to calculate an average over ten years. Additionally, based on common practice that loggers re-enter a logged over area after only ten years, by year eleven in the project cycle, the baseline scenario assumes that logging would begin again. However, the baseline would need to be validated again in year ten that would reflect current site conditions and national policies. It needs to be emphasized that the preceding revenue projections, while conservative in nature, are gross estimates and have not factored in the transaction or operational costs, which are discussed in the following section.

8.2 Estimated Transaction And Operational Costs

The costs of an IFM project can be broken down into two basic components, which are the origination and marketing of the carbon credits – often referred to as transaction costs, and annual operating costs that would initially include any infrastructure costs, such as the construction of guard posts, access roads or trails, etc. A rough estimate of the transaction costs is provided in Table 15.

Table 14: Approximate transaction costs to be able to sell carbon credits compliant with the Verified Carbon Standard (VCS).

Activity Description	Cost Estimate (USD)
VCS compliant biomass survey (sample error +/-10%)	50,000 – 55,000
Writing of full VCS PDD using new VCS/CCBA template	30,000
VCS validation	15,000
Annual monitoring using LANDSAT & Rapid Eye imagery (incl. only GIS/RS analysis) [a]	25,000
Reporting	10,000
VCS verification	25,000
Registry and credit issuance fees	2,500
Technical support services/interaction with VCS audit body before/during validation & verification	25,000
TOTAL	$182,500 – 187,500

[a] Patrolling and field-based monitoring assumed to be part of annual operating costs
[b] Assumes over-the-counter transaction of credits and no additional costs included to list project on a carbon exchange

Table 15 provides an approximate estimate of the transaction costs through the verification phase and issuance of the carbon credits. A typical timeframe for the completion of this process would be from three to five years. During this time, the carbon credits could either be sold under a 'futures' or 'forward sale' contract that could take place directly after VCS validation or could be held with the credits pooled together from multiple years. In any event, the accounting would take into account the number of years needed to obtain fungible credits subtracted by the transaction costs plus operational costs.

Given that Tetepare is an uninhabited island with a monitoring station already in place, an extensive system of guard posts most likely is not necessary. The annual operating costs would mostly be comprised of TDA patrols and inter-village meetings for coordination and communication. These costs are already born by existing grants for the TDA, but could rely on credit sales as a more long-term approach toward funding TDA awareness and communication activities. Initially, these costs, if managed by the TDA should not exceed US$ 20,000 – 30,000/year. Since the TDA is already a legal entity, there would be no associated costs to legalize it. However, there would be costs in creating a system of checks and balances in managing the funds, in addition to the costs of hiring an external auditor.

One cost not yet included would be to broker the credits. The majority of carbon credits generated by VCS projects are marketed through over-the-counter transactions, which essentially involves a buyer and seller of credits in addition to a broker. A broker's fees can vary depending on how the contract is structured and whether the broker contributes funds to develop the project. In this case, the funds to develop a REDD project would be generated through donors; thus, the brokerage fees should be approximately 5% of the total contract amount.

Even under the assumption that short-term prices would be low at US$ 3 per VCU, the gross revenues multiplied over three to five years would considerably exceed the transaction and operational costs. The real question is – are the revenues sufficient to provide significant benefits to the roughly 3,500 TDA households to ensure the island stays unlogged?

8.3 Costs/Benefits From A Community Standpoint

The reader should be aware that this section does not provide information on a comprehensive financial analysis typically done for businesses, but rather discusses what TDA members stand to gain or potentially lose by choosing this option. Additionally, there are various unknowns in the Solomon Islands that factor into a discussion of potential benefits and losses; first of which is that it is still very unclear whether the State will tax REDD credits or how the revenue should be distributed in an equitable and transparent manner.

Members of TDA are now spread across 31 villages in the Western Province. More than two thirds of the descendants are located on Rendova Island, as well Marovo Lagoon and the Roviana area on New Georgia, which are adjacent to Tetepare Island (Buncle 2012). Livelihood needs of people in the Western Province are met by both income generating activities and subsistence. Income generating activities comprise mostly of root crop production (22.6% of households), fruit and vegetable production (21.1%), and small-scale fishing activities (18.7%). Carving (9.6% of households), livestock farming (4.4%), and logging (4.7%) play a lesser role in income generation.[5] The Gross National Income (GNI) in the Solomon Islands is US$ 1,110 (World Bank 2013[6]) and is used in Table 15.

Given that there are so many unknowns about revenue distribution from REDD, this analysis uses gross revenue divided by the total households compared with gross revenue divided by total villages as two ways to assess benefits from the communities' perspective (Table 16).

Table 15: Gross revenue projections per TDA household and per village with TDA members.

Project Year	Gross Revenue/Household/Year 3,500 households			Gross Revenue/Village/Year 31 Villages		
	Low	Med	High	Low	Med	High
	$3	$6	$9	$3	$6	$9
1	$46	$91	$137	$5,138	$10,276	$15,415
2	$96	$192	$288	$10,839	$21,677	$32,516
3	$149	$299	$448	$16,868	$33,736	$50,604
4	$152	$304	$456	$17,175	$34,349	$51,524
5	$176	$352	$528	$19,858	$39,716	$59,574
6	$183	$367	$550	$20,708	$41,416	$62,125
7	$205	$410	$616	$23,172	$46,344	$69,516
8	$204	$409	$613	$23,083	$46,166	$69,249
9	0.00	0.00	0.00	0.00	0.00	0.00
10	0.00	0.00	0.00	0.00	0.00	0.00
Median	$151	$302	$452	$17,021	$34,043	$51,064
Median/GNI	14%	27%	41%			

Table 16 illustrates that on a household basis, the revenue distribution among the three VCU price scenarios is somewhat low, but not insubstantial. Using median values for revenue over the ten-year period as shown in Table 16 and dividing by the GNI indicates that the REDD project could contribute from a low of 14% to a high of 41% of gross income. However, of note is that REDD projects rarely distribute revenues directly to households and most frequently villages decide as a community on the most pressing needs which can be funded by REDD credit sales. An additional option is to distribute the funds proportionally according to the village with most TDA members. Either of those two options generate substantial funds that could be used to increase the reach of the existing school scholarship fund and build and equip schools and health clinics, among other needed development projects. The added advantage in funding village level development projects is that this could help diminish feelings of envy from non-TDA members that could lead toward conflict.

Typically, communities reap a variety of non-tangible benefits from REDD logged-to-protected projects such as flood and erosion control, the provision of clean drinking water, maintenance of forest, freshwater, and near-shore marine habitats that provide protein sources from fish, invertebrates and game animals. Since Tetepare is uninhabited, some of these environmental services are not directly utilised by TDA members. However, TDA members do hunt feral pigs on Tetepare and fish on the near-shore reefs. In addition, the island provides a source of logs used for making dugout canoes.

[5] Solomon Islands National Statistics Office (2006), *Household Income and Expenditure Survey 2005/06 Provincial Report*, http://www.spc.int/prism/country/sb/stats/Publication/Public-Index-new.htm p.57.

[6] http://devdata.worldbank.org/AAG/slb_aag.pdf

8.3.1 Costs

TDA members or the Association itself should not have direct costs from a REDD project. At least for the initial five years donor funds would be expected to cover the costs. After credit sales have been generated, the annual monitoring expenses and administrative expenses should be borne by TDA.

There are foregone opportunity costs, mostly arising from the decision to not allow logging of the island's forests, which are covered in the following section.

8.4 Potential Benefits Or Costs From Logging

8.4.1 Benefits

Round log exports remain the largest source of export earnings and have been increasing over the last ten years despite the warnings that demand far outstrips sustainable supply (Development 2003) (URS 2006). In 2011, exports surged 37% over the previous year and reached a total of $SBD 1.5 billion or US$ 221million[7] (Table 17). Assuming that the government collects 25% of the preceding in royalties, this would equate to US$ 55.25 million flowing into government coffers in 2011.

Table 16: National export statistics for timber by quarter for 2010 and 2011 in Solomon Island Dollars

TABLE 7: VALUE OF EXPORTS OF SELECTED COMMODITIES BY QUARTER : 2003-2011

HS Code	Commodity	Qtr ended on same period a year ago % change	QUARTER 2011 Dec	Sep	Jun	Mar	2010 Dec	Sep	Jun	Mar
										SBD '000
	Total Timber	37%	439,586	388,878	403,895	320,261	321,716	262,087	230,116	184,102
4403	Timber Logs	33%	415,822	376,137	387,344	301,782	313,590	248,833	216,463	172,932
4407	Timber Sawn	192%	23,764	12,741	16,551	18,480	8,126	13,254	13,653	11,170

Logging concessions have generated considerable employment in rural areas, especially in the Western Province where most of the log supply has been cut over the last decade (Table 2). However, timber concessions are given out on a five-year basis and this timeframe does not encourage the logging companies to take a long-term view with one impact being short-term employment before the concessionaire moves on to another site[8].

The distribution of logging royalties on customary land is shown in Table 18 and indicates that the landowners receive 5% of the total revenue. The FOB price for each commercial species is determined by the Ministry of Finance and set each quarter (see Annex 2). The table in Annex 2 shows 23 commercial species with a mean FOB price of $US112/m^3.

[7] Statistical Bulletin: 6/2012, http://www.spc.int/prism/solomons/index.php/economic/trade-statistics

[8] Personal communication 2013, Kennedy on Tetepare

Table 17: Distribution of royalties from export timber and per hectare USD royalty allocation by stakeholder, assuming 41 m3/ha as mean commercial volume and US$ 112/m3 as mean FOB timber price.

Stakeholder Description	Percentage Allocation	Royalty allocation/ha (US$)
Logging contractor	60	2,755.20
Government	25	1,148.00
Licensee	10	459.20
Customary landowner	5	229.60
TOTAL	100	4,592.00

Table 6 indicates that in the Western Province approximately 41 m^3/ha is the average exportable timber volume. Multiplying that with the mean FOB price for all commercial species of US$ 112/m3 equals roughly US$ 4,600/ha for royalties with US$ 230/ha allocated for the landowners. The licensee in many cases is also a landowner in the area being logged and is responsible for distributing the royalties to the other landowners, along with paying all the costs required to obtain the permits.

Table 18: Comparison between mean REDD gross revenue in US$ per hectare using three VCU price scenarios and the royalty allocation to customary landowners from logging.

Mean Gross Revenue/Ha over 9 Years From REDD			Logging
Low	Med	High	Scenario
$ 3	$ 6	$ 9	($/ha)
$ 279.78	$ 559.57	$ 839.35	$ 230.00

Table 19 suggests that revenues from all the REDD scenarios substantially exceed logging revenues allocated for landowners. However, it should be noted that REDD revenues are gross estimates and taxes, if any will be charged by the government, have not been factored in. Even if the government decides to tax carbon credits at the same price as export timber (25%), both the medium and high price REDD scenarios still substantially exceed the revenue generated from logging. It is also assumed that transaction costs to bring this REDD project to market would be covered through grants.

The preceding comparison between timber and REDD revenues assumes that the customary landowners actually receive the stipulated percentages. Frequently, many promises are made to the clans that are not fully delivered on, with the licensee using the excuse that costs were higher than anticipated. There is no government oversight of this allocation process and legal cases are financially prohibitive for most villagers.

This study also briefly examined how logging would affect seafood harvests that provide substantial protein and income sources to many TDA members. Table 20 was created from the data collected by TDA rangers over six years and suggest that of the seven taxa five appear to have harvest levels that have not declined over that time period and could be harvested on a sustainable basis.

Table 19: Resource harvests from Tetepare, 2004-2009 (Read et al. 2010)

Year	Crayfish	Green snail	Pig	Fish	Sea cucumber	Trochus	Coconut Crab
2004	262	41	404	1,285	2,768	2,410	268
2005	93	2	422	2,459	597	1,712	299
2006	54	1	233	1,745	2	1,294	188
2007	2,506	25	370	3,352	1,695	896	182
2008	642	20	296	2,663	497	1,102	244
2009	882	9	355	3,730	416	634	207

Since Tetepare's fringing reefs are quite close to the shore and much of the island is mountainous, logging would affect terrestrial, freshwater, and marine habitats. The freshwater and marine habitats would suffer due to high erosion and sediment runoff onto the reefs. A study done on Kolombangara and Vangunu (Morrisey et al. 1999) indicated that Trochus and crayfish numbers dropped by 36% and 42% respectively in logged versus unlogged areas.

9 Recommendations

1. REDD+ projects that participate on the voluntary carbon markets must be seen as an important hands-on learning experience that can provide much needed income to rural villagers in lieu of selling their logging rights and suffering the environmental consequences.
2. Clarification and legal recognition of carbon rights should be sought. VCS guidelines for verification require that the project proponents demonstrate legal tenure over the area; however, demonstrating clear legal tenure on customary lands is problematic in the Solomon Islands since the process is ambiguous, at best. There appears to be some effort at land reform and registering customary lands through a special office of the PM[9], reinforcement through donor funds could support the REDD+ case.
3. While the Tetepare Descendants Association can demonstrate a history of conserving the island, there is no national legislation that supports this conservation effort, and the island is certainly worthwhile of NPA status. However, it is important to note that in the formal justification for establishing Tetepare as NPA, there should be language that states that the conservation of Tetepare will partially contribute to the Solomon Islands commitment to reduce GHG emissions. Including the preceding language in the justification for NPA status will help to meet the additionality criteria for the project site.
4. The feasibility of inserting language into the draft Forestry Bill that would clarify carbon rights should be explored. Further support would be needed to ensure that adequate consultation at the province level has taken place. The current Forest Utilization act is widely unpopular, does not promote sustainable forest management and does not take into account customary landowners.

[9] Personal communication with Stephanie Price

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Annex I: Methods

A very rapid description of the forest survey is provided with the subsequent final report going into more detail. The purpose of the forest survey is to systematically ground truth the land cover analysis conducted by my GIS/RS staff. Since basal area and various remote sensing variables are highly correlated such as canopy openness, colour, and texture and Forest Carbon Consultants applies eCognition, recognized as the most advanced remote sensing software to distinguish these variables, basal area measurements at various sample points can provide a robust ground truthing method. Basal area is also strongly correlated with biomass and thus, a secondary benefit is that basal area sampling can rapidly indicate biomass present. Biomass was measured according to a 3P sampling technique using a cruising prism available from Forestry Suppliers with a BAF[10] of 2. I prefer cruising prism versus angle gauges such as the early Bitterlich sticks since the distance between the observers eye and hand holding the device does not have to remain fixed.

Figure 10: Digital form created in DoForms application

I have designed the process to be exceptionally rapid without requiring further data entry then what is done in the field using tablet computers and freely available applications. This method was also applied in Milne Bay, PNG but used a different application. The current digital form is shown in Figure 10, with the advantage that the application is available for Android and Apple tablets and phones; thus allowing me to bring two tablets (iPad and Samsung) and two Android phones that all run the same application containing the digital form, which provided two weeks of continuous field use without charging. After the form is completed for each sample point it si stored in the Samsung tablet and once a 3G signal is available, the data can be sent to the server and is available for analysis as an Excel file that can subsequently be imported into ARC GIS software.

Figure 11: Entering data into tablet. It rained every survey day and a protective dry bag cover was used to allow for continual operation even in heavy rainstorms.

Figure 12: Instructing Bill Apusae on the use of the cruising prism and digital form in the tablet computer.

In Tetepare, Reiner Schuler with the Australian Volunteer Service accompanied me along with TDA's best tree identifier and within less than 5 minutes fully understood how to enter the data, including capturing the GPS data automatically in the form. Sample points were systematically laid down every 300 to 500 meters along the trail according to the length of the trail visited during that day and in accordance with the overall target of gaining 30 to 40 sample points on each island. Besides a count of trees inside the variable plot, the number that was commercially acceptable by loggers was recorded along with the forest type and degradation level. In a similar REDD feasibility study on East Rennell, Bill Apusae from Live and Learn NGO also rapidly learned the methodology (Figure 12).

Annex II: Value Schedule To Determine Royalty Payment By Timber Species

Table 20: Value Schedule (Jan – March 2013) to Determine Royalty Payment by Timber Species (source: Ministry of Finance)

Timber Grade	Species Name	Regular Grade	Small Grade	Super Small Grade	Low Grade
		USD/m^3	USD/m^3	USD/m^3	USD/m^3
Grade 1	Insia bijuga (Kwila)				
	Vitex spp. (Vasa)				
	Palaquim (Pencil Cedar)	137	123	120	100
	Calophyllum	140	127	123	100
	Pometia spp. (Tuan, Akwa)	140	127	123	100
	Planchonella spp.	137	123	120	100
Grade 2	Schizomeria (Beabea)	123	113	109	96
	Dillenia spp.	113	104	100	93
	Gonostylus (Ramin)	120	113	104	93
	Terminalia brassii	117	109	100	88
	Terminalia (except T. brassii)	104	96	93	84
	Terminalia calamansanai	104	96	93	84
Grade 3	Canarium (Gnali)	109	100	96	93
	Burkella spp.	109	100	93	93
	Celtis spp.	104	96	93	84
	Astonia (Milky pine)	104	96	93	84
	Dysoxyllum spp.	104	96	93	84
	Eugenia (Water gum)	109	100	93	93
	Endosperma spp.	104	96	93	84
	Amoora spp.	104	96	93	84
	Campnosperma spp.	109	100	96	93
Grade 4	Maranthes spp.	96	93	84	73
	Parinari spp.	96	93	84	73
	Others	140	127	123	100

Annex III: Map Of Tetepare Indicating The Sample Point Locations Conducted Over Three Days Of Forest Surveys

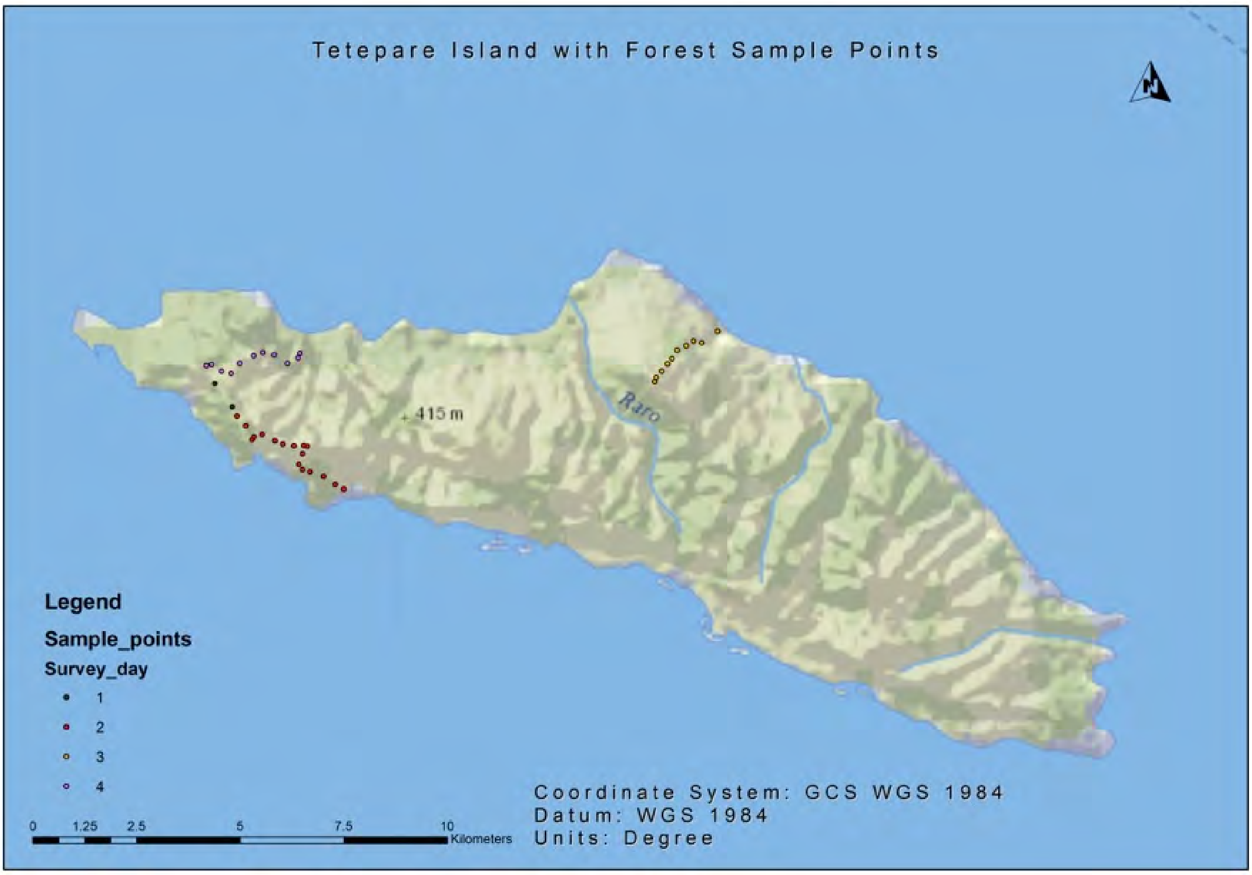

Figure 13: Map of Tetepare indicating the sample point locations conducted over three days of forest surveys