PNG COMMUNITIES BEST REDD

TAVOLO PROJECT

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with technical assistance from Face the Future, Wageningen, The Netherlands

Project Title	PNG Communities BEST REDD - Tavolo Project
Version	1.0
Date of Issue	27 July 2022
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1 PROJECT DETAILS

1.1 Summary Description of the Project

The Tavolo Community is located in East New Britain Province, on the South Coast of the island of New Britain, Papua New Guinea (PNG). The clans of the Tavolo Community hold customary land rights to a total area of 21,164 ha (hereafter referred to as the 'Tavolo Project Area'). This area has been under consistent threat from large scale logging and conversion to oil palm plantations.

In order to protect their forests and forest resources, whilst still obtain a revenue source, the community first approached FORCERT in 2007 to enquire into the possibility of carrying out community based small scale logging operations under the FSC Group Certification Service Network that FORCERT then managed. To become a member of this Service Network, the community organized itself first into the Tavolo Business Group, with the idea of using their FSC certified portable sawmilling operation to generate income and employment for the community, allowing them to protect their forest. When it became clear that these benefits alone would not be sufficient to guarantee this protection, the community started work with FORCERT to trial Payments for Environmental Services as additional income generation under the PNG Communities Benefits from Environmental Services Trust (PNG Communities BEST). The community then decided to organize themselves under the Tavolo Community Conservation Association (hereafter referred to as the 'Tavolo Community') and committed itself to sustainably manage their land, carrying out FSC certified small scale reduced impact logging on a dedicated part of their forest, while the remainder of their forest is put under conservation. Also the community has put the combined land area of all clans that make up the community under a sustainable land use plan, aimed at zoning of other land uses and avoiding their encroachment on forest land, and for some areas even relocating agricultural land converted in the past back to forest.

Currently the remaining natural forest in the Tavolo Project Area is under threat of being deforested by a Land Owner Company (LOC) called Kakuna-Lote Resource Development Ltd (Kakuna-Lote LOC) in cooperation with the contractor and investor Mekar (PNG) Ltd.[1] In 2019 Kakuna-Lote LOC gained access to the community land and the forest resources in the Tavolo Project Area through a Special Agriculture Business Lease (SABL) called the Mukus-Melkoi SABL. With this Mukus-Melkoi SABL, which is granted over a total area of 68,300 ha, Kakuna-Lote LOC and Mekar Ltd are now planning a large scale forest conversion to agriculture and

[1] Mekar PNG Ltd is a subsidiary of Vanimo Jaya Ltd (see ENB FM Committee minutes of a meeting in November 2019 handling the Kakuna-Lote FCA application)

other land use under the name of Kakuna-Lote Agro Forestry & Reforestation Plantation Development Project (hereafter referred to as the 'Kakuna-Lote Project'). In order to establish the Kakuna-Lote Project, the Kakuna-Lote LOC has requested for a Forest Clearing Authority (FCA) from the Papua New Guinea Forest Authority (PNGFA) in 2019 to clear fell 45,980 ha of forest in the Mukus-Melkoi SABL area, starting in 2019/2020.[1] After clear-felling, Kakuna-Lote LOC plans to convert 32% (16,800 ha) of the deforested area into a Eucalyptus plantation, and another 4% (1,800 ha) of the area into Cocoa/Coffee plantation.[2]

The Kakuna-Lote project however is planned by the Kakuna-Lote LOC and Mekar Ltd. without the free, prior and informed consent of the local communities who hold customary land rights over the area zoned under the Mukus-Melkoi SABL.

The aim of this PNG Communities BEST REDD – Tavolo Project (hereafter referred to as the 'Tavolo REDD Project') is to assist the Tavolo Community to conserve and protect the natural rainforest in the Tavolo Project Area from being cleared and converted under the Mukus-Melkoi SABL as part of the Kakuna-Lote Agro Forestry & Reforestation Plantation Development Project. In order to protect the forest from the planned deforestation the Tavolo REDD Project implements the following activities in the Tavolo Project Area:

1. A Court's or official Government administrative decision will be obtained to declare the Mukus-Melkoi SABL and any accompanying or underlying logging permits and project plans null and void;

2. The communities within the Tavolo Project Area who organized themselves into the Tavolo Community Conservation Association will develop and implement Community Conservation Laws, in which rules are set by the communities regarding the land use and the conservation of the forest in the project area. A system will be set up by the communities to enforce and monitor compliance with the rules set out in the Community Conservation Laws;

3. The communities will manage and conserve their forests under a sustainable land use plan which is designed by the communities in cooperation with FORCERT. These land use plans will focus on forest conservation, small scale eco-forestry and sustainable small scale agriculture;

4. The communities will participate in the PNG Communities Benefits from Environmental Services Trust (BEST). Through this Payment for Ecosystem Services (PES) fund the communities will receive financial benefits from preserving the forest in the project area, additional to the direct ecosystem service benefits their forest provides, and this

[1] Kakuna-Lote FCA Project proposal, June 2019, section 4.2.4 and attached map with Kakuna-Lote harvesting plan in Appendix 4

[2] Kakuna-Lote FCA Project proposal, June 2019, section 4.4

will enable the communities to carry out the activities necessary for the sustainable use of their land and natural resources, also in the future. Resources for the PNG Communities BEST will be attracted by obtaining FSC certification, Fairtrade certification and VCS & CCB validation and verification, carbon credit issuance, and finally selling these carbon credits on the voluntary market;

5. A formal protection status will be obtained for the forests under the REDD project. The Tavolo Community has now put the forest areas area under a Conservation Deed, which was signed in November 2019.

Through the above mentioned project activities the forests under the Tavolo REDD Project will be protected from clearance, and net GHG emission reductions or removals will be achieved. The lifetime of the project activities will be 30 years, starting from the Project Start Date of 23 January 2019. The estimated annual GHG emission reductions or removals for the first project instances is estimated at 4,544,004 tCO_2e over the project crediting period of 30 years.

1.2 Sectoral Scope and Project Type

VCS Sectoral scope: Scope 14 - Agriculture Forestry and Other Land Use (AFOLU)

AFOLU project category: Reduced Emissions from Deforestation and Degradation (REDD).

REDD activity type: Avoiding Planned Deforestation and/or Degradation (APDD).

Grouped project: No

1.3 Project Eligibility

The project qualifies as an Avoided Planned Deforestation/Degradation project (VCS category APD) because:

- The conversion of forest lands to a deforested condition in the Tavolo Project Area is legally permitted under the Mukus-Melkoi SABL;
- Project documentation is available to clearly demonstrate that the land in the project area would have been converted to non-forest use if not for the REDD project.

1.4 Project Design

The Tavolo REDD Project has been designed to include a single installation of an activity, focusing on the avoidance of the planned deforestation in the Tavolo Project Area.

1.4.1 Eligibility Criteria New Project Activity Instances

This is not a grouped project.

1.5 Project Proponent

Organization name	FORCERT
Contact person	Cosmas Makamet
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1.6 Other Entities Involved in the Project

Organization name	Tavolo Community Conservation Association
Role in the project	project beneficiary
Contact person	Peter Kikele
Title	Chairman
Address	P.O. Box 1789 Kokopo, East New Britain Province, Papua New Guinea
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Organization name	Face the Future
Role in the project	Technical assistance in VCS&CCB project development
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1.7 Ownership

Land ownership across PNG, and therefore also in the Tavolo Project Area, is organized at the clan level. There is no traditional individual ownership. Customary ownership of land in PNG is recognized in the Constitution of the Independent State of Papua New Guinea (1975) under the Division 3 Basic Rights in Section 53 (Protection from unjust deprivation of property) subject to Section 54 (Special provision in relation to certain lands). This also includes full ownership of all natural and forest resources on the land. Customary landownership can be claimed and proven through oral history and traditional knowledge of the land and its specific features. There is no need for written land titles or other paper documented proof of traditional landownership in PNG. Correlating to Section 54 (Special provision in relation to certain lands) is the Land Act 1996 Section 132. Disposal of Customary Land that says a customary landowner has no power to sell, lease or otherwise dispose of customary land or customary rights otherwise than to citizens in accordance with custom, and a contract or agreement made by him to do so is void.

As specified by Subsection (2) of Section 11 of the Lands Act 1996 that; Where the Minister leases customary land under Subsection (1), an instrument of lease in the approved form, executed by or on behalf of customary landowners, is conclusive evidence that the State has a good title to the lease and that all customary rights in the land, except those which are specifically reserved in the lease, are suspended for the period of the lease to the State. This safeguards the rights of the State and the sub lessee under a so called Special Agricultural Business Lease (SABL).

1.8 Project Start Date

Project start date of the Tavolo REDD Project is **23 January 2019**. This is the signing date of the Cooperation Agreement between FORCERT, Face the Future and Greenchoice (the project pre-financer). With this agreement the three parties have agreed to aid the Tavolo Community in a court case aiming to nullify the Mukus-Melkoi SABL and the Lote-Kakuna Project, and to develop a Payment for Ecosystem Service (PES) fund for the communities in the Tavolo Project Area, in order for them to benefit from preserving the forest, also in the future.

1.9 Project Crediting Period

Project Crediting Period is **30 years**.

The projection of baseline emissions is presented in this Project Document (PD) for the first 10-year period after the project start date. After every 10 years the baseline will be reassessed and revised. Emission reductions/removals will be claimed for the 10-year periods for which the baseline is fixed and a monitoring plan has been implemented.

1.10 Project Scale and Estimated GHG Emission Reductions or Removals

Projects are categorized by size according to their estimated average annual GHG emission reductions or removals, as set by the VCS Standard v.4.0 (section 3.9.1):

1) Projects: Less than or equal to 300,000 tonnes of CO_2e per year.

2) Large projects: Greater than 300,000 tonnes of CO_2e per year.

Looking at the estimated annual GHG emission reductions for the project crediting period of 151,368 tonnes of CO_2e per year, the project scale is categorized as a **'Project'**:

Project Scale	
Project	x
Large project	

The estimated annual GHG emission reductions or removals for the project crediting period are presented in the following table:

Year	Estimated GHG emission reductions or removals (tCO_2e)
2019	-
2020	1,086,291
2021	1,192,859
2022	776,947
2023	221,232
2024	432,133
2025	132,071
2026	131,975
2027	131,879
2028	131,783
2029	131,783
2030	90,757
2031	47,379
2032	21,402
2033	17,411
2034	5,633
2035	5,633
2036	5,633
2037	5,633
2038	5,633
2039	5,633

2040	2,435
2041	-
2042	-
2043	-
2044	-
2045	-
2046	-
2047	-
2048	-
Total estimated VCUs	**4,582,132**
Total number of crediting years	**30**
Average annual VCUs	**152,738**

1.11 Description of the Project Activity

Three communities in the Tavolo Project Area, Mukus, Tavolo and Lausus, have organized themselves into the Tavolo Community Conservation Association, with the objective to conserve and protect the natural forests on their community lands. The Tavolo Project Area covers a total of 21,782 ha, out of which 15,102 ha (69%) is currently planned to be deforested and converted into agriculture and other land uses under the Mukus-Melkoi SABL and the Kakuna-Lote Project. The Tavolo Community is working together with FORCERT to prevent the deforestation of their forest lands by implementing the following project activities:

1.11.1 Nullification of the Mukus-Melkoi SABL

The whole of the Tavolo Project Area falls under the Mukus-Melkoi SABL area, which was initially granted in 2008 to a landowner company called RERA Holdings Ltd (RHL) for a period of 99 years. The Tavolo Community never gave their consent for their land to be included in the Mukus-Melkoi SABL. Besides the SABL the Tavolo Community also never gave their consent for a large-scale deforestation and land use conversion under the Kakuna-Lote project on their land. Therefore, the Tavolo Community is taking administrative and legal actions to stop the Kakuna-Lote Project and its underlying FCA, and to get the Mukus-Melkoi SABL nullified to prevent the development of any other deforestation plans in the area in the future. The challenges for customary landowning communities to take on administrative actions and legal battles with large multinational companies and the state are very big, in particular to finance costs involved such as lawyers' fees, meeting logistical costs for movement of plaintiffs and witnesses to and from the provincial capital Kokopo (where a National Court resides), and lastly costs involved for gathering of documents and other evidence required for the case. Through individual family contributions, the Tavolo Community has fundraised the required PGK10,000 deposit for their selected lawyer to accept to be the legal representative for the Tavolo Community and the pre-

financing support from Greenchoice to the Tavolo Community will allow them to undertake the initial administrative and legal actions.

1.11.2 Tavolo Community Sustainable Land Use Plan and Conservation Laws

A High Conservation Value (HCV) assessment was completed by the Tavolo Community, facilitated by FORCERT. Upon the completion of the assessment, community conservation laws were drawn up with also laws being added that include development of enforcement strategies. The laws are endorsed by all the clans involved in the Tavolo Project Area. The Tavolo Community will seek official recognition for the community conservation laws from the Melkoi Local Level Government and through annexing the laws to their Conservation Deed. The implementation and enforcement of the Community conservation laws is governed by the Tavolo Community Conservation Law Committee, consisting of representatives of all clans involved.

The existing Tavolo Community Sustainable Land Use Plan (SLUP) was revised following completion of the HCV assessment and Community Conservation Laws. There are few changes to the land use zones following from discussions based on satellite images and ground truthing, done with assistance from FORCERT officers. The SLUP and the Community conservation laws will guide the community to themselves promote and strengthen conservation and sustainable management of their natural resources. They will be evaluated and if found necessary revised by the Tavolo community every 10 years, in line with the VCS baseline revision process.

1.11.3 Benefits from Environmental Service Trust (BEST) for PNG communities

FORCERT will establish the PNG Communities Benefits from Environmental Services Trust (PNG Communities BEST) as a general Service Trust for the local communities (their partners), and for which sufficient finance is available in the Trust to guarantee a minimum of 10 years of annual benefit payments to the communities.

The PNG Communities BEST will be managed by a reputable independent financial management entity, and will hold all funds received for specific environmental services provided and any other financial support for the conservation efforts of the member communities. This independent management will be established once the PNG Communities BEST has sufficiently grown in size, i.e., community membership and annual income, to warrant the expenses of engaging these management services, or if and when the planned PNG Biodiversity and Climate Fund would prove to be available and suitable to take on this task. At the start of PNG Communities BEST, with for now only the Tavolo Community Conservation Association as its first community member, and the Tavolo VCS REDD project VCU sales as its sole income source, funds will be managed by FORCERT in accordance with their strict financial procedures, overseen by the FORCERT Board of Directors, and kept strictly separated from other FORCERT funds. This financial management arrangement has been agreed to by the Tavolo Community.

General benefit sharing under the Trust has already been agreed to and results from various round of community discussions with the Tavolo Community and two other trial communities.

This general break-up is as follows:

- 15% to Government (4% Local Level, 3% District, 1% Provincial & 7% National)
- 20% to supporting organizations (FORCERT and Face the Future)
- 65% to the landowning community

NB: The proposed Government tax division is preliminary, as the final version of National REDD+ Benefit Sharing Distribution System Policy has not been released yet, and no Regulations governing benefit sharing under the Climate Change Management Act (CCMA, 2021 Amended) have yet been established If the Government tax percentage would be lower than 15%, that the percentage going to the landowning community will be increased with the difference.

The 65% community benefits can be allocated to seven possible funds:

- Community service projects
- School fee/education
- Health care costs
- Support for family income earning options
- Community organization (legal entity) management costs
- Emergencies
- Investment

Please note that this benefit sharing system does not include direct cash payment to families or individuals, while still catering for financial support to families and individuals for important areas such as school fees and health care. Also, it includes financial support to families to develop and support income earning options/small business.

The reason for not including direct cash payment to families or individuals in our benefit sharing system is that this will only create dependency, division, discrimination and exclusion, increase the danger of domestic violence, and even stimulate population growth (if also children are included in the cash distribution). Also, it may lead to outside people trying to trace themselves back to the clan/ILG involved, to claim clan/ILG membership.

The PNG Communities BEST benefit sharing system does allow for genuine existing clan members living elsewhere to still be considered in the benefit sharing, e.g., through the Education, Health, or family business support funds, something which can be decided upon by all clans involved.

There will be annual benefit disbursements in equal amounts for the 30-year duration of the PNG Communities BEST agreement signed with the community, based on secured income into the PNG Communities BEST. The decision on the actual breakup of the annual amount received by the participating community over the various "baskets" for each year, is with the community. Also, the management of the use of the funds for each basket is organized and implemented by

the community itself, except for the Investment basket, which will be managed at the PNG Communities BEST level. Considering the large annual amounts available for the Tavolo Community, disbursements will be made on a quarterly basis, allowing for both interim progress reporting on activity implementation and expenditure, and any necessary adjustments for the following quarter.

There will be annual public community meetings at which FORCERT will report back to the community on the management of the PNG Communities BEST, including its finances, and the community management committee will give their management and finances report back to FORCERT.

FORCERT will comply with the monitoring and reporting requirements of VCS, and with the annual reporting requirements of CCDA under the relevant CCMA (2021 Amended) clauses, and the yet to be finalized REDD+ project guidelines and regulations. The current applicable government reporting requirements can be found in Section 1.14 below.

1.11.4 Formal Protection Status

The Tavolo Community is looking at extending their current Wildlife Management Area (WMA) of only 2,400 ha to cover the whole of the Tavolo Project Area, however their application for this extension with the Conservation & Environmental Protection Authority (CEPA) has not been processed. Therefore the Tavolo Community has now put their whole SLUP area under a Conservation Deed, which was signed in November 2019.

1.12 Project Location

The Tavolo Project Area is located in East New Britain Province, on the South Coast of the island of New Britain, Papua New Guinea (PNG). It is formed by the customary lands of three different communities, namely Mukus, Tavolo and Lausus. The customary land under the Sustainable Land Use Plan of these three communities covers a total area of 21,164 ha, out of which 17,178 ha of these lands are zoned by the Tavolo community as forest area (see Tavolo Land Use Map in paragraph 3.3.3). The Tavolo REDD project aims to conserve the forests inside these forest zones and stop the planned deforestation inside the forest zones. The boundaries of the Tavolo Project Area and the forest zones are given in Figure 1.

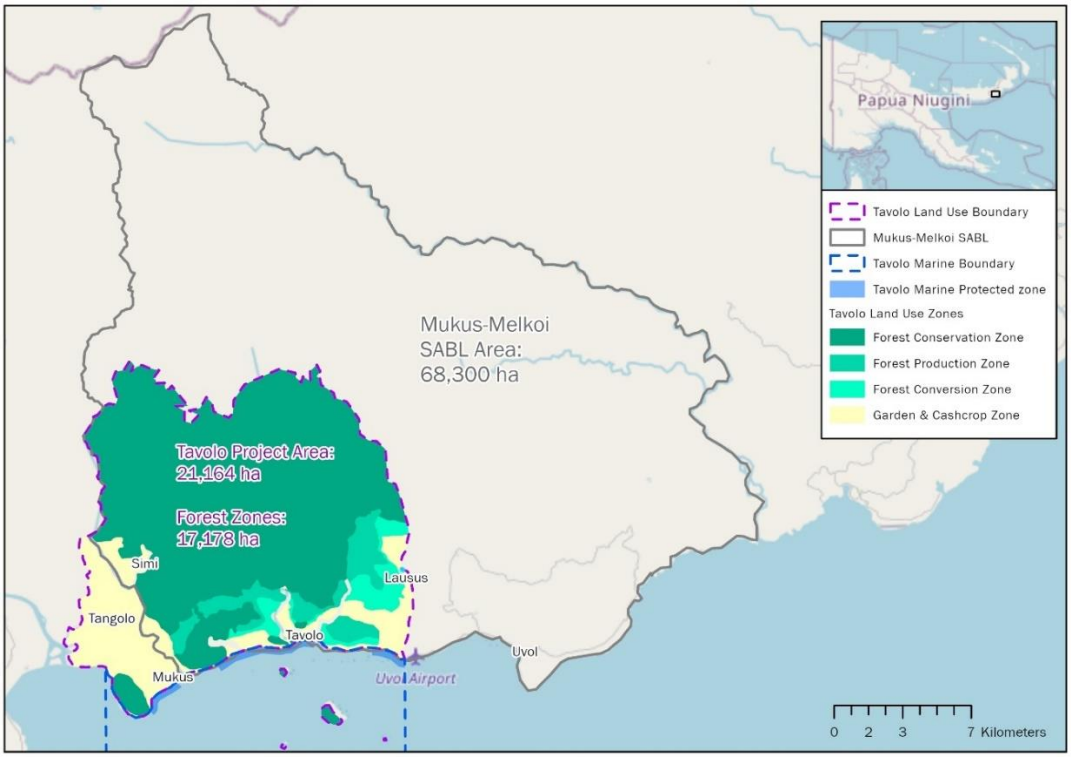

Figure 1 - Map with the geographical boundary of the Tavolo Land Use Area (in purple)

Within the Tavolo Land Use Boundaries, the baseline forest cover in 2019 (the start of the REDD project) have been classified using Landsat 8 imagery (see Figure 2). This Baseline Forest Cover classification is further described in Paragraph 5.3.1.

Since only forest cover should be included as REDD project area, the Tavolo REDD Project Area exists out of the baseline forest cover inside the zoned forest areas. Therefore the boundaries of the Tavolo REDD Project are as presented in green in Figure 3. The total Tavolo REDD Project Area is 16,493 ha. The Tavolo REDD Project Boundary is also provided digitally as kml and shapefile in Appendix 6.

Out of the 16,493 ha of forest cover inside the Tavolo REDD Project Area, 14,690 ha is zoned by the community as forest conservation zone, 1,387 ha as forest production zone and 694 ha as forest conversion zone (see Table 1 and Figure 3).

Table 1 – Land Use Zones inside Tavolo REDD Project Area

LU Zone	Area (ha)
Forest Conservation	14,412
Forest Production	1,387
Forest Conversion	694
Total area of Forest Cover inside Tavolo REDD Project	**16,493**

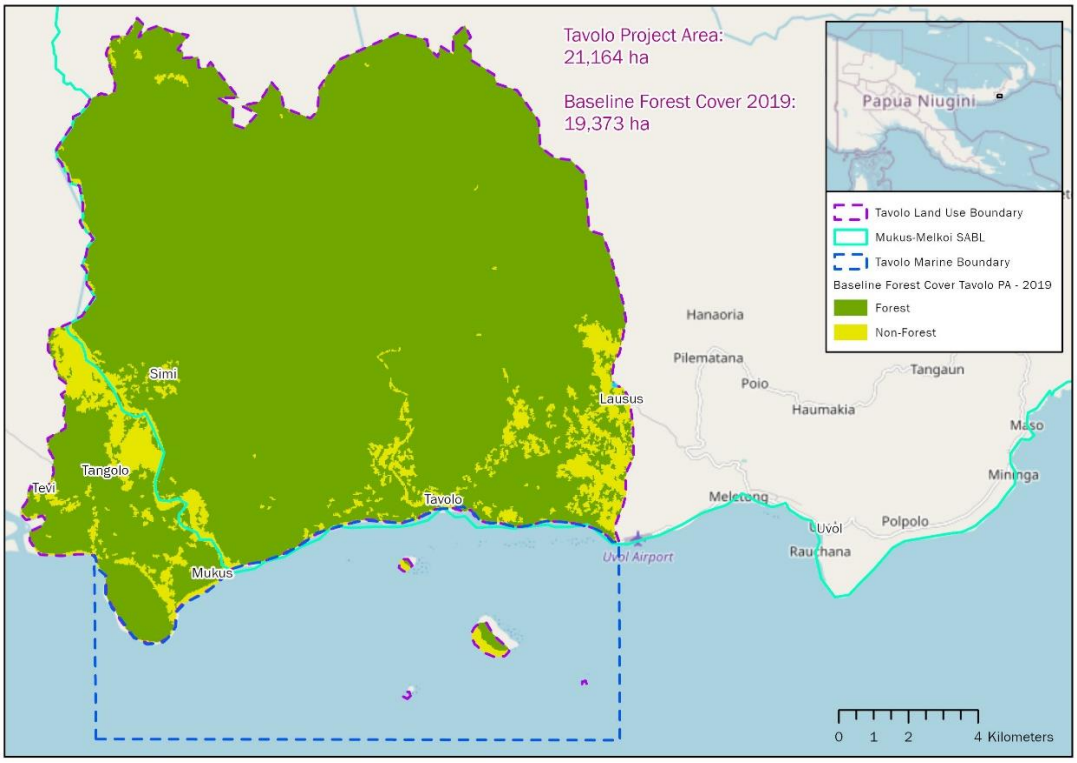

Figure 2 – Forest / Non-Forest Classification 2019 based on Landsat 8 Images

Figure 3 – Tavolo REDD Project Area (in green)

1.13 Conditions Prior to Project Initiation

1.13.1 Climate

New Britain has the mean maximum temperatures of 28-34°C while mean minimum temperatures are of 20-25°C. The Island has a tropical rainforest climate, with annual rainfall of 5,000-7,000mm, with heaviest and most frequent rainfall occurring on the South Coast between May and October. The Weather is also affected by the Monsoon and South West Trade Winds.

1.13.2 Topography

The southernmost part of the Tavolo project area is a relatively flat coastal zone of uplifted coral and river deposits. Moving inland this gives way to undulating hills of up to 600 m and gradually changes into the mountains. At the crest is the Nakanai Range and of below stretches mountains that have altitudes of up to 1200m. Slopes range between 0 and 30°, but mostly vary between 0 and 15°. The steepest slopes can be found around the river valleys of Tavolo.

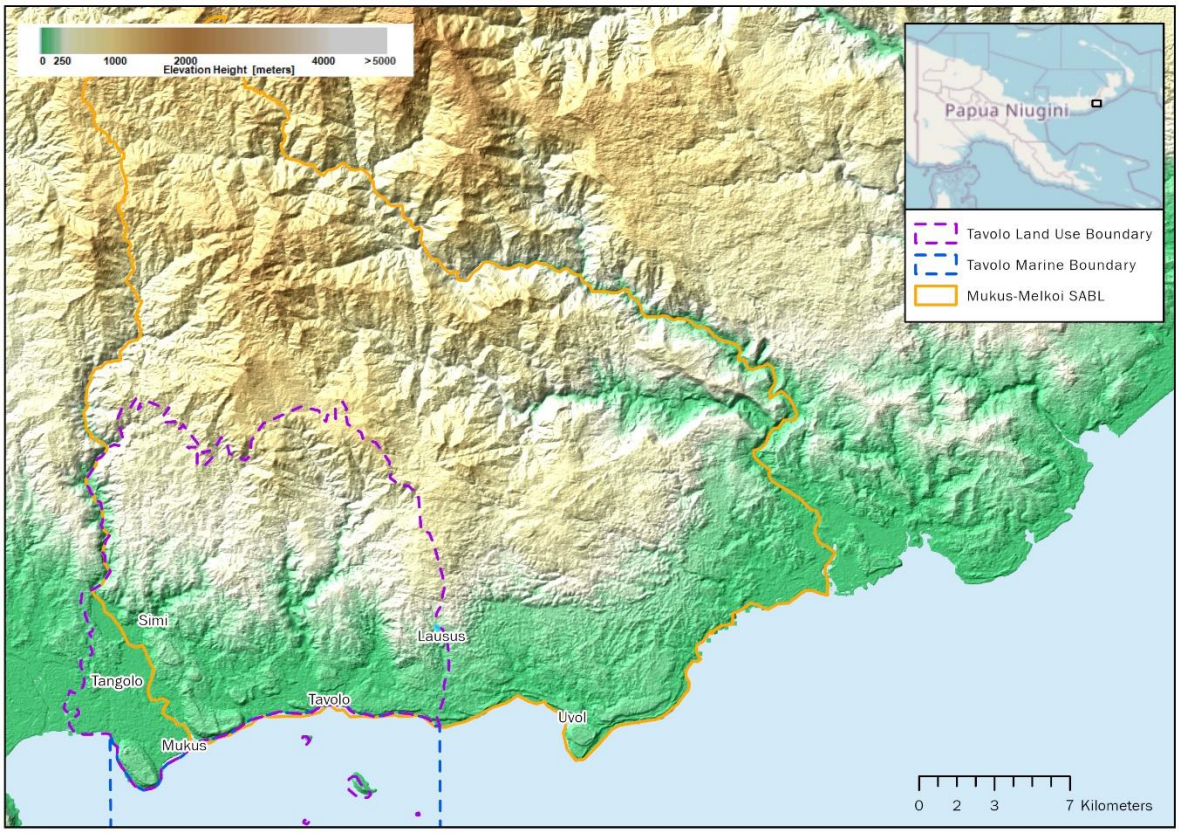

Figure 4 – Tavolo Elevation Map

1.13.3 Hydrology

Tavolo is located in the watersheds of the Wala, Ania, Mukus and Melkoi rivers of the East New Britain Province of Papua New Guinea. There are four rivers identified as important water resources, which are Tavolo, Eunga, Takai and Mukus. These water courses are used particularly for drinking, washing, ease of transport accessibility and sources for protein.

1.13.4 Soils

Based on Bleeker (1983) the inland soils can be characterised as being dystric Cambisols, Regosols or orthic Acrisols (classified with nr. 10 / brown colour in the map below). The soils on the coast are mainly characterised as gleyic Fluvisols, eutric Histosols or eutric Fluvisols (classified with nr. 14 / green colour in the map below).

Figure 5 - Map depicting the major soil types in and around the project area. Derived from Soil map of Bleeker (C.S.I.R.O.)[1]

1.13.5 Ecoregion

The majority of the project area is classified under the WWF Terrestrial Ecoregions as “New Britain-New Ireland Lowland Rain Forests”. The upper part of Tavolo however is classified as “New Britain-New Ireland Montane Rain Forests”. Both types fall under the tropical moist forest ecoregion.

1.13.6 Vegetation types

[1] Available at: https://esdac.jrc.ec.europa.eu/ESDB_Archive/EuDASM/Asia/lists/k10_cpg.htm

The following main forest types can be identified for the project area, as per the PNG National Forest Inventory (NFI) stratification;

1. **Low Altitude Forest on Plains and Fans**

The forest is found below 1000m elevation which composes of medium to large crowned forests. The main two species includes *Pometia pinnata* (Taun) and *Homalium foetidum* (Malas) are that dominate the canopy with under growth of vines, palms, scrubs and rattans. Apart from these there the is a small parcel of *Eucalyptus deglupta* (Kamarere) stand found along the Mukus river.

2. **Low Altitude Forest on Uplands**

This forest comprises of medium to large forest with even canopy, with *Castanopsis*, *Nothofagus* or *Araucaria*. Tree species of *Ficus spp, Alstonia scholaris* and *Terminalia spp* make up the upper storey and with *Instia spp, Petrocarpus indicus, Anisoptera thurifera* and *Hopea spp* found on the ridges and foot hills.

3. **Lower Montane Forest**

This forest is found above the elevation of 1000m which composes of small crown forests with *Casuarina papuana, Nothofagus* and *Araucaria spp* found.

Additional to these main forest types under the NFI, though observations on the ground, also small areas of the following forest types have been identified:

- Mangrove; This forest type occurs mainly at the coastal zone with the estuarine community but this is only a very small area at the Tavolo river mouth which is composed mainly of *Rhizophoeraceae*.
- Coastal regrowth forest; where forest has changed by former garden or cocoa blocks resulting in secondary tree species like *Callophyllum, Euodia, Artocarpus, Terminalia, Canarium* and *Octomelesetc.*
- Coastal Strandline Forest; dominated by species such as *Callophyllum inophyllum, Cordia subcordata* and *Hibiscus tiliaceus*.

1.13.7 Present condition of the forests in the project area

As described in section 3.3.3 and shown in the Tavolo Land use map in Figure 9, most of forest in the project area is allocated under conservation. Apart from the gathering of non-timber forest products, fishing and hunting for domestic and cultural uses, these forests have experienced little human intervention and can be considered as untouched natural forest. Forest areas allocated as production forest and conversion zone are predominantly secondary forest which are generally lower stocked.

While surrounding communities with lands under a comparable SABL scheme have experienced vast deforestation, Tavolo has to date managed to conserve their forest and has managed it sustainably, without any significant degradation or loss of forest over the past 20+ years. While the project area shows no significant degradation or loss of forest, the communities in the adjacent district Pomio have lost a huge part of their forest in recent years (2011-2020) due to clearcutting operations under an SABL scheme (see Figure 6). The community plans to strengthen their conservation efforts for the long term through the project activities as detailed in section 1.1. The threats to the forests in the projects area are described in detail in section 3.4.

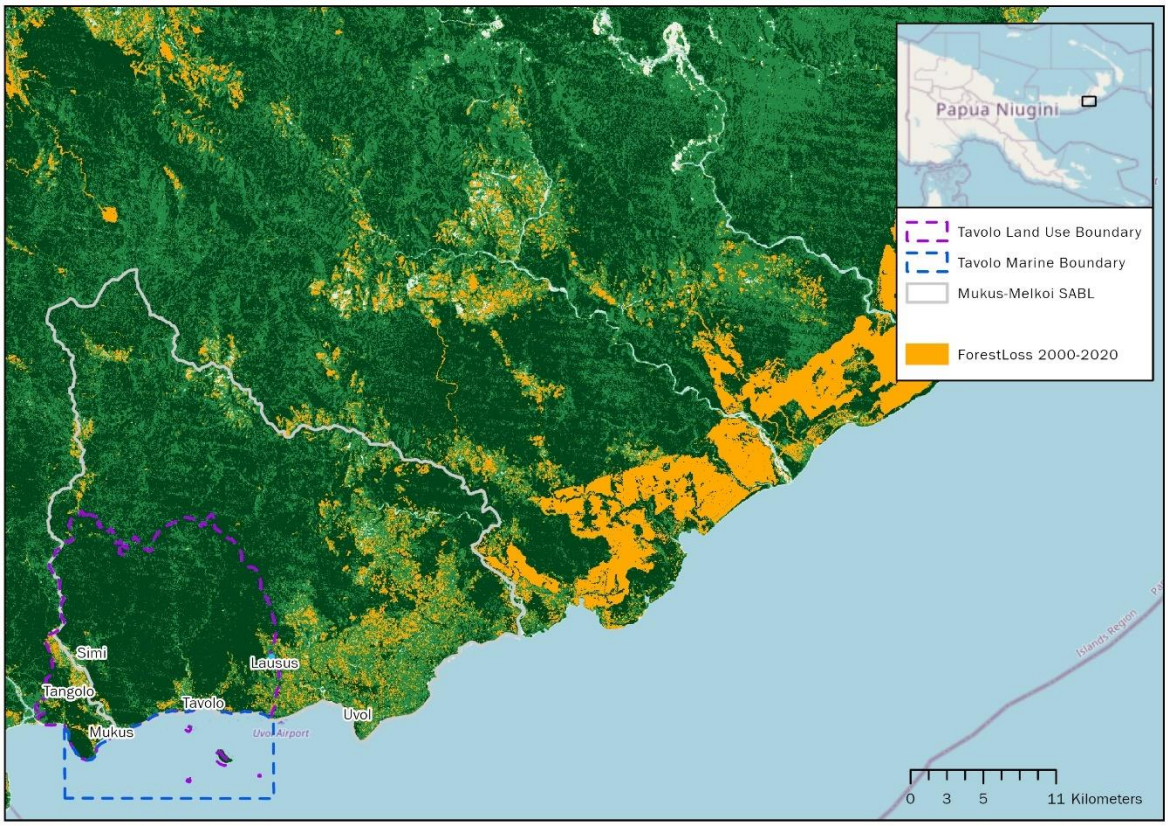

Figure 6 - Map of tree cover loss between 2000 and 2020, extract from Global Forest Watch

1.14 Compliance with Laws, Statutes and Other Regulatory Frameworks

All project activities described in this PD are in compliance with all and any relevant local, regional and national laws, statutes and regulatory frameworks. Below the most important laws and regulations are mentioned, with a short description of the part most appropriate to the project activities. It should be noted that some of these are still in (final) draft form and at this moment in time not yet legally binding or enforceable, but all of their main requirements and intents will still be met as much as possible.

National Climate Compatible Development Management Policy

1. Partnership Policies:

a. Equitable, Effective Participation: Networking, coordination, and equitable engagement with and between multiple stakeholders through active participation, consultation and engagement at national and subnational levels in all climate change programs, incentives and activities.

2. Partnership Strategies:

a. Community Partnerships: Promote recognition and respect of community rights, support for improved community climate change outcomes, and information sharing and collaborative partnerships for community climate risk management.

2.1 Gender-Balanced Decision-Making: Ensure gender balance in all community, national and sub-national decision-making processes.

2.4 Civil Society, Churches and Private Sector Partnerships: Encourage collaboration between government, civil society, churches and private sector through innovative approaches (e.g, MoUs and public private partnerships).

Climate Change Management Act (2021, Amended)

- Clause 60: use UNFCCC processes or procedures for verification.
- Clause 87: Landholder consent to be obtained through FPIC.
- Clause 88: Rights of customary landholders shale be fully recognised and respected in all transactions affecting the customary land.
- Clause 89: Obtaining consent of customary landholders; (1) land groups to be incorporated as ILG's for any climate change project agreement, or (2) without ILG if 85% of the adult members of each land group gave FPIC.
- Clause 90:

    1) A climate change related project agreement shall

        a) be in writing; in both Englsh and Tok Pisin, and in the local language if requested by the customary landholder; and

        b) explain and define landholder rights and benefits, including the monetary and other benefits, if any, to be received by the landholders, as prescribed under Part IX, in consideration for the rights granted; and

        c) specify the nature of project in the area covered by the agreement; and

        d) specify a term of sufficient duration in order to allow for proper project management measures to be carried out to completion to be determined based on the best available

science and shall include provisions for review of the agreement appropriate for the length of the project; and

e) be accompanied by a map showing clearly the boundaries of the area covered by the agreement; and

f) specify any other climate compatible or green growth related land use options, if any; and

g) be accompanied by a stakeholder engagement and awareness plan specific to the project area landholders and landholder representatives

2) An agreement under Subsection (1) in the prescribed format, shall be lodged with the Office of State Solicitor for necessary legal clearance before execution.

3) A copy of a duly executed agreement together with a copy of the legal clearance issued under Subsection (2) shall be lodged with the Authority.

4) The Board may, from time to time, determine appropriate lodgement fees in relation to the lodgement of a copy of an agreement.

5) An agreement under Subsection (1) shall comply with the requirements under Subsections (2), (3) and (4) and failure to comply with any one or more of those requirements shall render the agreement under Subsection (1) in valid and unenforceable for all intents and purposes.

6) Climate change related projects shall use the updated versions of relevant regulations and/or guidelines if none are available.

- Clause 93:

1) This Part applies to the participation and benefit sharing or allocation of incentives for climate change related projects or activities.

2) All affected landholders shall participate and benefit from the incentives of a climate change related project implemented on land or at sea.

3) Unless a law provides to the contrary, a Regulation shall provide for the participation and benefit sharing or incentive allocation mechanism under this Part.

- Clause 94:

1) The Authority or any person or entity who undertakes a climate change related project shall use every reasonable means to quantify the net income or net benefits (as the case may be) and present a project report at the completion of the project to the concerned landholders and the Authority and relevant provincial governments.

2) An abstract or summary of the report under Subsection (1) shall be published at least twice in a daily newspaper circulated nationwide.

3) A project report produced under Subsection (1) is a public document for all intent and purposes.

Papua New Guinea's National REDD+ Strategy (2017)

The development of the PNG Communities BEST REDD Project targeting the voluntary carbon market is in line with the national approach to REDD+ as set out by the Government of Papua New Guinea in their National REDD+ Strategy 2017-2027, as it states:

"The Government will not seek to develop or promote the development of REDD+ Projects targeting the voluntary carbon market. The government will, however, consider project proposals from landholders, private sector actors and NGOs who are able to demonstrate clear competencies within the areas of project development, secure long term financial investment and a strong commitment to the ongoing support and development of communities within the project location."[1]

Furthermore, the PNG Communities BEST REDD Project is developed in close cooperation with the Climate Change and Develop Authority (CCDA) of the Government of Papua New Guinea as can be seen in the MoU between FORCERT and the CCDA in Appendix 1 of this PD.

The development of this project is also in accordance with the other conditions set out in the National REDD+ Strategy for the development of projects targeting the voluntary market.

Papua New Guinea's National REDD+ Safeguard Documents: FPIC Guidelines, BSDS Policy, GRM Guidelines (Draft March 2022), REDD+ Development Guidelines (Various draft versions, being finalised)

FORCERT has been closely involved in the development of these REDD+ Safeguards documents for PNG, which are currently being finalised and will then be translated into Regulations under the CCMA (2021, Amended), as part of our MOU's with CCDA (Clause 7.4 The CCDA and FORCERT will cooperate and collaborate to incorporate the concepts and ideas of the Proposed PES System for PNG into all relevant Government policy, legislation and regulation).

The trial and further preparation work for the development of the PNG Communities BEST Program and the REDD Tavolo Project have very much informed the national level REDD+ Safeguards development and discussions, and FORCERT has been by far the main contributor of input and comments in all stakeholder consultation rounds.

Therefore, although at present we do not have any final draft or final versions of the four REDD+ Safeguard documents, we feel confident in stating that the PNG Communities BEST Program

[1] Government of Papua New Guinea, 2017. Papua New Guinea National REDD+ Strategy for the period 2017-2027, Papua New Guinea, p22.

and REDD Tavolo Project will be able to meet or exceed all relevant requirements under these documents and the to be developed related regulations.

Papua New Guinea's National REDD+ Forest Reference Level (2017)

The quantification of GHG emissions and removals and the monitoring plan presented in this PD follows the guidelines given in Papua New Guinea's REDD+ Forest Reference Level Document, submitted to the UNFCCC in 2017.

PNG Constitution (1975)

National Goal No.4 National Resources and Environment;

We, the people of Papua New Guinea declare our fourth goal to be for Papua New Guinea's natural resources and environment to be conserved and used for the collective benefit of all, and be replenished for the benefit of future generations.

1.15 Participation under Other GHG Programs

1.15.1 Projects Registered (or seeking registration) under Other GHG Program(s)

The Tavolo REDD Project has not been registered, or is not seeking registration under any other GHG programs.

1.15.2 Projects Rejected by Other GHG Programs

The Tavolo REDD Project has not been rejected by any other GHG programs.

1.16 Other Forms of Credit

1.16.1 Emissions Trading Programs and Other Binding Limits

The Tavolo REDD Project will not participate in an emissions trading programme or any other mechanism that includes GHG allowance trading.

1.16.2 Other Forms of Environmental Credit

The Tavolo REDD project has not sought or received another form of GHG-related environmental credit.

1.17 Sustainable Development Contributions

See CCB PD 1.1 / 4.2 / 5.2 for a summary description of project activities that result in Sustainable Development contributions.

The expected contributions of project activities to the SDG's are:

SDG 1. No poverty: TCCA has dedicated Family Business Support Fund under which all families can apply for support of 50% of the costs to set up and develop sustainable income earning options. TCCA also has a Pensioner scheme for people in the community of 70 years and older. TCCA has put a housing scheme (permanent house for every family) as their top priority under their Community Projects Fund.

SDG 3. Good health and well-being: TCCA has a dedicated Health Fund, supporting costs for hospital referrals, providing an ongoing training program for Village Health Workers and Village Birth Attendants. Under the TCCA Community Projects Fund the current health clinic in Tavolo village will be upgraded, and health clinics in Lausus and Mukus villages will be supported to become fully equipped and functioning.

SDG 4. Quality education: TCCA has a dedicated Education Fund providing stationary costs support for all primary students and 50% school fee support for all tertiary education students, including Technical Vocational Education Centre students, and Early Child Hood Teacher trainees. Under the TCCA Community Project Funds, the current Tavolo Primary School will be upgraded to become a Secondary School up to Grade 12, and the primary schools in Lausus and Mukus will be supported to become fully equipped and functioning.

SDG 5. Gender equality: Under the project agreement and all FORCERT's work, there is a general requirement for at least 30% of all participants in meetings, workshops, trainings and other activities to be females, and for any representative committees or management to have 30% or more female members. This also applies for the TCCA workforce. The family bank accounts in which the Family Business Support Funds will be deposited, are opened and managed by the wife of the family,

SDG 7. Affordable and clean energy: TCCA has planned a feasibility study into a micro-hydro power plant and support for solar power for all permanent family houses and all service facilities.

SDG 11. Sustainable cities and communities: TCCA has develop their Sustainable Land Use Plan and Community Conservation Laws, with a Community Conservation Law Committee governing the implementation and adherence. All planned community development, including transport infrastructure will be designed to minimize its environmental impact.

SDG 13. Climate action: TCCA has a dedicated Theme on Climate change, adaptation and mitigation in their 2022-2023 Management Plan with 4 associated Objectives and planned activities

SDG 14. Life below water: The Tavolo Community Sustainable Land Use Plan and Community Conservation Laws also include rivers, creeks and the sea. Buffer zones for water courses will be respected and where necessary restored. There are marine conservation zones closed to fishing and collection, Also there are community conservation laws relating to fishing and

collecting riverine and marine animals. This combination of conservation measures is aimed at securing long-term sustainable management of all Life below water for the Tavolo Community.

SDG 15. Life on land: The Tavolo Community Sustainable Land Use Plan and Community Conservation Laws cover the total area and all SLUP user zones. There are conservation zones closed to hunting and collection, Also there are community conservation laws relating to hunting and collecting in other user zones. This combination of conservation measures is aimed at securing long-term sustainable management of all Life on land for the Tavolo Community.

The project contributes to achieving PNG's nationally stated sustainable development priorities in PNG's Vision 2050 through support of the development and growth of sustainable land and natural resource based livelihood options at the Tavolo Community, which contributes to Pillars 1,2,5,6 and 7 of the PNG Vision 2050. Also, the project assists to implement the National Strategy for Responsible Sustainable Development for PNG (StaRS), which redefines PNG's development road map using sustainable development principles, focusing on renewable resources rather than extractive activities, placing priority on preservation and sustainable use of the environment. The project's activities are completely in line with this Strategy.

Through its National Level Program, FORCERT has an ongoing working relationship with the Department of National Planning and Monitoring (DNPM), and FORCERT has been asked to work with DLPP on the monitoring of and reporting on the achievement of the SDG's in Papua New Guinea. Details on this collaboration still need to be further discussed and agreed to with DNPM.

FORCERT will also provide annual update reports to CCDA on its overall PNG Communities BEST Program and the Tavolo project, including on the achievements related to the SDG's, and Vision 2050.

1.18 Additional Information Relevant to the Project

1.18.1 Leakage Management

No leakage is expected for this Avoided Planned Deforestation project.

Activity Shifting Leakage

VM0007 states that, where the specific deforestation agent can be identified, leakage does not need to be considered where it can be demonstrated that the management plans and/or land-use designations of the deforestation agent's other lands have not materially changed as a result of the project (e.g., the deforestation agent has not designated new lands as timber concessions, increased harvest rates in lands already managed for timber, cleared intact forests for agricultural production or increased fertilizer use to enhance agricultural yields).

Mekar PNG has one other current operation in PNG; Aliai-Sisimi-Hargy Consolidated in the West New Britain Province, which is a logging operation (license type unknown), from which it exported 26,750m3 in 2020 and 41,485m3 in 2021. After the exclusion of the Tavolo Project area from the overall Lote-Kakuna FCA, no other FCA areas have been obtained by Mekar PNG, and preparations for the Lote-Kakuna FCA operation have continued.

Market Leakage

VM0007 states that the market-effect leakage should be considered by a REDD project if the deforestation in the baseline is caused by timber harvesting for commercial markets.

For the Tavolo REDD project however, the deforestation in the baseline is caused by forestclearance to allow for the development of a large scale agricultural project under the Special Agricultural Business Lease. Therefore market-effect leakage does not need to be considered.

1.18.2 Commercially Sensitive Information

No commercially sensitive information has been excluded from the public version of the project description.

2 SAFEGUARDS

2.1 No Net Harm

Any potential negative environmental and socio-economic impacts of the project, and the steps taken to mitigate them are described in the project's registered CCB Project Design Document (CCB PDD v1.0).

2.2 Local Stakeholder Consultation

The process for, and the outcomes from, ongoing communication with local stakeholders conducted prior to validation are described in the project's registered CCB Project Design Document (CCB PDD v1.0).

2.3 Environmental Impact

Any environmental impact assessments carried out prior to validation are described in the project's registered CCB Project Design Document (CCB PDD v1.0).

2.4 Public Comments

No public comments received yet on the VCS Project Design Document.

2.5 AFOLU-Specific Safeguards

Any potential negative environmental and socio-economic impacts of the project, and the steps taken to mitigate them are described in the project's registered CCB Project Design Document (CCB PDD v1.0).

3 APPLICATION OF METHODOLOGY

3.1 Title and Reference of Methodology

The Tavolo REDD Project is designed for validation under the Verified Carbon Standard Version 3.7 and AFOLU Requirements Version 3.6.

The project applies VM0007 REDD+ Methodology Framework (REDD-MF) version 1.6 (VM0007 REDD+ Methodology Framework (REDD+MF), v1.6 - Verra). Under this REDD Methodology Framework, the following modules and tools are applied by the project:

	Modules/Tools
Additionality	CDM Combined tool to identify the baseline scenario and demonstrate additionality in A/R CDM project activities (T-ADD), v1
Permanence	VCS AFOLU Non-Permanence Risk Tool, v3.3 (T-BAR)
Baseline	VMD0006 Estimation of baseline carbon stock changes and greenhouse gas emissions from planned deforestation and planned degradation (BL-PL), v1.2
Carbon pool above- and belowground biomass	VMD0001 Estimation of carbon stocks in the above- and belowground biomass in live tree and non-tree pools (CP-AB), v1.1
Carbon pool wood products	VMD0005 Estimation of carbon stocks in the long-term wood products pool (CP-W), v1.1
Activity shifting leakage	VMD0009 Estimation of emissions from activity shifting for avoided planned deforestation (LK-ASP), v1.2
Market effect leakage	VMD0011 Estimation of emissions from market effects (LK-ME), v1.0
Emissions	VMD0013 Estimation of greenhouse gas emissions from biomass and peat burning (E–BPB), v1.1

Monitoring	VMD0015 Methods for monitoring of greenhouse gas emissions and removals (M-MON), v2.1
Stratification	VMD0016 Methods for stratification of the project area (X-STR), v1.1
Uncertainty	VMD0017 Estimation of uncertainty for REDD project activities (X-UNC), v2.1
Significance	CDM Tool for testing significance of GHG emissions in A/R CDM project activities (T-SIG), v1

3.2 Applicability of Methodology

As described underneath, the project activities for the Tavolo Project Area meets each of the applicability conditions of the VM0007 REDD+ Methodology Framework and the different tools and modules applied by the project. The project qualifies as a REDD project under the VM0007 REDD-MF because:

- Land in the Tavolo Project Area has qualified as forest (following the definition used by VCS) at least 10 years before the project start date;
- There are no peat soils present in the Tavolo Project Area;
- Baseline deforestation and forest degradation in the project area falls within the category of Planned deforestation/degradation (VCS category APD);
- Leakage avoidance activities by the project does not include either agricultural lands that are flooded to increase production (e.g. paddy rice), or intensifying livestock production through use of feed-lots and/or manure lagoons;
- The project proponents can show ownership of the project site and ownership of the carbon rights for the project area;
- The proposed project activities within the project area will not lead to violation of any applicable law even if the law is not enforced.

The project qualifies as an Avoided Planned Deforestation/Degradation project (VCS category APD) because:

- The conversion of forest lands to a deforested condition in the Tavolo Project Area is legally permitted under the Mukus-Melkoi SABL;
- Project documentation is available to clearly demonstrate that the land in the project area would have been converted to non-forest use if not for the REDD project.

3.3 Project Boundary

3.3.1 Geographical Boundary REDD Project Area

As described in section 1.12 the Tavolo REDD Project Area includes a total forest area of 16,493 ha out of which 14,695 ha of forest cover is currently planned to be deforested as part of the Kakuna-Lote FCA project under the Mukus-Melkoi SABL. The geographical boundary of the Tavolo REDD Project Area is presented in Figure 7 underneath.

PNG's national forest definition is "land spanning more than 1 hectare, with trees higher than 3 meters and the canopy cover of more than 10 percent (%).[1] The Global 2010 Tree Cover dataset, which is available on the Global Forest Watch (GFW) platform online,[2] shows that the Tavolo Project Area includes only land qualifying as forest for a minimum of 10 years prior to the project start date. The forest cover in 2010 within the Tavolo Project Area is visualized in Figure 8.

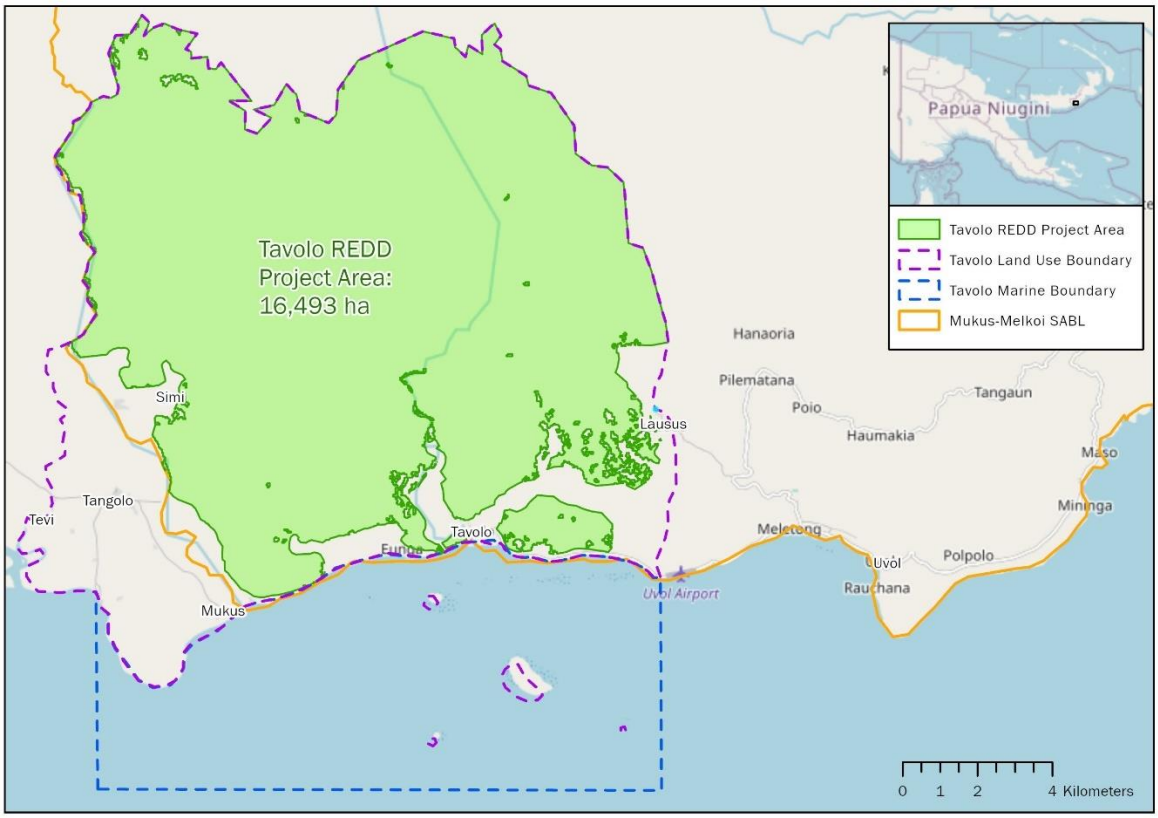

Figure 7 - Map with the geographical boundary of the Tavolo Project Area (in green)

[1] Papua New Guinea's National REDD+ Forest Reference Level; Modified Submission for UNFCCC Technical Assessment in 2017

[2] Hansen, et al., 2013

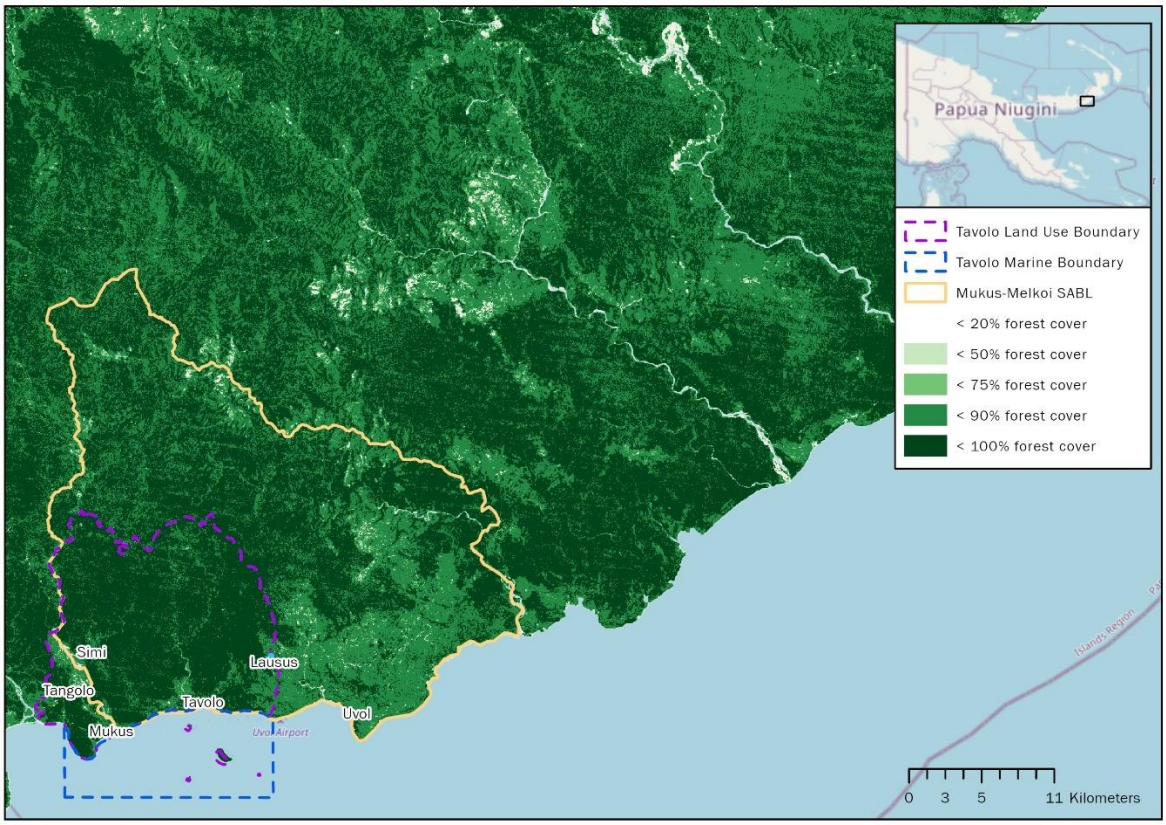

Figure 8- Forest cover in 2010 in the Tavolo Project Area

3.3.2 Carbon Pools and Sources of GHG Emissions

The carbon pools and the GHG emission sources included in or excluded for the Tavolo REDD Project activity are shown in Table 2 and Table 3 below.

Table 2 - Carbon Pools and sources of GHG emissions in the Baseline Scenario

Source		Gas	Included?	Justification/Explanation
Baseline scenario	Aboveground tree biomass	CO_2	Yes	This is a mandatory pool
		CH_4	No	
		N_2O	No	
		Other	No	
	Aboveground non-tree biomass	CO_2	No	The carbon stock in this pool is conservatively excluded.
		CH_4	No	
		N_2O	No	
		Other	No	

Source		Gas	Included?	Justification/Explanation
	Belowground tree biomass	CO_2	Yes	The carbon stock in this pool is calculated based on the aboveground tree biomass pool
		CH_4	No	
		N_2O	No	
		Other	No	
	Soil Carbon	CO_2	No	The carbon stock in this pool is conservatively excluded
		CH_4	No	
		N_2O	No	
		Other	No	
	Dead Wood	CO_2	No	The carbon stock in this pool is conservatively excluded
		CH_4	No	
		N_2O	No	
		Other	No	
	Harvested Wood Products	CO_2	Yes	The carbon stock in this pool is conservatively included since the carbon storage in the baseline scenario is likely to be a significant pool since large scale deforestation and exportation of timber is expected in the baseline
		CH_4	No	
		N_2O	No	
		Other	No	
	Litter	CO_2	No	The carbon stock in this pool is conservatively excluded
		CH_4	No	
		N_2O	No	
		Other	No	
	Biomass burning	CO_2	No	The carbon stock in this pool is conservatively excluded
		CH_4	No	
		N_2O	No	
		Other	No	
	Combustion of fossil fuels	CO_2	No	The carbon stock in this pool is conservatively excluded

Source		Gas	Included?	Justification/Explanation
		CH_4	No	
		N_2O	No	
		Other	No	
	Use of fertilizers	CO_2	No	The carbon stock in this pool is conservatively excluded
		CH_4	No	
		N_2O	No	
		Other	No	

Table 3 - Carbon Pools and sources of GHG emissions in the Project Scenario

Source		Gas	Included?	Justification/Explanation
Project scenario	Aboveground tree biomass	CO_2	Yes	This is a mandatory pool
		CH_4	No	
		N_2O	No	
		Other	No	
	Aboveground non-tree biomass	CO_2	No	The carbon stock in this pool is conservatively excluded.
		CH_4	No	
		N_2O	No	
		Other	No	
	Belowground tree biomass	CO_2	Yes	The carbon stock in this pool is calculated based on the aboveground tree biomass pool
		CH_4	No	
		N_2O	No	
		Other	No	
	Soil Carbon	CO_2	No	The carbon stock in this pool is conservatively excluded
		CH_4	No	
		N_2O	No	
		Other	No	

Source		Gas	Included?	Justification/Explanation
	Dead Wood	CO_2	No	The carbon stock in this pool is conservatively excluded
		CH_4	No	
		N_2O	No	
		Other	No	
	Harvested Wood Products	CO_2	Yes	The carbon stock in this pool is conservatively included since the carbon storage in the baseline scenario is likely to be a significant pool since large scale deforestation and exportation of timber is expected in the baseline
		CH_4	No	
		N_2O	No	
		Other	No	
	Litter	CO_2	No	The carbon stock in this pool is conservatively excluded
		CH_4	No	
		N_2O	No	
		Other	No	
	Biomass burning	CO_2	No	The carbon stock in this pool is conservatively excluded
		CH_4	No	
		N_2O	No	
		Other	No	
	Combustion of fossil fuels	CO_2	No	The carbon stock in this pool is conservatively excluded
		CH_4	No	
		N_2O	No	
		Other	No	
	Use of fertilizers	CO_2	No	The carbon stock in this pool is conservatively excluded
		CH_4	No	
		N_2O	No	

Source		Gas	Included?	Justification/Explanation
		Other	No	

3.3.3 Project Map

On the map presented below (Figure 9) the geographical boundaries are presented of the different project activities taking place within the Tavolo Project Area. The following zones are defined:

1. Forest Conservation Zone: Forest areas under full conservation protection. Gathering of non-timber forest products, fishing and hunting for domestic and cultural uses may take place, provided this is done in accordance with the Community conservation laws.
2. Forest Production Zone: Forest areas designated for small-scale portable sawmilling operations in accordance with Forest Stewardship Council certification requirements. Gathering of non-timber forest products, fishing and hunting for domestic and cultural uses may take place, provided this is done in accordance with the Community conservation laws.
3. Garden and Cash Crop Zone: Areas currently in use for family food gardens and small scale agricultural plots for various cash crops (a/o betelnut and cocoa).
4. Conversion Zone: Allocation of current forest areas for potential future conversion to garden or cash crop areas, as and when needed due to increasing population numbers. An assessment has been made to ensure the conversion of these areas does not affect the maintenance and management of identified High Conservation Values.

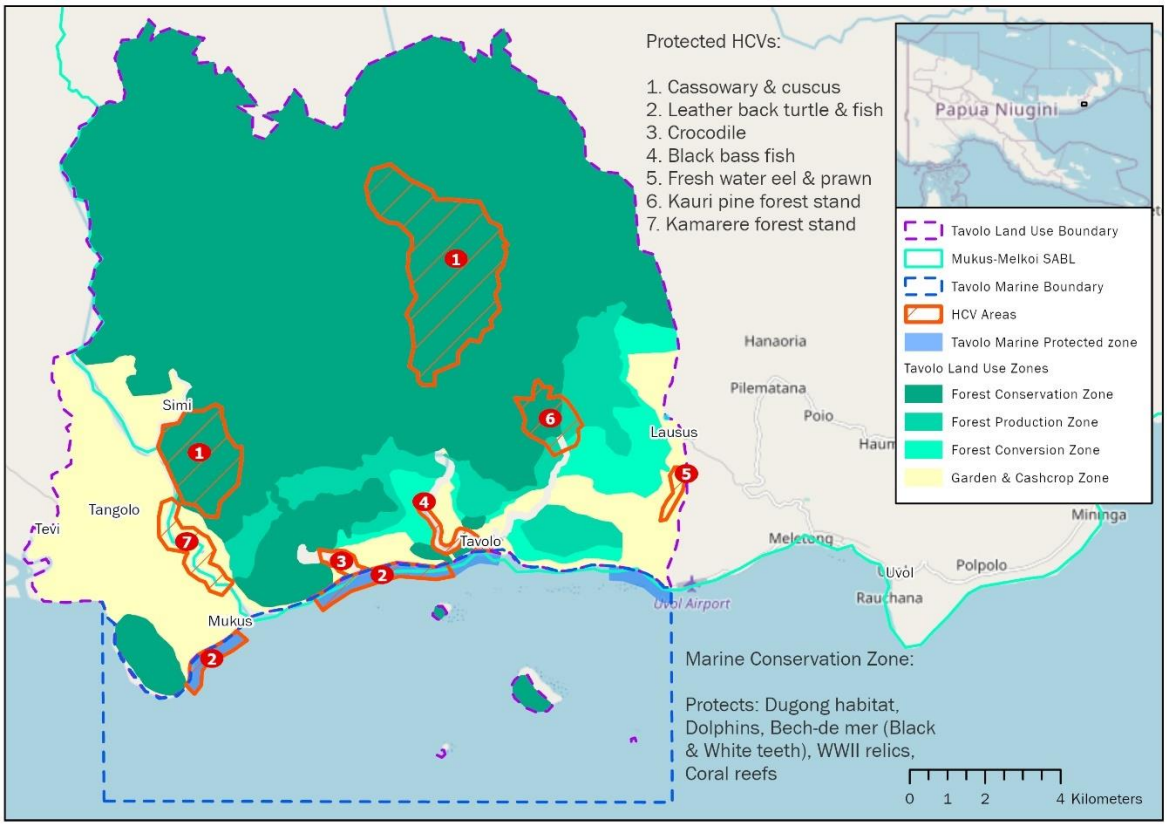

Figure 9 - Tavolo Land Use Map

3.4 Baseline Scenario

3.4.1 Context of Deforestation in PNG

Almost all land in PNG (97%) is held under customary tenure and approximately 99% of the forest lands are owned by customary landowners. [1] This right to land ownership and use by local landowners is recognized in PNG's Land Act 1996. However, while the formal land rights lie with the communities and prior, informed consent of customary landowners is required, the systems whereby rights to selectively log and clear-fell customary owned forests are obtained do not work properly. Large areas of land are zoned by the Government of PNG as Forest Concessions (FC) or Special Agricultural Business Leases (SABL) and to a smaller extent (and on a smaller scale) 'mini-estates' for establishment of agriculture or forestry plantations. A recent development is the issuance of Forest Clearing Authorities (FCAs) directly to Incorporated Land Groups or Land Owner Companies, who have struck deals with companies for clear felling of their forest allegedly for agricultural or forest plantation development. Some form of written consent is normally obtained, but very often the process by which consent is given is seriously

[1] GIZ, 2014

flawed, with local people not sufficiently informed or with individuals who do not represent the views of the community as a whole.[1] Licenses to operate are often obtained by companies, with the help of government officials, from individuals that claim they represent the community/land owners, but that actually do not have a mandate to operate on the community's behalf.

The current forestry legislation (Forestry Act 1991) provides for the utilization of forest resources under three (3) different project types:

1. **Forest Management Agreement (FMA)**:

   Under the FMA process, the state acquires the rights to harvest timber from customary owners The state then issues a timber permit to a timber operator. These areas are zoned as Forest Concessions. These concessions are intended to be selectively logged, however logging intensity in most cases is far from sustainable and leads to forest degradation.

2. **Timber Authority (TA)**:

   Is designed for small scale operations and small-scale forest clearances (road line or agriculture or other land use, less than 50ha) and can only be issued for areas that are not covered by a current FMA or TRP.

3. **Forest Clearing Authority (FCA)**:

   The FCA was created in 2000 when section 90 of the Forestry Act 1991 was amended to cater for large scale agricultural and infrastructural projects that involve the clearance of large tracts of forests (which is a contradiction of the Forestry Act's stated aim of securing the sustainable use of PNG's forests). This is the only arrangement that allows for the large scale clearing of forests.

There also still are current old type licenses called Timber Rights Purchases (TRPs) and Local Forest Areas (LFAs). Many expired TRP's have recently been renewed, following a much criticized Supreme Court decision on one expired TRP area, which is used as a precedent to get renewals on often long term expired TRPs.

The below image depicts the proportion of log exports per project type in m3 in 2017.

[1] Chatham House, 2014

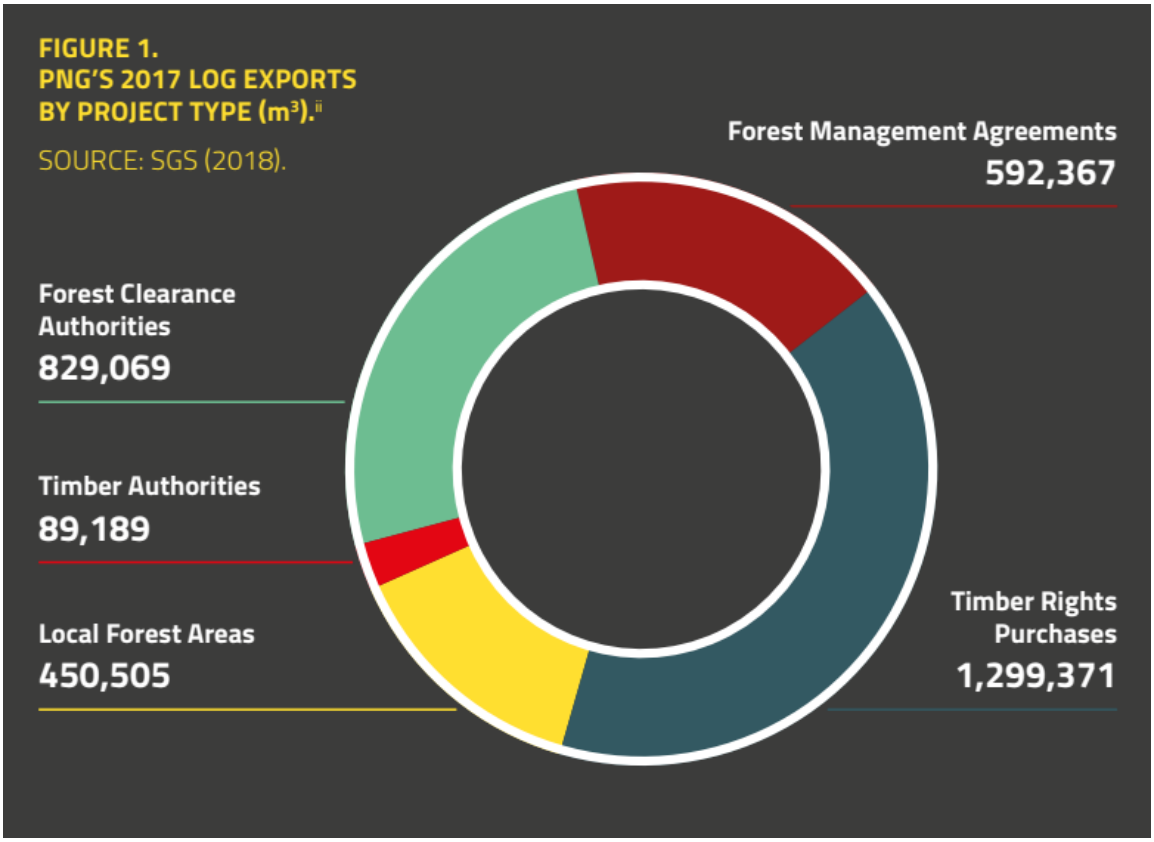

Figure 10 - PNG's 2017 log export by project type (Source: Global Witness, 2018)

There exists overlap of areas gazetted under different project types. A large proportion of PNG's forests is gazetted as logging concession (under FMA, TRP or LFA). These concessions often overlap with areas that are granted an FCA.

In this project we limit our scope for the baseline activities to the customary forest lands:

1. Which have a documented threat for reforestation, leading to issuance of a Forest Clearing Authority (FCA) by the PNGFA;
2. Which is challenged by the customary landowners;
3. Which results in conversion of forest to agriculture (including plantations) or forest plantations.
4. For which the baseline agents of deforestation are : an Incorporated Land Group (ILG) or Land Owner Company (LOC) of customary landowners, together with a third party company, who implements the forest clearing and subsequent agricultural development or forest plantation.

The original primary scheme that resulted in the granting of FCA's is the Special Agriculture and Business Lease (SABL). The lease-leaseback arrangement under the SABLs involves first the

establishment of an Incorporated Land Group (ILG) by the customary landowners. This enables them to lease it to the national government, facilitated through the Ministry for Lands and Physical Planning (the 'head lease'). The Ministry issues an SABL for that parcel of land back to the ILG without rent payable generally for a period of 99 years. The SABL can be used as a basis for a sub-lease agreement between the ILG and a third party, for instance a company to develop and manage the land.[1]

The scheme was incorporated in PNG's Land act in 1996. Originally the SABL was introduced to facilitate the development and harvesting of commercial crops such as cocoa, coffee, rubber and oil palm on customary land. SABLs were intended to provide certainty of land tenure for an agricultural investor, also allowing customary landowners to raise finance for an agricultural activity by using the lease as security. However, contrary to its original intention, the SABL scheme resulted in massive deforestation, especially after the introduction of the FCA in 2000, allowing companies to clear-fell forest areas (conditional on the agricultural development of the area). The ease with which FCAs could be attained facilitated the massive abuse of the SABL scheme.

Under the SABL scheme, Papua New Guinea has undergone a massive land rush between July 2003 and April 2011, during which 5.5 million hectares of customary land were leased to predominantly foreign-owned companies, representing around 12 percent of the country's total land mass and 16% of its commercially accessible forests. By 2012, logs cut under SABLs accounted for about one-third of PNG's exports of rainforest logs each year. In total, about 6.3 million cubic meters worth of timber from SABLs had been exported by the end of 2016.[2]

At minimum, 75 percent of the land under SABLs are now controlled by foreign-owned corporations (mostly Malaysian and Australian). A 2012 report from Greenpeace showed that this figure in practice to be even higher: a number of deals signed by landowner companies and ILGs use the addresses of logging companies when registering their companies with the PNG Investment Promotion Authority.[3]

Companies that acquired a sub-lease on forest land under SABL promised not only to develop large-scale agricultural development (oil palm production), but also to provide other benefits such as road infrastructure, health centres, and schools. However, because the companies' primary target is to extract the valuable timber, most of them delivered neither.[4]

[1] Filer C., 2012

[2] Global Witness, 2017

[3] Greenpeace, 2012; Oakland Institute, 2013

[4] Gabriel et al., 2017; Mirou, 2013; Nelson et al., 2014; Numapo, 2013 in Hambloch, 2018

In March 2011, academics raised concerns over the rapid rise in the use of SABLs,[1] and whether landowners had given their free, prior and informed consent to these leases which alienated their land for 99 years. They argued that SABLs were being used to clear-fell forests on the pretext of carrying out agro-forestry projects. Due to these controversies, the PNG government established a Commission of Inquiry (COI), which held hearings between 2011 and 2012. The COI looked at the legality of 77 SABLs. However only two of the three appointed commissioners presented their final reports, covering 42 of the 77 leases investigated. In only 4 of the 42 SABLs assessed they found evidence of genuine landowner consent and commercially viable agricultural projects being undertaken. The Commission concluded most of the SABL leases were unlawful and recommended that they should be revoked.[2] On 12 June 2014, the National Executive Council (NEC) confirmed that no further SABLs or FCAs should be issued, and approved action to revoke those SABLs that the Commission of Inquiry recommended should be revoked. However, despite this NEC decision, it is reported that the defective SABLs and FCAs are yet to be cancelled and that logging is continuing to take place under them (GIZ 2016). Till date, only one lease has been cancelled and five have been revoked by the courts after they were challenged in lawsuits by customary landowners.[3] Although the government has stopped granting new SABLs,[4] they have continued to issue Forest Clearance Authorities: in 2016 and 2017, eight new FCAs described as agriculture projects appeared in PNG's timber export records. In recent years an unknown number of new FCA's have been issued directly to individual Incorporated Land Groups (ILGs) and/or Land Owner Companies (LOCs), who have gone into direct deals with companies for clear felling of the forest on their customary land, allegedly for agricultural or forest plantation establishment. In many cases there is no or hardly any sign of the agricultural or forest plantation development following the clear felling.5This underlines that although the position of the government towards SABLs may change, the threat of large scale deforestation remains. As long as there are legal possibilities for these activities without proper Free Prior and Informed Consent, there remains a strong incentive for local people to establish a landholding group and enter into a contract with a (foreign) company. Long-term conservation and sustainable management of the forests can only be attained when the community re-affirm their customary land rights, while at the same time the community together establishes a land use plan in which community conservation rules are embedded.

Although projects which are granted an FCA require approval on their 'agro-forestry project' proposal from the Department of Agriculture and Livestock (DAL), this does not mean that these projects are financially viable or even that the areas are necessarily suitable for the agricultural

[1] Filer C., 2011; Greenpeace, 2012

[2] Global Witness, 2014

[3] ActNow, 2015

[4] NEC, 2014

[5] Filer C., 2019

land use proposed in these plans. For instance, the 4 Sigite-Mukus SABLs in the Pomio district of East New Britain, were clear-felled under the guise of establishing oil palm plantations, while the soils and terrain are considered not to be very suitable for oil palm (Nelson et al., 2014; Hambloch, 2018). Also, infrastructure and market accessibility are often an issue. Although the SABL scheme was intended for agricultural development, the main interest of the companies is the timber. Past forest clearing operations in SABLs, such as for the Turubu SABL in East Sepik Province, have demonstrated as such, as many operating companies made little to no effort to establish actual plantations after clearing and shipping off all the timber (CEPA, 2019).

3.4.2 The Baseline Scenario for the Tavolo Project Area

The clans of the Tavolo Community in East New Britain Province hold the customary land rights over the total area of 21,782 ha, out of which 84% is classified as forest cover in the PNGFA Forest Basemap 2012.

The Tavolo Project Area is currently under the Mukus-Melkoi SABL over a total area of 68,300 ha which was issued in August 2008 to a landowner company called Rera Holdings Ltd for a period of 99 years. This has been done without the FPIC from the Tavolo Community whom hold the customary rights over a large part of the land covered by the SABL (see maps in section 3.3.1).

Upon invitation by Rera Holdings a company called Double Dynasty Lumber Ltd (DDLL)[1] developed a project proposal (Appendix 2) to clear fell and establish 45,000 ha of oil palm plantation in the SABL under the name of 'Mukus-Melkoi Large Scale Integrated Agriculture Project'. Based on their project proposal DDLL was able to secure a Forest Clearing Authority (FCA) in October 2010, valid for 17 years.

In February 2012, the Commission of Inquiry (COI) on SABLs also investigated the Mukus-Melkoi SABL.[2] Although the hearing transcripts already indicate that the COI found substantial shortcomings, the final COI report on the SABLs of East New Britain was never submitted to the PNG Government by the Commissioner. Also, the files on the Mukus-Melkoi SABL with the Department of Lands and Physical Planning are claimed to have been lost or misplaced.[3] There has been an investigation done on all SABLs not reported on by the COI, by the Lands Department Ministerial SABL Investigation Committee, which is said to have completed its work,

[1] DDLL is a subsidiary of Brilliant Investment Ltd, which was able to secure an SABL (in 2007) and an FCA (in 2009) for the Angoram (Marienberg) Integrated Agriculture Project in East Sepik Province (see Table 7.3), and then proceeded to harvest and export about 340,000 cubic meters of logs from that area between 2010 and 2013. (McDonell et al. 2017)

[2] The transcript of proceedings can be found here: https://www.oaklandinstitute.org/sites/oaklandinstitute.org/files/CoI_SABL_KIMBE_10_February_2012.pdf

[3] Verbal communication with Chairman of the Lands Department Ministerial SABL Investigation Committee, confirmed by separate communications with 2 members of the Committee, and by investigations with Land Dpt by lawyer John Sirigoi on 2 occasions

but to date no official statement or recommendation has been made that the Mukus-Melkoi SABL is unlawful and should be or will be revoked.

According to the Chairperson of the Kakuna-Lote Resource Development Limited (KLRDL) LOC, they bought the lease from Rera Holdings in October 2019 for PGK350,000, and signed a MOU with Mekar (PNG) Limited, a subsidiary of Vanimo Jaya Ltd1 for them to operate the Kakuna-Lote Agro-Forestry & Reforestation Plantation Development Project (to be called the Kakuna-Lote Plantation Project).

The Kakuna-Lote LOC and Mekar (PNG) Ltd are now moving forward with their deforestation plans for the Mukus-Melkoi SABL Area. In June 2019 the Kakuna-Lote LOC in cooperation with Mekar (PNG) Ltd presented a FCA project proposal under the name of Kakuna-Lote Agro Forestry & Reforestation Plantation Development Project. The FCA project proposal (in Appendix 3) states that 45,980 ha out of the total 64,180 ha of Mukus-Melkoi is planned to be deforested in a time span of 8 years, starting in 2019/2020.[2] Furthermore the project plan indicates that 32% (16,800 ha) of the deforested area will be converted into Eucalyptus plantations, and another 4% (1,800 ha) into Cocoa/Coffee plantations.[3]

According to the Kakuna-Lote Plantation Project proposal, KLRDL was incorporated on 4 September 2018 as a LOC of one Incorporated Land Group (ILG), the Litupupuna Land Group, comprising of 5 clans; Chamoso, Awila, Kietuna, Una and Valiangata. However, the Kakuna-Lote Plantation Project's proposal annexes show two different ILG certificates, of Awila ILG and Kipolo ILG. There is no copy of a Litupupuna ILG certificate, KLRDL is owned by its Board Chairman Felix Akai and its Managing Director Alois Nausei, who each hold 100 shares.

As part of the application for the Kakuna-Lote Plantation Project FCA, a so-called "public hearing" on the proposed project was organised by the Department of Agriculture & Livestock (DAL), the Kakuna-Lote LOC and Vanimo Jaya in September in Kokopo, the East New Britain Provincial capital. This public hearing was supposed to be held within the project area, to determine if there is FPIC for the project with each of the clans whose land is included in the project area. Only a small number of landowners attended this public hearing, and the community of Tavolo was only informed about the hearing after it took place.

The East New Britain Provincial Forest Management Committee (ENB PFMC) approved the Kakuna-Lote FCA application in its meeting of 20 December 2019, but ordered a number of "corrections" to take place, a/o holding public hearings within the project area to confirm the FPIC of the landowning clans.

[1] Vanimo Jaya's past operations were mainly in forest concessions. They were responsible for 7.6% of PNG's total timber exports in 2018 (SGS, 2019), 9.7% in 2017 (SGS, 2018) and 7.7% in 2016 (SGS, 2017)

[2] Kakuna-Lote FCA Project proposal, June 2019, section 4.2.4 and attached map with Kakuna-Lote harvesting plan

[3] Kakuna-Lote FCA Project proposal, June 2019, section 4.4

Till August 2019 Vanimo Jaya was actively logging in two timber rights purchasing agreements in the Open Bay area, Lasul, East New Britain. In a lawsuit against Vanimo Jaya, after finding that the timber purchasing permits under which it operated were illegally granted extension, PNG's National Court has ordered to cease its logging operations in this area and leave within 28 days. It is feared that Vanimo Jaya will move quickly and transfer their machinery to the Mukus-Melkoi SABL, now they have obtained the sublease.

Additionally, (vast) deforestation activities between 2011 and 2018 (>22,000 ha) and the development of oil palm plantations in the Sigite-Mukus SABLs in the Pomio district (adjacent to the Tavolo Project Area) by another logging company (Gilford Ltd, subsidary of Rimbunan Hijau) have made the area more accessible for further deforestation in neighbouring areas. It is therefore expected that in the baseline scenario similar deforestation and palm oil plantation activities will take place within the near future.

The scope for this Tavolo REDD Project is limited to the Tavolo Community, and does not cover the other communities within the Mukus-Melkoi SABL. This is because FORCERT has not yet established partnership relations with other communities in the area, although recently some interest has been shown by other communities to start work with FORCERT.

The PNG Communities BEST Program, of which the Tavolo Community Conservation Association will be the first member, works with communities who have already shown a strong interest and commitment to sustainable management of their land and resources. This means these communities will have undertaken a High Conservation Values assessment, and have started their participatory community sustainable land use planning process, which will result in an agreed sustainable land use plan and community conservation laws. This is the foundation for strong commitment and ownership by the community on sustainable land and resource use and on nature conservation for their land and waters based on the essential local ecosystem services or environmental benefits they receive from nature. Only once this foundation is clearly laid, potential monetary benefits from environmental services provided by third parties will be considered and discussed with the community, This preparation process allows a selection of committed communities and avoids an influx of community leaders that are mainly lured by potential monetary benefits, lacking the underlying conservation commitments by the whole community, needed to ensure permanence for the building of the PNG Communities BEST Program membership and its long-term income generating efforts.

3.5 Additionality

Following the instructions given in VM0007 REDD methodology, the CDM methodological tool "Combined tool to identify the baseline scenario and demonstrate additionality in A/R CDM project activities" (T-ADD) is used to identify credible alternative land use scenarios and evaluate both the alternatives and the proposed project scenarios and to demonstrate the additionality of the project. The result of this analysis is presented in the different steps below.

3.5.1 Identification of alternative land use scenarios to the proposed REDD project activity

Alternative land use scenarios		Consistency with enforced mandatory applicable laws and regulations	Plausibility
Alternative 1	**Large scale agricultural project:** Forest is clear-cut by the SABL sublease holder and a large-scale agricultural project is established, before the national government declares the SABL and its corresponding FCA null and void.	**(Consistent)** As described in section 3.4.1, the legality of the SABL is under scrutiny and no new SABLs are being granted. Past government statements have indicated that many of the existing SABLs (and their underlying FCAs) may become void and nullified in the future. However, till date, the government is reluctant to act. In contrast, new FCAs are still being handed out. Additionally, it is unclear if the already issued FCA under the Mukus-Melkoi SABL is formally still valid, while a new FCA application has already been approved by the ENB PFMC granted to a new company & project developer, Lote-Kakuna LOC and Mekar PNG Ltd.	**(Most plausible scenario)** Considering the forest clear-cutting activities in the adjacent Sigite-Mukus SABLs areas, the start of forest clear-cutting under a new FCA west of Mukus, and the ongoing postponement of the decision to revoke the SABLs, it can be expected that the forest will be cleared in the near future. The expectancy that the SABLs will be cancelled in the future even adds pressure on the deforestation agents to rapidly start logging. As the adjacent areas, covered by the Sigite-Mukus SABLs, and the FCA west of Mukus, are being converted to large-scale agriculture plantations, it is expected that the same would happen in the project area.
Alternative 2	**Deforested degraded fallow land:** Forest is clear-cut by the SABL sublease holder and the land is abandoned, before the national government declares the SABL and its corresponding FCA null and void. The deforested land may develop in secondary forest over time.	**(Consistent)** Same as Alternative 1	Comparable to the above, but **less plausible, b**ecause the premise of the SABL is the development of a large-scale agricultural project. Also oil-palm plantations have been developed in the adjacent deforested Sigite-Mukus SABL.
Alternative 3	**Subsistence agriculture:** Forest is (partially) cleared by the community for subsistence farming, while the SABL is still in place.	**(Inconsistent)** As described above the SABL is formally still valid, even though it has been deemed fraudulent by the Commission of Inquiry. So	**(Not plausible)** Apart from the fact that it is inconsistent with the applicable laws, the community has zoned these project areas into

Alternative land use scenarios		Consistency with enforced mandatory applicable laws and regulations	Plausibility
		as the situation is now, officially the communities have no rights over their land as it is State land, and would officially need to get permission from the sublease holder for any clearance of forest to establish subsistence agriculture.	natural forest, conservation and sustainably managed production forest in their sustainable land use management plans, and are abiding by these plans.
Alternative 4	SABL and FCA are cancelled as a result of a lawsuit by the Tavolo Community which could result in: **a)** Forest remains forest, or; **b)** Forest is (partially) cleared by the community for subsistence farming	**(Consistent)** After cancellation of the SABL and the FCA, the communities again would have the land rights.	**(Less plausible)** The community alone has insufficient financial resources to pay for the lawsuit. Also, the threat of a new company obtaining a permit to clear the forest remains, while land has no formal (community) conservation status. **a)** Although the Tavolo Community is committed to conserve the forest it will be very difficult for them to maintain this on the long-term without financial resources **b)** The community has zoned the project areas into conservation and sustainably managed production forests in their sustainable land use management plans and are abiding by these plans.
Alternative 5	SABL and FCA are nullified (in time) by the government of PNG which could result in **a)** Forest remains forest, or; **b)** Forest partly cleared by the community for subsistence farming	**(Consistent)** Same as Alternative 4.	**(Less plausible)** The decision to nullify all illegal SABLs was already made in 2013 and the government has been reluctant to implement this decision. Only through court actions have some of the SABLs been cancelled. a) Same as alternative 4a b) same as alternative 4b
Alternative 6	**Forest remains forest:** Forest is not logged by the	**(Consistent)** Same as Alternative 1 and 2	**(Not plausible)** As logging and wood export trends

Alternative land use scenarios		Consistency with enforced mandatory applicable laws and regulations	Plausibility
	SABL sublease holder due to low profit and high investment costs.		indicate the logging business in PNG is ever increasing, making PNG currently the largest exporter of round logs in the world. Also, the past large-scale operations by the same agent in the adjacent areas indicates the willingness of the company to harvest the trees and establish plantations.

3.5.2 Investment Analysis

Although the benefits that the communities receive from conserving their forest are manifold - such as food, building materials, medicines and other forest products (mainly for subsistence), regulating services (water regulation), cultural/spiritual values- they are mostly non-monetary. As many traditional communities in Papua New Guinea, the Tavolo Community is very much aware of the value of the forest and the importance to conserve it, not only for their own well-being, but also for future generations. However, naturally they also want to develop and improve their standard of living.

The difference in (short-term) financial gain between conserving a forest or clearing it for timber is big. First of all a direct benefit for the landowners within the whole area under the Mukus-Melkoi SABL of around 30M PGK is projected by the project developer in the form of landowner royalties, LOC premiums and development levies.[1] Additional to this cash payment, logging and large-scale agricultural companies promise “development” through establishment of roads and bridges, schools, health clinics, water supply (tanks), and paid jobs.

This means that without the revenue from the sale of carbon credits providing long term guarantee annual benefits, people will remain tempted to choose for quick gains.

A crucial part of the project will be the establishment of a Payment for Ecosystem Services (PES) trust (see section 1.11.3), called the PNG Communities Benefits from Environmental Services Trust (PNG Communities BEST), that will facilitate structured and transparent benefit distribution of revenues from carbon credits sales to the community to finance the priority needs as identified by the Tavolo Community.

3.5.3 Barrier analysis

[1] Kakuna-Lote FCA Project proposal, June 2019, attachment 4

There is a substantial barrier related to the governance. Due to the uncertainty whether or not the SABLs will be nullified by the PNG government, the sublease holder of the Mukus-Melkoi SABL is encouraged to operate quickly and cut the forests before the government reaches a decision and acts on it. On the other hand it is very uncertain when the government of PNG will implement their decision on the nullification of the SABLs, or even if they will implement it at all. Therefore, there is a need for immediate upfront investment to force a court decision to declare the SABL illegal. This barrier does not prevent (even encourages) alternatives 1 and 2.

Protection of the forests in Tavolo requires significant funding. First of all the lawsuit to cancel the SABL requires significant upfront investment. All previous SABLs that have been cancelled as a result from lawsuits, have been dependent on outside donor support, often combined with pro-bono efforts of lawyers originating from or related to the SABL area (the Tavolo Community is not so fortunate to have a lawyer among its members). Also, there are costs for formalizing the forest area under a protection status. But these funds are scarce and difficult to obtain by local communities without significant operational and administrative support. The landowning communities in the neighbouring West Pomio SABL areas have experienced serious disruptions and delays in their court case against this SABL due to the lack of funds to meet legal fees. Secondly, the communities need to have income to achieve needed and/or aspired development in their community, e.g., school buildings, health clinic, permanent houses, community hall, church building, solar or hydro power, water supply, money for school fees and visits to town hospitals. Thirdly, they need to develop alternative sustainable livelihood options that will allow them to secure the long-term income that will allow them to guarantee adherence to their sustainable land use plan and forest protection activities in the long run. This barrier does not prevent alternatives 1, 2, 3, 5b and 6. Alternative 5a would also not be (immediately) prevented by lack of funding, however in the long term, to ensure protection of the forests, funding is expected to be a requirement.

3.5.4 Common practice analysis

It is not common practice for local communities in PNG to protect forest for financial return, in the absence of carbon finance. Regarding the recent legal actions by local land owners that have thus far successfully halted 4 SABL contracts, the goal of these communities was to regain their land rights, not necessarily to establish a protected forest area. As described above, through their collaboration with FORCERT, Tavolo was also identified by the national government as one of the pilot sites for the development and field testing of a national REDD/PES payment distribution system. This project can therefore be considered a pioneering community managed REDD+ project PNG and thus not as common practice.

3.5.5 Conclusion

Based on the above analysis we conclude that the project can be considered **additional** and we consider Alternative 1 as the most plausible Baseline Scenario.

3.6 Methodology Deviations

No methodology deviations are made.

4 QUANTIFICATION OF GHG EMISSION REDUCTIONS AND REMOVALS

4.1 Baseline Emissions

For the estimation of baseline carbon stock changes and greenhouse gas emissions from the planned deforestation under the FCA, the VCS module VMD0006 "Estimation of baseline carbon stock changes and greenhouse gas emissions from planned deforestation and planned degradation (BL-PL)" is used.

The VMD0006 module prescribes that the baseline net GHG emissions for planned deforestation will be determined as:

$$\Delta C_{BSL,planned} = \sum_{t=1}^{t*} \sum_{i=1}^{M} \left(\Delta C_{BSL,i,t} + GHG_{BSL-E,i,t} \right) \quad (1)$$

Where:

$\Delta C_{BSL,planned}$ Net GHG emissions in the baseline from planned deforestation; tCO_2e

$\Delta C_{BSL,i,t}$ Net carbon stock changes in all pools in the baseline stratum *i* at time *t*; tCO_2e

$GHG_{BSL-E,i,t}$ Greenhouse gas emissions as a result of deforestation activities within the project boundary in the baseline stratum *i* during project year *t*; $tCO_2e\ year^{-1}$

i 1, 2, 3, … *M* strata

t 1, 2, 3, … t^* years elapsed since the projected start of the REDD project activity

This quantification of the baseline emissions is done through the following three steps:

1. Calculation of annual area of land deforested
2. Calculation carbon stock change in the baseline
3. Calculation greenhouse gas emissions in the baseline

4.1.1 Step 1 - Calculation of annual area of land deforested

The annual area of deforestation in the baseline is calculated as follows:

$$AA_{planned,i,t} = \left(A_{planned,i} * D\%_{planned,i,t}\right) * L - D_i \quad (2)$$

Where:

$AA_{planned,i,t}$	Annual area of baseline planned deforestation for stratum *I* at time *t*; ha
$D\%_{planned,i,t}$	Projected annual proportion of land that will be deforested in stratum *i* during year *t*; %
$A_{planned,i}$	Total area of planned deforestation over the baseline period for stratum *i*; ha
$L - D_i$	Likelihood of deforestation for stratum *i*; %

As described in the baseline scenario (section 3.4.2) the Tavolo Project Area is situated under the Mukus-Melkoi SABL which is currently granted to the Kakuna-Lote LOC. Therefore the agent of planned deforestation in the Tavolo Project Area is the Kakuna-Lote LOC.

For the Mukus-Melkoi SABL, with a total area of 68,300 ha, the Kakuna-Lote LOC developed a FCA Project proposal, under the name of 'of Kakuna-Lote Agro Forestry & Reforestation Plantation Development Project', which presents a plan to clear fell 45,980 ha of forest and to convert it into other land uses (section 4.2.4 of the Kakuna-Lote FCA proposal). Figure 11 presents a digitized representation of the map with the plan of deforestation which is attached to the Kakuna-Lote Project proposal (original map attached as Appendix 4). As can be seen, the clear felling of the 45,980 will take place in 8 blocks over a time span of 8 years, ranging from PY01 (year 1) to PY08 (year 8). The first block to be deforested (block PY01, year 1) is located in the south-west corner of the SABL, inside the Tavolo Project Area. According to the Kakuna-Lote plan, presented in the map, the forest inside the Tavolo Project Area will be cleared in the first 5 year.

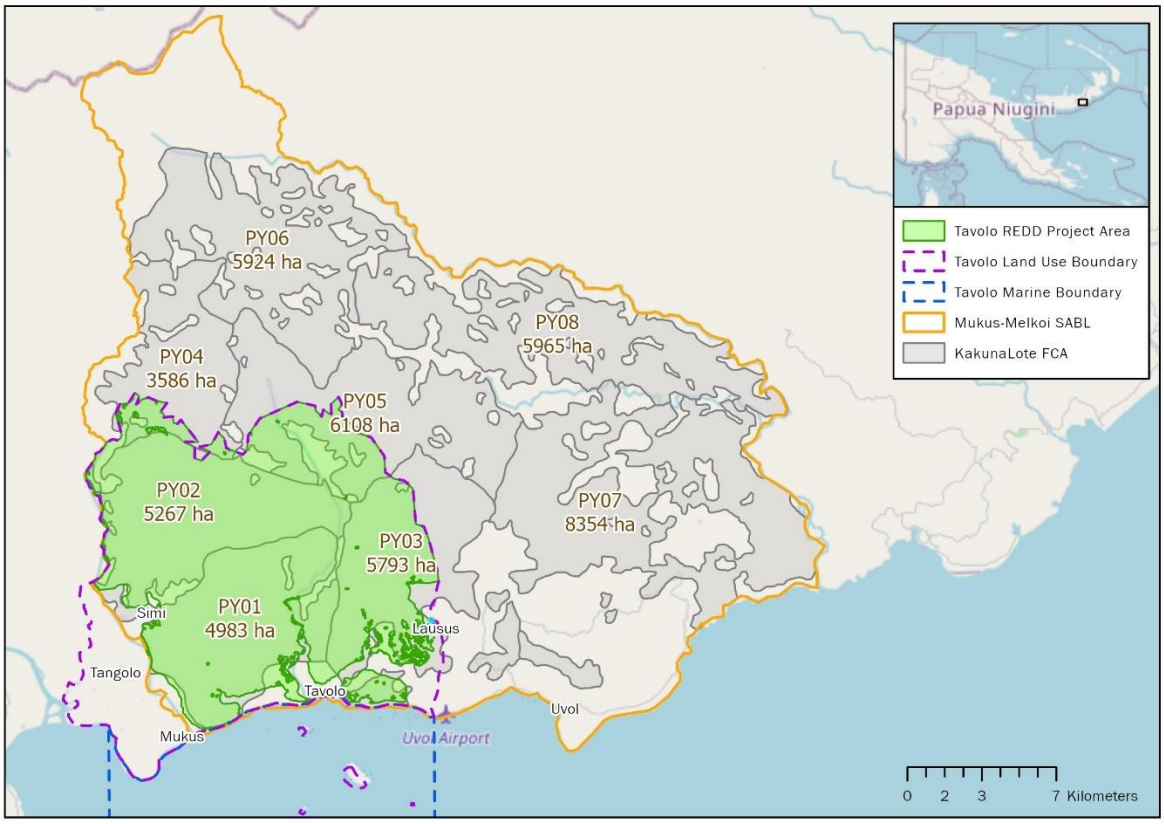

Figure 11 - Plan of Deforestation as presented by Kakuna-Lote LOC in their FCA Project proposal

Based on the forest clearance plan by Kakuna-Lote LOC in the Mukus-Melkoi SABL, as presented in section 3.4.2, it is found that the total area of forest planned to be cleared inside the Tavolo REDD Project Area is 14,695 ha out of the 16,493 ha.

Therefore the total area of planned deforestation by Kakuna-Lote over the baseline period within the Tavolo REDD Project Area $A_{planned,i}$ is **14,695 ha**.

Since Kakuna-Lote LOC proposes to clear fell one block per year, the annual deforestation rate $D\%_{planned,i,t}$ for each individual block is different as presented in Table 4.

Since the area under the Mukus-Melkoi SABL is not under government control nor under the control of the original customary landowning clans (the Kakuna-Lote LOC owns the 99 year State Lease over the total area under the SABL), the likelihood of deforestation $L - D_i$ is set to 100%.

Thus the total area of planned deforestation over the baseline period for the Tavolo Project Area is:

$A_{planned,i}$ = **14,695 ha**

And the annual area of deforestation in the first year of the baseline scenario is:

$AA_{planned,i,t} = \left(A_{planned,i} * D\%_{planned,i,t}\right) * L - D_i$ = (14,695 * 33%) * 100% = **4,779 ha**

This calculation is repeated for the other blocks (years) of deforestation. The result is presented in the Table 4 below:

Table 4 - Kakuna-Lote Deforestation plan for the Tavolo Project Area

Block i, t	Annual deforestation rate (%) $D\%_{planned,i,t}$	Annual deforestation area inside Tavolo Project Area (ha) $AA_{planned,i,t}$
PY01 (2020)	33%	4,779
PY02 (2021)	34%	5,053
PY03 (2022)	21%	3,026
PY04 (2023)	3%	465
PY05 (2024)	9%	1,372
Total area of planned deforestation (ha) $A_{planned,i}$		**14,695**

4.1.2 Step 2 - Calculation carbon stock change in the baseline

The net carbon stock changes in the baseline is equal to the baseline pre-deforestation stock minus the long-term carbon stock after deforestation and minus the baseline stock that enters the wood products pool at the time of deforestation (i.e. not emitted from aboveground biomass at the time of deforestation).

The carbon pools included for this project (see section 3.3.2) are the aboveground tree biomass, the belowground tree biomass and the harvested wood products.

Above- and belowground tree biomass pools

Carbon stock changes in the aboveground tree biomass (AGB) and belowground tree biomass (BGB) pools are calculated by subtracting post-deforestation carbon stocks from pre-deforestation forest carbon stocks in the baseline:

$$\Delta C_{ABtree,i} = C_{ABtree_{bsl},i} - C_{ABtree_{post},i} \quad (3)$$

$$\Delta C_{BBtree,i} = C_{BBtree_{bsl},i} - C_{BBtree_{post},i} \quad (4)$$

Where:

$\Delta C_{ABtree,i}$	Baseline carbon stock change in aboveground tree biomass in stratum *i*; tCO_2e ha^{-1}
$C_{ABtree_{bsl},i}$	Forest carbon stock in aboveground tree biomass in stratum *i*; tCO_2e ha^{-1}
$C_{ABtree_{post},i}$	Post-deforestation carbon stock in aboveground tree biomass in stratum *i*; tCO_2e ha^{-1}
$\Delta C_{BBtree,i}$	Baseline carbon stock change in belowground tree biomass in stratum *i*; tCO_2e ha^{-1}
$C_{BBtree_{bsl},i}$	Forest carbon stock in belowground tree biomass in stratum *i*; tCO_2e ha^{-1}
$C_{BBtree_{post},i}$	Post-deforestation carbon stock in belowground tree biomass in stratum *i*; tCO_2e ha^{-1}

Pre-deforestation carbon stock

To estimate the pre-deforestation carbon stocks in above- and belowground tree biomass in the Tavolo Project Area, a forest inventory was carried out by FORCERT and the Tavolo community between September and November 2020. During this forest inventory tree biomass was measured on 56 different sample plots distributed over the Tavolo Project Area. The sample plots were installed in the project area according to a clustered sampling design (see Figure 12). Following PNG's National Forest Inventory (NFI), [1] the sample plots are grouped together in a cluster of four plots, and the location of these clusters were determined using a regular grid. In order to avoid inaccessible terrain, clusters located in steep areas (>20 degrees) are excluded from the forest inventory. The operating procedure followed during this inventory is described in Appendix 7. Furthermore the north-western side of the project area was also excluded from the forest inventory since at the time of the inventory, the adjacent community, who has some user rights over that area, disputed the ownership of the area. In the first quarter

[1] PNGFA 2018, NFI Information Booklet, 3rd Edition

of 2022, the disputing party has dropped their complaint, and has requested talks with the Tavolo Community on how they may also be involved in the project.

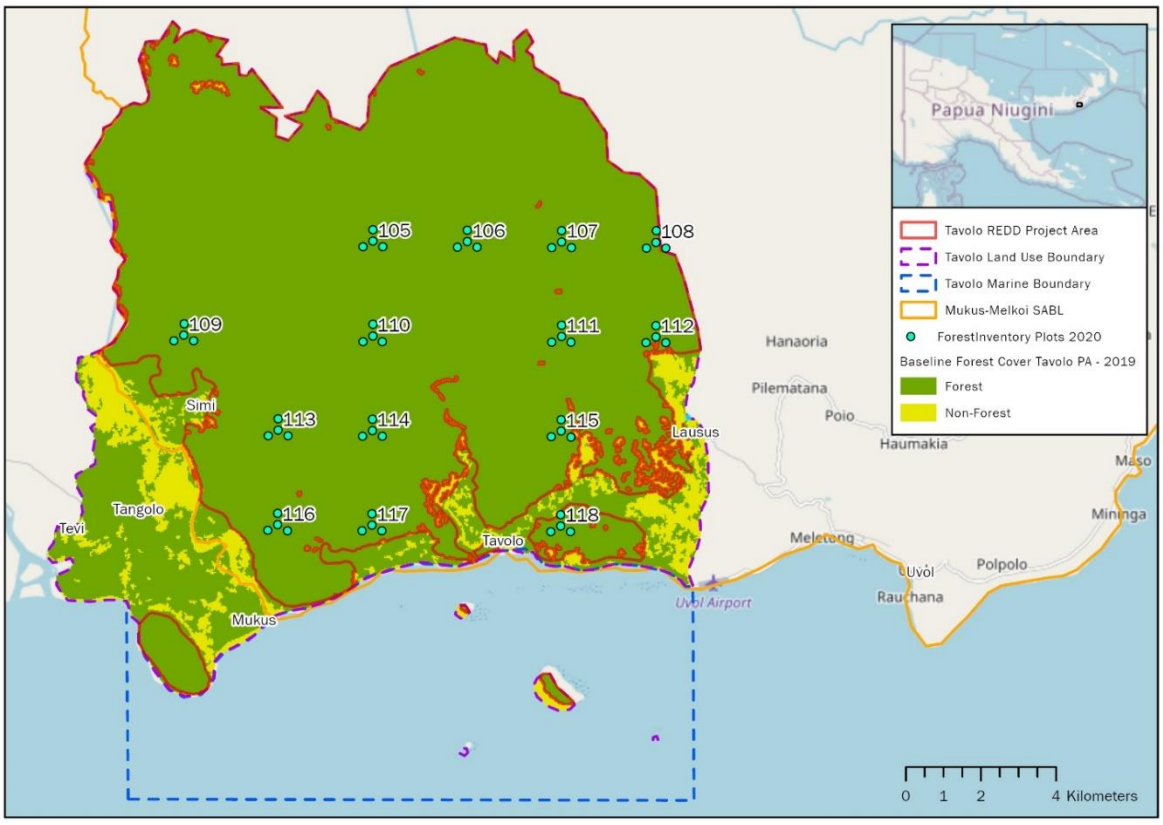

Figure 12 - Map with the locations of the sample plots of the baseline carbon inventory conducted in 2020

Based on the measured tree diameter's (DBH) and tree heights (H) on the sample plots, the aboveground tree biomass is calculated for each tree using the allometric equations and wood density values provided in the ACIAR database for tree species in PNG.[1] The mean Belowground tree biomass (BGB) is subsequently calculated using the default root-shoot ratio's provided PNG's FREL. For both forest strata present in the project area, the root-shoot ratio is 0.37.[2] For the calculation of the carbon content in the whole tree biomass, the default carbon fraction (CF)

[1] ACIAR database PNG: Fox, J. C., Yosi, C. K., Nimiago, P., Oavika, F., Pokana, J. N., Lavong, K.,and Kennan, R. J. (2010). Assessment of aboveground carbon in primaryand selectively harvested tropical forest in Papua New Guinea. Biotropica 42, 410–419

[2] Papua New Guinea's National REDD+ Forest Reference Level; Modified Submission for UNFCCC Technical Assessment in 2017 – Table 6.2

for PNG of 0.47 tC t^{-1} dry matter is used as given in PNG's FREL and the IPCC 2006 Guidelines.[1] Furthermore 44/12 is used as the standard ratio molecular weight of CO_2 to carbon (CO_2F).

The results of the 2020 baseline (pre-deforestation) forest carbon stock inventory are presented for the different strata in the Table 5 below.

Table 5 - Results of the 2020 baseline assessment of the above ground tree biomass in forest area planned to be cleared in the Tavolo Project Area

	Area (ha)	No. Plots in 2020 (n)	$C_{ABtree_{bsl}}$ ($tCO_2e\ ha^{-1}$)	$C_{BBtree_{bsl}}$ ($tCO_2e\ ha^{-1}$)	$C_{ABtree_{bsl}} + C_{BBtree_{bsl}}$ ($tCO_2e\ ha^{-1}$)	Uncertainty (at 95% CL)
Forest area under Kakuna-Lote FCA	15,102 ha	56 plots	400.8	148.3	549.2	15,9%

Post-deforestation carbon stock

As for the post-deforestation carbon stock a combination of land uses are proposed by the project developer in the baseline: 32% will be converted into forest plantations (Eucalyptus), another 4% will be converted into Cocoa/Coffee plantations, and the remaining 64% will probably turn into subsistence agriculture and other land uses, with plans also indicated for cattle farming. The IPCC Guidelines 2006 and PNG's FREL provides default carbon stocks for the different land uses, these are presented in the Table 6 below. Based on these defaults a mean post-deforestation carbon stock in AGB is calculated at **111.7 tCO_2e** ha^{-1} and the carbon stock in BGB at **41.3 $tCO_2e\ ha^{-1}$**.

Table 6 - Calculation of the mean post-deforestation C-stock in the Tavolo Project Area

Land use	Area (%)	$C_{ABtree_{post}}$ ($tCO_2e\ ha^{-1}$)	Root-Shoot factor	$C_{BBtree_{post}}$ ($tCO_2e\ ha^{-1}$)	Reference
Cocoa plantation	4%	199.9	37%	74.0	Table 5.3, IPCC 2006
Forest plantation	32%	168.9	37%	62.5	Table 6.2 PNG FREL
Subsistence & other land use	64%	77.6	37%	28.7	Table 6.3 PNG FREL, Table 5.1, IPCC 2007
Mean post-deforestation C-stock	**100%**	**111.7**	**37%**	**41.3**	

Thus, based on the mean values given by PNG's FREL, the baseline carbon stock change in aboveground tree biomass for the two different forest strata area calculated as:

$\Delta C_{ABtree,i} = C_{ABtree_{bsl},i} - C_{ABtree_{post},i}$ = 400.8 – 111.7 = **289.2 $tCO_2e\ ha^{-1}$**

[1] 2006 IPCC Guidelines for National Greenhouse Gas Inventories – Chapter 4 – Table 4.3

When the root-shoot ratio (RS) of 0.37 is applied, the baseline carbon stock change in belowground tree biomass for the two different forest strata is calculated as:

$\Delta C_{BBtree,i} = C_{BBtree_{bsl},i} - C_{BBtree_{post},i}$ = 148.3 – 41.3 = **107.0 tCO_2e ha^{-1}**

Harvested wood products pool

To calculate the carbon stocks in the wood products resulting from timber harvest occurring prior to, or in the process of deforestation, the VCS module VMD0005 is followed for the estimation of carbon stocks in the long-term wood products pool[1]:

First the biomass carbon entering the wood products pool at the time of deforestation is calculated as:

$$C_{WP,i} = C_{XB,i} * (1 - WWty) \quad (5)$$

Where:

$C_{WP,i}$	Carbon stock entering the wood products pool at the time of deforestation from stratum *i*; tCO_2e ha^{-1}
$C_{XB,i}$	Mean stock of extracted biomass carbon at the time of deforestation from stratum *i*; tCO_2e ha^{-1}
$WWty$	Wood waste. The fraction immediately emitted through mill inefficiency by class of wood product *ty*; dimensionless
ty	Wood product class – defined here as sawnwood (s), wood-based panels (w), other industrial roundwood (oir), paper and paper board (p), and other (o)
i	1, 2, 3, … *M* strata

Then the amount of wood products entering the pool at the time of deforestation that is expected to be emitted over a 100-year timeframe is calculated as follows:

$$C_{WP100,i} = C_{WP,i} - C_{WP,i} * (1 - SLFty) * (1 - OFty) \quad (6)$$

Where:

[1] VMD0005 Estimation of carbon stocks in the long-term wood products pool (CP-W), v1.1

$C_{WP100,i}$	Carbon stock entering the wood products pool at the time of deforestation that is expected to be emitted over 100-years from stratum *i*; $tCO_2e\ ha^{-1}$
$C_{WP,i}$	Mean stock of extracted biomass carbon by class of wood product *ty* from stratum *i*; $tCO_2e\ ha^{-1}$
$SLFty$	Fraction of wood products that will be emitted to the atmosphere within 5 years of timber harvest by class of wood product *ty*; dimensionless
$OFty$	Fraction of wood products that will be emitted to the atmosphere between 5 and 100 years of timber harvest by class of wood product *ty*; dimensionless
ty	Wood product class – defined here as sawnwood (s), wood-based panels (w), other industrial roundwood (oir), paper and paper board (p), and other (o)
i	1, 2, 3, … *M* strata

In its project proposal the Kakuna-Lote LOC projects a mean salvageable timber volume of 33.792 $m^3\ ha^{-1}$.[1] This volume is converted into a mean stock of extracted biomass carbon of 27.8 $tCO_2e\ ha^{-1}$. For this conversion the default factors for tropical timber species are used as provided by the IPCC 2006 Guidelines. [2] The average value for wood density of 0.477 t oven-dry timber per m^3 solid wood product is used from the ACIAR PNG database.[3] The default carbon fraction used is 0.47 tC per t oven-dry timber as given in PNG's FREL. Furthermore 44/12 is used as the standard ratio molecular weight of CO_2 to carbon (CO_2F).

As a next step the carbon stock entering the wood products pool at the time of deforestation is calculated using the default factor for wood waste of 0.24 as given by VCS module VMD0005 for developing countries:

$C_{WP,i} = C_{XB,i} * (1 - WWty)$ = 27.8 * (1 - 0.24) = 21.1 $tCO_2e\ ha^{-1}$

Following VCS Module VMD0005, the carbon stock entering the wood products pool at the time of deforestation that is expected to be emitted over 100-years is calculated using the default fraction parameters for roundwood:

$C_{WP100,i} = C_{WP,i} - C_{WP,i} * (1 - SLFty) * (1 - OFty)$ = 21.1 – 21.1 * (1 – 0.3) * (1 – 0.7) =

16.7 $tCO_2e\ ha^{-1}$

[1] Kakuna-Lote LOC. & Mekar (PNG) LTD. June 2019. Project Proposal: Kakuna-Lote Agroforestry & Reforestation Plantation Development Project Project - Attachment 5 - Paragraph 4.2.2

[2] 2006 IPCC Guidelines for National Greenhouse Gas Inventories - Chapter 12: Harvested Wood Products

[3] ACIAR database PNG: Fox, J. C., Yosi, C. K., Nimiago, P., Oavika, F., Pokana, J. N., Lavong, K.,and Kennan, R. J. (2010). Assessment of aboveground carbon in primaryand selectively harvested tropical forest in Papua New Guinea. Biotropica 42, 410–419

This carbon stock in the wood products pool will be emitted at an annual rate of 1/20 of the stock for 20 years.

Sum of baseline carbon stock change in all pools

Stock changes in the aboveground tree biomass are emitted at the time of deforestation. Following deforestation, emissions from belowground biomass are emitted at an annual rate of 1/10 of the stock change for 10 years. Carbon stocks entering the wood products pool at the time of deforestation, and that are expected to be emitted over 100-years, are emitted at an annual rate of 1/20 of the stock for 20 years. Thus for a given year *t*, emissions are summed across areas deforested from time *t-10* up to time *t* (for belowground biomass) and from time *t-20* up to time *t* (for wood products), in equation below:

$$\Delta C_{BSL,i,t} = AA_{planned,i,t} * \left(\Delta C_{ABtree,i} - C_{WP100,i}\right) + \sum_{t-10}^{t} \left(AA_{planned,i,t} * \left(\Delta C_{BBtree,i}\right) * \frac{1}{10}\right) + \sum_{t-20}^{t} \left(AA_{planned,i,t} * \left(C_{WP100,i}\right) * \frac{1}{20}\right) \quad (7)$$

Where:

$\Delta C_{BSL,i,t}$	Sum of the baseline carbon stock change in all pools in stratum *i* at time *t*; tCO_2e
$AA_{planned,i,t}$	Annual area of baseline planned deforestation for stratum *I* at time *t*; ha
$\Delta C_{ABtree,i}$	Baseline carbon stock change in aboveground tree biomass in stratum *i*; tCO_2e ha^{-1}
$\Delta C_{BBtree,i}$	Baseline carbon stock change in belowground tree biomass in stratum *i*; tCO_2e ha^{-1}
$C_{WP100,i}$	Carbon stock entering the wood products pool at the time of deforestation that is expected to be emitted over 100-years from stratum *i*; tCO_2e ha^{-1}
i	1, 2, 3, … *M* strata
t	1, 2, 3, … *t* years elapsed since the projected start of the REDD project activity

Summing the different carbon pools given above, the carbon stock change in the baseline for the Tavolo Project Area is calculated for the first year as:

$$\Delta C_{BSL,i,t} = AA_{planned,i,t} * \left(\Delta C_{ABtree,i} - C_{WP100,i}\right) + \sum_{t-10}^{t}\left(AA_{planned,i,t} * \left(\Delta C_{BBtree,i}\right) * \frac{1}{10}\right) + \sum_{t-20}^{t}\left(AA_{planned,i,t} * \left(C_{WP100,i}\right) * \frac{1}{20}\right) =$$

4,779 * (289.2 – 16.7) + (4,779 * (107.0 * 0.1)) + (4,779 * (16.7 * 0.05)) = **1,357,391 tCO_2e**

And for the second year as:

5,035 * (289.2 – 16.7) + (8,199 * (107.0 * 0.1)) + (8,199 * (16.7 * 0.05)) = **1,490,334 tCO_2e**

The baseline carbon stock changes for all the baseline carbon pools over the project period of 30 years are given in Table 7 below.

Table 7 - Stock change in the baseline carbon pools

Year	Annual deforestation in open forest (ha)	Stock change in AGB (tCO_2e)	Stock change in BGB (tCO_2e)	Stock change in WP (tCO_2e)	Sum of stock change in all baseline carbon pools (tCO_2e)
2019	-	-	-	-	-
2020	4,779	1,381,976	51,133	-75,719	1,357,391
2021	5,053	1,461,211	105,198	-76,075	1,490,334
2022	3,026	875,049	137,575	-39,745	972,879
2023	465	134,467	142,550	3,355	280,372
2024	1,372	396,751	157,230	-10,628	543,352
2025	-	-	157,230	12,254	169,484
2026	-	-	157,230	12,254	169,484
2027	-	-	157,230	12,254	169,484
2028	-	-	157,230	12,254	169,484
2029	-	-	157,230	12,254	169,484
2030	-	-	106,097	12,254	118,351
2031	-	-	52,032	12,254	64,286
2032	-	-	19,655	12,254	31,909
2033	-	-	14,680	12,254	26,934
2034	-	-	-	12,254	12,254
2035	-	-	-	12,254	12,254
2036	-	-	-	12,254	12,254

2037	-	-	-	12,254	12,254
2038	-	-	-	12,254	12,254
2039	-	-	-	12,254	12,254
2040	-	-	-	8,269	8,269
2041	-	-	-	4,055	4,055
2042	-	-	-	1,532	1,532
2043	-	-	-	1,144	1,144
2044	-	-	-	-	-
2045	-	-	-	-	-
2046	-	-	-	-	-
2047	-	-	-	-	-
2048	-	-	-	-	-
Total	**14,695**	**4,249,454**	**1,572,298**	**0**	**5,821,751**

4.1.3 Step 3 - Calculation greenhouse gas emissions in the baseline

The GHG emissions in the baseline within the project boundary is estimated as:

$$GHG_{BSL-E,i,t} = E_{FC,i,t} + E_{BiomassBurn,i,t} + N_2O_{direct-N,i,t} \quad (8)$$

Where:

$GHG_{BSL-E,i,t}$	Greenhouse gas emissions as a result of deforestation activities within the project boundary in the stratum *i* in year *t*; tCO_2e
$E_{FC,i,t}$	Emission from fossil fuel combustion in stratum *i* in year *t*; tCO_2e
$E_{BiomassBurn,i,t}$	Non-CO_2 emissions due to biomass burning in stratum *i* in year *t*; tCO_2e
$N_2O_{direct-N,i,t}$	Direct N_2O emission as a result of nitrogen application on the alternative land use within the project boundary in stratum *i* in year *t*; tCO_2e
i	1, 2, 3, … *M* strata
t	1, 2, 3, … *t* years elapsed since the projected start of the REDD project activity

The GHG emissions pool due to deforestation and degradation activities is conservatively excluded for the with-project scenario as well as the without-project scenario. See also paragraph 3.3.2 for selected carbon pools.

Therefore $GHG_{BSL,E,i,t}$ = **0 tCO_2e.**

4.2 Project Emissions

For estimating ex-ante net carbon stock changes and GHG emissions in the project scenario VCS module VMD0015 is followed.[1]

For the project area the net greenhouse gas emissions in the project scenario is equal to the sum of stock changes due to deforestation and degradation plus the total greenhouse gas emissions minus any eligible forest carbon stock enhancement:

$$\Delta C_{PRJ} = \sum_{t=1}^{t^*} \sum_{i=1}^{M} (\Delta C_{PRJ,DefPA,i,t} + \Delta C_{PRJ,Deg-IT,i,t} + \Delta C_{PRJ,Deg-FSC,i,t} + \Delta C_{PRJ,DistPA,i,t} + \Delta GHG_{PRJ-E,i,t} - \Delta C_{PRJ,Enh,i,t}) \quad (9)$$

Where:

ΔC_{PRJ}	Net greenhouse gas emissions within the project area under the project scenario; tCO_2e
$\Delta C_{PRJ,DefPA,i,t}$	Net carbon stock change as a result of deforestation in the project area in the project scenario in stratum *i* at time *t*; tCO_2e
$\Delta C_{PRJ,Deg-IT,i,t}$	Net carbon stock change as a result of forest degradation through extraction of trees for illegal timber or fuelwood and charcoal in the project area in the project scenario in stratum *i* at time *t*; tCO_2e
$\Delta C_{PRJ,Deg-FSC,i,t}$	Net carbon stock change as a result of forest degradation due to selective logging of forest management areas possessing a FSC certificate in the project area in the project scenario in stratum *i* at time *t*; tCO_2e
$\Delta C_{PRJ,DistPA,i,t}$	Net carbon stock change as a result of natural disturbance in the project area in the project scenario in stratum *i* at time *t*; tCO_2e

[1] VCS Module VMD0015 REDD Methodological Module: Methods for Monitoring of GHG Emissions and Removals (M-MON)

$\Delta GHG_{PRJ-E,i,t}$ Greenhouse gas emissions as a result of deforestation and degradation activities within the project area in the project scenario in stratum *i* in year *t*; tCO_2e

$\Delta C_{PRJ,Enh,i,t}$ Net carbon stock change as a result of forest growth and sequestration during the project in areas projected to be deforested in the baseline in stratum *i* at time *t*; tCO_2e

i 1, 2, 3 … *M* strata

t 1, 2, 3, … t* years elapsed since the start of the REDD project activity

4.2.1 Carbon stock change as a result of deforestation

In the project scenario it is projected that deforestation will only occur within the areas zoned as conversion forests in the Tavolo Land Use Map (presented in paragraph 3.3.3). Within the conversion zone, current forest areas are allocated by the Tavolo Community for potential future conversion to garden or cash crop areas, as and when needed due to increasing population numbers. For all other zones mentioned in the Tavolo Land Use Map no deforestation is expected in the future.

A total area of 694 hectares is zoned as conversion forest. It is expected that a total area of 300 hectares under this zone will be deforested over the project period of 30 years. For the estimation of project emissions due to this conversion, a linear deforestation rate is being used resulting in an annual deforestation of 10 hectares per year. The pre-deforestation Carbon stock in above- and belowground tree biomass is estimated at 549.2 tCO_2e ha^{-1} (see paragraph 4.1.2). The post-deforestation land-use is expected to be subsistence farming, therefore the corresponding post deforestation carbon stock is projected at 77.6 tCO_2e ha^{-1} (see paragraph 4.1.2).

Using the same factors and equations as presents in section 4.1.2, the ex-ante estimation of the deforestation in the with-project scenario within the Tavolo Project Area ($\Delta C_{PRJ,DefPA,i,t}$) is given in Table 8 below.

Table 8 - Ex-Ante estimation of carbon stock change as a result of deforestation in the project scenario

Year	Annual deforestation area (ha)	Stock change in AGB (tCO2)	Stock change in BGB (tCO2) VM0007: annual emission rate of 1/10 over 10 years	Sum of stock change due to deforestation in the project scenario (tCO2)
2019	10	3,233	120	3,353

2020	10	3,233	239	3,472
2021	10	3,233	359	3,592
2022	10	3,233	478	3,711
2023	10	3,233	598	3,831
2024	10	3,233	718	3,951
2025	10	3,233	837	4,070
2026	10	3,233	957	4,190
2027	10	3,233	1,077	4,310
2028	10	3,233	1,196	4,429
2029	10	3,233	1,196	4,429
2030	10	3,233	1,196	4,429
2031	10	3,233	1,196	4,429
2032	10	3,233	1,196	4,429
2033	10	3,233	1,196	4,429
2034	10	3,233	1,196	4,429
2035	10	3,233	1,196	4,429
2036	10	3,233	1,196	4,429
2037	10	3,233	1,196	4,429
2038	10	3,233	1,196	4,429
2039	10	3,233	1,196	4,429
2040	10	3,233	1,196	4,429
2041	10	3,233	1,196	4,429
2042	10	3,233	1,196	4,429
2043	10	3,233	1,196	4,429
2044	10	3,233	1,196	4,429
2045	10	3,233	1,196	4,429
2046	10	3,233	1,196	4,429
2047	10	3,233	1,196	4,429

2048	10	3,233	1,196	4,429
Total	**300**	**96,990**	**30,503**	**127,493**

4.2.2 Carbon stock change as a result of forest degradation through extraction of trees for illegal timber or fuelwood and charcoal

The agreed zoning of the Tavolo Sustainable Land Use Plan, together with the Community Conservation Laws developed and put in place by the members of the Tavolo Community themselves, address the issue of potential forest degradation as a result of illegal logging. The Community Conservation Law Committee has done awareness on the plan and laws to neighbouring communities, and sign boards will be placed on strategic entry points around the land use plan area. It is assumed that no additional forest degradation will occur in the project scenario as a result of illegal timber extraction.

Regarding the expected carbon stock change in the project scenario as a result of forest degradation through extraction of fuelwood (charcoal is not used in PNG), it is assumed that sufficient timber will be available from the deforestation activities in the forest conversions zone for which the emissions are already accounted for in the former section 4.2.1. Furthermore the "Garden & Cash crop" zone also still provide sufficient timber to provide the Tavolo Community for their fuelwood demand. Therefore, it is assumed that no additional forest degradation will occur as a result of fuelwood and charcoal extraction.

The expected carbon stock change as a result of forest degradation ($\Delta C_{PRJ,Deg\_IT,i,t}$) is thus assumed to be **0 tCO2e** for all years.

4.2.3 Carbon stock change as a result of forest degradation due to selective logging of forest management areas possessing a FSC certificate

The Tavolo Community has forest areas inside the project boundary designated for small-scale portable sawmilling operations in accordance with FSC certification requirements (see paragraph 3.3.3). This FSC small-scale portable sawmill operation by Tavolo is anticipated to start in 2023, with an estimated annual production of max 100 m^3 sawn timber, meaning 200 m^3 round log input. This figure is based on FORCERT's experience as FSC Group Certificate manager from 2004-2014, and is very conservative, i.e. the production may very well remain considerably lower; only a very few of the best organized sawmilling business groups managed to achieve an annual production of 100 m^3 or more.

The net ex-post emissions and removals related to selective logging activities in the project case are equal to the summed emissions arising from selective logging operations. The net emissions in the project case are estimated by combining:

- Emissions arising from logging gap: encompass emissions from felling timber tree and emissions from incidental damage caused by falling timber tree,

- Emissions from infrastructure: from constructing logging infrastructure for removal of timber, such as haul roads, skid trails and logging decks,
- Removals from long term wood products resulting from timber extraction

Following the VCS tool VMD0011, this estimation is calculated as follows:

$$\Delta C_{PRJ,Deg-FSC,i,t} = ([V_{BSL,EXT,i,t} * D_{mn} * CF] + [V_{BSL,EXT,i,t} * LDF] + [V_{BSL,EXT,i,t} * LIF] * CO_2F \quad (10)$$

Where:

$\Delta C_{PRJ,Deg-FSC,i,t}$ Net carbon stock change as a result of forest degradation due to selective logging of forest management areas possessing a FSC certificate in the project area in the project scenario in stratum *i* at time *t*; tCO_2e

$V_{BSL,EXT,i,t}$ Volume of timber projected to be extracted from within the project boundary during the baseline in stratum *i* at time *t*; m^3

D_{mn} Mean wood density of commercially harvested species; tdm m^{-3} (the default wood density of 0.59 tdm m^{-3} for tropical species is used as provided by the IPCC 2006 Guidelines[1])

CF Carbon fraction of biomass for commercially harvested species *j*; tC tdm^{-1} (default carbon fraction of 0.47 tC per t tdm^{-1} is used as given in PNG's FREL)

LDF Logging damage factor; tC m^{-3} (default factor of 0.53 tC m^{-3} for broadleaf and mixed forests is used, as provided by VCS tool VMD0011)

LIF Logging infrastructure factor; tC m^{-3} (default factor of 0.29 tC m^{-3} is used, as provided by VCS tool VMD0011)

i 1, 2, 3 … *M* strata

t 1, 2, 3, … t^* years elapsed since the start of the REDD project activity

CO_2F Standard ratio molecular weight of CO_2 to carbon of 44/12; dimensionless

Using the equation and factors mentioned above, the estimation of the net ex-post emissions and removals related to selective logging activities in the project case are given per year in Table 9 below. Forest regrowth after FSC logging is conservatively not quantified.

1 2006 IPCC Guidelines for National Greenhouse Gas Inventories - Chapter 12: Harvested Wood Products – Table 12.4

Table 9 - Ex-Ante estimation of carbon stock change as a result of selective logging activities in the project scenario

Year	FSC Selective Logging Plan (m^3)	Summed emissions from FSC logging (tCO_2e)
2019	-	-
2020	-	-
2021	-	-
2022	200	805
2023	200	805
2024	200	805
2025	200	805
2026	200	805
2027	200	805
2028	200	805
2029	200	805
2030	200	805
2031	200	805
2032	200	805
2033	200	805
2034	200	805
2035	200	805
2036	200	805
2037	200	805
2038	200	805
2039	200	805
2040	200	805
2041	200	805
2042	200	805
2043	200	805
2044	200	805
2045	200	805
2046	200	805
2047	200	805
2048	200	805
Total	5,400	**21,727**

4.2.4 Carbon stock change as a result of natural disturbance

In 1997 a forest fire degraded an area of approximately 1,050 ha of forest in the south-eastern part of the Tavolo land use plan area. The extent of the degradation was relatively limited, and the recovery from this damage by the forest in the area was such that there was no need for the area to be treated as a separate stratum during the forest carbon inventory in 2021.

Other incidents of natural disturbance leading to carbon stock loss haven't been observed since then. Therefore the expected carbon stock change as a result of natural disturbance in the project area ($\Delta C_{PRJ,DistPA,i,t}$) is **0 tCO2e** for all years.

4.2.5 Greenhouse gas emissions as a result of deforestation and degradation activities

The GHG emissions pool due to deforestation and degradation activities is conservatively excluded for the with-project scenario as well as the without-project scenario. See also paragraph 3.3.2 for selected carbon pools.

Therefore greenhouse gas emissions as a result of deforestation and degradation activities ($\Delta GHG_{PRJ-E,i,t}$) is set at **0 tCO2e** for all years.

4.2.6 Carbon stock change as a result of forest growth

Following VCS monitoring module VMD0015, the carbon stock change as a result of forest growth in the project area is conservatively set to **0 tCO_2e** for all years.

Therefore the carbon stock change as a result of forest growth ($\Delta C_{PRJ,Enh,i,t}$) is set at **0 tCO2e** for all years.

4.2.7 Sum of project carbon stock change in all pools

As described at the beginning of this paragraph 4.2, the total expected carbon stock change in the project scenario is calculated as:

$$\Delta C_{PRJ} = \sum_{t=1}^{t^*} \sum_{i=1}^{M} (\Delta C_{PRJ,DefPA,i,t} + \Delta C_{PRJ,Deg-IT,i,t} + \Delta C_{PRJ,Deg-FSC,i,t} + \Delta C_{PRJ,DistPA,i,t} + \Delta GHG_{PRJ-E,i,t} - \Delta C_{PRJ,Enh,i,t}$$

The estimated carbon stock changes in the with-project scenario for all years over the project period are given in Table 10 below.

Table 10 - Stock change in the project carbon pools

Year	Stock change due to deforestation (tCO_2e)	Stock change due to forest degradation through illegal logging or fuelwood and charcoal collection (tCO_2e)	Stock change due to forest degradation through selective logging under FSC (tCO_2e)	Stock change due to natural disturbance (tCO_2e)	GHG emissions dur to deforestation and degradation activities (tCO_2e)	Stock change as a result of forest growth (tCO_2e)	Sum of stock change in all project carbon pools (tCO_2e)
2019	3,353	-	-	-	-	-	3,353
2020	3,472	-	-	-	-	-	3,472
2021	3,592	-	-	-	-	-	3,592
2022	3,711	-	805	-	-	-	4,516
2023	3,831	-	805	-	-	-	4,636
2024	3,951	-	805	-	-	-	4,755
2025	4,070	-	805	-	-	-	4,875
2026	4,190	-	805	-	-	-	4,995
2027	4,310	-	805	-	-	-	5,114
2028	4,429	-	805	-	-	-	5,234
2029	4,429	-	805	-	-	-	5,234
2030	4,429	-	805	-	-	-	5,234
2031	4,429	-	805	-	-	-	5,234
2032	4,429	-	805	-	-	-	5,234
2033	4,429	-	805	-	-	-	5,234
2034	4,429	-	805	-	-	-	5,234
2035	4,429	-	805	-	-	-	5,234
2036	4,429	-	805	-	-	-	5,234
2037	4,429	-	805	-	-	-	5,234
2038	4,429	-	805	-	-	-	5,234

2039	4,429	-	805	-	-	-	5,234
2040	4,429	-	805	-	-	-	5,234
2041	4,429	-	805	-	-	-	5,234
2042	4,429	-	805	-	-	-	5,234
2043	4,429	-	805	-	-	-	5,234
2044	4,429	-	805	-	-	-	5,234
2045	4,429	-	805	-	-	-	5,234
2046	4,429	-	805	-	-	-	5,234
2047	4,429	-	805	-	-	-	5,234
2048	4,429	-	805	-	-	-	5,234
Total	**127,493**	**-**	**21,727**	**-**	**-**	**-**	**149,219**

4.3 Leakage

4.3.1 Activity shifting leakage

Following VCS Module VMD0009 the net greenhouse gas emissions due to activity shifting leakage for projects preventing planned deforestation is calculated as follows:

$$\Delta C_{LK-AS,planned} = \sum_{t=1}^{t^*} \sum_{i=1}^{M} (LKA_{planned,i,t} * \Delta C_{BSL,i}) \quad (11)$$

Where:

$\Delta C_{LK-AS,planned}$ Net greenhouse gas emissions due to activity shifting leakage for projects preventing planned deforestation; tCO_2e

$LKA_{planned,i,t}$ The area of activity shifting leakage in stratum *i* in year *t*; ha

$\Delta C_{BSL,i}$ Net carbon stock changes in all pre-deforestation pools in baseline stratum *i*; tCO_2e

i 1, 2, 3 … *M* strata

t 1, 2, 3, … t^* years elapsed since the start of the REDD project activity

By estimating the total area of deforestation across all the lands managed by the baseline deforestation agent (including the projected baseline deforestation within the project boundaries) it makes it possible to monitor possible activity shifting by agents to other areas under its management. The predicted deforestation within the project boundary is then

subtracted from the total deforestation across all the land managed by the baseline agent/class. This subtraction gives the expected deforestation if no leakage occurs. If deforestation is subtracted from the total area of monitored deforestation by the baseline agent of deforestation, the result is the area of leaked deforestation.

VM0007 states that, where the specific deforestation agent can be identified, leakage does not need to be considered where it can be demonstrated that the management plans and/or land-use designations of the deforestation agent's other lands have not materially changed as a result of the project (e.g., the deforestation agent has not designated new lands as timber concessions, increased harvest rates in lands already managed for timber, cleared intact forests for agricultural production or increased fertilizer use to enhance agricultural yields).

Mekar PNG has one other current operation in PNG; Aliai-Sisimi-Hargy Consolidated in the West New Britain Province, which is a logging operation (license type unknown), from which it exported 26,750m3 in 2020 and 41,485m3 in 2021. After the exclusion of the Tavolo Project area from the overall Lote-Kakuna FCA, no other FCA areas have been obtained by Mekar PNG, and preparations for the Lote-Kakuna FCA operation have continued.

Therefore activity shifting leakage ($\Delta C_{LK-AS,planned}$) is expected to be **0 tCO_2e**.

4.3.2 Market-effect leakage through decreased timber harvest

Following VCS Module VMD0011, the leakage due to market effects is equal to the baseline emissions from logging multiplied by a leakage factor:

$$\Delta C_{LK-ME} = \sum_{i=1}^{M} (LF_{ME} * AL_{T,i}) \quad (12)$$

Where:

ΔC_{LK-ME}	Net GHG emissions due to market- effects leakage through decreased timber harvest; tCO_2e
LF_{ME}	Leakage factor for market-effects calculations; dimensionless
$AL_{T,i}$	Summed emissions from timber harvest in stratum *i* in the baseline case potentially displaced through implementation of carbon project; tCO_2e
i	1, 2, 3 … *M* strata

VM0007 states that the market-effect leakage should be considered by a REDD project if the deforestation in the baseline is caused by timber harvesting for commercial markets.

For the Tavolo REDD project however, the deforestation in the baseline is caused by forest clearance to allow for the development of a large scale agricultural project under the Special Agricultural Business Lease. Therefore market-effect leakage does not need to be considered.

Therefore activity leakage (ΔC_{LK-ME}) is assumed to be **0 tCO_2e**.

4.4 Net GHG Emission Reductions and Removals

4.4.1 Summary of GHG emission reductions and removals

The total net greenhouse gas emissions reductions of the Tavolo REDD Project are calculated as:

$$NER_{REDD} = \Delta C_{BSL,planned} - \Delta C_{PRJ} - \Delta C_{LK} \quad (13)$$

Where:

NER_{REDD}	Total net GHG emission reductions of the REDD project activity over the project period; tCO2e
$\Delta C_{BSL,planned}$	Net GHG emissions in the baseline from planned deforestation; tCO2e
ΔC_{PRJ}	Net greenhouse gas emissions within the project area under the project scenario; tCO2e
ΔC_{LK}	Net GHG emissions due to leakage from the REDD project activity over the project period; tCO2e

The results are presented in Table 11 below.

Table 11 - The total net greenhouse gas emissions reductions of the Tavolo REDD Project

Year	Estimated baseline emissions or removals (tCO_2e) $\Delta C_{BSL,planned}$	Estimated project emissions or removals (tCO2e) ΔC_{PRJ}	Estimated leakage emissions (tCO_2e) ΔC_{LK}	Estimated net GHG emission reductions or removals (tCO_2e) NER_{REDD}
2019	-	3,353	-	-3,353
2020	1,357,391	3,472	-	1,353,918
2021	1,490,334	3,592	-	1,486,742
2022	972,879	4,516	-	968,362

2023	280,372	4,636	-	275,736
2024	543,352	4,755	-	538,597
2025	169,484	4,875	-	164,609
2026	169,484	4,995	-	164,489
2027	169,484	5,114	-	164,370
2028	169,484	5,234	-	164,250
2029	169,484	5,234	-	164,250
2030	118,351	5,234	-	113,117
2031	64,286	5,234	-	59,052
2032	31,909	5,234	-	26,675
2033	26,934	5,234	-	21,700
2034	12,254	5,234	-	7,020
2035	12,254	5,234	-	7,020
2036	12,254	5,234	-	7,020
2037	12,254	5,234	-	7,020
2038	12,254	5,234	-	7,020
2039	12,254	5,234	-	7,020
2040	8,269	5,234	-	3,035
2041	4,055	5,234	-	-1,179
2042	1,532	5,234	-	-3,702
2043	1,144	5,234	-	-4,090
2044	-	5,234	-	-5,234
2045	-	5,234	-	-5,234
2046	-	5,234	-	-5,234
2047	-	5,234	-	-5,234
2048	-	5,234	-	-5,234
Total	**5,821,751**	**149,219**	**-**	**5,672,532**

4.4.2 Calculation of AFOLU pooled buffer account contribution

Following VM007, the number of credits to be held in the AFOLU pooled buffer account is determined as a percentage of the total carbon stock benefits by the REDD project activity, which is calculated for this project in paragraph 4.4.1. Leakage emissions are not factored into the buffer calculations.

The project analyzed and described the non-permanence risk of the project implementation in its VCS Non-Permanence Risk Report (see appendix 5). Using the VCS Risk Report Calculation Tool, the total non-permanence risk for the project is calculated at **19%**.

Therefore, the number of credits to be held annually by the project in the AFOLU pooled buffer account ($Buffer_{Total}$) is projected to be as presented in the following table.

Table 12 – Projection of the Non-Permanence Risk Buffer Withholding

Year	Estimated net GHG emission reductions or removals excluding Leakage (tCO_2e) $\Delta C_{BSL,planned} - \Delta C_{PRJ}$	Estimated Non-Permanence Risk Buffer (19%) (tCO_2e) $Buffer_{Total}$
2019	-3,321	-
2020	1,341,100	254,809
2021	1,472,666	279,806
2022	959,194	182,247
2023	273,126	51,894
2024	533,498	101,365
2025	163,050	30,980
2026	162,932	30,957
2027	162,813	30,935
2028	162,695	30,912
2029	162,695	30,912
2030	112,046	21,289
2031	58,493	11,114
2032	26,423	5,020
2033	21,495	4,084

2034	6,954	1,321
2035	6,954	1,321
2036	6,954	1,321
2037	6,954	1,321
2038	6,954	1,321
2039	6,954	1,321
2040	3,006	571
2041	-1,167	-
2042	-3,667	-
2043	-4,051	-
2044	-5,184	-
2045	-5,184	-
2046	-5,184	-
2047	-5,184	-
2048	-5,184	-
Total	**5,618,825**	**1,074,821**

4.4.3 Uncertainty analysis

Following VCS Module VMD0017, the rate of uncertainty in REDD baseline estimates is calculated as follows:

$$Uncertainty_{REDD-BSL,t*} = \sqrt{Uncertainty_{REDD-BSL,RATE,t*}{}^2 + Uncertainty_{REDD-BSL,SS}{}^2} \quad (14)$$

Where:

$Uncertainty_{REDD-BSL,t*}$	Cumulative uncertainty in REDD baseline scenario up to time t; %
$Uncertainty_{REDD-BSL,RATE,t*}$	Cumulative uncertainty in the baseline rate of deforestation up to time t; %

$Uncertainty_{REDD-BSL,SS}$	Total uncertainty in the combined carbon stocks and greenhouse gas sources in the REDD baseline case; %
t	1, 2, 3, … t^* years elapsed since the start of the REDD project activity

Step 1: Uncertainty in Projection of Baseline Rate of Deforestation

It is here assumed that there is zero uncertainty in baseline rate of deforestation, because the numbers are based on actual deforestation plans. Furthermore, there is assumed to be no unplanned deforestation in the baseline. Therefore:

$Uncertainty_{REDD-BSL,RATE}$ = 0

Step 2: Uncertainty of Emissions and Removals in Project Area in Baseline Scenario

The uncertainty is calculated for each included carbon pools for this project as the 95% confidence interval half width as a percentage of the Mean. The results per carbon pool are as follows:

- Aboveground Biomass (AGB) – the Mean Baseline AGB is estimated based on measurements done on 56 forest inventory plots in 2020. The uncertainty of the plot measurements is calculated at **15.9%** at the 95% confidence Interval (see Table 13).
- Belowground Tree Biomass (BGB) –BGB estimated based on AGB values and Root-Soot factor provided in PNG's FREL. Therefore, Uncertainty = 0%
- Wood Products (WP) – The long-term wood products pool is estimated based on an actual deforestation plan. Therefore, Uncertainty = 0%

All other pools are conservatively excluded.

Table 13 - Uncertainty calculation based - Forest Inventory 2020

Uncertainty calculations	
Area (ha)	15,102
Average AGB (tCO2/ha)	400.8
STDEV	244.1
N	56.0
STE	32.6
tSx	63.9
LOWER LIMIT	336.9
UPPER LIMIT	464.8
UNCERTAINTY (%)	**15.9%**

Step 3: Total Uncertainty in REDD Baseline Scenario

The total uncertainty in the REDD baseline scenario for this project is calculated as:

$$Uncertainty_{REDD-BSL,t*} = \sqrt{Uncertainty_{REDD-BSL,RATE,t*}{}^2 + Uncertainty_{REDD-BSL,SS}{}^2} =$$

$\sqrt{0^2 + 15.9^2}$ = **15.9%**

Step 4: Adjustment of net GHG emission reductions to account for uncertainty

The allowable uncertainty for the used methodology VM0007 is +/- 15% of NER_{REDD} at the 95% confidence level. With a total uncertainty of 15.9% (see calculation in step 3 above), this precision level is not met for this project. Therefore NER_{REDD} shall be adjusted with a deduction equal to the amount that the uncertainty exceeds the allowable level. The adjusted value for NER_{REDD} to account for uncertainty is calculated as:

$$Adjusted\_NER_{REDD} = NER_{REDD} * (100\% - NER_{REDD+ERROR} + 15\%) \quad (15)$$

Where:

$Adjusted\_NER_{REDD}$	Total net GHG emission reductions of the REDD+ project activities up to year t^* adjusted to account for uncertainty; tCO_2e
NER_{REDD}	Total net GHG emission reductions of the REDD project activity up to year t^*; tCO_2e
$NER_{REDD+ERROR}$	Cumulative uncertainty for the REDD+ (REDD and WRC) project activities up to year t^*; %

The adjusted NER_{REDD} is presented for each year in Table 14.

4.4.4 Calculation of Verified Carbon Units

Following VM0007, the number of Verified Carbon Units (VCUs) is estimated for the monitoring period T = $t_2 - t_1$ using the following equation:

$$VCU_t = (Adjusted\_NER_{REDD,t_2} - Adjusted\_NER_{REDD,t_1}) - Buffer_{Total} \quad (16)$$

Where:

VCU_t	Number of Verified Carbon Units at year $t = t_2 - t_1$; VCU

$Adjusted\_NER_{REDD,t_2}$ Total net GHG emission reductions of the REDD+ project activity up to year t_2 and adjusted to account for uncertainty; tCO_2e

$Adjusted\_NER_{REDD,t_1}$ Total net GHG emission reductions of the REDD+ project activity up to year t_1 and adjusted to account for uncertainty; tCO_2e

$Buffer_{Total}$ Total permanence risk buffer withholding; tCO_2e

Following this calculation, the annual estimated VCU's as a result of the project are presented in Table 14 below.

Table 14 - Number of Verified Carbon Units (VCUs) estimated annually over the project period

Year	Estimated net GHG emission reductions or removals adjusted to account for uncertainty (tCO2e) $Adjusted\_NER_{REDD}$	Estimated Non-Permanence Risk Buffer (19%) (tCO2e) $Buffer_{Total}$	Estimated VCUs after risk buffer subtraction (VCUs) VCU_t
2019	-3,321	-	-
2020	1,341,100	254,809	1,086,291
2021	1,472,666	279,806	1,192,859
2022	959,194	182,247	776,947
2023	273,126	51,894	221,232
2024	533,498	101,365	432,133
2025	163,050	30,980	132,071
2026	162,932	30,957	131,975
2027	162,813	30,935	131,879
2028	162,695	30,912	131,783
2029	162,695	30,912	131,783
2030	112,046	21,289	90,757
2031	58,493	11,114	47,379
2032	26,423	5,020	21,402
2033	21,495	4,084	17,411
2034	6,954	1,321	5,633

2035	6,954	1,321	5,633
2036	6,954	1,321	5,633
2037	6,954	1,321	5,633
2038	6,954	1,321	5,633
2039	6,954	1,321	5,633
2040	3,006	571	2,435
2041	-1,167	-	-
2042	-3,667	-	-
2043	-4,051	-	-
2044	-5,184	-	-
2045	-5,184	-	-
2046	-5,184	-	-
2047	-5,184	-	-
2048	-5,184	-	-
Total	**5,618,825**	**1,074,821**	**4,582,132**

5 MONITORING

5.1 Data and Parameters Available at Validation

Data / Parameter	i
Data unit	dimensionless
Description	Stratum
Source of data	Baseline forest cover classification
Value applied	Land-use categories used for the Tavolo Forest Cover Benchmark Map: • Forest • Non-forest
Justification of choice of data or description of measurement methods and procedures applied	
Purpose of Data	Determination of baseline scenario Calculation of baseline emissions Calculation of project emissions
Comments	

Data / Parameter	t
Data unit	years
Description	Years elapsed since the projected start of the REDD project activity
Source of data	
Value applied	1, 2, 3, …
Justification of choice of data or description of	

measurement methods and procedures applied	
Purpose of Data	Determination of baseline scenario Calculation of baseline emissions Calculation of project emissions Calculation of leakage
Comments	

Data / Parameter	$\Delta C_{BSL,planned}$
Data unit	tCO_2e
Description	Net GHG emissions in the baseline from planned deforestation
Source of data	Based on deforestation plan provided in the Kakuna-Lote FCA application 2019, and default C-stocks provided in PNG's FREL and IPCC 2006 Guidelines
Value applied	5,821,751 tCO_2e; See Table 7
Justification of choice of data or description of measurement methods and procedures applied	Project proposal and logging map attached to this PD as Appendix 3 and Appendix 4
Purpose of Data	Determination of baseline scenario Calculation of baseline emissions
Comments	

Data / Parameter	$\Delta C_{BSL,i,t}$
Data unit	tCO_2e
Description	Sum of the baseline carbon stock change in all pools in stratum *i* at time *t*
Source of data	Based on deforestation plan provided in the Kakuna-Lote FCA application 2019, and default C-stocks provided in PNG's FREL and IPCC 2006 Guidelines
Value applied	See Table 7

Justification of choice of data or description of measurement methods and procedures applied	Project proposal and logging map attached to this PD as Appendix 3 and Appendix 4
Purpose of Data	Determination of baseline scenario Calculation of baseline emissions
Comments	

Data / Parameter	$GHG_{BSL-E,i,t}$
Data unit	tCO_2e
Description	Greenhouse gas emissions as a result of deforestation activities within the project boundary in the baseline stratum *i* during project year *t*
Source of data	
Value applied	0 tCO_2e
Justification of choice of data or description of measurement methods and procedures applied	The GHG emissions as a result of deforestation activities in the baseline for the Tavolo Project Area are conservatively set to **0 tCO_2e** for all years
Purpose of Data	Determination of baseline scenario Calculation of baseline emissions
Comments	

Data / Parameter	$AA_{planned,i,t}$
Data unit	ha
Description	Annual area of baseline planned deforestation for stratum *i* at time *t*
Source of data	Deforestation plan provided by the Kakuna-Lote FCA application 2019
Value applied	See Table 4

Justification of choice of data or description of measurement methods and procedures applied	Project proposal and logging map attached to this PD as Appendix 3 and Appendix 4
Purpose of Data	Determination of baseline scenario Calculation of baseline emissions
Comments	

Data / Parameter	$A_{planned,i}$
Data unit	Ha
Description	Total area of planned deforestation over the baseline period for stratum *i*
Source of data	Deforestation plan provided by the Kakuna-Lote FCA application 2019
Value applied	14,695 ha; See Table 4
Justification of choice of data or description of measurement methods and procedures applied	Project proposal and logging map attached to this PD as Appendix 3 and Appendix 4
Purpose of Data	Determination of baseline scenario Calculation of baseline emissions
Comments	

Data / Parameter	$D\%_{planned,i,t}$
Data unit	%
Description	Projected annual proportion of land that will be deforested in stratum *I* during year *t*
Source of data	Deforestation plan provided by the Kakuna-Lote FCA application 2019
Value applied	See Table 4 Year 1: 33% Year 2: 34%

	Year 3: 21% Year 4: 3% Year 5: 9%
Justification of choice of data or description of measurement methods and procedures applied	Project proposal and logging map attached to this PD as Appendix 3 and Appendix 4
Purpose of Data	Determination of baseline scenario Calculation of baseline emissions
Comments	Will be revisited at the time of baseline revision

Data / Parameter	$L - D_i$
Data unit	%
Description	Likelihood of deforestation for stratum *i*
Source of data	VMD0006
Value applied	100%
Justification of choice of data or description of measurement methods and procedures applied	VMD0006 is followed: For all areas not both under Government control and zoned for deforestation, L-Di shall be equal to 100%
Purpose of Data	Determination of baseline scenario Calculation of baseline emissions
Comments	

Data / Parameter	$\Delta C_{ABtree,i}$
Data unit	$tCO_2e\ ha^{-1}$
Description	Baseline carbon stock change in aboveground tree biomass in stratum *i*
Source of data	PNG's FREL and IPCC 2006 Guidelines
Value applied	289.2 $tCO_2e\ ha^{-1}$

Justification of choice of data or description of measurement methods and procedures applied	VMD0006 is followed as guideline for calculations
Purpose of Data	Determination of baseline scenario Calculation of baseline emissions
Comments	

Data / Parameter	$C_{ABtree_{bsl},i}$
Data unit	$tCO_2e\ ha^{-1}$
Description	Forest carbon stock in aboveground tree biomass in stratum *i*
Source of data	PNG's FREL and IPCC 2006 Guidelines
Value applied	400.8 $tCO_2e\ ha^{-1}$; see Table 5
Justification of choice of data or description of measurement methods and procedures applied	VMD0006 is followed as guideline for calculations
Purpose of Data	Determination of baseline scenario Calculation of baseline emissions
Comments	

Data / Parameter	$C_{ABtree_{post},i}$
Data unit	$tCO_2e\ ha^{-1}$
Description	Post-deforestation carbon stock in aboveground tree biomass in stratum *i*
Source of data	PNG's FREL and IPCC 2006 Guidelines
Value applied	111.7 $tCO_2e\ ha^{-1}$; see Table 6
Justification of choice of data or description of measurement methods and procedures applied	VMD0006 is followed as guideline for calculations

Purpose of Data	Determination of baseline scenario Calculation of baseline emissions
Comments	

Data / Parameter	$\Delta C_{BBtree,i}$
Data unit	$tCO_2e\ ha^{-1}$
Description	Baseline carbon stock change in belowground tree biomass in stratum *i*
Source of data	PNG's FREL and IPCC 2006 Guidelines
Value applied	107.0 $tCO_2e\ ha^{-1}$
Justification of choice of data or description of measurement methods and procedures applied	VMD0006 is followed as guideline for calculations
Purpose of Data	Determination of baseline scenario Calculation of baseline emissions
Comments	

Data / Parameter	$C_{BBtree_{bsl},i}$
Data unit	$tCO_2e\ ha^{-1}$
Description	Forest carbon stock in belowground tree biomass in stratum *i*
Source of data	PNG's FREL and IPCC 2006 Guidelines
Value applied	148.3 $tCO_2e\ ha^{-1}$; see Table 5
Justification of choice of data or description of measurement methods and procedures applied	VMD0006 is followed as guideline for calculations
Purpose of Data	Determination of baseline scenario Calculation of baseline emissions

Comments	

Data / Parameter	$C_{BBtree_{post},i}$
Data unit	$tCO_2e\ ha^{-1}$
Description	Post-deforestation carbon stock in belowground tree biomass in stratum *i*
Source of data	PNG's FREL and IPCC 2006 Guidelines
Value applied	41.3 $tCO_2e\ ha^{-1}$; see Table 6
Justification of choice of data or description of measurement methods and procedures applied	VMD0006 is followed as guideline for calculations
Purpose of Data	Determination of baseline scenario (AFOLU projects only) Calculation of baseline emissions
Comments	

Data / Parameter	RS
Data unit	dimensionless
Description	Ratio of belowground biomass to aboveground biomass
Source of data	PNG's FREL and IPCC 2006 Guidelines
Value applied	0.37
Justification of choice of data or description of measurement methods and procedures applied	VMD0006 is followed as guideline for calculations
Purpose of Data	Calculation of baseline emissions Calculation of project emissions Calculation of leakage
Comments	

Data / Parameter	CF
Data unit	dimensionless
Description	Conversion factor for conversion of oven-dry weight to carbon stock in tree biomass
Source of data	PNG's FREL and IPCC 2006 Guidelines
Value applied	0.47 tC tdm^{-1}
Justification of choice of data or description of measurement methods and procedures applied	VMD0006 is followed as guideline for calculations
Purpose of Data	Calculation of baseline emissions Calculation of project emissions Calculation of leakage
Comments	

Data / Parameter	CO_2F
Data unit	Dimensionless
Description	Standard ratio molecular weight of CO_2 to carbon
Source of data	PNG's FREL and IPCC 2006 Guidelines
Value applied	44/12
Justification of choice of data or description of measurement methods and procedures applied	VMD0006 is followed as guideline for calculations
Purpose of Data	Calculation of baseline emissions Calculation of project emissions Calculation of leakage
Comments	

Data / Parameter	$C_{WP,i}$

Data unit	$tCO_2e\ ha^{-1}$
Description	Carbon stock entering the wood products pool at the time of deforestation from stratum *i*
Source of data	Deforestation plan provided by the Kakuna-Lote FCA application 2019
Value applied	21.1 $tCO_2e\ ha^{-1}$
Justification of choice of data or description of measurement methods and procedures applied	Followed VMD0005, using values from deforestation plan
Purpose of Data	Determination of baseline scenario Calculation of baseline emissions
Comments	

Data / Parameter	$C_{XB,i}$
Data unit	$tCO_2e\ ha^{-1}$
Description	Mean stock of extracted biomass carbon at the time of deforestation from stratum *i*
Source of data	Deforestation plan provided by the Kakuna-Lote FCA application 2019
Value applied	27.8 $tCO_2e\ ha^{-1}$
Justification of choice of data or description of measurement methods and procedures applied	Followed VMD0005, using values from deforestation plan
Purpose of Data	Determination of baseline scenario Calculation of baseline emissions
Comments	

Data / Parameter	$WWty$

Data unit	dimensionless
Description	Wood waste. The fraction immediately emitted through mill inefficiency by class of wood product *ty*
Source of data	VMD0005
Value applied	0.24
Justification of choice of data or description of measurement methods and procedures applied	Default factor for wood waste of 0.24 as given by VCS module VMD0005 for developing countries Since VMD0005 provides a single default wood waste factor for all timber categories in the developing countries, only one class of Wood products is used for the calculation of the Harvested Wood Product pool
Purpose of Data	Determination of baseline scenario Calculation of baseline emissions
Comments	

Data / Parameter	ty
Data unit	
Description	Wood product class
Source of data	VMD0005
Value applied	defined here as sawnwood (s), wood-based panels (w), other industrial roundwood (oir), paper and paper board (p), and other (o)
Justification of choice of data or description of measurement methods and procedures applied	Since VMD0005 provides a single default wood waste factor for all timber categories in the developing countries, only one class of Wood products is used for the calculation of the Harvested Wood Product pool
Purpose of Data	Determination of baseline scenario Calculation of baseline emissions
Comments	

Data / Parameter	$C_{WP100,i}$
Data unit	$tCO_2e\ ha^{-1}$
Description	Carbon stock entering the wood products pool at the time of deforestation that is expected to be emitted over 100-years from stratum *i*
Source of data	Deforestation plan provided by the Kakuna-Lote FCA application 2019
Value applied	16.7 $tCO_2e\ ha^{-1}$
Justification of choice of data or description of measurement methods and procedures applied	Followed VMD0005, using values from deforestation plan
Purpose of Data	Determination of baseline scenario Calculation of baseline emissions
Comments	

Data / Parameter	$SLFty$
Data unit	Dimensionless
Description	Fraction of wood products that will be emitted to the atmosphere within 5 years of timber harvest by class of wood product *ty*
Source of data	VMD0005
Value applied	0.3
Justification of choice of data or description of measurement methods and procedures applied	Followed VMD0005, using default fraction parameters for roundwood
Purpose of Data	Determination of baseline scenario Calculation of baseline emissions
Comments	

Data / Parameter	$OFty$

Data unit	Dimensionless
Description	Fraction of wood products that will be emitted to the atmosphere between 5 and 100 years of timber harvest by class of wood product *ty*
Source of data	VMD0005
Value applied	0.7
Justification of choice of data or description of measurement methods and procedures applied	Followed VMD0005, using default fraction parameters for roundwood
Purpose of Data	Determination of baseline scenario Calculation of baseline emissions
Comments	

Data / Parameter	$E_{FC,i,t}$
Data unit	tCO_2e
Description	Emission from fossil fuel combustion in stratum *i* in year *t*
Source of data	
Value applied	0 tCO_2e
Justification of choice of data or description of measurement methods and procedures applied	The Emission from fossil fuel combustion in the baseline for Tavolo the Project Area are conservatively set to **0 tCO_2e** for all years
Purpose of Data	Determination of baseline scenario Calculation of baseline emissions
Comments	

Data / Parameter	$E_{BiomassBurn,i,t}$
Data unit	tCO_2e
Description	Non-CO_2 emissions due to biomass burning in stratum *i* in year *t*

Source of data	
Value applied	0 tCO_2e
Justification of choice of data or description of measurement methods and procedures applied	The Non-CO_2 emissions due to biomass burning in the baseline for Tavolo the Project Area are conservatively set to **0 tCO_2e** for all years
Purpose of Data	Determination of baseline scenario Calculation of baseline emissions
Comments	

Data / Parameter	$N_2O_{direct-N,i,t}$
Data unit	tCO_2e
Description	Direct N_2O emission as a result of nitrogen application on the alternative land use within the project boundary in stratum *i* in year *t*
Source of data	
Value applied	0 tCO_2e
Justification of choice of data or description of measurement methods and procedures applied	The Direct N_2O emission as a result of nitrogen application in the baseline for Tavolo the Project Area are conservatively set to **0 tCO_2e** for all years
Purpose of Data	Determination of baseline scenario Calculation of baseline emissions
Comments	

5.2 Data and Parameters Monitored

Data / Parameter	ΔC_{PRJ}
Data unit	tCO_2e

Description	Net greenhouse gas emissions within the project area under the project scenario
Source of data	Tavolo Land Use Plan
Description of measurement methods and procedures to be applied	
Frequency of monitoring/recording	
Value applied	See Table 10; 149,219 tCO_2e (estimation)
Monitoring equipment	
QA/QC procedures to be applied	
Purpose of data	Calculation of project emissions
Calculation method	See paragraph 4.2
Comments	

Data / Parameter	$\Delta C_{PRJ,DefPA,i,t}$
Data unit	tCO_2e
Description	Net carbon stock change as a result of deforestation and natural disturbances in the project area in the project scenario in stratum *i* at time *t*
Source of data	Tavolo Land Use Plan
Description of measurement methods and procedures to be applied	See paragraph 5.3.1
Frequency of monitoring/recording	
Value applied	See Table 8; 127,493 tCO_2e (estimation)
Monitoring equipment	

QA/QC procedures to be applied	See paragraph 5.3.1
Purpose of data	Calculation of project emissions
Calculation method	See paragraph 5.3.1
Comments	

Data / Parameter	$\Delta C_{PRJ,DistPA,i,t}$
Data unit	tCO_2e
Description	Net carbon stock change as a result of natural disturbance in the project area in the project scenario in stratum *i* at time *t*
Source of data	
Description of measurement methods and procedures to be applied	See paragraph 5.3.1
Frequency of monitoring/recording	
Value applied	See Table 10; 0 tCO_2e (estimation)
Monitoring equipment	
QA/QC procedures to be applied	See paragraph 5.3.1
Purpose of data	Calculation of project emissions
Calculation method	See paragraph 5.3.1
Comments	

Data / Parameter	$\Delta C_{PRJ,Deg-IT,i,t}$
Data unit	tCO_2e
Description	Net carbon stock change as a result of forest degradation through extraction of trees for illegal timber or fuelwood and charcoal in the project area in the project scenario in stratum *i* at time *t*

Source of data	Tavolo Land Use Plan and PRA
Description of measurement methods and procedures to be applied	See paragraph 5.3.2
Frequency of monitoring/recording	
Value applied	See Table 10; 0 tCO_2e (estimation)
Monitoring equipment	
QA/QC procedures to be applied	See paragraph 5.3.2
Purpose of data	Calculation of project emissions
Calculation method	See paragraph 5.3.2
Comments	

Data / Parameter	$\Delta C_{PRJ,Deg-FSC,i,t}$
Data unit	tCO_2e
Description	Net carbon stock change as a result of forest degradation due to selective logging of forest management areas possessing a FSC certificate in the project area in the project scenario in stratum *i* at time *t*
Source of data	Tavolo Land Use Plan and FSC Logging Plan for Tavolo
Description of measurement methods and procedures to be applied	See paragraph 5.3.3
Frequency of monitoring/recording	
Value applied	See Table 9; 21,727 tCO_2e (estimation)
Monitoring equipment	
QA/QC procedures to be applied	See paragraph 5.3.3

Purpose of data	Calculation of project emissions
Calculation method	See paragraph 5.3.3
Comments	

Data / Parameter	ΔC_{LK}
Data unit	tCO_2e
Description	Net GHG emissions due to leakage from the REDD project activity over the project period
Source of data	PNGi Forest Portal (www.pngiforest.org) on other operational licenses, in combination with information from Global Forest Watch (www.globalforestwatch.org)
Description of measurement methods and procedures to be applied	See paragraph 5.3.4
Frequency of monitoring/recording	
Value applied	See paragraph 4.3 Table 10; 0 tCO_2e (estimation)
Monitoring equipment	
QA/QC procedures to be applied	See paragraph 5.3.4
Purpose of data	Calculation of project emissions
Calculation method	See paragraph 5.3.4
Comments	

Data / Parameter	NER_{REDD}
Data unit	tCO_2e
Description	Total net GHG emission reductions of the REDD project activity over the project period
Source of data	

Description of measurement methods and procedures to be applied	See paragraph 4.4
Frequency of monitoring/recording	
Value applied	
Monitoring equipment	
QA/QC procedures to be applied	See paragraph 4.4
Purpose of data	Calculation of project emissions
Calculation method	See paragraph 4.4
Comments	

5.3 Monitoring Plan

After the implementation of the project, the ex-post emissions and removals of GHGs due to deforestation and forest degradation that has been induced as a result of project implementation within the project area and as a result of natural disturbances will be monitored by the project periodically.

This monitoring plan for the Tavolo REDD project includes the following:

1. Monitoring deforestation and natural disturbances in the project area ($\Delta C_{PRJ,DefPA,i,t}$ and $\Delta C_{PRJ,DistPA,i,t}$)
2. Monitoring forest degradation due to illegal logging or fuelwood and charcoal in the project area ($\Delta C_{PRJ,Deg-IT,i,t}$)
3. Monitoring forest degradation due to selective logging under FSC in the project area ($\Delta C_{PRJ,Deg-FSC,i,t}$)
4. Monitoring leakage due to project implementation

5.3.1 Monitoring deforestation and natural disturbances

This step will produce an estimate of the emissions resulting from any deforestation and natural disturbances that occurs within the project area ($\Delta C_{PRJ,DefPA,i,t}$ and $\Delta C_{PRJ,DistPA,i,t}$).

The net carbon stock change as a result of deforestation and natural disturbances is equal to the area deforested multiplied by the emission per unit area.

$$\Delta C_{PRJ,DefPA,i,t} = \sum_{u=1}^{U} (A_{DefPA,u,i,t} * \Delta C_{pools,P,Def,u,i,t}) \quad (17)$$

$$\Delta C_{PRJ,DistPA,i,t} = \sum_{u=1}^{U} (A_{DistPA,u,i,t} * \Delta C_{pools,P,Def,u,i,t}) \quad (18)$$

Where:

$\Delta C_{PRJ,DefPA,i,t}$	Net carbon stock change as a result of deforestation in the project case in the project area in stratum *i* at time *t*; tCO_2e
$A_{DefPA,u,i,t}$	Area of recorded deforestation in the project area stratum *i* converted to land use *u* at time *t*; ha
$\Delta C_{PRJ,DistPA,i,t}$	Net carbon stock change as a result of deforestation in the project case in the project area in stratum *i* at time *t*; tCO_2e

$A_{DistPA,u,i,t}$ Area of recorded deforestation in the project area stratum *i* converted to land use *u* at time *t*; ha

$\Delta C_{pools,Def,u,i,t}$ Net carbon stock changes in all pools as a result of deforestation in the project case in land use *u* in stratum *i* at time *t*; $tCO_2e\ ha^{-1}$

u 1, 2, 3 … *U* post-deforestation land uses

i 1, 2, 3 … *M* strata

t 1, 2, 3, … t^* years elapsed since the start of the REDD project activity

The emission per unit area is equal to the difference between the stocks before and after deforestation minus any wood products created from timber extraction in the process of deforestation:

$$\Delta C_{pools,Def,u,i,t} = C_{BSL,i} - C_{P,post,i} - C_{WP,i} \quad (19)$$

Where:

$\Delta C_{pools,Def,u,i,t}$ Net carbon stock changes in all pools as a result of deforestation in the project case in land use *u* in stratum *i* at time *t*; $tCO_2e\ ha^{-1}$

$C_{BSL,i}$ Carbon stock in all pools in the baseline case in stratum *i*; $tCO_2e\ ha^{-1}$

$C_{P,post,u,i}$ Carbon stock in all pools in post-deforestation land use *u* in stratum *i*; $tCO_2e\ ha^{-1}$

$C_{WP,i}$ Carbon stock sequestered in wood products from harvests in stratum *i*; $tCO_2e\ ha^{-1}$

u 1, 2, 3 … *U* post-deforestation land uses

i 1, 2, 3 … *M* strata

t 1, 2, 3, … t^* years elapsed since the start of the REDD project activity

As indicated in section 3.3.2, only above- and belowground tree biomass are selected as carbon pools for this project. The harvested wood products are conservatively excluded as carbon pool. It is assumed that no wood products are produced from the deforestation occurring in the project area. Therefore the carbon stock for each post-deforestation land use (*u*) is estimated as follows:

$$C_{P,post,i} = C_{ABtree_{post},i} + C_{BBtree_{post},i} \quad (20)$$

Where:

$C_{P,post,u,i}$	Carbon stock in all pools in post-deforestation land use *u* in stratum *i*; $tCO_2e\ ha^{-1}$
$C_{ABtree_{post},i}$	Carbon stock in aboveground tree biomass in stratum *i*; $tCO_2e\ ha^{-1}$
$C_{BBtree_{post},i}$	Carbon stock in belowground tree biomass in stratum *i*; $tCO_2e\ ha^{-1}$
u	1, 2, 3 … *U* post-deforestation land uses
i	1, 2, 3 … *M* strata

Monitoring area of recorded deforestation

Forest cover change due to deforestation and natural disturbance is monitored through periodic assessments of classified satellite imagery covering the project area.

The project boundary, as set in this PD (see paragraph 1.12 and Figure 14 below), will serve as the initial "forest cover benchmark map" against which changes in forest cover will be assessed over the project crediting period. The entire project area has been demonstrated to meet the forest definition at the beginning of the project crediting period in 2019 (see results 2019 forest cover classification below). For the following monitoring periods, change in forest cover will be assessed against the preceding classified forest cover map marking the beginning of the monitoring interval.

Data collection and analysis to determine forest cover change at each monitoring event will follow the procedures detailed below. The resulting classified image is compared with the preceding classified image (forest cover benchmark map marking the start of the monitoring interval) to detect forest cover change over the monitoring interval, and subsequently becomes the updated forest cover benchmark map for the next monitoring interval. Thus, the forest benchmark map is updated at each monitoring event. All changes in forest cover detected for the monitoring interval will be annualized (to produce estimates of area of deforestation for each year) by dividing the area by the number of years in the period.

Satellite data acquisition

For each monitoring/verification date, satellite imagery for that year will be acquired and interpreted to produce a classified forest cover map in which forest and non-forest are distinguished. The satellite images used by the project for the forest cover classification will meet the minimum required resolution of 30 meters in the GOFC-GOLD 2016 guidelines.[1]

[1] GOFC-GOLD, 2016, A sourcebook of methods and procedures for monitoring and reporting anthropogenic greenhouse gas emissions and removals associated with deforestation, gains and losses of carbon stocks in forests remaining forests, and forestation. GOFC-GOLD Report version COP22-1, (GOFC-GOLD Land Cover Project Office, Wageningen University, The Netherlands).

The satellite imagery will cover the entire project area and will be from a single year, though it may include a mosaic of scenes over several months. Imagery will be 90% cloud free. To achieve 90% classified area, multiple scenes or portions of multiple scenes may be mosaicked. Where possible, areas that are continually clouded will be classified on the basis of other data sources (e.g. ground surveys in the year of interest, radar, over-flights or classified imagery from a year subsequent to the monitored year).

Interpretation and Classification

The satellite images will be processed using supervised pixel-based classification. Pixels will be grouped according to similarities in band values and assigned to one of the following classes:

- Forest (including primary and secondary/degraded forest)
- Non-forest (including all land use types other than forest)

Conform the national forest definition of PNG[1] and the GOFC-GOLD guidelines, [1] isolated pixel-groups of less than 1 hectare (11 Landsat pixels, 0.99 ha) will be dissolved in the surrounding class to get a minimum mapping unit (MMU) of 1 hectare. This MMU will be used throughout the duration of the project crediting period.

Change detection

Post-classification change detection techniques will be implemented to identify forest cover change. Basic cross-tabulation techniques will be used to identify changes from forest to non-forest. Area data from the two maps (benchmark map at beginning of monitoring interval and newly-generated map for current monitoring year) will be cross-tabulated to identify locations that change from forest to non-forest during the monitoring period, which represent deforestation in the actual with-project case.

Quality Assurance and Quality Control

The accuracy of the forest cover classification will be assessed by comparing the classification with samples of high-resolution satellite imagery (e.g. NICFI, SPOT or RapidEye).

Data Archiving

All data sources and processing, classification and change detection procedures will be documented and archived by the project proponent.

2019 Tavolo Forest Cover Benchmark Map

Following the procedure described above, the Forest Cover Benchmark Map was produced for the Tavolo Project Area based on the 2019 Landsat images. The 2019 forest cover classification of the landsat images is given in Figure 13 below.

[1] Papua New Guinea, 2017, Papua New Guinea's National REDD+ Forest Reference Level, https://redd.unfccc.int/files/png_frl__submission-15.01.2017.pdf

As can be seen, 19,373 hectares out of the 21,164 hectares has been classified as forest cover in 2019. However, since only the three different forest zones, as defined by the Tavolo community in their Land Use Plan (see paragraph 3.3.3), are included as forest conservation area, 16,493 hectares out of the 19,373 hectares of 2019 forest cover has been selected as REDD project area and together form the 2019 Forest Cover Benchmark Map for the Tavolo REDD project (see Figure 14). The Tavolo REDD Project Boundary is also provided digitally as kml and shapefile in Appendix 6.

The accuracy of the 2019 Forest Cover Benchmark Map was assessed by using high resolution NICFI satellite imagery. The SEPAL.io "Stratified area estimator - Design"- tool was used to generate random samples per identified class, with a minimum of 50 sample points per class. Ground-truthing was done by uploading the random samples to Collect Earth Online and assessing them using high-resolution NICFI imagery. The confusion matrix of the accuracy assessment of the 2019 LULC map, is shown in Table 15. The overall accuracy of the 2019 map is 90.00%.

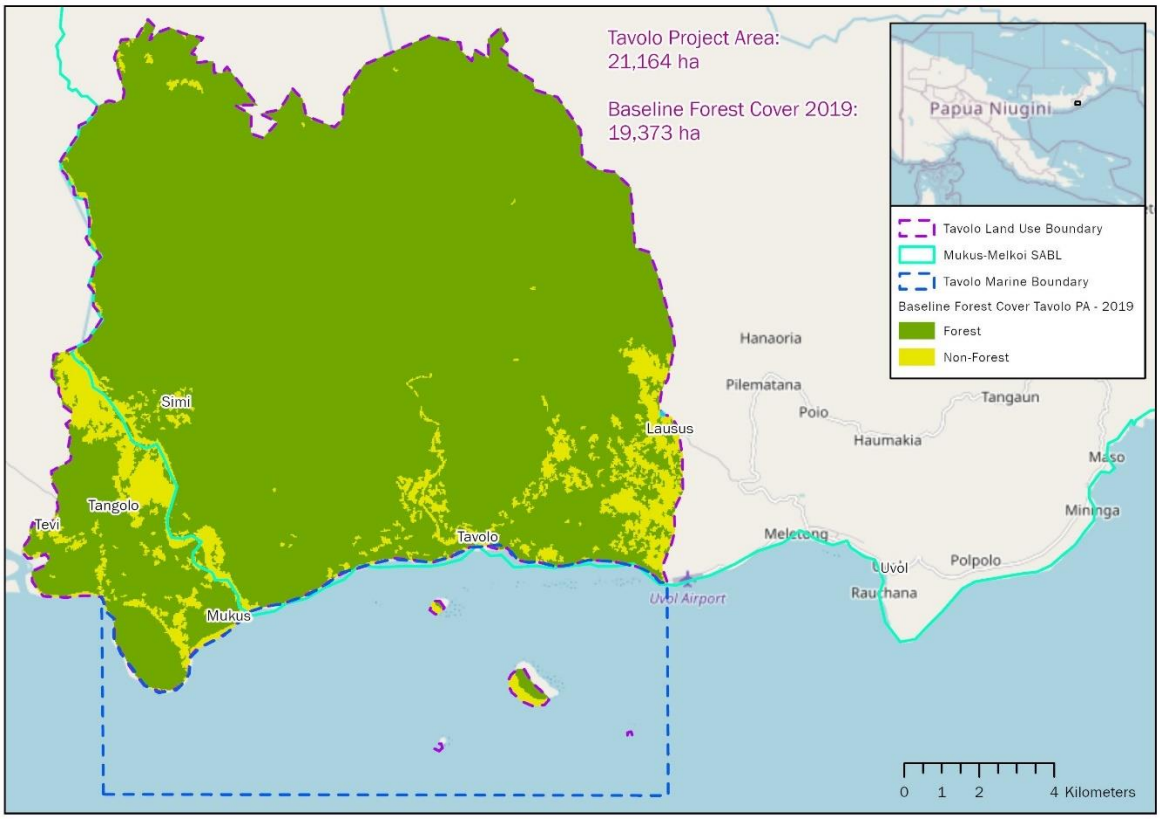

Figure 13 - 2019 Forest Cover Classification based on Landsat 8 Images

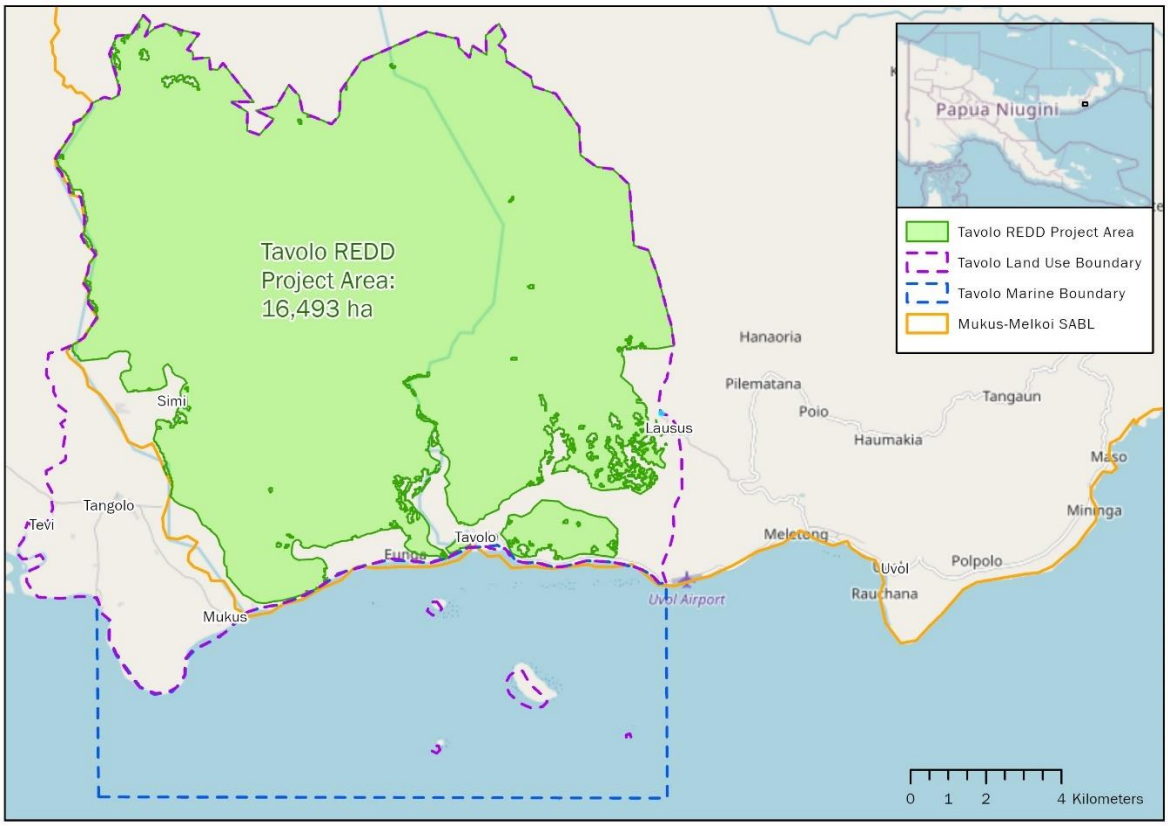

Figure 14 - 2019 Forest Cover Benchmark Map based on Landsat 8 Image Classification

Table 15 – Confusion Matrix forest cover classification - 2019 Forest Cover Benchmark Map

Land use class as classified	Reference data		Total	User's Accuracy	Error of Commission
	Forest	Non-forest			
Forest (50 samples)	50	0	50	100%	0%
Non-forest (50 samples)	10	40	50	80%	20%
Total	60	40	100		
Producer's Accuracy	83.33%	100%			
Error of Omission	16.67%	0%			

Change in carbon stock due to deforestation

As already presented in section 4.1.2, the pre- and post-deforestation carbon stocks are estimated for the Tavolo project as follows:

Pre-deforestation carbon stock

The pre-deforestation carbon stock is based on the results of the 2020 baseline forest carbon stock inventory done within the Tavolo project area. The resulting pre-deforestation carbon

stocks are presented in Table 16 below. Please note that the forest area is not stratified, so only one pre-deforestation carbon stock applies for forest areas within the Tavolo REDD project area.

Table 16 - Results of the 2020 baseline assessment of the above ground tree biomass in forest area planned to be cleared in the Tavolo Project Area

Pre-deforestation strata	$C_{ABtree_{bsl}}$ ($tCO_2e\ ha^{-1}$)	Root-Shoot factor	$C_{BBtree_{bsl}}$ ($tCO_2e\ ha^{-1}$)	$C_{ABtree_{bsl}}$+ $C_{BBtree_{bsl}}$ ($tCO_2e\ ha^{-1}$)	Uncertainty (at 95% CL)
Forest area under Kakuna-Lote FCA	400.8	37%	148.3	549.2	15,9%

Post-deforestation carbon stock

For the Tavolo project one potential post-deforestation (*u*) land uses are identified for the project scenario: Subsistence & other land use.

The IPCC Guidelines 2006 and PNG's FREL provides default carbon stocks for the identified post-deforestation land use, these carbon stocks are given in Table 17 below.

Table 17 – Post-deforestation land use and the carbon stock values for above- and belowground tree biomass

Post-deforestation land use	$C_{ABtree_{post}}$ ($tCO_2e\ ha^{-1}$)	Root-Shoot factor	$C_{BBtree_{post}}$ ($tCO_2e\ ha^{-1}$)	$C_{P,post,u,i}$ ($tCO_2e\ ha^{-1}$)	Reference
Subsistence & other land use	77.6	37%	28.7	106.2	Table 6.3 PNG FREL, Table 5.1, IPCC 2007

5.3.2 Monitoring forest degradation due to illegal logging or fuelwood and charcoal

For monitoring forest degradation due to illegal logging or fuelwood and charcoal, VCS module VMD0015 will be followed.[1]

The Tavolo Community has gone through a participatory process to develop its Sustainable Land Use Plan agreeing on the various user zones (see Figure 1, Section 1.12) and its Community Conservation Laws. For the monitoring and enforcement of the SLUP and Conservation Laws a Community Conservation Law Committee has been established, at all three villages (Mukus, Tavolo and Lausus). This Committee monitors the compliance by Tavolo Community members and neighbouring clans on an ongoing basis. There is no charcoal production or sales done anywhere in PNG. Firewood is collected from food garden areas. The potential for illegal

[1] VCS Module VMD0015 REDD Methodological Module: Methods for Monitoring of GHG Emissions and Removals (M-MON)

extraction of trees to occur, at a larger scale than an incidental tree felled for local house building purposes in the conservation zones is very low. This will be confirmed in the first annual project monitoring meeting between FORCERT and TCCA, and if this lack of potential pressure for these activities is confirmed, then degradation ($\Delta C_{PRJ,Deg\_IT,i,t}$) can be assumed to be zero and no monitoring is needed. The Community Conservation Law Committee monitoring will be ingoing and the FORCERT-TCCA project monitoring meetings will be held every year.

If there would be a potential for degradation activities, then limited field sampling must be undertaken. First, the area that is potentially subject to degradation needs to be delineated ($A_{Deg\_IT,i}$). An output of the PRA shall be a distance of degradation penetration from all access points (access buffer), such as roads and rivers or previously cleared areas, to the project area. The distance of degradation penetration will vary by form of degradation with a deeper penetration likely for illegal logging than for fuelwood/charcoal.

The area subject to degradation shall be delineated ($A_{Deg\_IT,i}$) based on an access buffer from all access points, such as roads and rivers or previously cleared areas, to the project area, with a width equal to the distance of degradation penetration. $A_{Deg\_IT,i}$ shall be sampled by surveying several transects of known length and width across the access-buffer area (equal in area to at least 1% of $A_{Deg\_IT,i}$) to check whether new tree stumps are evident or not. If there is little to no evidence that trees are being harvested (see next paragraph on how to estimate emissions and use tool T- SIG to determine if significant or not) then degradation can be assumed to be zero and no monitoring is needed. This limited sampling must to be repeated each time the PRA indicates a potential for degradation.

If the limited sampling does provide evidence that trees are being removed in the buffer area, then a more systematic sampling must be implemented. The sampling plan must be designed using plots systematically placed over the buffer zone so that they sample at least 3% of the area of the buffer zone ($A_{Deg\_IT,i}$). The diameter of all tree stumps will be measured and conservatively assumed to be the same as the DBH. If the stump is a large buttress, identify several individuals of the same species nearby and determine a ratio of the diameter at DBH to the diameter of buttress at the same height above ground as the measured stumps. This ratio will be applied to the measured stumps to estimate the likely DBH of the cut tree. The above and below ground carbon stock of each harvested tree must be estimated using the same allometric regression equation and root to shoot ratio used in the module for estimating the carbon pool in trees (CP- AB) in the baseline scenario.[1] The mean above and below ground carbon stock of the harvested trees is conservatively estimated to be the total emissions and to

[1] If species-specific equations are used in the baseline and species cannot be identified from stumps then it shall be assumed that the harvested species is the species most commonly harvested for the specific degradation purpose (e.g. fuelwood, charcoal or timber). A PRA shall be used to determine the most commonly harvested species.

all enter the atmosphere. This sampling procedure shall be repeated every 5 years and the results annualized by dividing the total emissions by five.

Where the PRA or the limited sampling indicate no degradation occurring:

$$\Delta C_{PRJ,Deg\_IT,i,t} = 0$$

Where the PRA and the limited sampling indicate degradation is occurring:

$$\Delta C_{PRJ,Deg\_IT,i,t} = A_{Deg\_IT,i} * \frac{C_{Deg\_IT,i,t}}{AP_i} \quad (21)$$

Where:

$\Delta C_{PRJ,Deg\_IT,i,t}$	Net carbon stock change as a result of forest degradation through extraction of trees for illegal timber or fuelwood and charcoal in the project area in the project scenario in stratum *i* at time *t*; tCO_2e
$A_{Deg\_IT,i}$	Area potentially impacted by degradation processes in stratum *i*; ha
$C_{Deg\_IT,i,t}$	Biomass carbon of trees cut and removed through degradation process from plots measured in stratum *i* at time *t*; tCO_2e
AP_i	Total area of degradation sample plots in stratum *i*; ha
i	1, 2, 3 … *M* strata
t	1, 2, 3, … *t** years elapsed since the start of the REDD project activity

5.3.3 Monitoring forest degradation due to selective logging under FSC

The impact of any small-scale portable sawmilling operation taking place in the production forest area of the Tavolo land use plan area will be monitored by FORCERT as part of their FSC Group certificate monitoring plans. For this monitoring VCS module VMD0015 will be followed.

The calculation procedure for estimating net ex post emissions and removals related to selective logging activities in the project case will be equal to the summed emissions arising from selective logging operations. Emissions resulting from selective logging may be omitted if they are deemed de minimis through the use of the module T-SIG.

The net emissions from small-scale FSC logging in the project case are estimated by combining:

- Emissions arising from logging gap: encompass emissions from felling timber tree and emissions from incidental damage caused by falling timber tree,
- Emissions from infrastructure: from constructing logging infrastructure for removal of timber, such as haul roads, skid trails and logging decks,
- Removals from long term wood products resulting from timber extraction

$$\Delta C_{PRJ,Deg-FSC,i,t} = \sum_{t=1}^{t^*} (C_{LG,i,t} + C_{LR,i,t} - C_{WP,i,t}) \quad (22)$$

Where:

$\Delta C_{PRJ,Deg-FSC,i,t}$ Net carbon stock change as a result of forest degradation due to selective logging of forest management areas possessing a FSC certificate in the project area in the project scenario in stratum *i* at time *t*; tCO_2e

$C_{LG,i,t}$ Actual net project emissions arising in the logging gap in stratum *i* at time *t*; tCO_2e

$C_{LR,i,t}$ Actual net project emissions arising from logging infrastructure in stratum *i* at time *t*; tCO_2e

$C_{WP,i,t}$ Carbon stock in wood products pool from stratum *i* at time *t*; tCO_2e

i 1, 2, 3 … *M* strata

t 1, 2, 3, … *t** years elapsed since the start of the REDD project activity

FORCERT will undertake annual monitoring of the small-scale sawmilling operation in the Tavolo production forest area, to collect information on area, number of trees and timber volume harvested, and m^3 of sawn timber produced. At least every five (5) years FORCERT will further monitor the operation to determine its impact through determining the number and size of logging gaps, and the extend of logging infrastructure.

5.3.4 Monitoring leakage

All areas deforested by the baseline agent of deforestation will be monitored. Areas of deforestation may be anywhere in the host country. International leakage will not be tracked.

$$LKA_{planned,i,t} = A_{defLK,i,t} - NewR_{i,t} \quad (23)$$

Where:

$\mathrm{LKA_{planned,i,t}}$ The area of activity shifting leakage in stratum *i* in year *t* (ha)

$\mathrm{NewR_{i,t}}$ New calculated forest clearance by the baseline agent of the planned deforestation in stratum *i* in year *t* where no leakage is occurring; ha

$\mathrm{A_{defLK,i,t}}$ The total area of monitored deforestation by the baseline agent of the planned deforestation in stratum *i* in year *t*; ha

i 1, 2, 3, … *M* strata; unitless

t	1, 2, 3, … *t**	time elapsed since the start of the project activity; years

If $\mathrm{NewR_{i,t}}$ exceeds $\mathrm{A_{defLK,i,t}}$ then $\mathrm{LKA_{planned,i,t}}$ will be set as zero as positive leakage is not considered under the VCS.

All future operations by Mekar PNG Ltd will be monitored on an annual basis using information from the PNGi Forest Portal (www.pngiforest.org) on other operational licenses, in combination with information from Global Forest Watch (www.globalforestwatch.org) on actual sizes of forest areas cleared.

5.3.5 Baseline revision

The baseline of the Tavolo REDD Project will be revised after every 10 years during the project period. The procedure used to update the baseline will be the same as used for the baseline determination in this PD.

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APPENDIX 1 - MOU BETWEEN CCDA AND FORCERT LTD

<attached as pdf>

APPENDIX 2 – DDLL MUKUS-MELKOI PROJECT PROPOSAL

<attached as pdf>

APPENDIX 3 – KAKUNA-LOTE AGRO FORESTRY & REFORESTATION PLANTATION DEVELOPMENT PROJECT (FCA PROJECT PROPOSAL)

<attached as pdf>

APPENDIX 4 – KAKUNA-LOTE AGRO FORESTRY & REFORESTATION PLANTATION DEVELOPMENT PROJECT (FCA PROJECT MAP)

<also attached as jpeg>

APPENDIX 5 – NON-PERMAMNENCE RISK REPORT

<attached as pdf>

APPENDIX 6 – TAVOLO REDD PROJECT BOUNDARY (BOUNDARY OF 2019 BENCHMARK FOREST COVER)

<attached as kml and shapefile>

APPENDIX 7 – STANDARD OPERATING PROCEDURE FOREST INVENTORY TAVOLO

<attached as pdf>

APPENDIX 8 – QUANTIFICATION OF GHG EMISSION REDUCTIONS AND REMOVALS TAVOLO

<attached as Excel file>