KATINGAN PEATLAND RESTORATION AND CONSERVATION PROJECT

Document prepared by PT. Rimba Makmur Utama

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Validation/Verification Body	Environmental Services, Inc.
GHG Accounting/ Crediting Period	01-November-2010 – 31-October-2070; 60 years
Monitoring Period of this Report	VCS: 01-January-2017 - 31-December-2017; 1 year CCB: 01-November-2015 – 31-December 2017; 2 years
History of CCB Status	Validated: 14-October-2016 First verification: 14-October-2016

Gold Level Criteria	The Katingan Project seeks to achieve all climate, community and biodiversity Gold Level criteria. A) Climate Gold Standard The Katingan Project has provided significant support and benefits to the project-zone communities in coping with and adapting to the expected impacts of climate change in coming years. The project has strengthened community and biodiversity resilience through various project activities, including restoration of peat swamp ecosystems and reforestation, climate resilient infrastructural development, adjustment and diversification of agroforestry and agricultural practices, capacity building for forest management and non-timber forest product development, and the implementation of integrated natural disaster prevention and management systems. B) Community Gold Standard The project zone is qualified as a rural area of a high concentration of population living under the national poverty line, and the Katingan Project delivers significant well-being benefits to smallholders/community members. The project has benefited communities through a variety of socio-economic activities which also target the most vulnerable and marginalized community members. These programs are designed to lift the poorest out of poverty by engaging them in community-based business development such as microfinance, women's empowerment, sustainable agroforestry, renewable energy development, and NTFPs. All community programs are designed and implemented through community participation, transparent decision-making processes based on mutual trust, and proper management of project activities. C) Biodiversity Gold Standard The Katingan Project is qualified as a Key Biodiversity Area (KBA), and conserves and protects the biodiversity of global significance. The project has generated exceptional biodiversity benefits based on multiple achievement of the criteria defined in the CCB Standards Third Edition. This includes five species considered critically endangered, 11 considered endangered, and 36 species considered vulnerable. For two of these at least, Orangutan and Proboscis Monkey, the project zone is estimated to hold over 5% of the entire global population.

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1 SUMMARY OF PROJECT BENEFITS

1.1 Unique Project Benefits

Outcome or Impact	Achievements during the Monitoring Period	Section	Achievements during the Project Lifetime
1) Climate: Protection and restoration of unique peat swamp forest habitat.	Avoided emissions equivalent to 4,830,326 tonnes of carbon dioxide.	3	Avoided emissions equivalent to 21,918,171 tonnes of carbon dioxide.
2) Community: Creating sustainable livelihoods and improving well-being in 34 villages surrounding the project area	Training, technical assistance, financial support, employment opportunities, awareness raising and participatory management provided to over 7,000 recipients.	4	Training, technical assistance, financial support, employment opportunities, awareness raising and participatory managed provided to over 11,000 recipients.
3) Biodiversity: Protecting and enhancing the biodiversity of a Key Biodiversity Area.	Continued protection of the populations of five critically endangered, 11 endangered, and 36 vulnerable species; including 5% of the world's population of Orangutan.	5	Protection of the populations of five critically endangered, 11 endangered, and 36 vulnerable species; including 5% of the world's population of Orangutan

1.2 Standardized Benefit Metrics

Category	Metric	2016-17	Section	2010-17
GHG emission reductions & removals	Net estimated emission removals in the project area, measured against the without-project scenario	9,169,559	3	21,918,171
	Net estimated emission reductions in the project area, measured against the without-project scenario	Not yet evaluated	3	Not yet evaluated
Forest cover	For REDD projects: Number of hectares of reduced forest loss in the project area measured against the without-project scenario	11,669	3	33,805
	For ARR projects: Number of hectares of forest cover increased in the project area	496	3	496

Category	Metric	2016-17	Section	2010-17
	measured against the without-project scenario			
Improved land management	Number of hectares of existing production forest land in which IFM practices have occurred as a result of the project's activities, measured against the without-project scenario	N/A	N/A	N/A
	Number of hectares of non-forest land in which improved land management has occurred as a result of the project's activities, measured against the without-project scenario	5,022	3	5,022
Training	Total number of community members who have improved skills and/or knowledge resulting from training provided as part of project activities	298	2	945
	Number of female community members who have improved skills and/or knowledge resulting from training provided as part of project activities of project activities	27 (9%)	2	319 (34%)
Employment	Total number of people employed in of project activities, expressed as number of full time employees	127	2	127
	Number of women employed in project activities, expressed as number of full time employees	11 (9%)	2	11 (9%)
Livelihoods	Total number of people with improved livelihoods or income generated as a result of project activities	1,102	4	2,740
	Number of women with improved livelihoods or income generated as a result of project activities	351 (32%)	4	Data not collected
Health	Total number of people for whom health services were improved as a result of project	200	4	200

Category	Metric	2016-17	Section	2010-17
	activities, measured against the without-project scenario			
	Number of women for whom health services were improved as a result of project activities, measured against the without-project scenario	112 (56%)	4	112 (56%)
Education	Total number of people for whom access to, or quality of, education was improved as a result of project activities, measured against the without-project scenario	51	4	51
	Number of women and girls for whom access to, or quality of, education was improved as a result of project activities, measured against the without-project scenario	34 (67%)	4	34 (67%)
Water	Total number of people who experienced increased water quality and/or improved access to drinking water as a result of project activities, measured against the without-project scenario	96	4	256
	Number of women who experienced increased water quality and/or improved access to drinking water as a result of project activities, measured against the without-project scenario	48 (50%)	4	128 (50%)
Well-being	Total number of community members whose well-being was improved as a result of project activities	7,412	4	11,929
	Number of women whose well-being was improved as a result of project activities	1,008 (14%)	4	Data not collected
Biodiversity conservat.	Change in the number of hectares significantly better managed by the project for biodiversity conservation,	149,800	5	149,800

Category	Metric	2016-17	Section	2010-17
	measured against the without-project scenario			
	Number of globally Critically Endangered or Endangered species benefiting from reduced threats as a result of project activities, measured against the without-project scenario	16	5	16

2 GENERAL

2.1 Project Description

2.1.1 Implementation Description

The Katingan Project's goal is to protect and restore 149,800 hectares of peatland ecosystems; to offer local people sustainable sources of income; and to tackle global climate change – all based on a solid business model.

The project area stores vast amounts of CO_2, and plays a vital role in stabilizing water flows, preventing devastating peat fires, enriching soil nutrients and providing clean water. It is rich in biodiversity, being home to large populations of many high conservation value species, including some of the world's most endangered; such as the Bornean Orangutan (*Pongo pygmaeus*) and Proboscis Monkey (*Nasalis larvatus*). It is surrounded by villages for which it supports traditional livelihoods including farming, fishing, and non-timber forest products harvesting.

This monitoring report covers the period from November 1st, 2015 through December 31st, 2017 in respect of CCB, and January 1st, 2017 through December 31st, 2017 in respect of VCS. During this time, the project continued to build upon activities conducted during the first monitoring period and introduced new activities as required. Conservation and reforestation efforts focused on fire prevention and awareness training and seedling nursery development. Community activities included ongoing support of community-based businesses and microfinance operations, introduction of coconut sugar operations, piloting a new sustainable energy program, advancing the community participatory planning efforts, and funding public health clinics.

During the 2017 monitoring period, the project avoided the emission of 4,830,326 tonnes CO_2e. Zero leakage was recorded, and non-permanence risk was determined to be the minimum. No significant events occurred that might have affected emission reductions. A small amount of deforestation occurred in 2017 (around 22ha) and there was a relatively small increase in the area affected by degradation (1,510ha), but losses in terms of emissions (against prior predictions) were small in comparison to the total credits generated.

2.1.2 Project Category and Activity Type

The Katingan Project is categorized as an Agriculture, Forestry and Other Land Use (AFOLU) project under the Reduced Emissions from Deforestation and Degradation (REDD) project category. The project activities are categorized under the VCS as a combination of REDD+WRC and ARR+WRC; specifically, as Avoiding Planned Deforestation (APD) and Reforestation (ARR), in combination with Conservation of Undrained and Partially-drained Peatland (CUPP) and Rewetting of Drained Peatland (RDP) activities. This is not a grouped project.

2.1.3 Project Proponent(s)

The Katingan Project is developed and managed by PT. Rimba Makmur Utama (RMU). By collaborating with the project-zone communities and partner organizations, PT. RMU takes full responsibility to manage, finance and implement project activities for the duration of the project. The table below shows the project proponent's information.

Organization name	PT. Rimba Makmur Utama (PT. RMU)
Contact person	Dharsono Hartono
Title	Director
Address	Menara BCA, Fl. 45, Jl. MH Thamrin No. 1, Jakarta, Indonesia
Telephone	Phone: +62 (0)21 2358 4777; Fax +62 (0)21 2358 4778; Mobile: +62 (0)816-976-294
Email	dharsono@ptrmu.com

2.1.4 Other Entities Involved in the Project

Key implementing and technical partners are shown below.

Organization name	Yayasan Puter Indonesia
Role in the project	Community development activities, including: • Participatory land-use mapping • Community consultations and REDD+ awareness building • Livelihood programs
Contact person	Andaman Muthadir
Title	Program Manager
Address	Jalan Ahmad Yani II, Nomor 11A, Bogor, 16151, Indonesia
Telephone	Tel/Fax: +62 (0)251-831-2836
Email	andaman.muthadir82@gmail.com

Organization name	Wetlands International
Role in the project	Wetlands International leads technical aspects of MRV-related activities, including: • MRV methodology and platform development for monitoring above- and below-ground carbon emissions; • The provision of technical expertise including biodiversity management, fire management, land-use management and community development
Contact person	I. Nyoman Suryadiputra
Title	Director Indonesia Programme, Wetlands International
Address	Indonesia Programme office: Jl. Bango 11, Bogor, 16161, Indonesia
Telephone	+62 251 8312189
Email	nyoman@wetlands.or.id

Organization name	Permian Global

Role in the project	Technical advice and support, including: • MRV methodology design and technical support • Remote sensing • Carbon commercialization and marketing • Technical management advice including protection and restoration methods
Contact person	Dr. Nick Brickle
Title	Asia Director
Address	Savoy Hill House, 7-10 Savoy Hill, London, WC2R 0BU, United Kingdom
Telephone	+44 20 3617 3310
Email	info@permianglobal.com

2.1.5 Project Start Date (G1.9)

1st November 2010.

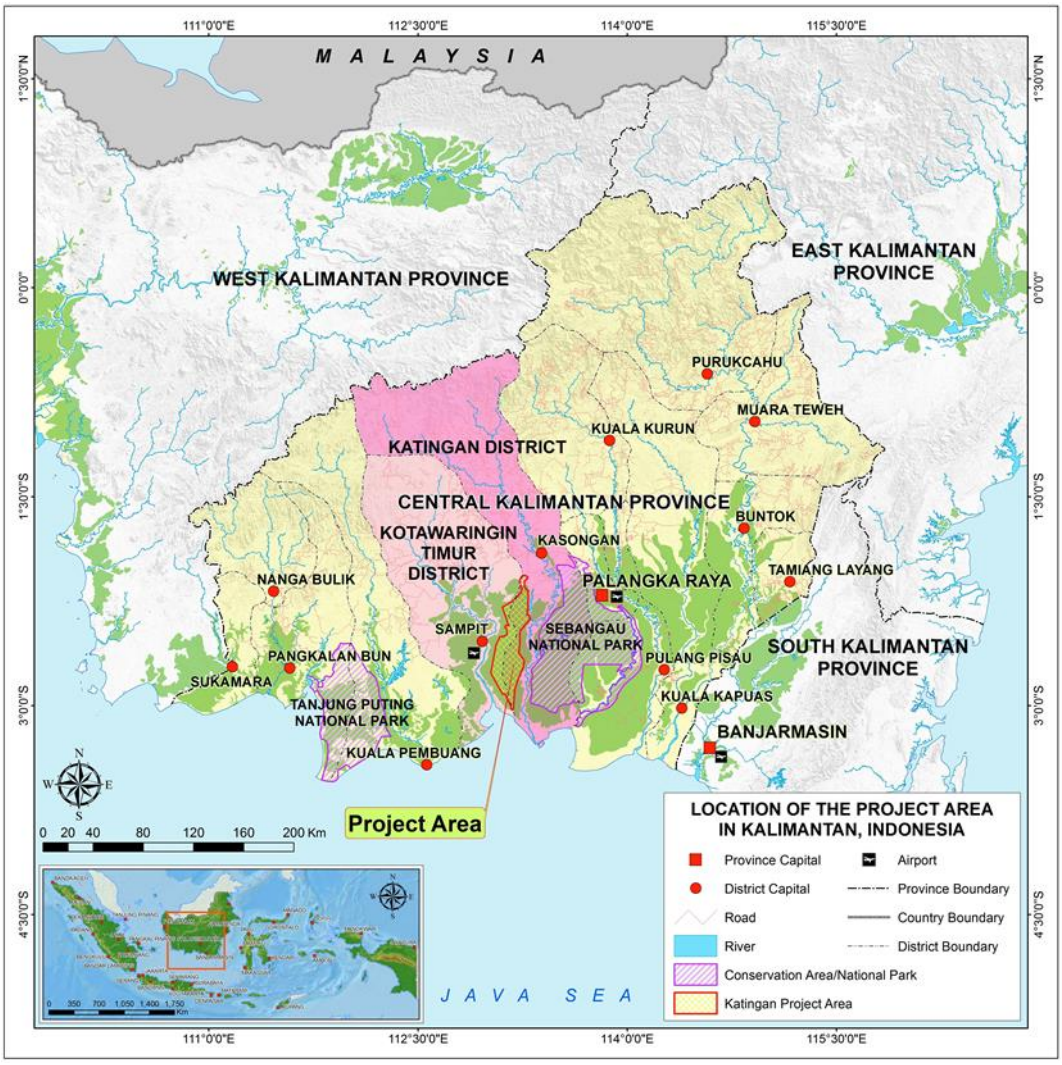
2.1.6 Project Crediting Period (G1.9)

The duration of the VCS project crediting period is 60 years, beginning on the project start date of 01-November-2010 and ending on 31-October-2070

2.1.7 Project Location

The project is located in the Mendawai, Kamipang, Seranau and Pulau Hanaut sub-districts of Katingan and Kotawaringin Timur districts, Central Kalimantan Province, Republic of Indonesia (see Map 1). The project lies within the following geographic boundaries: S2° 32’ 36.8" to S3° 01' 43.6" E113° 00' 29.7" to E113° 18' 57.4".

Map 1. Location of the Katingan Project in Kalimantan, Indonesia



2.1.7.1 Project Area

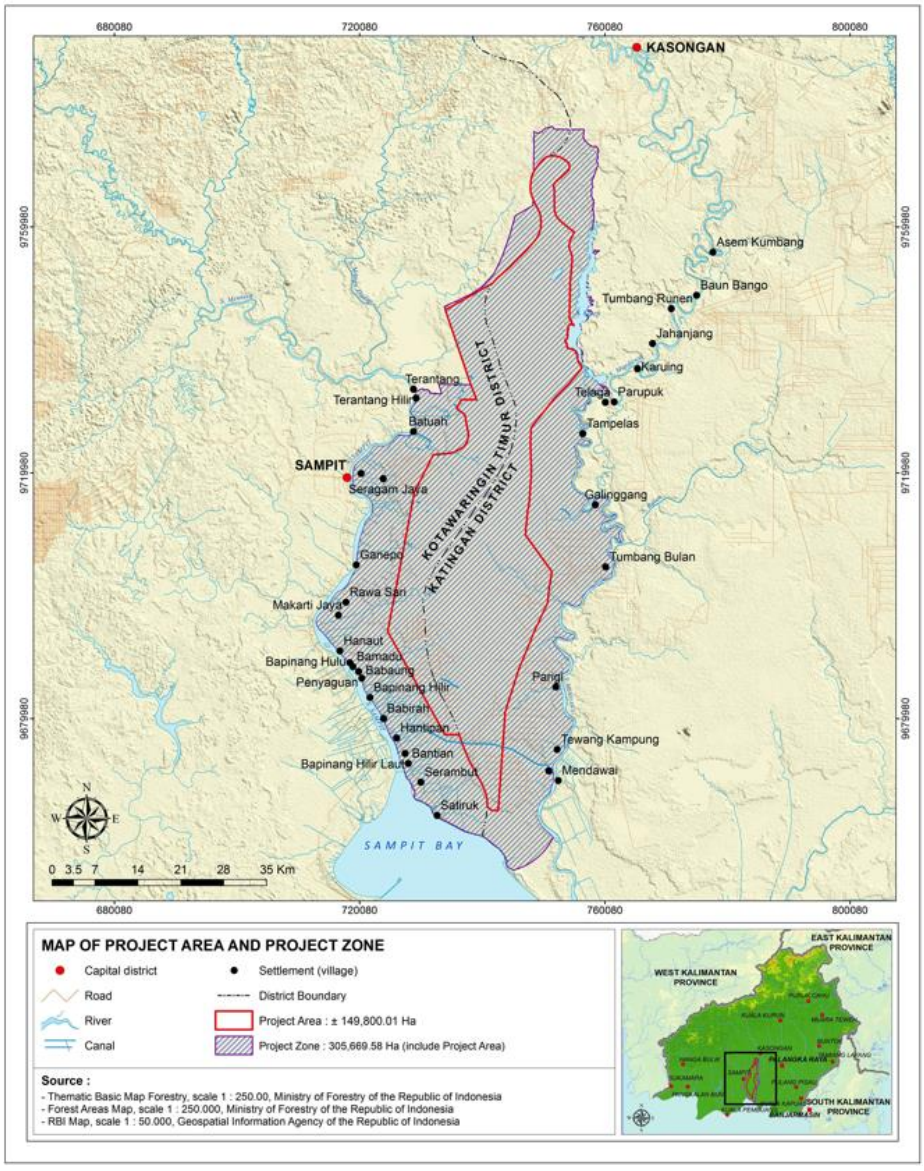
The project area encompasses 149,800 ha of land with a total perimeter of 254.12 km (see Map 2). The project area boundary delineates the area in which GHG emission reductions are quantified.

The project area is in the process of being physically demarcated using concrete and wooden marker posts, in line with prevailing regulation concerning Ecosystem Restoration Concessions: where the bordering land-use is of an equivalent legal status (i.e. Production Forest/Hutan Produksi), and/or the border marks the edge of the concession, then wooden marker posts every 100m should be used (Directorate General Forest Planology Decree Number P.5/VII-KUH/2011). Where the bordering land use is a different status (e.g. Conversion Forest/Hutan Produksi Konversi), then concrete posts every 700-1100m should be used (Directorate General Forest Planology Decree Number: P.6/VII-KUH/2011). By the end of this monitoring period 143.89km of the project area boundary has already been physically demarcated, with the remainder scheduled to be completed by mid-2018.

2.1.7.2 Project Zone

The wider project zone represents the extent of the area in which the project activities are implemented. It extends to the banks of the Mentaya River in the west and the Katingan River in the east, and encompasses bordering areas to the north and south of the project area, covering an area of 305,669 ha (see Map 2). The project zone was selected based on the dominant ecological, landscape and socio-economic features and in particular to include the main river catchments and to encompass the land of 34 villages likely to be affected by the project. No additional areas beyond the project zone are expected to be directly affected by the project.

Map 2. The location of the project area and project zone



2.1.8 Title and Reference of Methodology

The Katingan Project applies the latest version of approved VCS methodology VM0007 (version 1.5), including all applicable modules as detailed in this report, and the CCB Standards, Third Edition.

2.1.9 Other Programs (G5.9)

Emission Trading Programs and Other Binding Limits: During this monitoring period, activities carried out by the project are not covered by any emission trading programs or other binding limits in relation to GHG emissions. Presidential Decree No. 61/2011 regarding the National Action Plan for Reducing Green House Gas Emissions requires government agencies to set reduction targets for specific sectors and identify plans for achieving these goals. The project is not currently subject to these targets nor will its reductions be used to demonstrate achievement of the agency goals.

Other Forms of Environmental Credit: The Katingan Project currently only seeks carbon credits under the VCS program, and has not received other forms of environmental credits from its activities.

Participation under Other GHG Programs: The Katingan Project has not been registered under any emissions trading programs, but may seek to do so in the future. In this case applicable requirements in the VCS Standard, AFOLU Requirements, and the Registration and Issuance process will be followed. The project will not claim credit for the same GHG emission reduction or removal under the VCS Program and another GHG program.

2.1.10 Sustainable Development

Indonesia's sustainable development priorities are now closely aligned with the UN Sustainable Development Goals. Indonesia assisted in the creation of the UN SDGs and has expressed its strong commitment to the 2030 Agenda and the SDGs overall. The current President Joko Widodo instructed the National Development Planning Agency (Bappenas), to map the goals and targets of Indonesia's national plan to the SDGs, finding that 108 out of 169 SDG targets are addressed already in the national plan. A Presidential Regulation in now being drafted to establish governance mechanisms for the SDGs, to guide mainstreaming of the SDGs into sectoral development plans and budgets, and to ensure provincial governments lead implementation of the SDGs at their level. The Katingan Project supports the achievement of the SDGs as outlined in Table 1. All project data is available to support monitoring efforts at the provincial and national levels.

Table 1. Katingan project support of UN SDGs

No poverty	Overarching commitment to provide demonstrable positive livelihood benefits to all surrounding communities
Zero hunger	Social programs to increase food security, sustainable agriculture and community resilience
Good health and well-being	Project activities to improve local public health, sanitation and access to health care facilities
Quality education	Vocational training, improved access to education and provision of scholarships

Gender equality	A range of activities designed to deliberately empower women, notably through the provision of micro-finance
Clean Water and Sanitation	Watershed protection though the protection of peat swamp aquifers. Activities to improve sanitation and access to clean drinking water
Affordable and clean energy	Provision of training and resources to increase usage of renewable energy sources, in particular solar lighting
Decent work and economic growth	Direct employment of local people, extensive support for the development of small- to medium-sized local enterprises
Industry, Innovation and Infrastructure	Innovative model of sustainable natural resources management and benefit sharing. Improved local infrastructure and support for local enterprises
Reduced Inequality	Enshrined principles of inclusive and collaborative management. Activities specifically targeted towards marginalized groups.
Responsible consumption and production	Commitment and extensive activities to promote sustainable agriculture, aquaculture and agroforestry in villages surrounding the core project area
Climate Action	Central objective. Anticipated average avoided emissions of 7,451,846 tonnes of CO_2 equivalent annually; equivalent to the avoided emission of 447,110,760 tonnes of CO_2 over the project's first 60 years
Life on Land	Protection and restoration of one of Indonesia's largest remaining natural peat forests, supporting incredible biodiversity
Peace, Justice and Strong Institutions	Commitment to collaborative and inclusive management, capacity building at all levels and strengthening public-sector institutions and processes
Partnerships for the Goals	Full commitment to working in partnership with all stakeholders

2.2 Project Implementation Status

2.2.1 Implementation Schedule (G1.9)

The project implementation schedule and major project milestones are listed in the tables below (Table 2 & 3).

Table 2. Implementation schedule

Start Date	Activity
2010	APD+CUPP
2016	Reforestation (ARR)
2016	Peatland rewetting and conservation (RDP)
2014	Fire prevention and suppression
2014	Protection and law enforcement
2014	Species conservation and habitat management

2010	Participatory planning
2010	Community-based business development
2010	Microfinance development
2010	Sustainable energy development
2017	Improved public health and sanitation services
2014	Basic education support

Table 3. Major project milestones

Year	Milestones in the project's development and implementation
2010	Project Begins
2010	Participatory planning process begun (ongoing process)
2015	Data collection, methodology revision, project documentation
2015 - 2016	VCS/CCB monitoring events and reports generated
2016	Project VCS/CCB Validation and Verification, dissemination of Reports
2014 - 2018	Nursery established
2016 - 2017	Canal blocking begun
2018	Project VCS/CCB Validation and Verification, dissemination of Reports
2020	VCS /CCB monitoring events and reports generated
2015 - 2017	Boundary demarcation begun
2021	Project VCS/CCB Verification dissemination of Verified Monitoring Reports
2025	VCS/CCB monitoring events and reports generated
2026	Project VCS/CCB Verification dissemination of Verified Monitoring Reports
2030	VCS/CCB monitoring events and reports generated
2031	Project VCS/CCB Verification dissemination of Verified Monitoring Reports
2035	VCS/CCB monitoring events and reports generated
2036	Project VCS/CCB Verification dissemination of Verified Monitoring Reports
2040	VCS/CCB monitoring events and reports generated
2041	Project VCS/CCB Verification dissemination of Verified Monitoring Reports
2045	VCS/CCB monitoring events and reports generated
2046	Project VCS/CCB Verification dissemination of Verified Monitoring Reports
2050	VCS/CCB monitoring events and reports generated
2051	Project VCS/CCB Verification dissemination of Verified Monitoring Reports
2055	VCS/CCB monitoring events and reports generated
2056	Project VCS/CCB Verification dissemination of Verified Monitoring Reports
2060	VCS/CCB monitoring events and reports generated
2061	Project VCS/CCB Verification dissemination of Verified Monitoring Reports
2065	VCS/CCB monitoring events and reports generated
2066	Project VCS/CCB Verification dissemination of Verified Monitoring Reports
2070	VCS/CCB monitoring events and reports generated

2071	Project VCS/CCB Verification dissemination of Verified Monitoring Reports

2.2.2 Methodology Deviations

No methodology deviations were made during this monitoring period.

2.2.3 Minor Changes to Project Description (*Rules* 3.5.6)

None.

2.2.4 Project Description Deviations (*Rules* 3.5.7 – 3.5.10)

One project description deviation was made during this monitoring period, in common with previous periods: The Global Forest Watch data used for a portion of the leakage assessment was not yet available for the 2017 calendar year, and so in order to complete the assessment, the project used the most conservative value from the previous five years. Additional detail is provided in Section 3.

2.2.5 Grouped Projects

This is not a grouped project.

2.2.6 Risks to the Project (G1.10)

The project manages risks to project benefits during the project lifetime in a variety of ways. These have been implemented as planned in the PD and are summarized in the non-permanence risk assessment conducted by the project (Appendix 1). This assessment was designed to address the risk to climate benefits but is equally applicable to the risks associated with community and biodiversity benefits. No additional risks to project benefits were identified.

2.2.7 Benefit Permanence (G1.11)

The Katingan Project is based on a 60-year concession license, extendable to 100 years. Project benefits are expected to extend beyond this time scale. The effective protection status of the forest and peatlands is anticipated to be maintained and extended, either through a further concession license or directly under state ownership as the global importance of the stored carbon stocks and biodiversity are fully recognized as a result of the project. The project's close working relationship with the government established before the project began and strengthened during this monitoring period will support this outcome. In parallel, the future actions of the project to restore both hydrology and degraded areas will result in the project area being more resilient to the threat of fire. Similarly, activities targeting community benefits have been and will continue to be designed to be managed in the future by the local communities themselves, without the need for further external interventions. The community work completed during this monitoring period and outlined in other portions of this report demonstrates this commitment. Ensuring the communities are able to undertake and manage the activities themselves is the most secure means of ensuring the activities will continue even after project's lifetime. Finally, the project itself is anticipated to set an example of sustainable land use management in the region, leading to wider adoption of the practices it is pioneering.

The project has and will continue to offer tours to government agencies, other non-profits and any other groups interested in learning about its activities in order to spread best practices and lessons learned throughout the region. In this way the Katingan Project is and will continue to contribute to a wider region managed more sustainably with respect to carbon emissions, biodiversity conservation and equitable development of local communities.

2.3 Stakeholder Engagement

2.3.1 Stakeholder Access to Project Documents (G3.1)

The Katingan Project publicizes a variety of project documentation and monitoring plans in both Indonesian and English languages through appropriate means by which local communities and stakeholders can have the opportunity to provide comment. They include a combination of media such as newsletters, workshops, meetings, notice boards and the project website.

2.3.2 Dissemination of Summary Project Documents (G3.1)

A summary of the Monitoring Report has been prepared in the Indonesian language and will be disseminated to the local stakeholders for their comments, as with previous Monitoring Reports and the project's PDD. The summary in both English and Indonesian languages will also be available on the CCB website for the public comment period to allow a wider range of individuals to comment if they wish to do so.

2.3.3 Informational Meetings with Stakeholders (G3.1)

The Katingan Project holds regular meetings with stakeholders, on a wide variety of subjects, in a wide range of fora. At the community-level alone, the project held 350 separate meetings during this reporting period, attended by over 5,500 people. These meetings are all summarized in Appendix 2, which serves as a reference for this section, and subsequent sections referencing all forms of stakeholder or community meetings, engagement and consultation. Further details are available on all such events on the project's database (including attendance sheets, minutes, further notes, etc). The subject of these meetings has ranged from the very general (the project's plans, publication of monitoring reports, general information on the project's legal basis, etc) to the very specific (individual village participatory plans, fire management, agroforestry development, etc)

In addition to informational meetings at the community level, the project has conducted and participated in many stakeholder meetings at the national, provincial and district levels, providing information on the ongoing operation and future plans of the project and disseminating information on the ecosystem restoration concession concept.

2.3.4 Community Costs, Risks, and Benefits (G3.2)

During all consultations with communities, strenuous efforts have been made to ensure that adequate, understandable, honest and accurate information is provided as a basis for any decisions, including information on costs, risks and benefits. This process has been ensured by a number of means, including:

- A written Standard Operating Procedure that all project staff must follow when working with local communities. This document describes the need to ensure any information is presented in a form that can be fully understood and in a timely manner to allow due consideration, together with guidelines as to how that should be achieved. A copy of the SoP is available on the project database.
- During the development of all written agreements (including MoUs and SPK agreements) a period of 1-2 months was allocated to allow each village time to discuss internally, raise questions, seek clarification and amend the draft agreement. This iterative process is evidenced by a comparison of early drafts of each agreement, written notes of feedback from each community, and the revised final agreements.
- The project has offered, and accepted requests from prospective villages to visit other project zone villages where activities have already been conducted in order to more clearly understand the nature of collaboration. This has allowed villages to directly raise questions to members of those villages about the project.

2.3.5 Information to Stakeholder on Verification Process (G3.3)

Communities have been (and will continue to be) informed about the ongoing process of VCS and CCB verification through a variety of channels, including by a combination of media such as newsletters, workshops and notice boards, through regular planning and evaluation meetings at the village level, and directly via the project's representative at the village level. As each verification event occurs, village communities are informed of the timing, provided copies of the relevant documents (including Indonesian translations), informed of how they can provide comments and input, and informed of the schedule for external audit field visits.

2.3.6 Site Visit Information and Opportunities to Communicate with Auditor (G3.3)

As above, village communities are (and will continue to be) informed of any upcoming visit by external verification auditors, including dates and times as appropriate. They are encouraged to speak directly and freely to the auditors, and to voice any opinions they hold regarding the project. They are also informed as to how they can provide written comments via the grievance process (see below) or via the CCB website and public comment period. During the field visit, project staff work with the communities and auditors to schedule time for the two to interact without project staff present.

2.3.7 Stakeholder Consultation (G3.4)

As described in Section 2.3.3, the project has conducted 350 separate meetings with village community stakeholders, reaching over 5,500 participants. A full list of all such meetings is provided as Appendix 2. Further details are available on all such events on the project's database (including attendance sheets, minutes, further notes, etc). The vast majority of these meetings, whether general in nature or highly specific, revolve around open discussion, evaluation and future planning based on consensus. The very activities that are supported are borne out of such discussion and the direct input of village communities. This can be seen quite clearly by the different approaches and plans being followed by different villages. There is no 'one size fits all' approach imposed by the project. One village may see its future development focused on cattle breeding, alternative energy and improved agriculture, while another may be pursuing a legal land claim within the project zone, improved health care and

better agroforestry practice. The project team take this fully on board and seek to tailor a package of assistance to the needs of each village.

2.3.8 Continued Consultation and Adaptive Management (G3.4)

As above, ongoing consultation and adaptive management is a central philosophy to the Katingan Project. We seek to provide assistance to village communities that adapts to their changing needs and to changing circumstances; be this changes in regulation, economic environment, or simply a desire to experiment. Since the project was started this adaption can be seen in the increasing range of village level collaborations with which the project is now involved, and also by the discontinuation of some activities that were collectively agreed not to be delivering, or to have lost support. Some of the new activities that have become a major focus in 2016-17 include the project's support for two forms of legal land tenure that communities can seek for land within the project zone (Hutan Desa and Hutan Tanaman Rakyat), support for agriculture based on organic and no-fire methodologies, and support for improved livelihoods through coconut sugar production – none of these activities were anticipated at the outset of the project. Conversely, some activities that previously were the focus of support, such as salvage timber collecting and solar lighting have been reduced, in response to community desires.

2.3.9 Stakeholder Consultation Channels (G3.5)

At all times the project has sought to ensure consultations and participatory processes have been targeted directly at those affected by the issue under consideration, and through the legitimate representation relevant to that issue. The specific target of any given consultation depends on the matter at hand. In the case of an issue that affects all communities such as the project's work plan or latest monitoring report, the target audience is all community members. The information may be presented formally at the level of the village's administration, before being disseminated more widely so as to be accessible to all and to ensure all appropriate community subgroups receive the information and have an opportunity to ask questions or provide comments. In the case of more specific issues that concern a specific group such as a village enterprise group (e.g. a 'BUMDes' of 'KSM' group), the project team would first contact the administration of that group. Additional consultation would also be taken more widely as appropriate. For full details of all meetings and consultations held during the monitoring period, see Appendix 2. Further details are available on all such events on the project's database (including attendance sheets, minutes, further notes, etc).

2.3.10 Stakeholder Participation in Decision-Making and Implementation (G3.6)

Meeting types, structure and locations are always designed to enable the target audience to participate freely and to contribute openly. While many meetings take a quite formal structure, many, many more are informal in nature held with specific target groups at locations that ensure participants are at ease. This includes meeting at homes or other locations away from population centers to ensure travel time or distance does not prevent attendance. Project team members work within the cultural setting, but also create opportunities for participation that are more novel to this setting, such as women-only meetings.

2.3.11 Anti-Discrimination Assurance (G3.7)

As described below (Section 2.3.15) PT RMU has collated and defined all employment terms into a Staff Handbook. This handbook has, in turn, been submitted to the Ministry of Manpower for approval of its compliance with the law. Once approved, the Staff Manual was provided to all staff, together with a detailed explanation of the articles contained within and opportunity to raise any questions or concerns. All staff members were then asked to sign to indicate that they have received the manual and that they fully understand its contents (itself a requirement of manpower regulations). The staff manual includes a lengthy section (Section XII) that must be acknowledged by all staff relating to harassment, and defines and prohibits all forms of harassment based on race, color, religion, sex, age, sexual orientation, national origin or ancestry, disability, medical condition, marital status, veteran status, or any other protected status defined by law. It further defines and prohibits all forms of sexual harassment and states that in the case of all forms of harassment that the regulation extends not only to other staff members but to all beneficiaries and counterparts of the project. A full copy of the company regulation is available on request. To date, no staff have been sanctioned for infringement of these regulations, and no such grievances have been reported (See next section).

2.3.12 Grievances (G3.8)

The Katingan Project has adopted a formal grievance and redress procedure to prevent and handle any conflicts with and among communities and other stakeholders which may arise during the implementation of project activities.

One of the most important elements of the grievance redress procedure is to prevent potential conflicts before they arise. Such precautionary approaches include the implementation of FPIC-based community consultations, participatory planning and regular communication. This helps to identify underlying grievances well in advance and allows them to be addressed. The formal village level planning processes also help to strengthen the bargaining position of project-zone communities when dealing with other stakeholders.

If any grievances occur and are reported from the project-zone communities and/or other relevant stakeholders in the form of letters, short messages or verbal communication, PT. RMU will quickly respond to them by following the formal handling process as shown in Figure 1. All reported cases will be assessed to identify and verify the cause, actors and scale of grievances, and PT. RMU's verification team will recommend resolution options based on the feedback from the stakeholders. The degree of intervention and process will depend on the nature of disputes, and PT. RMU will continue to monitor the cases.

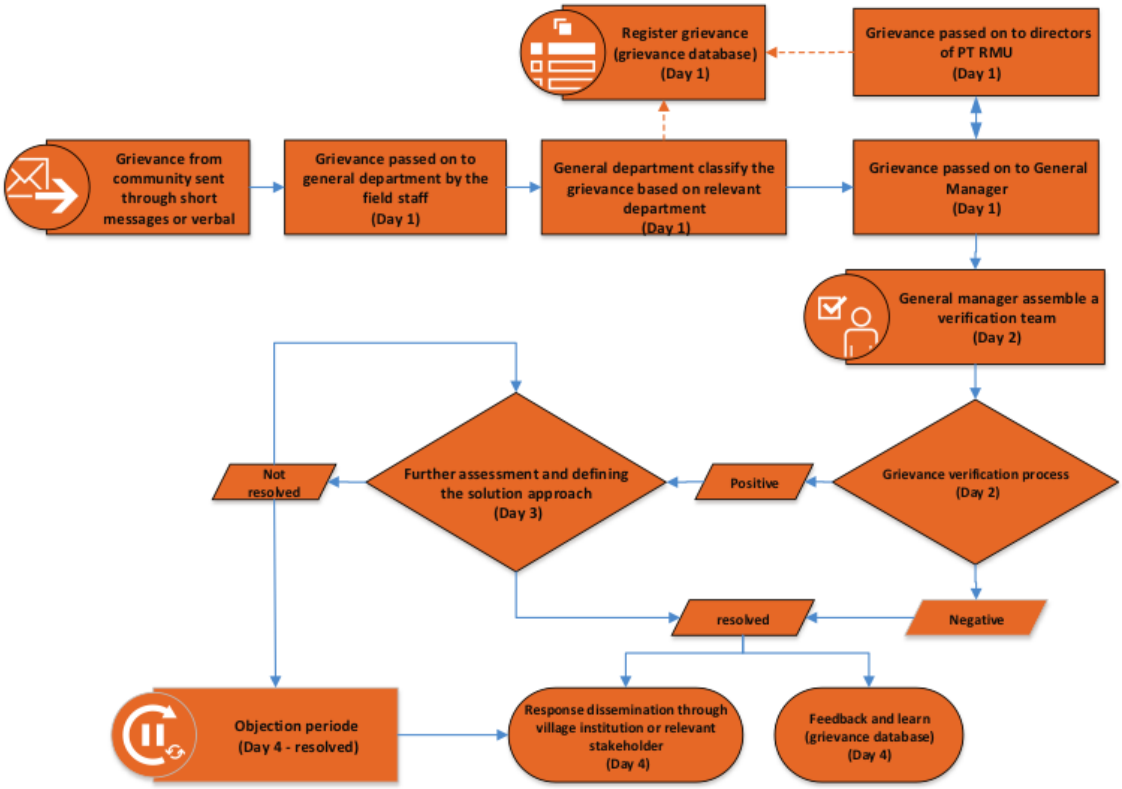
In the case where a grievance is not amicably resolved after this process, it will be submitted to an unbiased third party for a formal mediation and arbitration process, and subject to a hearing at which both disputing parties have the opportunity to testify. All cases will be referred and examined to the extent allowed by Indonesian laws and regulations of the relevant jurisdiction before decisions are made, and both parties are bound to satisfy the result of arbitration.

Local facilitators, community organizers and PT. RMU staff have all been contacted with questions or comments directly. Almost all of these questions have been addressed successfully without the formal grievance process. The formal process has been used to successfully resolve issues five times during the monitoring period demonstrating stakeholder

awareness of and engagement with the process. The issues and resolutions have been logged and disseminated to the affected individuals and communities.

A full list of grievances received during this monitoring period are listed in Appendix 3 (with individual names removed for data protection reasons). This lists the original grievance, how it was received, how it was responded to, and the eventual outcome (unless ongoing). Further details can be made available to auditors on request.

Figure 1. Grievance handling process



2.3.13 Worker Training (G3.9)

The Katingan Project remains committed to investment in training and capacity building, and this commitment extends from project staff to project-zone communities to local collaborators (both NGO and government). Such training has taken many forms, from work shadowing, internships, and *ad hoc* training to formal classroom style teaching. Table 4 below summarizes training held during this monitoring period. The table includes all formal training events, and also the attendance of project staff at external events and conferences. In the case of many community meetings, consultation and workshops, an element of 'training' was included in the agenda, but these are not included here, but are listed in full in Appendix 2.

Training for staff was developed based on identified needs and planning for specific activities. Training provided to communities has been based on needs identified during the participatory

planning process. For example, if a village proposed an aquaculture program, the project team and the village identified all of the training required for successful design and sustainable implementation of the program. The training became part of the work plan and the project team then ensured that the appropriate community members received the necessary training.

The project's ultimate goal is for the communities to be self-sufficient. As such, training includes project management, legal and administrative topics related to village planning and management, and financial planning and management. To ensure this capacity is not lost over time, internships, apprenticeships and work shadowing are also used to continue to train new individuals on these topics. In addition, change management is incorporated into the work plans to ensure the continued success of each program.

Table 4. Staff and community training events, showing date, theme and number of staff attended. Table includes both formal training, and staff attendance at conferences and external events where relevant.

Target	Date	Theme	Men	Women	Total
Staff	09/02/2016	Orientation	21	4	25
	10/02/2016	Orientation	22	3	25
	23/02/2016	Restoration	2	0	2
	01/03/2016	Restoration	2	1	3
	19/04/2016	Restoration	1	0	1
	05/05/2016	Agroforestry	24	0	24
	23/05/2016	Reforestation	26	1	27
	01/06/2016	Conflict Resolution	2	0	2
	20/06/2016	Gender Issues	20	5	25
	04/07/2016	Restoration	2	0	2
	08/12/2016	Gender Issues	9	2	11
	03/01/2017	Restoration	2	1	3
	06/02/2017	Conflict Resolution	35	5	40
	13/02/2017	Restoration	2	1	3
	17/04/2017	Climate change	2	0	2
	27/04/2017	Climate change	1	0	1
	22/05/2017	Climate change	2	1	3
	06/06/2017	Restoration	0	1	1
	07/06/2017	Fire Prevention	22	4	26
	10/07/2017	Collaborative Management	2	0	2
	13/07/2017	Restoration	2	2	4
	23/07/2017	Restoration	20	5	25
	26/07/2017	GIS	10	2	12
	05/08/2017	Fire Prevention	58	0	58
	13/09/2017	Drones	10	0	10
	17/09/2017	Alternative livelihoods	3	0	3
	20/09/2017	Biodiversity	3	0	3
	21/09/2017	Biodiversity	7	0	7

	24/10/2017	Climate change	0	1	1
	30/10/2017	Research methods	0	1	1
	08/11/2017	Restoration	2	1	3
	13/11/2017	Biodiversity	1	0	1
	24/11/2017	Biodiversity	1	0	1
	18/12/2017	Alternative livelihoods	4	0	4
Staff Sub-total			320	41	361
Community	07/09/2016	Fire Prevention	25	0	25
	14/10/2016	Agroecology	10	11	21
	27/01/2017	Agroecology	5	0	5
	22/05/2017	Agroecology	18	0	18
	01/06/2017	Agroecology	18	0	18
	20/07/2017	Fire Prevention	15	3	18
	21/07/2017	Fire Prevention	19	0	19
	22/07/2017	Fire Prevention	21	0	21
	21/08/2017	Livestock	2	1	3
	14/09/2017	Agroforestry	25	1	26
	16/09/2017	Agroforestry	27	1	28
	12/10/2017	Agroforestry	30	4	34
	16/10/2017	Agroecology	6	2	8
	06/11/2017	Agroecology	39	3	42
	10/11/2016	Coconuts	19	0	19
	30/01/2017	Coconuts	4	0	4
	05/02/2017	Coconuts	2	0	2
	14/02/2017	Coconuts	12	0	12
	01/04/2017	Coconuts	1	1	2
Community Sub-total			298	27	325
Total			618	68	686

2.3.14 Community Employment Opportunities (G3.10)

The Katingan Project seeks to invest in people; in particular those who are living within the project zone, the wider region, and Indonesia as a whole. It provides employment opportunities irrespective of gender, age, social class or ethnicity and other factors, although the priority goes to the project-zone communities. Staff or contractors, whether employed on a long-term or short-term basis, are all entitled to employment terms based on similar types of work and working conditions in the area of employment.

Open positions have been advertised in a variety of ways to reach a broad array of potential applicants. This includes online posting on job boards, announcements and postings in villages and Palangkaraya University, and through social media. Local facilitators and/or field staff visit all villages to announce job vacancy opportunities, so that the village government has an opportunity to discuss the position's requirements and qualifications. After this consultation process, villagers who fit the job description and meet the minimum requirements are recommended to the project team. This recruiting effort has resulted in over 88% of

project field staff (109 full-time equivalent) being hired from project zone communities, representing 76% of the total project personnel (127 full-time equivalent), 9% of which are women. All other staff are from Indonesia.

2.3.15 Relevant Laws and Regulations Related to Worker's Rights (G3.11)

The Katingan Project and PT. RMU operate in full compliance with Indonesia's labor laws and continues to strive to set an example of best practice with respect to employment terms, conditions and practices.

Indonesian labor law is principally governed by the Labor Law 13 of 2003. This represents the highest and most comprehensive set of regulations governing employment, including such issues as employment agreements, working hours, wages, paid leave, termination of employment, discrimination and grievance procedures. Below this is a raft of implementing legislation in the form of government regulations, presidential and ministerial decrees.

As per this body of regulation, PT RMU has collated and defined all employment terms into a Staff Handbook. This handbook has, in turn, been submitted to the Ministry of Manpower for approval of its compliance with the law. Every page and article of the manual is inspected and stamped and PT RMU has received a certificate of compliance from the Ministry (available on request). Once approved the Staff Manual was provided to all staff, together with a detailed explanation of the articles contained within and opportunity to raise any questions or concerns. All staff members were then asked to sign to indicate that they have received the manual and that they fully understand its contents (itself a requirement of manpower regulations). Certification of the Staff Manual is valid for two years, at which point the process must be repeated. PT RMU is also required to report its employment statistics to the Ministry of Manpower on an annual basis, under terms of the law regarding Compulsory Company Manpower Reporting (UU 7/1981). PT RMU is up-to-date and fully compliant with this requirement.

Amongst many other things, the Staff Manual describes in detail the grievance process that any employees can take if they are unhappy with any term of their employment. If the issue cannot be resolved internally any employees can report their complaint directly to the local Manpower Office which can then address the complaint directly to the company, seek to assist a bipartite resolution, or enlist the assistance of an independent mediator to seek a tripartite resolution. To date no staff have initiated such grievance procedures, but the opportunity always remains open.

In addition to requirements under the body of employment law, PT RMU is also fully compliant with Social Security Law (Laws 3/1992, 40/2004 and 4/2011). These laws require PT RMU to register all employees for Social Security (known as BPJS Ketenagakerjaan and BPJS Kesehatan) and to make payments on their behalf. All staff are issued membership cards to the scheme.

2.3.16 Occupational Safety Assessment (G3.12)

Worker safety remains a priority of the Katingan Project which conforms with the requirements of the labor law, UU No. 13/2003. Occupational safety and health are stipulated in the company safety regulation (available to verifiers upon request) and include:

- Providing workers with a first aid kit including anti-venom cream and insect repellent;

- Providing navigation and communication equipment such as GPS, compass and handheld transceivers;
- Enforcing a buddy system (minimum two persons in a group) for all field activities;
- Providing standard safety equipment such as microfiber mask, rubber boots, heavy-duty gloves, uniform, hat, harness, survival kit, portable water bottles/bags, and life jacket;
- Providing additional logistics such as fuel, propeller for a boat, and water and meals enough for three extra days; and
- Providing proper training on safety procedures, evacuation, communication, equipment use, and shelter making in order to ensure worker safety and mitigate potential risks inherent to certain field activities such as fire suppression and surveys.

PT. RMU has and will continue to provide safety training and equipment as described above. Training is provided prior to the start of any activity so that it can be specific to the risks associated with that activity. In addition, a safety SOP is in effect and maintained and employee safety is an important priority in all planning.

During the monitoring period, 23 incidents of injury were recorded to either staff employees or community members working on aspects of the project were recorded. The majority related to minor cuts or minor burns. In all cases the affected individuals received first aid in the field and/or were taken to the nearest medical facility for follow-up care. All made full recoveries. Full details are available on request to the auditors.

2.4 Management Capacity

2.4.1 Required Technical Skills (G4.2)

The project activities described in the PD and in this Monitoring Report have been and will continue to be implemented primarily by the project proponent, PT. RMU. The company employs a large, highly-qualified and professionally-experienced staff drawn from various backgrounds and with expertise including forest management, peatland biochemistry, conservation biology, silviculture, aquaculture, community development, financial management, business management, legal and technical regulation and policy. This team is based in headquarters in Bogor and Jakarta, within regional offices in Sampit, and throughout the project zone. Furthermore, local communities are also considered to be one of the key collaborating experts since they are the source of a wealth of local and traditional knowledge. Table 5 below summarizes some of the main project activity themes and the range of skills required for their implementation.

Table 5. Key skills required to implement the project, by activity

Project activity	Sub-project activity	Key skills required
Ecosystem Restoration	Hydrology management; reforestation; enrichment planting; MRV	Hydrology; Carbon MRV, GIS/remote sensing; silviculture; peatland biogeochemistry

Project activity	Sub-project activity	Key skills required
Forest Resources Conservation	Protection and enforcement; Forest fire prevention and control; Habitat conservation and management	HCV mapping, forest conservation; Peat forest fire management; biodiversity conservation, biodiversity MRV
Research and Development	Knowledge management; MRV methods; restoration methods; biodiversity conservation methods	Carbon MRV, hydrology, silviculture, peatland biogeochemistry, forest conservation, biodiversity conservation
Livelihood Development	Non-timber forest products; Agroforestry; Ecotourism; Salvaged wood production; Aquaculture and sustainable fisheries	Community organizing, conflict resolution, participatory land-use mapping, business management; Agroforestry, peatland biogeochemistry
Community Resilience	Microfinance institutions and enterprises; Energy efficiency and production; Mother and child health care; Clean water and sanitation; Basic education support	Microfinance, community organizing, conflict resolution; Renewable energy, community organizing

2.4.2 Management Team Experience (G4.2)

The project employs staff with several decades in combined experience covering all areas of expertise required for implementing land management and carbon projects at the scale of this project. Resumes of involved staff are available for the auditors' review as requested.

2.4.3 Project Management Partnerships/Team Development (G4.2)

In addition to in-house experts, PT. RMU collaborates with a wide-range of institutions both as implementing partners and as sources of technical advice. These institutions include those partners listed above, and a range of other partners that assist the project on an issue-based or *ad hoc* basis both *pro bono* and as contracted consultants. Amongst these partners are a range of nationally and internationally recognized scientific and technical experts, providing advice on issues such as climate science, community development, practical site management and biodiversity conservation.

These collaborations have been established in an effort to *enhance* the project's wider benefits, by making the site and its data open to a range of new partners. They have not been established to specifically address identified gaps in capacity required to implement the project's core activity, as to date no such gaps have been identified.

2.4.4 Financial Health of Implementing Organization(s) (G4.3)

The financial management plan and supporting evidence presented during the project validation remains the valid and functional financial management plan for the project. Project financing remains in place and secure, as demonstrated at the time of validation and

subsequent verifications. Project expenses and financing during this monitoring period have remained as predicted and future projections of expense and revenue provided during validation and subsequent verifications remain unchanged. Additional financial detail is provided in the NPRA in Appendix 1 and available to the auditors upon request.

2.4.5 Avoidance of Corruption and Other Unethical Behavior (G4.3)

Financial control within the project is taken very seriously. Written financial management practices, including full segregation of responsibilities, are enshrined in the deeds of enactment of the company and in supporting documentation agreed on behalf of the shareholders by the Board of Directors. PT RMU conducts routine internal audits and undergoes annual independent external audit. Full external audit reports for the years ending 2014-2016 are available to the verifiers on request. A draft audit report is also available for 2017.

PT RMU has a strict non-corruption policy. This is reflected in both the company's deeds of enactment and in the Staff Manual governing acceptable staff behavior and extends to practices that include bribery, embezzlement, fraud, favoritism, cronyism, nepotism, extortion and collusion. Measures taken to ensure these policies are complied with include strict contractual arrangements with project partners, routine field inspections (including of implementing partners), strict documentation of all expenses (including documented authorization), centralized procurement and documented procurement procedures, full segregation of financial management practices (i.e. segregated responsibility for activity/purchase authorization, expense authorization, payment and bookkeeping), staff training, and internal and independent external audit.

2.4.6 Commercially Sensitive Information (*Rules* 3.5.13 – 3.5.14)

The following information is commercially sensitive and is not publicly available:

- Financial projections – Detailed 30-year financial projections for the project which include all project-related costs and ex-ante carbon estimates
- Computer model code for the hydrological model
- Electronic shape files of project areas, proxy areas and buffer zones – GIS boundary shape files used to delineate the project area, proxy areas and buffer zones
- Classified satellite imagery – Used to determine land-use classes and forest strata within the project area and proxy area
- Original data social assessments – Hard copies and electronic copies of data sheets used to record field data for social assessments and meeting minutes
- Agreements between implementing, technical partners, communities and government – All agreements between project proponents and other implementing partners governing the implementation of project activities
- Models used to create carbon calculations – Computer models to generate carbon estimates from all field data and remote sensing data
- Project workplans and budgets – Detailed implementation workplans

2.5 Legal Status and Property Rights

2.5.1 Recognition of Property Rights (G5.1)

2.5.1.1 Legal approval from the national, provincial and district authorities

PT RMU is the sole concession holder of the Project Area under two Ecosystem Restoration Concession licenses; the first issued by Minister of Forestry Decree SK 734/Menhut-II/2013 covering 108,225 ha, and the second issued by Capital Investment Coordinating Board Agency Decree 23/1/IUPHHK-RE/PMDN/2016 covering 49.620 ha. These licenses grant a range of rights and responsibilities, of which is included the right to generate and sell carbon offset credits derived from forest and peatland protection and restoration, and prevent any other organization from applying for concessions in the project area. Table 6 below lists these and other relevant legal approvals in relation to the project to date, in chronological order. Copies of the licenses and supplementary approvals are available on request.

Table 6. List of decrees and legal approvals

Decree / Approval No.	Description	Approval from	Date of issuance
08/RMU/XI/2008	Application letter from PT. RMU for IUPHHK-RE	N/A	November 10, 2008
S.442/Menhut-VI/2009	First order letter to do UKL-UPL (SP-1)	Minister of Forestry	June 12, 2009
522/185/Ek.	Legal support from The Governor of Central Kalimantan for PT RMU IUPHHK-RE	Governor of Central Kalimantan	February 17, 2010
660/89/II/BLH/2012	Approval of UKL-UPL and recommendation to proceed with the IUPHHK-RE licensing process	Environmental Agency, Central Kalimantan Province	February 13, 2012
S. 104/Menhut-VI/BRPUK/2012	Instruction to produce a working area map (SP-2)	Ministry of Forestry Directorate General of Forest Production Development	February 17, 2012
S. 320/VII-WP3H/2012	Issuance of working area map for PT. RMU's IUPHHK-RE concession	Ministry of Forestry, Forestry Planning Agency	March 15, 2012
S.295/VI-BRPUK/2012	Draft Concept Concession Decree for PT. RMU's IUPHHK-RE	Ministry of Forestry, Directorate General of Forest Production Development	April 27, 2012
SK.734/Menhut-II/2013	**Issuance of IUPHHK-RE License to PT RMU for an area of 108,225 ha in District of Katingan,**	**Ministry of Forestry**	**October 25, 2013**

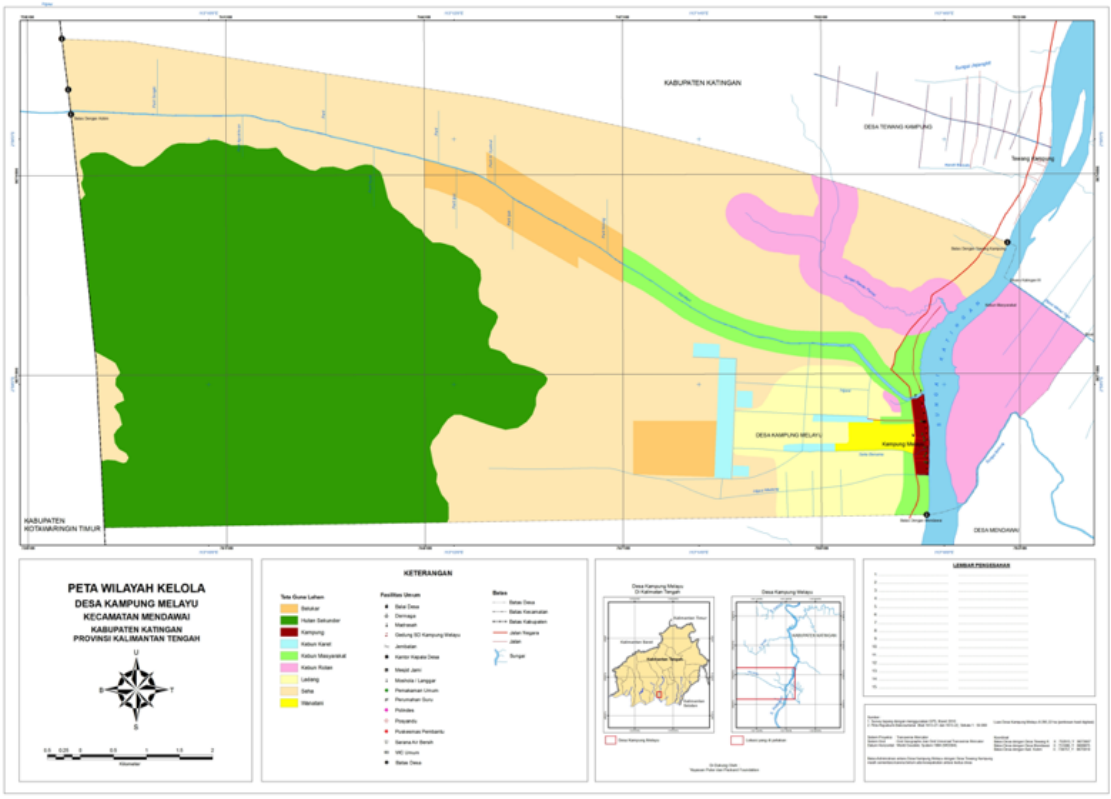
Decree / Approval No.	Description	Approval from	Date of issuance
	Central Kalimantan Province		
522.1.200/2156/Dishut	Technical Consideration for IUPHHK-RE for PT RMU	Forestry Provincial Office of Central Kalimantan Province	October 16, 2014
No. 522/0212/PTSP	Letter of Recommendation for PT RMU for IUPHHK-RE for an area of 49,497,9 ha	Governor of Central Kalimantan	March 2, 2015
Letter no 25/1/SK/S-IUPHHK-RE/P-MON/2016	Principle License (RATTUSIP) for PT RMU for an area of 49,500 ha in Katingan Regency, West Kalimantan as an official approval of the Technical Proposal and instruction to process further steps	Investment Coordinating Board of the Republic of Indonesia (BKPM)	April 26, 2016
Environmental & social Impact Study (UKL-UPL)	Conducted by certified 3rd party consultant	P9/MenLHK/2015	May 21, 2016
Decree no 23/1/IUPHHK-RE/PMDN/2106	**Issuance of IUPHHK-RE License to PT RMU for an area of 49,620 ha in District of Kotawaringan Timur and Katingan, Central Kalimantan Province**	Capital Investement Coordinating Board Agency	November 15, 2016
Letter No. 312/RMU-I/VII/2017	Request for approval of 10 years workplan (RKTUPPH-RE) 2017 for PT Rimba Makmur Utama	Director of PT RMU	Juli 21, 2017
Letter No. 322/RMU-1/VIII/2017	Request for Development of Boundary Marking guidelines for Unit II	Director of PT RMU	August 7, 2017
- Letter of Decree No 522.1.200/500/Dishut	Approval of 10 years workplan (RKTUPPHK-RE) 2017 for PT Rimba Makmur Utama	Head of Forestry Office Province of Central Kalimantan	November 28, 2017

2.5.1.2 Respect for rights to lands, territories and resources

The Katingan Project designed and implemented all project activities in participation with project-zone communities and based on full consultation and FPIC principles. This includes

the creation of agreed upon spatially accurate maps that define the agreed extent of village land and the agreed boundary of the project area, as well as recognition of other spatially explicit landscape features, which is the final step in the participatory planning process. These maps also allow the project-zone communities to understand their spatial positions in relation to the project area, and to be able to plan their future land use within their village boundaries without disputing other village territories or the project area. This tenure-based approach ensures that rights of the project-zone communities to lands, territories and natural resources are respected and protected. An example of community maps is provided in Map 3, and community maps of other villages are available to the verifiers on request. Currently over half of the communities have completed the maps. Additional village maps will be created until all project zone communities have agreed upon maps. This process is also set to continue in many areas through formal applications for 'Hutan Desa' (Village Forest) status, which grants communities a form of legal land tenure over forest estate land in the proximity to their village. This process has been piloted in two villages during this monitoring period and is set to be extended to more in the coming years.

Map 3. Example of the community map of Kampung Melayu village



2.5.1.3 Consensus and approval from village authorities

Mutual understanding of the goals and objectives of the Katingan Project between PT. RMU and the project-zone communities is crucial for long-term success. To this end, and as part of the company's commitment to FPIC and outreach activities having been conducted since 2010, PT. RMU has agreed, and now signed a memorandum of understanding (MoU) with 14

village authorities in the project zone (See Table 7; copy of each MoU is available to verifiers upon request).

Each MoU is initially for a three-year period with opportunity for extension after review and evaluation by the village. For villages who signed the first term in 2015, the second term of MoUs will start in April 2018. Most of these villages have already agreed to extend the MoUs for another three years, without changing the substance or text of original MoU. Some villages have requested further elaboration of the MoU, especially related to education, health, and institutional strengthening support. Several more villages that have yet to sign MoUs, particularly on the Kotawaringin Timur side of the project zone (e.g. Pulau Hanaut District, Babirah, Rawasari, Bapinang Hulu, and Hanaut villages) are currently consulting within their communities on drafts documents, with an expectation that a formal MoU will be signed in 2018.

Table 7. List of signed community agreement and approval with the Katingan Project. More are currently under negotiation.

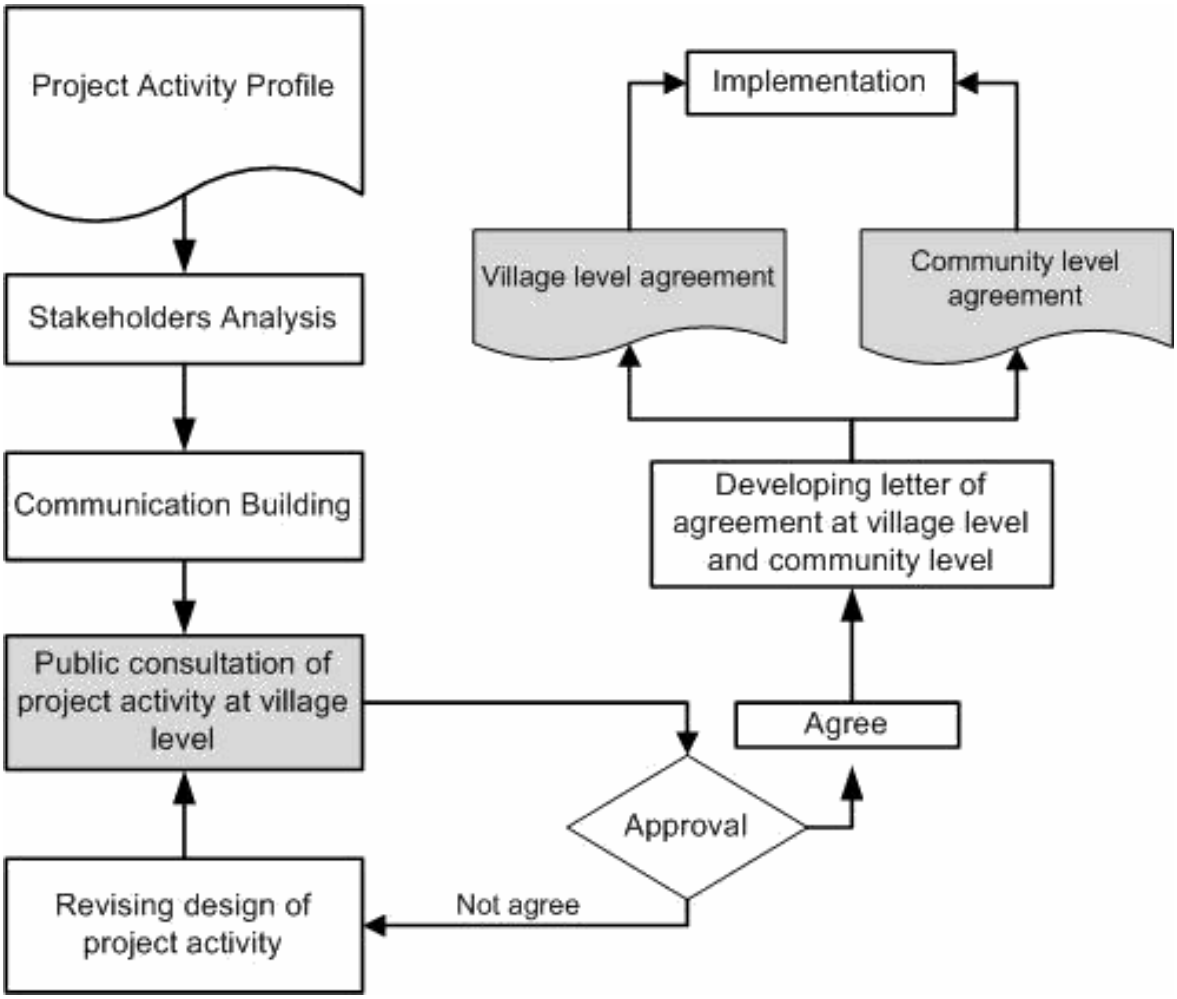
Village	MoU No.	Partnership agreement No.	Date of agreement
Mendawai	081/RMU-I/V/2015	082/RMU-I/V/2015	May 22, 2015
Kampung Melayu	079/RMU-I/V/2015	080/RMU-I/V/2015	May 22, 2015
Tewang Kampung	077/RMU-I/V/2015	078/RMU-I/V/2015	June 4, 2015
Galinggang	073/RMU-I/V/2015	074/RMU-I/V/2015	May 21, 2015
Tumbang Bulan	075/RMU-I/V/2015	076/RMU-I/V/2015	May 21, 2015
Tampelas	071/RMU-I/V/2015	072/RMU-I/V/2015	May 20, 2015
Telaga	069/RMU-I/V/2015	070/RMU-I/V/2015	May 20, 2015
Perupuk	067/RMU-I/V/2015	068/RMU-I/V/2015	May 20, 2015
Tumbang Runen	061/RMU-I/V/2015	062/RMU-I/V/2015	May 19, 2015
Karuing	065/RMU-I/V/2015	066/RMU-I/V/2015	May 19, 2015
Jahanjang	063/RMU-I/V/2015	064/RMU-I/V/2015	May 19, 2015
Bahun Bango	059/RMU-I/V/2015	060/RMU-I/V/2015	May 18, 2015
Asem Kumbang	057/RMU-!/V/2015	058/RMU-I/V/2015	May 18, 2015
Makarti Jaya	In process	In process	In process

In addition to the MoUs, PT. RMU and the project-zone communities have developed cooperation arrangements through a partnership agreement (*Kesepakatan Kerjasama*). This agreement describes specific support which PT. RMU seeks to provide to the communities, and the communities propose priority activities to reach their objectives. The proposed priority activities are based on community participatory planning and bottom-up process. The agreement is valid for one year, and will be evaluated and revised every year thereafter. After the evaluation, the community can decide either to continue the previous activity e.g. scaling up the activity, or change the activity. The partnership agreements are a binding document which explains PT. RMU's commitment to ensuring net positive impacts and benefit sharing for the project-zone communities.

2.5.2 Free, Prior and Informed Consent (G5.2)

The Katingan Project adopts FPIC principles in all community consultation processes (see Figure 2). This approach has been and will be maintained throughout the life of the project. It allows local people to critically consider potential impacts of the project and to negotiate based on mutual consensus without being forced or manipulated. The FPIC approach is also used for stakeholder consultations and communications which were discussed earlier in this report.

Figure 2. FPIC process



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2.5.3 Property Right Protection (G5.3)

The Katingan Project has not and will not undertake any involuntary relocations. The current project area has never contained permanent human settlements.

2.5.4 Identification of Illegal Activity (G5.4)

Illegal activities, including logging or mining within protected forests, hunting of protected species, or making use of fire for land clearing have been historically practiced in parts of the project zone. The Katingan Project aims to reduce and put an end to these activities by a

combination of protection and enforcement, education and incentive, including strengthening tenure rights and providing sustainable livelihood options and employment opportunities.

The Katingan Project will not and has not derived benefits from illegal activities.

2.5.5 Ongoing Disputes (G5.5)

Section 2.3.12 and Appendix 3 show grievances and disputes reported during this monitoring period, details of the actions taken in response and eventual outcomes where resolved. While some more recent grievances are still being resolved, no ongoing, long-term disputes have occurred.

2.5.6 National and Local Laws (G5.6)

2.5.6.1 National and local laws and regulations

The Katingan Project is designed and has been implemented in full compliance with both national and regional laws of the Republic of Indonesia. This includes laws and regulations governing aspects of carbon emissions offsets, REDD+ and ecosystem restoration concession (ERC). In addition, the project falls into line with the REDD+ National Strategy developed by the Government of Indonesia. In late 2016 and early 2017, the Government of Indonesia, particularly the Ministry of Environment and Forestry, issued various regulation related to peatland management, including peatland restoration and conservation. Most of this regulation is relevant to the project area and activities, and provide stronger justification for protection and restoration of project area. The lists provided below show relevant laws and regulations regarding land use, forestry, REDD+ and climate change, and are fully update to the end of 2017.

- Law No. 6/1994 concerning the Ratification of United Nations Framework Convention on Climate Change
- Law No. 41/1999 concerning Forestry
- Law No. 5/1997 concerning Biodiversity
- Law No. 17/2003 concerning State Finances
- Law No. 17/2004 concerning the Ratification of Kyoto Protocol on the UN Framework Convention on Climate Change
- Law No. 25/2004 concerning National Development Planning System
- Law No. 17/2005 concerning Medium and Long Term National Development Plan (RPJP) 2005-2025
- Law No. 31/2009 concerning Meteorology, Climatology and Geophysics
- Law No. 32/ 2009 concerning Environmental Protection and Management
- Law No. 41/2009 concerning Sustainable Food Land Protection
- Government Regulation No. 6/2007 and its amendment No. 3/2008 concerning Forest Arrangement and Formulation of Forest Management Plan as well as Forest Exploitation
- Government Regulation No. 26/2008 concerning National Spatial Plan

- Government Regulation No. 10/2010 concerning Method of Change of Forest Area Allocation and Function
- Government Regulation No. 15/2010 concerning Implementation of Spatial Structuring
- Government Regulation No. 24/2010 concerning the Use of Forest Area
- Presidential Decree No. 5/2010 concerning National Medium Term Development Plan (RPJMN) of 2010-2014
- Presidential Decree No. 61/2011 regarding the National Action Plan for Reducing Green House Gas Emission
- Ministry of Environment Regulation No. 13/2010 regarding Environmental Management and Monitoring Effort
- Ministry of Environment Regulation No. 16/2012 regarding the Guidelines on the Development of Environmental Document
- Ministry of Environment and Forestry Decree no P.17 /MENLHK/SETJEN/KUM.1/2/2017 regarding revision of P 12/2015 regarding development of Industrial Timber Plantation
- Ministry of Environment and Forestry Decree no P.22/MENLHK/SETJEN/SET.1/3/2017 regarding Procedure for grievance management on suspected environmental polution and degradation
- Ministry of Environment and Forestry Decree no P.47/MenLHK/Setjen/KUM.1/7/2017 on National Indonesia Qualification Framework and Competence Certification for forest and land fire supression
- Presidential Decree no 88 Tahun 2017 on settling land dispute in forest area
- Ministry of Environment and Forestry Decree no P.70/MenLHK/Setjen/KUM.1/12/2017 on the procedure for implementation of Reducing Emissions From Deforestation and Forest Degradation, Role of Conservation, Sustainable Management of Forest and Enhancement of Forest Carbon Stocks
- Ministry of Environment and Forestry Decree no P.71/MenLHK/Setjen/KUM.1/12/2017 on the organization of National Registry for Climate Change control
- Ministry of Environment and Forestry Decree no P.72/MenLHK/Setjen/KUM.1/12/2017 on Climate Change control action and resources implementation guidelines for measurement, Reporting and Verificarication
- Ministry of Environment and Forestry Decree no P.73/MenLHK/Setjen/KUM.1/12/2017 on the guidelines for organization and reporting of national greenhouse gas inventory

Relevant laws and regulations on Ecosystem Restoration Concession management include:

- Ministry of Forestry Regulation No. P.56/Menhut-II/2009 regarding Business Planning for Ecosystem Restoration Licence, updated by No. P.24/Menhut-II/2011
- Ministry of Forestry Regulation No. P.8/Menhut-II/2014 regarding Limitation for the Allocation of the Concession Area for Business Licenses for Forest Timber Utilization in Natural Forest, Business Licenses for Ecosystem Restoration and Business License for Forest Plantation in Production Forest

- Ministry of Forestry Regulation No. P.64/Menhut-II/2014 regarding Application of Silviculture Techniques within the Ecosystem Restoration Concession License in Production Forest
- Ministry of Forestry Regulation No. P.66/Menhut-II/2014 regarding the Procedures for Periodical Forest Inventory and Work Plan in Ecosystem Restoration Concession License
- Ministry of Forestry Regulation no 39/Menhut-II/2008 on The Guidelines for applying administrative sanction towards forest concession holders
- Ministry of Forestry Regulation no 44/Menhut-II/2012 on the ratification and issuance of forest area
- Ministry of Forestry Regulation no 39/Menhut-II/2013 on community development program through forestry partnership
- Ministry of Forestry Regulation no 43/Menhut-II/2013 on the arrangement of forest working area boundary within forest utilization license, principle license of forest utilization, principle license of forest lease and Forest and Management of Forest Area under Forest Management Unit and Forest area for special designation.
- Ministry of Forestry Regulation no 32/Menhut-II/2014 on guidelines for Financial reporting in Production Forest Utilisation
- Ministry of Environment and Forestry Regulation No. P1/Menhut-II/2015 on the revision of Ministry of Environment and Forestry regulation no P.97/MENHUT-II/2014 on delegation of authority for the issuance of environmental and forestry license and non-license as implementation on one door integrated service to the investment coordinating board
- Ministry of Environment and Forestry Letter No. SE.1/Menlhk-II/2015 on The Processing legal Enviornmental and Forestry cases
- Ministry of Environment and Forestry Decree no P.32/MENLHK/SETJEN/KUM.1/5/2017 on revision of P.9/Menlhk-II/2015 about the procedure for issuance working area expansion and extension of IUPHHK HA-RE or IUPHHK HTI in production forest

As the majority of the project area is forested and situated on peatland, the Katingan Project must also comply with various regulations on the management of forest and peatland, including:

- Presidential Instruction INPRES No. 10/2011 regarding Suspension on the Issuance of New Licenses and Improved Management of Primary Forest and Peatlands", renewed by INPRES No. 6/2013, No. 8/2015 and No 7/2017
- Government Regulation PP No. 71/2014 regarding Protection and Management of Peatland Ecosystem revised by PP 57/2016
- Ministry of Environment and Forestry Decree no P.14/MENLHK/SETJEN/KUM.1/2/2017 regarding Procedures for Inventory and Designation of Peat Ecosystem Function
- Ministry of Environment and Forestry Decree no P.15 /MENLHK/SETJEN/KUM.1/2/2017 regarding Procedures for Water Table Measurement in Peat Ecosystem
- Ministry of Environment and Forestry Decree no P.16 /MENLHK/SETJEN/KUM.1/2/2017 regarding Technical Guidelines of Peat Ecosystem Function Restoration

- Decree Head of Peatland Restoration Agency no SK.05/BRG/KPTS/2016 regarding designation of indicative map for Peat restoration
- Ministry of Environment and Forestry Decree no SK.130/MENLHK/SETJEN/PKL.0/2/2017 regarding designation of national peat ecosystem function map
- Ministry of Environment and Forestry Decree no P.40 /MENLHK/SETJEN/KUM.1/6/2017 regarding government facilitation to Industrial timber plantation towards protection and management of peat ecosystem

In addition, the following regulations, which were in effect at the time of the last verification period, have now been *canceled* due to issuance of revised regulation and/or because of conflicting contents:

- Ministry of Forestry Regulation P.68/2009 concerning Organization of Demonstration Activities for Reducing Emissions from Deforestation and Degradation
- Ministry of Forestry Regulation P.30/2009 concerning Mechanisms for Reducing Emissions from Deforestation and Degradation
- Ministry of Forestry Regulation No. P.20/Menhut-II/2007 regarding Provision and Expansion of Business Licenses for Forest Timber Utilization in Natural Forest, Business Licenses for Ecosystem Restoration and Business License for Forest Plantation in Production Forest, revised by No. P.61/2008, No. P.50/2010, No. P.26/2012, and No P.31/Menhut-II/2014

With the issuance of Ministry of Environment and Forestry no P70, P71, P72 and P73 in late December 2017, REDD projects within the jurisdiction of Indonesia should now be registered with the newly created National Registry System. It is also proposed that this may in turn make projects eligible to receive Result Based Payments for avoided emissions. However, this law is yet to be trialed, and it is currently unclear whether in future the Katingan Project will become eligible for such payments. Avoided carbon emission generated in this monitoring period are unaffected by this regulation, but any potential impact on the project in future will be fully reported in forthcoming Monitoring Reports.

While there are no laws specifically requiring FPIC in Indonesia, the Katingan Project has adopted the Free, Prior and Informed Consent (FPIC) standard *Prinsip Persetujuan atas Dasar Informasi Awal tanpa Paksaan* (*PADIATAPA*) and the social safeguard standard called *Prinsip Kriteria dan Indikator Safeguards Indonesia* (*PRISAI*), which were developed by the Indonesian REDD+ Agency. The Katingan Project is among the first REDD+ projects in Indonesia which adopted these standards in the process of project design and implementation. Indeed, PT. RMU and its project implementation partner, Yayasan Puter Indonesia contributed substantially to the development of *PRISAI* standards since 2010; providing input to their design and conducting a series of public consultations to test the standards at the Katingan Project site. This helped the Government of Indonesia integrate important safeguard standards in its national REDD+ policy framework development.

2.5.6.2 International treaties

In addition to complying with national and local laws, the Katingan Project has also complied with the requirements of international treaties and agreements. Treaties that are or may become relevant to the project include the following:

- Ramsar Convention on Wetlands of International Importance, 1971
- Convention on International Trade in Endangered Species (CITES) 1973
- Rio Declaration on Environment and Development 1992
- United Nations Framework Convention on Climate Change (UNFCCC) 1992
- Convention on Biological Diversity in 1992 and enactment 1993
- United Nations Convention against Corruption (UNCAC) 2003
- Kyoto Protocol in 1997 and enactment 2005
- Cartagena Protocol on Biosafety to the Convention on Biological Diversity 2004
- Bali Action Plan (COP 13) 2007
- Nagoya Protocol on Genetic Resources Access and Equal and Fair Benefit Sharing from the Utilization of the Biodiversity Convention 2013

3 CLIMATE

3.1 Monitoring GHG Emission Reductions and Removals

3.1.1 Data and Parameters Available at Validation

Data and parameters available at validation per VCS methodology VM0007 MF are provided in the tables below. A full list of all relevant data and parameters are further provided in the Climate MRV Tracker (Appendix 4).

Data / Parameter	$\Delta C_{BSL,planned}$
Data unit	t CO_2-e
Description	Net greenhouse gas emissions in the baseline from planned deforestation
Source of data	Module BL-PL
Value applied	N/A
Justification of choice of data or description of measurement methods and procedures applied	See Module BL-PL
Purpose of the data	Calculation of baseline emissions
Comments	N/A

Data / Parameter	$\Delta C_{BSL-ARR}$
Data unit	t CO_2-e
Description	Net GHG removals in the ARR baseline scenario up to year t*
Source of data	Module BL-ARR
Value applied	N/A
Justification of choice of data or description of measurement methods and procedures applied	See Module BL-ARR
Purpose of the data	Calculation of baseline emissions
Comments	N/A

Data / Parameter	$GHG_{BSL-WRC}$
Data unit	t CO_2-e
Description	Net GHG emissions in the WRC baseline scenario up to year t*
Source of data	Module BL-PEAT
Value applied	N/A
Justification of choice of data or description of measurement methods and procedures applied	See Module BL-PEAT
Purpose of the data	Calculation of baseline emissions
Comments	N/A

3.1.2 Data and Parameters Monitored

Data and parameters monitored per VCS methodology VM0007 MF are provided in the tables below. A full list of all relevant data and parameters are further provided in the Climate MRV Tracker (Appendix 4).

Data / Parameter	$\Delta C_{WPS-REDD}$
Data unit	t CO_2-e

Description	Net GHG emissions in the REDD project scenario up to year t*
Source of data	Module M-MON
Description of measurement methods and procedures to be applied	See Module M-MON
Frequency of monitoring/recording	See Module M-MON
QA/QC procedures to be applied	See Module M-MON
Purpose of the data	Calculation of project emissions
Calculation method	See Module M-MON
Comments	N/A

Data / Parameter	$\Delta C_{LK\text{-}AS,planned}$
Data unit	t CO_2-e
Description	Net greenhouse gas emissions due to activity shifting leakage for projects preventing planned deforestation
Source of data	Module LK-ASP
Description of measurement methods and procedures to be applied	See Module LK-ASP
Frequency of monitoring/recording	See Module LK-ASP
QA/QC procedures to be applied	See Module LK-ASP
Purpose of the data	Calculation of leakage
Calculation method	See Module LK-ASP
Comments	N/A

Data / Parameter	$\Delta C_{LK\text{-}ME}$
Data unit	t CO_2-e
Description	Net greenhouse gas emissions due to market-effects leakage
Source of data	Module LK-ME
Description of measurement methods and procedures to be applied	See Module LK-ME
Frequency of monitoring/recording	See Module LK-ME

QA/QC procedures to be applied	See Module LK-ME
Purpose of the data	Calculation of leakage
Calculation method	
Comments	N/A

Data / Parameter	$\Delta C_{WPS-ARR}$
Data unit	t CO_2-e
Description	Net GHG emissions in the ARR project scenario up to year t*
Source of data	Module M-ARR
Description of measurement methods and procedures to be applied	Module M-ARR
Frequency of monitoring/recording	Module M-ARR
QA/QC procedures to be applied	Module M-ARR
Purpose of the data	Calculation of project emissions
Calculation method	Module M-ARR
Comments	N/A

Data / Parameter	ΔC_{LK-ARR}
Data unit	t CO_2-e
Description	Net GHG emissions due to leakage from the ARR project activity up to year t*
Source of data	Module LK-ARR
Description of measurement methods and procedures to be applied	See Module LK-ARR
Frequency of monitoring/recording	See Module LK-ARR
QA/QC procedures to be applied	See Module LK-ARR
Purpose of the data	Calculation of leakage
Calculation method	See Module LK-ARR
Comments	N/A

Data / Parameter	$GHG_{WPS-WRC}$
Data unit	t CO_2-e

Description	Net GHG emissions in the WRC project scenario up to year t*
Source of data	Module M-PEAT
Description of measurement methods and procedures to be applied	See Module M-PEAT
Frequency of monitoring/recording	See Module M-PEAT
QA/QC procedures to be applied	See Module M-PEAT
Purpose of the data	Calculation of project emissions
Calculation method	See Module M-PEAT
Comments	N/A

Data / Parameter	$GHG_{LK\text{-}ECO}$
Data unit	t CO_2-e
Description	Net GHG emissions due to ecological leakage from the WRC project activity up to year t
Source of data	Module LK-ECO
Description of measurement methods and procedures to be applied	See Module LK-ECO
Frequency of monitoring/recording	See Module LK-ECO
QA/QC procedures to be applied	See Module LK-ECO
Purpose of the data	Calculation of leakage
Calculation method	See Module LK-ECO
Comments	N/A

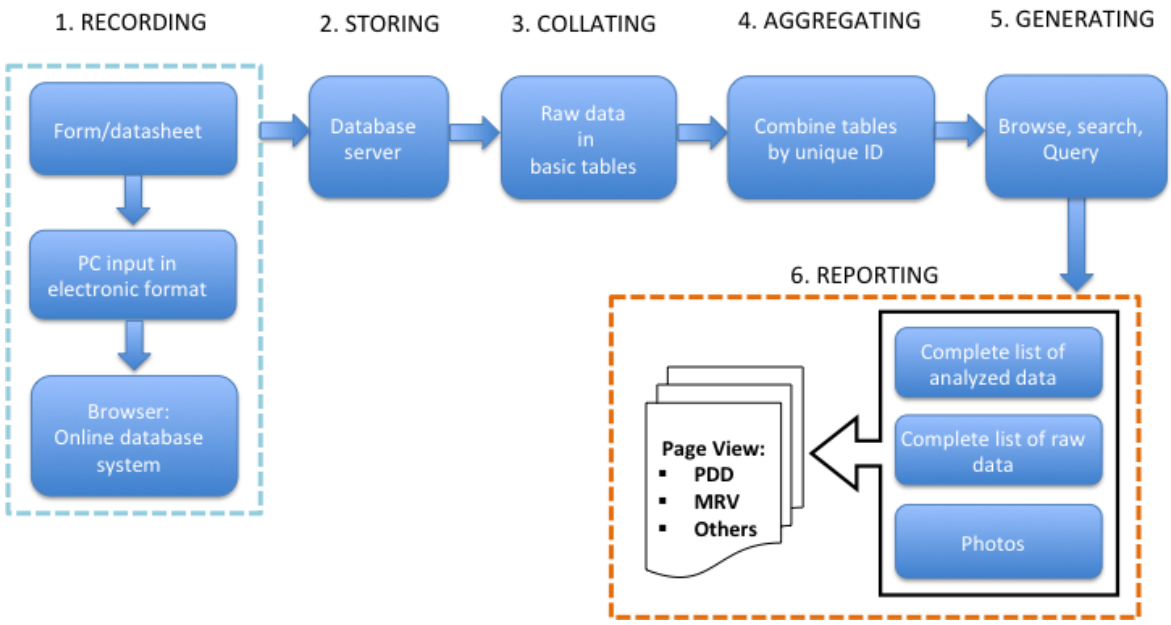
3.1.3 Monitoring Plan

3.1.3.1 Data management methods and structure

All data generated by the Katingan Project is centrally managed in an online-based database. Hard copies of all data sheets are archived in field offices, with duplicate copies stored centrally in PT. RMU's headquarter in Bogor. Field data is uploaded directly into the online database system from the field office, allowing simultaneous multi-user input through a local server network. After the data is collated by the database server, it can be adapted to fulfil all monitoring and reporting needs using standard and custom-made report formats. Hard and soft copies of all data will be stored for a minimum of two years beyond the end of the project crediting period (31st October 2070).

All climate, community and biodiversity monitoring parameters, including both raw and processed data, together with their frequency, are detailed in Appendix 4, Appendix 5, and Table 50 (MRV Trackers).

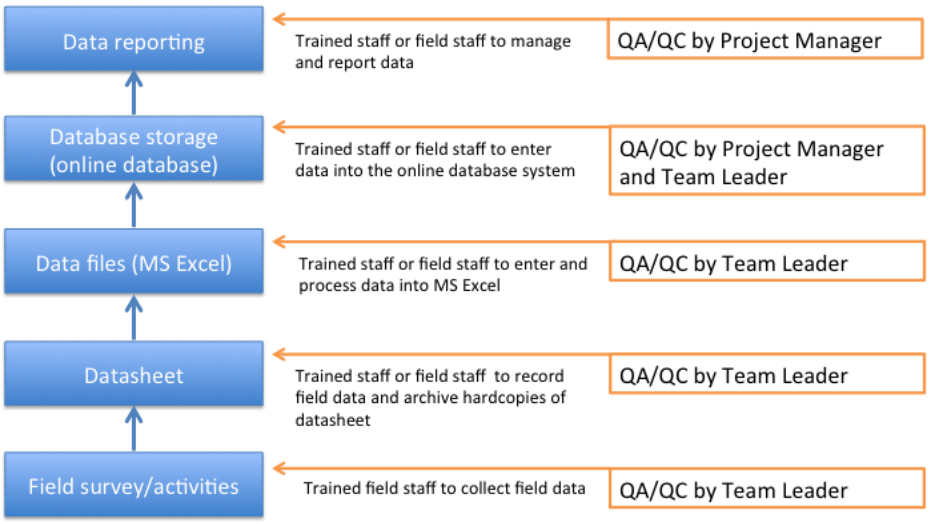
Figure 3. Simple schematic of data management structure



3.1.3.2 Procedures for handling internal auditing and non-conformities

Internal auditing and non-conformities are addressed through standard operation procedures (SOPs) that incorporate multiple quality assurance and quality control (QA/QC) measures. All data collected, recorded, stored and reported are subject to review and approval by team leaders and/or project managers with reference to written SOPs covering each level of data management. In order to ensure the security and traceability of data entry and QA/QC procedures, all users are allocated unique user IDs and passwords in order to access the database, and in turn their access and roles can be restricted as appropriate.

Figure 4. Data management QA/QC procedures



3.1.3.3 Climate impact monitoring plan and methodological approach

Climate impacts have been monitored, reported and evaluated according to the Climate MRV Tracker (Appendix 4). This includes monitoring changes in land cover, land use, peat thickness and water table depth, as per the VCS VM0007 methodological requirements and GHG emissions associated with relevant land uses in the project area. A summary of the main monitoring methods followed during this reporting period is given below. For further details consult the PDD and relevant Annex.

The formal monitoring period reported in this report extends from 1st January 2017 to 31st December 2017 for climate data. In general, all reported climate data refers to this exact time period.

3.1.3.3.1 Remote sensing

As the original project description only included ‘forest’ and ‘non-forest’ strata, monitoring during this reporting period focused on the integrity of these two strata.

In both the PD, and the previous monitoring reports (2010-2015 and 2016), multispectral satellite imagery was used to asses the forest integrity. During this monitoring period the project continued to use multispectral data for the regular monitoring of deforestation in the project site. Due to frequent cloud cover and its limitated to multispectral imagery, data from Landsat, Sentinel2 and PlanetLabs was regularly acquired to increase temporal data coverage. A virtually cloud free mosaic of PlanetLabs high resolution multispectral imagery was also acquired for December 2017 to assess deforestation with an unsupervised classification.

As per the data switch approved in the last monitoring report (2016) ALOS PALSAR 2 data from January 25th 2018 was also acquired to assess any deforestation. This analysis followed

the same methodology approved during the previous monitoring report (see Section 3.3.3.1 of the last MR).

The use of remote sensing data from the NASA Fire Information for Resource Management System continued to be used during this monitoring period for near-real time fire detections.

3.1.3.3.2 Monitoring GHG emissions from microbial decomposition of peat

GHG emissions from microbial decompositions of peat were quantified by monitoring land use change (as described above) in combination with IPCC default emission factors and the procedures provided in the VSC methodology VM0007, module M-PEAT (see Section 3.2.2.2.3 for results). In addition, direct monitoring of water table depth was initiated in 2015 using dip-wells (point-based monitoring) installed along transects designed to be representative of each stratum. In the future this data can be used as an additional proxy for future analysis, but was not used for any emission calculations in this monitoring report.

3.1.3.3.3 Monitoring GHG emissions from water bodies

GHG emissions from water bodies were estimated based on IPCC default values applied to the estimated area of water bodies in the project area, as described in the PD Section 5.4. As per section 3.3.3.1 of this report, the forest's integrity was monitored using remote sensing analysis. Any land cover changes indicative of new water features were followed up with ground checks to verify the change and, if confirmed, the water body's dimensions were measured. Additionally, the field team travelled down all waterway access points within the project to search for new canals that weren't visible in the satellite imagery.

3.1.3.3.4 Monitoring GHG emissions from peat and biomass burning

MODIS FIRMS hotspot data were collected for the entire monitoring period. Potential fire alert response times from the field staff were improved by automating the hotspot alerts using two online tools, Twilio and Mail Parcer, in the Zapier platform. This automated system allows the GPS locations of new hotspots to be automatically extracted from the FIRMS email alerts and directly sent to the field staff via cellular text message.

3.1.3.4 Community impact monitoring plan and methodological approach

3.1.3.4.1 Community impact monitoring plan

Impacts of the Katingan Project on the project-zone communities have been and will continue to be closely monitored, reported and evaluated according to the Community MRV tracker (Appendix 5).

Monitoring results were used to evaluate the progress of community-based activities, lessons learned and community inputs, and to implement adaptive management. Methods adopted for community impact monitoring include:

Step 1: Village-based survey teams, consisting of a community facilitator and organizers;

Step 2: Random sampling amongst representative village groups within each village;

Step 3: Standardized questionnaires that are adaptable to fit target groups;

Step 4: Standardized measures to manage and analyze sample data;

Step 5: Quantitative and qualitative data analysis to evaluate community impacts;

Step 6: Dissemination of results to all stakeholders to maintain transparency and participation.

In addition to on-the-ground surveys, data was also collected through secondary sources (e.g., village and local government census data, third-party studies). See the Community MRV Tracker for more details.

3.1.3.4.1.1 High conservation value plan

HCV 4, 5 and 6 areas have significant impacts on community well-being. The Katingan Project monitored and evaluated the effectiveness of measures taken to maintain or enhance HCV attributes through the community impact monitoring program. Ground truthing of information and maps was also conducted on a regular basis in order to assess the accuracy of spatial impacts on communities.

3.1.3.5 Biodiversity impact monitoring plan and methodological approach

3.1.3.5.1 Biodiversity monitoring plan

Biodiversity impacts in the project zone were monitored based on the Biodiversity MRV Tracker (Table 50). Biodiversity monitoring was focused on the project zone's HCV areas and key species. Monitoring was carried out using a variety of field survey techniques, including local community interview surveys to assess hunting level and threats.

3.1.3.5.2 High conservation value monitoring plan

It was anticipated that project activities would lead to positive enhancement of HCV areas, particularly HCV 1, 2 and 3 areas which include a particular focus on those areas critical for the survival of Critically Endangered and Endangered species. For more details see the Biodiversity MRV Tracker (Table 50). The planned HCV monitoring program allowed the project to demonstrate that the Katingan Project has achieved the stated HCV objectives for maintaining and enhancing these HCV species' populations.

3.1.4 Dissemination of Monitoring Plan and Results (CL4.2)

A Project Implementation and Monitoring Report will be issued at least every five years and as often as every year. When the PIMR is completed, summaries will be prepared in English and Indonesian and disseminated to the relevant stakeholders in accordance with the process described previously in in Section 2. In addition, each PIMR will undergo third party verification and as a result, will be publicly posted on the CCB website for public review and comment and on the VCS Project Database following verification.

3.2 Quantification of GHG Emission Reductions and Removals

3.2.1 Baseline Emissions

This section describes baseline emissions based on the VCS methodology VM0007 REDD+ MF and its modules BL-PL, BL-ARR, AR ACM 003, and BL-PEAT. The analysis and results presented in this section is unchanged from that presented in the PD (Section 5.3) and the previous monitoring report (Section 4.1).

3.2.1.1 General procedures and assumptions

Baseline emissions and changes in baseline emissions and carbon stocks were determined based on analyses of the most likely baseline scenario as described in Section 4 of the PD.

Emissions that are accounted result from:

- Above ground biomass stock changes due to conversion to plantations
- Peat microbial decompositions
- Peat burning
- Dissolved Organic Carbon from Water bodies

It is assumed that no non-human induced rewetting (e.g. collapse of dikes or canals that would have naturally closed over time, progressive subsidence leading to raising relative water table depths, increasingly thinner aerobic layers and reduced CO_2 emission rates) will occur in the baseline scenario. For peatland areas that were abandoned before the project started, this assumption was based on expert judgment taking account of verifiable local experience and/or studies and/or scientific literature in a conservative way.

It is assumed that the baseline agents perform regular maintenance of canals for drainage and transportation purposes. Due to limitations of available information on volume and frequency of dredging of the baseline agents, emissions from dredging (emissions from peat exposed to aerobic decomposition by spreading or piling following the establishment or maintenance of canals) is conservatively omitted in the baseline calculations. Note that the omission of this source of GHG emissions is very conservative, resulting in lower emission estimates in the baseline water body stratum compared to strata at the same location in the project scenario, since emissions from water bodies are lower than emissions resulting from peat microbial decomposition.

CO_2 and CH_4 are accounted for in the baseline, while N_2O emissions were conservatively omitted. It was assumed that uncontrolled burning of peat occurs only in part of the deforested project area. These emissions are accounted for since the loss is significant. GHG emissions from biomass burning in the baseline were conservatively omitted.

Baseline changes in land cover classes and drainage status during the project life-time determines (changes in) emissions of CO_2 and CH_4. Baseline emissions therefore have been calculated on an annual basis. (for further details see PD Section 5.3).

3.2.1.2 Proxy area analysis

3.2.1.2.1 Proxy area selection

Since the project area does not have a verifiable plan for the rate of deforestation, per module BL-PL, a minimum of 6 proxy areas are required to determine the baseline rate of deforestation, as well as 5 proxy areas to demonstrate the risk of abandonment. According to the methodology, all proxy areas must meet the following criteria:

- Land conversion practices shall be the same as those used by the baseline agent or class of agent;
- The post-deforestation land use shall be the same in the reference regions as expected in the project area under business as usual;

- The reference regions shall have the same management and land use rights type as the proposed project area under business as usual;
- If suitable sites exist they shall be in the immediate area of the project; if an insufficient number of sites exists in the immediate area of the project, sites shall be identified elsewhere in the same country as the project; if an insufficient number of sites exists in the country, sites shall be identified in neighbouring countries;
- Agents of deforestation in reference regions must have deforested their land under the same criteria that the project lands must follow (legally permissible and suitable for conversion);
- Deforestation in the reference region shall have occurred within the 10 years prior to the baseline period; and
- The three following conditions shall be met:
    - The forest types surrounding the reference region or in the reference region prior to deforestation shall be in the same proportion as in the project area (±20%).
    - Soil types that are suitable for the land-use practice used by the agent of deforestation in the project area must be present in the reference region in the same proportion as the project area (±20%). The ratio of slope classes “gentle” (slope<15%) to “steep” (slope≥15%) in the reference regions shall be (±20%) the same of the ratio in the project area.
    - Elevation classes (500m classes) in the reference region shall be in the same proportion as in the project area (±20%).

Suitable reference regions were identified using a database, provided by the Indonesian Ministry of Forestry[1], of pulp and paper concessions in Indonesia whose licenses were granted between 2000 and 2010. Using peat distribution geospatial data for Indonesia, obtained from Wetlands International Indonesia [2], the pulp and paper concessions with similar peat proportions as the project area were identified. Next, NASA Shuttle Radar Topography Mission’s (SRTM) 90m Digital Elevation Model (DEM) data, downloaded via the Consultative Group on International Agricultural Research’s online database[3], was analysed to identify the concessions that met the slope and elevation requirements. To determine which of the remaining concessions met the forest type and forest cover percentage criteria, medium-resolution satellite imagery was used. Table 8 shows proxy area requirements based on the project area’s land cover.

Table 8. Reference region selection criteria

Project area	Reference region Requirement
96.65% forest cover	At least 77.32% forest cover
97.44% peat	At least 77.95% peat

[1] Ministry of Forestry (2010), downloaded from Global Forest Watch Commodities (http://commodities.globalforestwatch.org/#v=home)

[2] Wahyunto, S. Ritung dan H. Subagjo (2004). Peta Sebaran Lahan Gambut, Luas dan Kandungan Karbon di Kalimantan / Map of Peatland Distribution Area and Carbon Content in Kalimantan, 2000 – 2002. Wetlands International - Indonesia Programme & Wildlife Habitat Canada (WHC).

[3] Available at http://srtm.csi.cgiar.org/SELECTION/inputCoord.asp

Project area	Reference region Requirement
100% of area in the 0-500m class	At least 80% of the area must fall in the 0-500m class
100% of area has “gentle” (slope<15%) slopes	At least 80% of the area must have “gentle” slopes

3.2.1.2.2 Satellite imagery analysis

A) Data acquisition

For each concession, Landsat 5 Thematic Mapper (TM), Landsat 7 Enhanced Thematic Mapper Plus (ETM+) or Landsat 8 Operational Land Imager (OLI) data was downloaded from the United States Geological Survey’s online database[4]. All Landsat Level 1 data provided by USGS is geometrically corrected, using precision ground control points and SRTM DEM data, orthorectified and meets all standards laid out by the GOFC-GOLD 2013 handbook. For the first time-step, imagery from the concession grant date was downloaded. Due to Landsat’s long revisit time and the high level of cloud cover in Indonesia, a compromise had to be made between cloud cover and the imagery acquisition date’s proximity to the concession grant date.

B) Landsat pre-processing

All Landsat data was atmospherically corrected using the ATCOR2 for IMAGINE software. For optimal results, the radiometric rescaling values from each Landsat scene’s metadata were used to create the scene’s calibration file. Landsat 7 imagery acquired after 31/05/2003, when the sensor’s Scan Line Corrector (SLC) failed, were also masked using the Landsat 7 gap-mask layer to remove all pixels affected by the scan line error.

C) Landsat classification

To increase the classification’s accuracy, the concession shapefile data was used to subset the Landsat scene in order to remove all spectral data outside of the area of interest. The Unsupervised Classification ISODATA algorithm, with the standard clustering parameters, was then used to classify all concessions into forest and non-forest classes. The clouds, cloud shadows and scan line error gaps were masked out for all images and cross-applied to both time-steps to ensure only data available in both time-steps was used to calculate deforestation rates. When necessary, additional imagery from the same calendar year was processed and used to fill in cloud gaps to reduce overall cloud cover below 10%. All images were further processed with a 3*3 majority filter to remove noise and improve the classification accuracy. Lastly, an accuracy assessment was run on each map to ensure the overall classification accuracy was at least 90%. 100 points, with a 50-meter buffer between points, were randomly created for both forest and non-forest classes and compared with the unprocessed Landsat data and high-resolution imagery from Google Earth (when available). The accuracy was then calculated using the equation (1).

$$\text{Overall Classification Accuracy} = \frac{\text{Number of Pixels Classified Correctly}}{\text{Total Number of Classified Pixels}} \quad (1)$$

[4] Available at http://earthexplorer.usgs.gov

All maps had a satisfactory overall accuracy with the lowest accuracy being 91%.

3.2.1.2.3 Area of deforestation

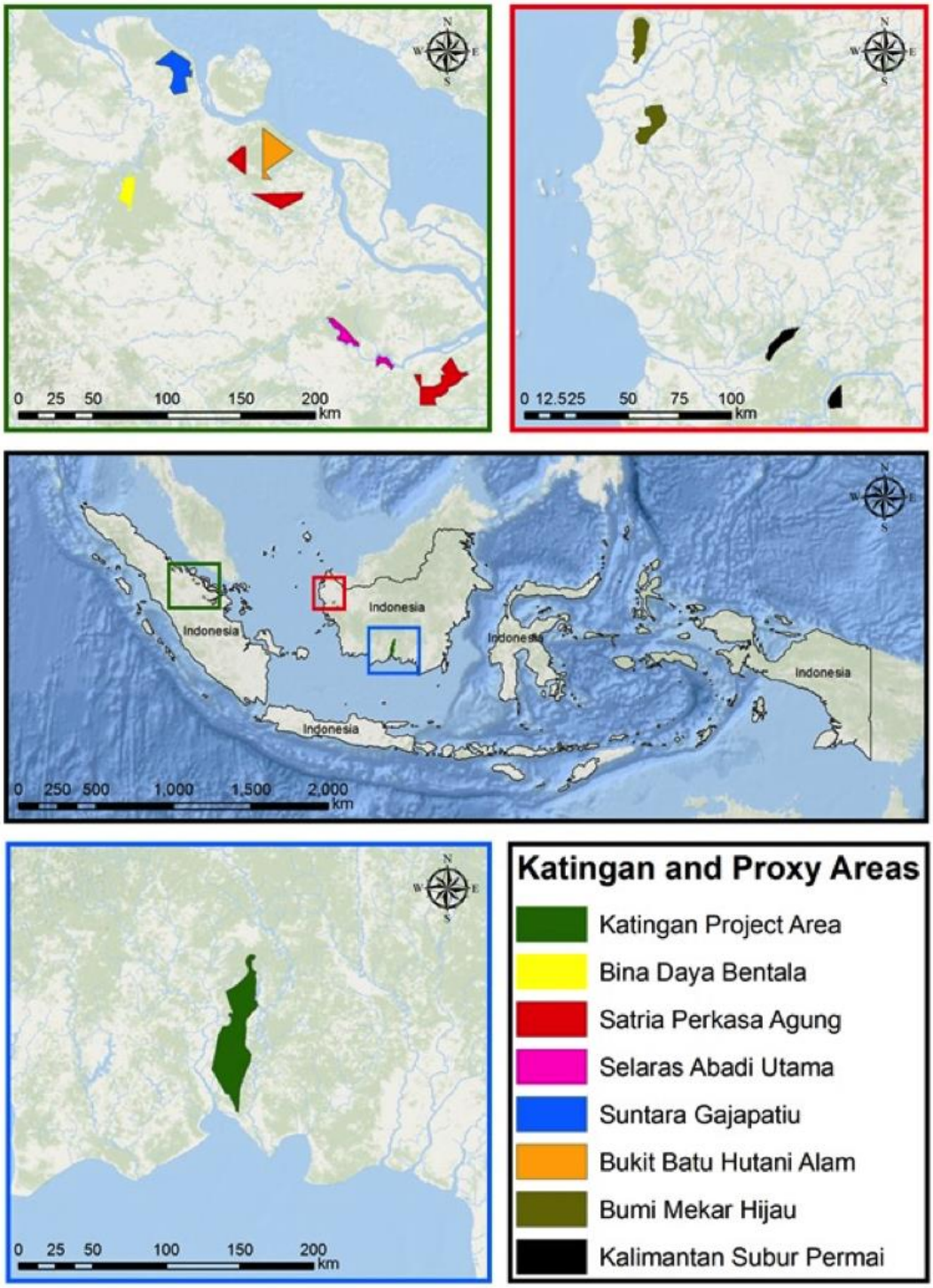
Using the module BL-PL, a total of 7 suitable proxy areas were identified (see Table 9 and Map 4).

Table 9. Summary of suitable reference regions

Reference region	Deforestation Rate	Area in Ha	Province	Concession Grant Date	Peat %	Timestep 1 date	Forest % at Timestep 1	Timestep 2 date	Forest % at Timestep 2	Cloud Gap
Satria Perkasa Agung full concession	7.31%	97533.25	Riau	22/08/2000	88.31%	26/04/2000[a] 21/05/2000[b] 23/02/2000[c] 06/12/2000[d] 01/09/2000[d]	84.50%	09/10/2005[a] 15/02/2009[b] 01/05/2007[c] 19/06/2005[d]	42.55%	3.04%
Suntara Gajapatiu	6.42%	34258.30	Riau	15/03/2001	100%	20/09/2001	92.26%	28/08/2010	34.48%	8.30%
Bukit Batu Hutani Alam	14.31%	33030.50	Riau	30/10/2003	100%	21/05/2000	88.07%	09/10/2005	16.55%	7.85%
Selaras Abadi Utama	8.13%	17434.80	Riau	30/12/2002	100%	02/10/2002	92.40%	15/02/2009	35.52%	1.47%
Kalimantan Subur Permai	**3.91%**	13246.02	West Kalimantan	04/04/2006	92.11%	12/08/2005	93.42%	11/05/2009 30/07/2009 18/10/2009	77.79%	1.42%
Bumi Mekar Hijau	4.40%	25118.70	West Kalimantan	01/05/2007	85.93%	05/07/2006 13/07/2006	83.88%	12/10/2010 15/12/2010	66.27%	7.38%
Bina Daya Bentala	10.63%	14124.76	Riau	22/12/2006	100%	03/08/2004	77.55%	15/10/2010 13/09/2010	13.76%	1.86%

a. Plot 1 of the Satria Perkasa Agung concession; b. Plot 2 of the Satria Perkasa Agung concession; c. Plot 3 of the Satria Perkasa Agung concession; d. Plot 4 of the Satria Perkasa Agung concession

Map 4. Geographic location of the Katingan Project and reference regions for the baseline deforestation rate calculations



The baseline deforestation rate was calculated using the following equation.

$$D\%_{planned,i,t} = \left(\sum_{pn=1}^{n^*} \left(D\%_{pn} / Yrs_{pn} \right) \right) / n \quad (2)$$

Where:

$D\%_{planned,i,t}$	Projected annual proportion of land that will be deforested in stratum I during year t. If actual annual proportion is known and documented (e.g. 25% per year for 4 years), set to proportion; %
$D\%_{pn}$	Percent of deforestation in land parcel pn etc of a reference region as a result of planned deforestation as defined in this module; %
Yrs_{pn}	Number of years over which deforestation occurred in land parcel pn in reference region; years
n	Total number of land parcels examined
pn	1, 2, 3, …n land parcels examined in reference region
i	1, 2, 3, …M strata

The average projected annual deforestation rate for these proxy areas was estimated to be 7.82%. However, in order to guarantee that a conservative approach was used, the deforestation rate applied in the baseline emission calculation (Section 5 of the PD) was the lowest rate of the 7 proxy areas, **3.91%** (see Table 9). Since this approach is unquestionable conservative, the baseline rate of deforestation uncertainty was set to zero.

3.2.1.2.4 Likelihood of Deforestation

Since all pulpwood plantation concessions are zoned for deforestation, and are not under government control for the duration of the concession license, the likelihood of deforestation ($L\text{-}D_i$) is assumed to be equal to 100%.

3.2.1.2.5 Risk of Abandonment

To assess the risk of abandonment, 5 proxy areas with concession grant dates of at least ten years before the project start date were selected using the criteria outlined in Sub-subsection **Error! Reference source not found.**. After confirming the elevation, slope and soil criteria were met, Landsat 5 TM, Landsat 7 ETM+ and Landsat 8 OLI imagery was downloaded for three time-steps and visually analysed to determine if any areas were abandoned for forest regrowth. All 5 proxy areas showed clear signs of continued deforestation and plantation activities for all three time-steps, therefore the BL-PL module is applicable to this project.

3.2.1.2.6 Area of Deforestation

The annual area of deforestation in the baseline is calculated using equation 3.

$$AA_{planned,i,t} = (A_{planned,i} * D\%_{planned,i,t}) * L\text{-}D_i \quad (3)$$

Where:

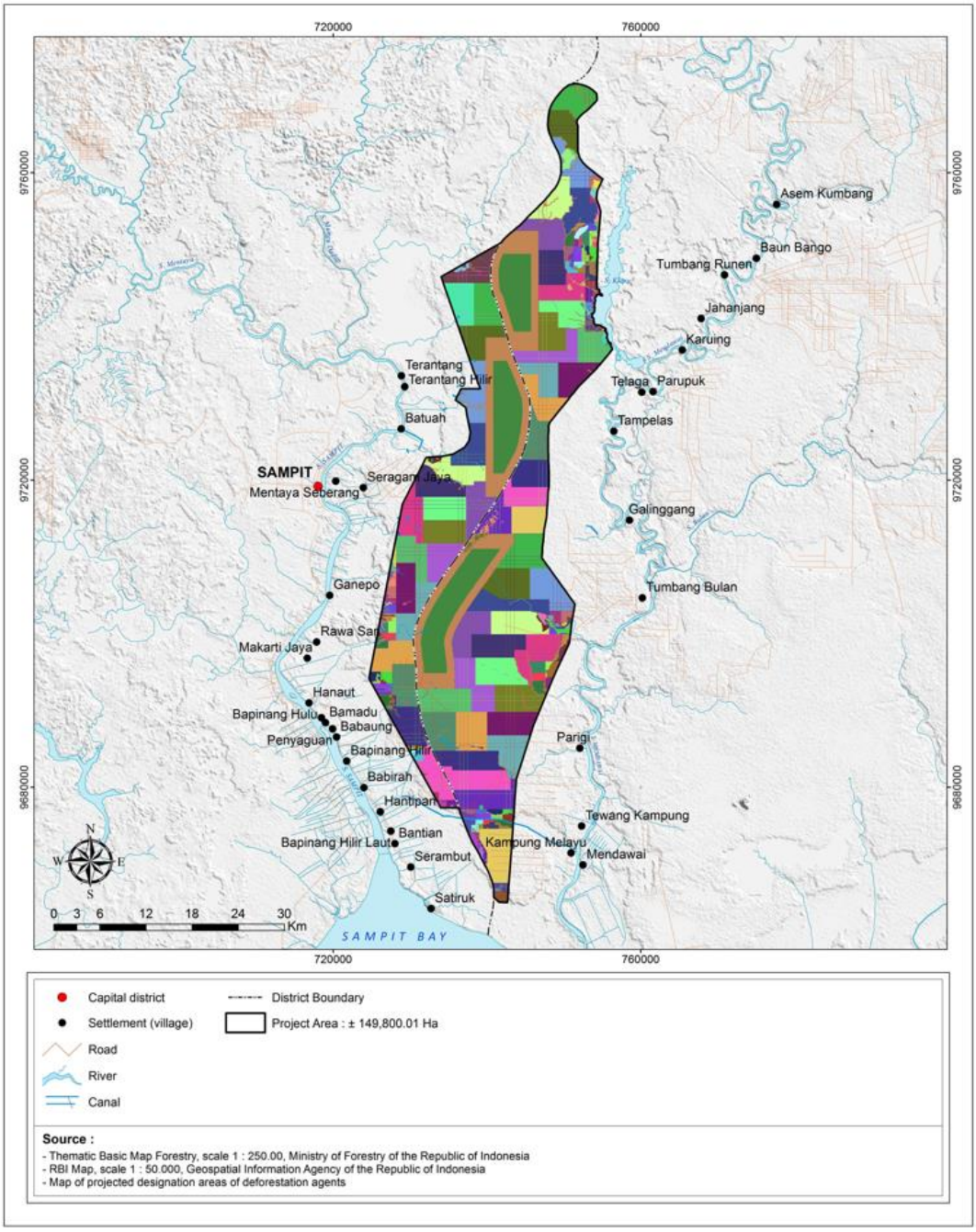
$AA_{planned,I,t}$	Annual area of baseline planned deforestation for stratum I at time t; ha
$D\%_{planned,I,t}$	Projected annual proportion of land that will be deforested in stratum I during year t. If actual annual proportion is known and documented, set to proportion; %
$A_{planned,I}$	Total area of planned deforestation over the baseline period for stratum I; ha
$L\text{-}D_i$	Likelihood of deforestation for stratum I; %

3.2.1.3 Projection of deforestation under the baseline scenario

Following the determination of the total annual area deforested in the baseline ($AA_{planned,i,t}$), the area was allocated spatially to produce a spatial map of the baseline scenario. The project area was stratified into six strata (Table 10) based on five land use classes, two drainage statuses and one water body class through a Combination-Elimination process as described in Annex 14 of the PD. A baseline scenario map is provided in Map 5. The mapping process involved the following steps:

- Delineation of forest and non-forest area at the project start date. This process is described in Sub-subsection **Error! Reference source not found.** in the PD.
- Delineation of water bodies present at the project start date (rivers and canals)
- Division of the project area into three assumed concession areas, corresponding to different baseline agents. The division is in compliance with historical records that timber plantation license being given is decreasing with size range from 30,000 to 70,000 ha. Strengthened in 2014 by Ministry of Forestry Decree no P.8/Menhut-II/2014 that limits concession sizes in Indonesia to a maximum of 50,000 hectares.
- Division of each concession area into five zones (acacia plantations, conservation areas, indigenous species area, infrastructure, and areas for community crops) in line with specific regulation (see Table 32 in PD).
- Delineation of 50 meters width river buffers (25 meters from both sides of natural rivers). Forest cover inside the buffers are prohibited to log or convert under regulation.
- Drainage canals were laid out in a step wise approach complying with applicable regulations, common practice and hydrotopography of the project area. Primary canals that enclose the concession areas (mandatory by regulation) were delineated first; then secondary canals that act as main outlets for tertiary canals and discharging channels into main canals or natural streams. Considering the hydrotopograhy of the area, baseline agents were assumed to construct secondary canals perpendicular to elevation contour-lines. Tertiary canals are not necessarily perpendicular to elevation contour-line and act as planting block borders, therefore the delineation was carried out in step 8. All the canals were placed in *Acacia* plantations and community crop zones only.
- Division of the *Acacia* plantation area of each assumed agent's concession into 4 Major Blocks (termed Blok RKT, Rencana Kerja Tahunan), resulting in 12 Major blocks in the project area.
- Division of each Major Blocks into smaller planting blocks (termed Blok Tanam) of 500 by 500 meter square parcels
- Division of all Major Blocks into deforestation/planting zones based on deforestation rate (D%) resulting in analysis of Reference Region. Each planting zone consists of several planting blocks.
- Division of all community crop zones into agriculture planting zones based on deforestation rate (D%) resulting in form the analysis of the proxy area analysis
- Assigning canals' construction years, starting from the closest area to access points, in this case rivers
- Assigning deforestation/planting years to deforestation/planting zones, starting from the closest area to access points, in this case rivers
- Assigning planting years to community crop zones
- Choosing and delineating locations for camps and log yards
- Assigning camps and log yards construction years, starting from the closest area to access points, in this case rivers

Map 5. Baseline scenario map[5]



[5] Legend of this map is continued to the box below the map. Numbers preceding alphabet symobols denote year of drainge/deforestation in reference to project start date. Abbreviations: AC=Acacia, CA= Community crops, IF=Ground fascility, IS=Indigineous species area, CF=Conservation area.

3.2.1.4 Emission characteristics in the baseline scenario

3.2.1.4.1 Stratification of emission characteristics for CUPP activities under the baseline scenario

Baseline strata of relative homogeneous emission characteristics were mapped on the basis of the Master Baseline Scenario Map (see Map 27) by taking into account (1) Coverage of land use / cover / drainage status; (2) Timing of land use change / drainage status under the assumed baseline; and (3) the delineation of peat. The stratification map of emission characteristics presents the following information:

- Land use (vegetation cover, water bodies, etc.) and the related emission factors: different land uses translate into different emission factors.
- Timing of deforestation or conversion (*Acacia* plantings) other agriculture plantings and canal constructions. Temporal variability of these activities and the different drainage status translate into different emissions. For example, if a peatland parcel belongs to the acacia stratum (forest planned to be drained in year 3 and to be deforested and converted to acacia in year 6) and was initially undrained and forested, then the Emission Factor (EF) of undrained peatland forest will be used for year 1 – 2, the EF for drained peatland forest for year 3 – 5, and finally the EF for acacia for year 6 onwards.
- Area of peatland, outside which peat-related emissions are absent

In the baseline scenario, the six strata that significantly differ in peat GHG emission characteristics are summarized in Table 10 and Map 6. A summary of dynamics of these strata is presented in Map 9, and Appendix 4 of the PD.

Map 6. Baseline stratification of the project area for CUPP activities

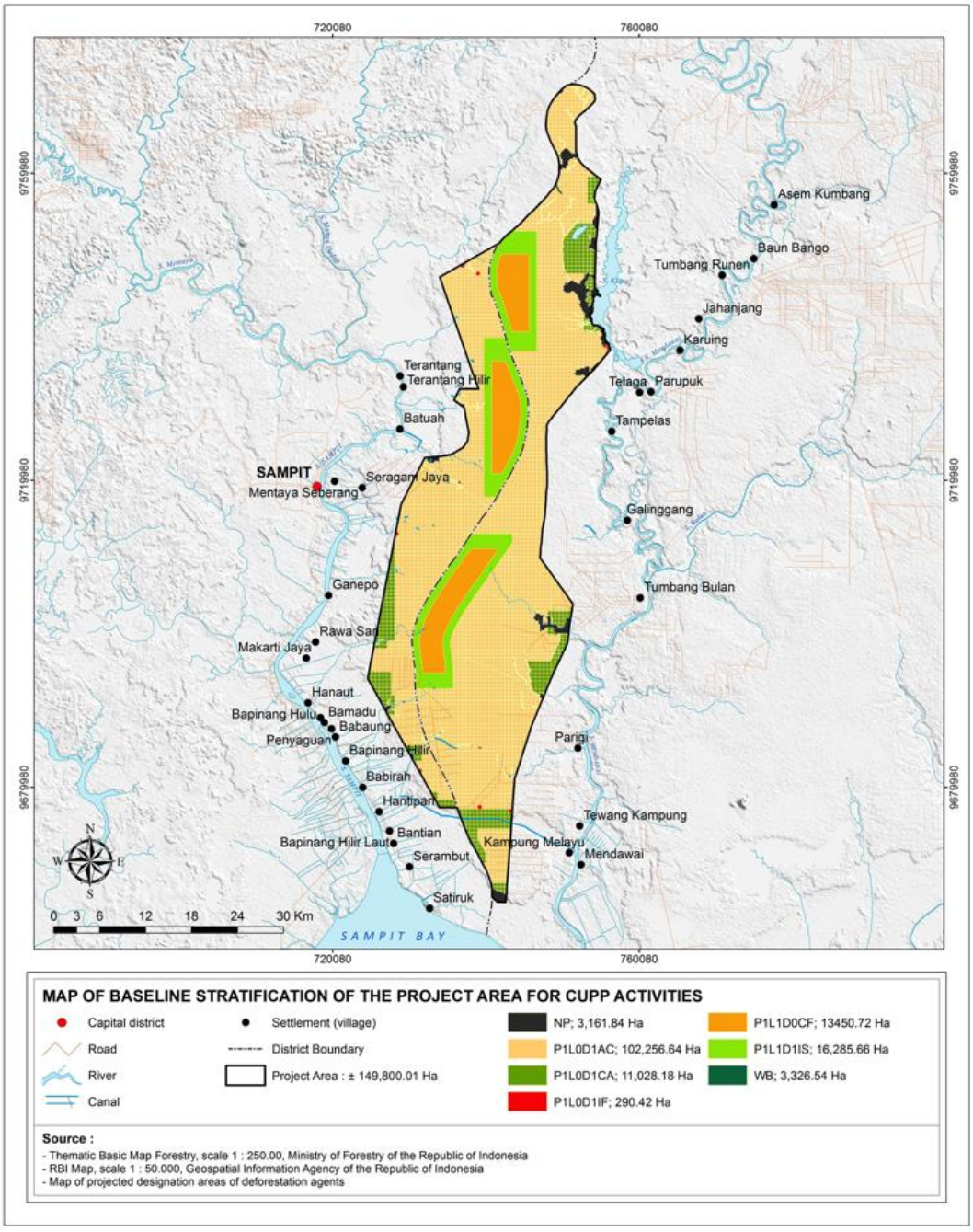
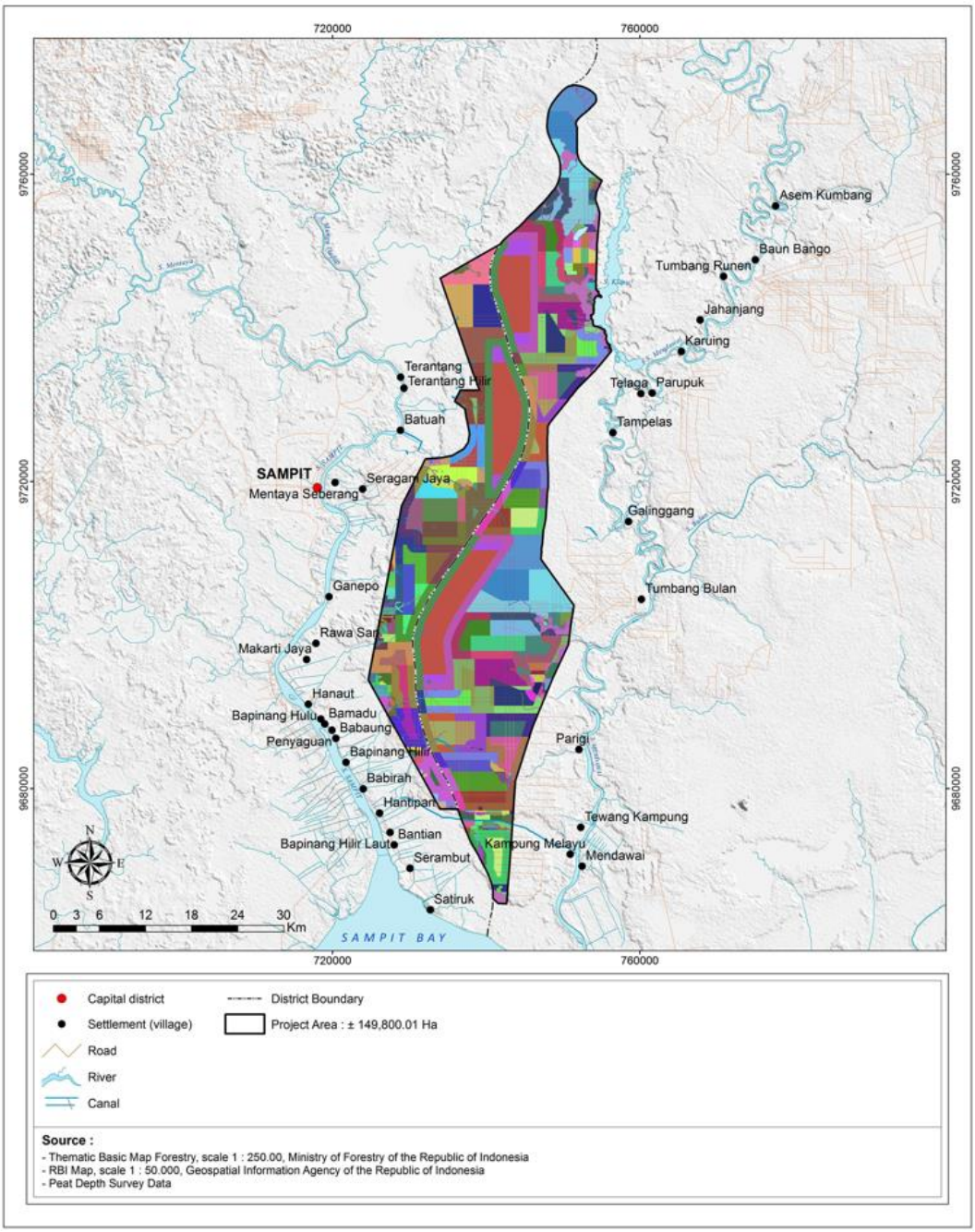


Table 10. Baseline stratification of peatlands and water bodies based on relative homogeneous emission characteristics

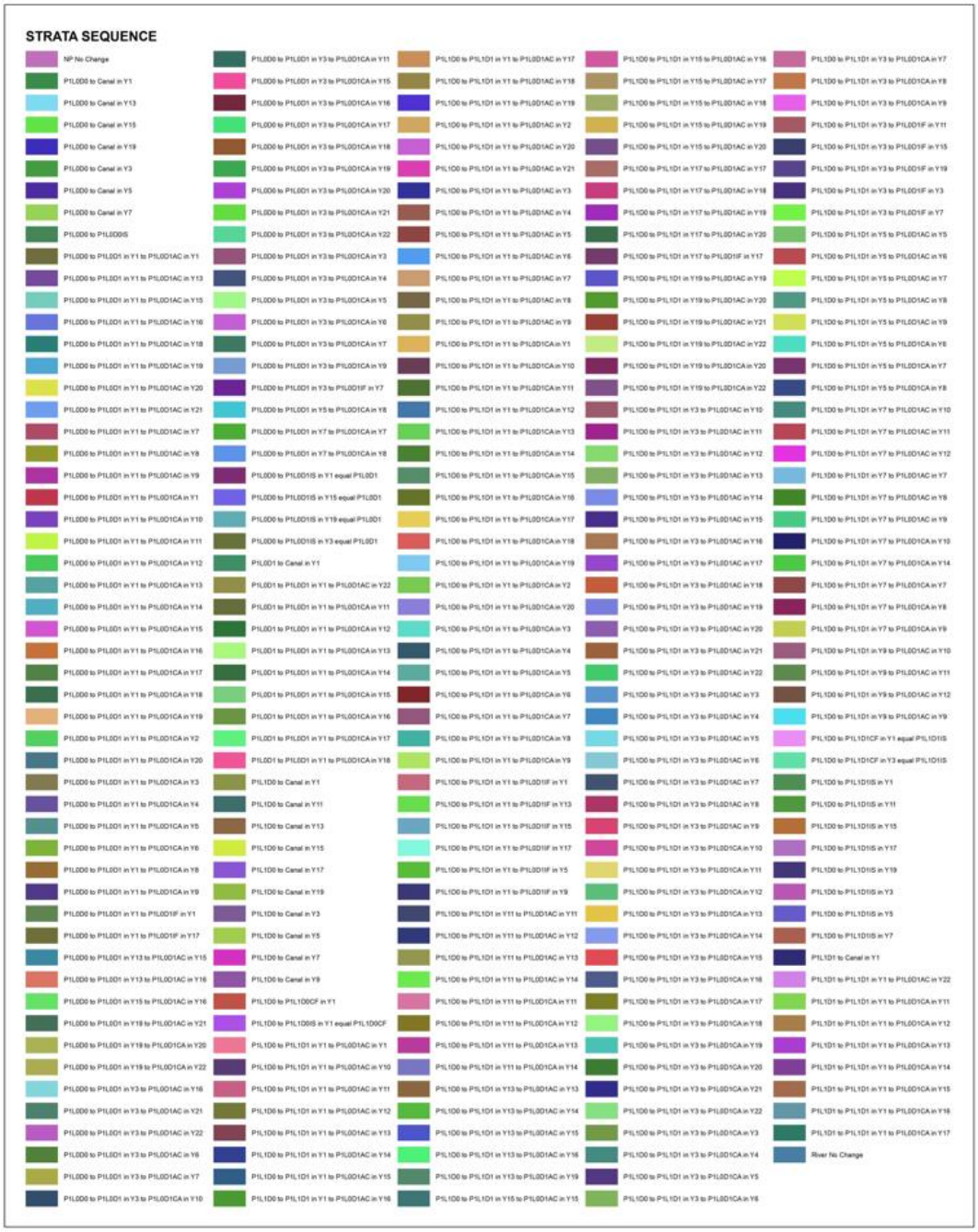
Strata	Description	Area (ha)	Percentage of Project Area	Assumed water table depth (cm-ss)
P1L0D1AC	Acacia Plantation on drained peatland. This stratum represents typical acacia plantations on peatland in Indonesia. For this stratum, drainage is required and forest covers are removed if present. Acacia planting starts in the same year as deforestation. The development of drainage constructions is assumed to happen just before- or at the same year as the deforestation/planting (details are provided in Map 29 and Appendix 7).	102,257	68.3	80
P1L1D0CF	Conservation Forest (undrained peatland forest). This stratum represents peatlands where forest covers are not removed and drainage is absent. This stratum remains unchanged since the project start date. The locations of these strata have been selected and positioned in areas where forest cover and peat were present at the project start date	13,451	9.0	20
P1L0D1CA	Community crops on drained peatland. This stratum represents areas nearby community villages that are or will be utilized for agriculture crops. The locations of these strata have been selected in or near deforested areas and with sufficient transportation access, in this project, rivers.	11,028	7.4	80
P1L0D1IF	Infrastructures on drained peatland. This stratum represents lands within acacia plantations planting that would be used for company operation supports, such as base camps, station camps and log yards. Infrastructure areas are usually drained (when on peatland) and barren. The locations have been selected as close as possible to transportation access (rivers).	290	0.2	80
P1L1D1IS	Native Tree species area and river buffer (drained peatland forest). This stratum consists of 2 types of drained forested peatlands in the	16,286	10.9	50

Strata	Description	Area (ha)	Percentage of Project Area	Assumed water table depth (cm-ss)
	project area. The indigenous species areas were positioned as c.a. 1 km buffer zone around each conservation area (stratum P1L1D0CF). Peatlands in this stratum are assumed to experience drainage impacts from the surrounding drained areas, but the forest cover remains unchanged during the project duration. Boundary canals are also constructed along the periphery of the indigenous species area. River buffers were positioned as a 50 m belt extending from both sides of rivers in the project area			
WB	Water bodies. This stratum represents rivers and drainage canals on peatlands. Rivers remain unchanged during the project period, while drainage canals coverage gradually expands following the assumed yearly operation of the baseline agents.	3,327	2.2	NA
Total		146,638	97.9	

Map 7. Stratification changes in the baseline scenario for CUPP activities[6]



[6] Legend of this map is extended to the box below.



3.2.1.4.2 Stratification based on the emission characteristics for REDD under the baseline scenario

Carbon stock changes and emissions regarding aboveground biomass under the baseline scenario are driven by land cover changes before, during and after the occurances of deforestation. In the project area, GHG emissions as a result of deforestation occurred over 114,694 ha of forest land designated as acacia plantations, community crops, and infrastructure. Ministry of Forestry regulation [7]mandates that 30,348 ha of forest land must be

[7] Ministry of Environemnt and Forestry. (1995). Keputusan Mentri Kehutanan Nomor: 70/Kpts-II/95 tentang pengaturan tata ruang hutan tanaman industri.

set aside, of which 15,123 ha designated as conservation forest and 14,966 ha designated as native tree species area. These areas were therefore excluded from emission calculations. Given that no land cover change would occur in these areas, they are referred as non relevant strata and therefore excluded from emission calculations.

A total 114,778 ha of the forest in the project area is planned to be deforested in the baseline scenario, of which 103,364 ha will be transformed into areas designated as acacia plantation areas. In areas designated as 'community crops', 7,980 ha of forested area will be deforested and replaced by rubber tree plantations. While in areas designated as 'infrastructure area', 3,346 ha of forest area will be deforested and converted into canals, drainage ditches and other infrastructures. Given relatively small impacts (compared to peat/belowground), the carbon loss of AGB due to uncontrolled burning under the baseline scenario is excluded in the calculation.

In the baseline scenario, the stratification of AGB and land cover changes which significantly differ in GHG emission characteristics were estimated and summarized as summarized in Map 8 and Table 11. The dynamics of strata changes are provided in more detail in Appendix 4 of the PD.

Map 8. Stratification of aboveground biomass in the baseline scenario for REDD

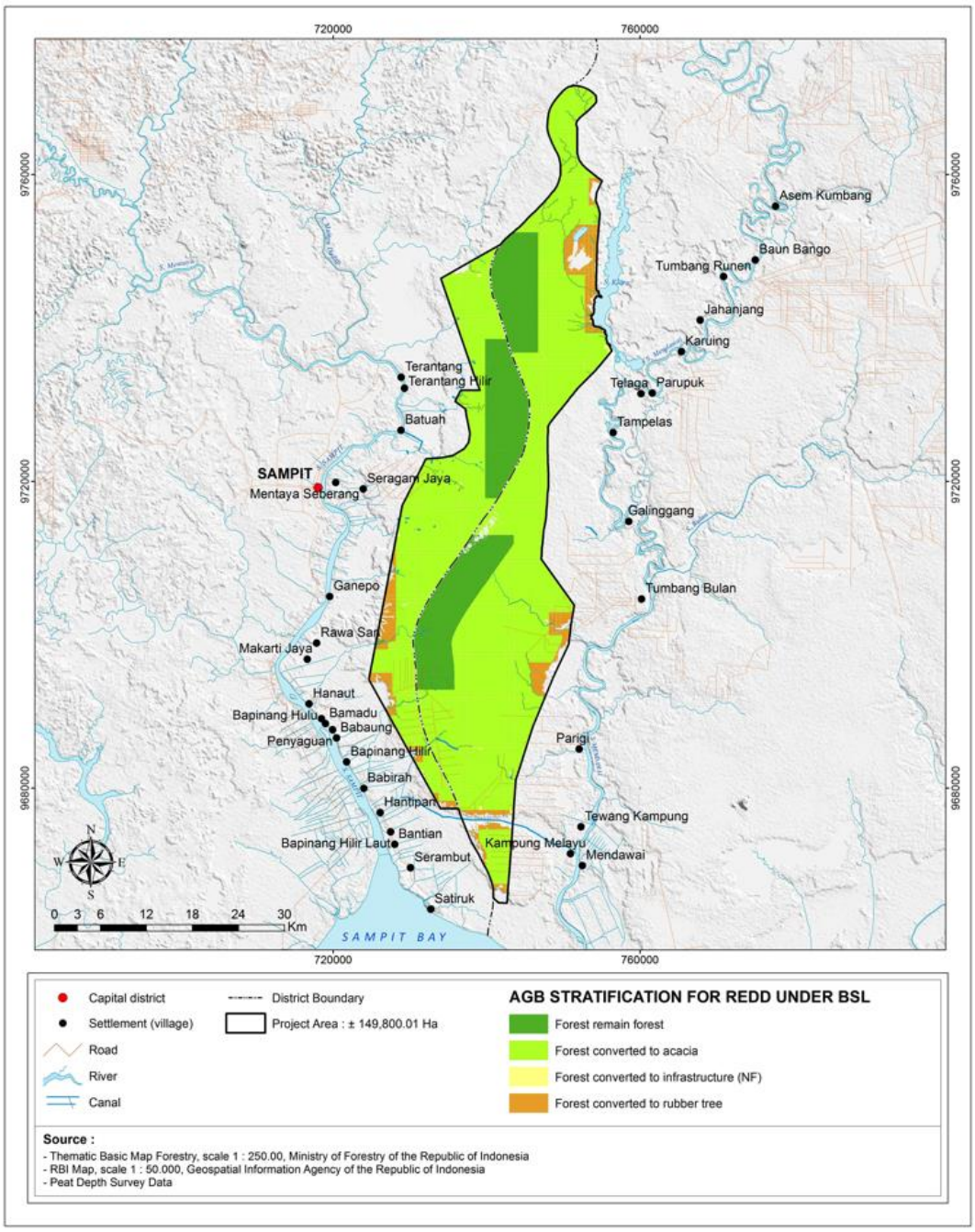


Table 11. Land cover changes strata in the baseline scenario for REDD

Strata	Description	Land use	Area (ha)	Proportion
F0F1*	Forest to forest	Protected area	15,122.82	10.45%
F0F1*	Forest to forest	Native tree area	14,965.81	10.34%
F0Ac1	Forest to *Acacia* plantation	Acacia plantation area	103,363.53	71.39%
F0Rbr1	Forest to rubber tree plantation	Community crops	7,980.38	5.51%
F0NF1	Forest to Non-forest	Infrastructure	3,345.73	2.31%
Total			144,778.26	100.00%

*Non relevant strata as there is no land cover change in baseline scanario

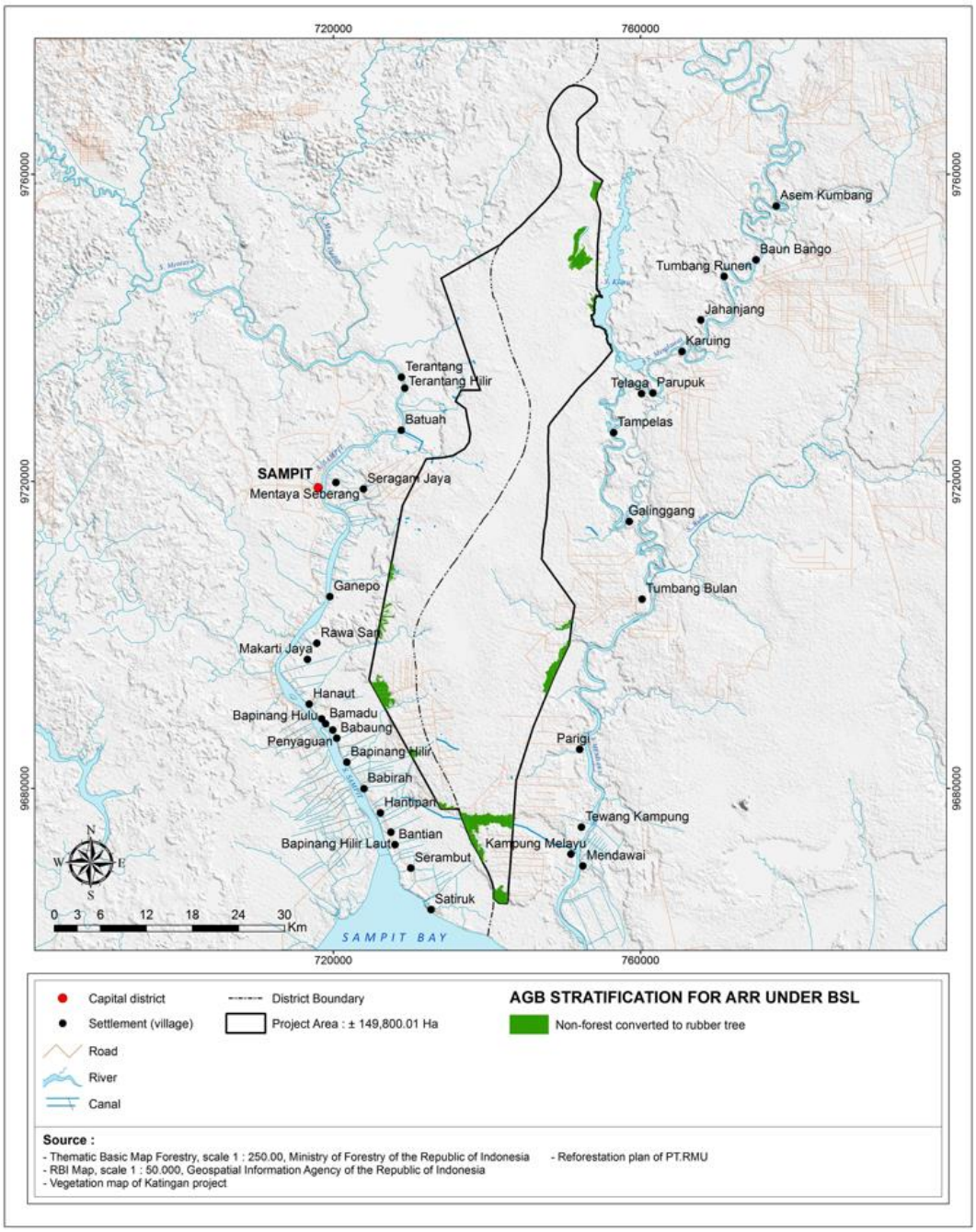
3.2.1.4.3 Stratification of emission characteristics for ARR activities under the baseline scenario

Replanting under the ARR activities in the areas designated for 'community crops' in the baseline will increase carbon stocks and will therefore be subtracted from the emissions resulting from other baseline activities such as deforestation and forest degradation. Spatial analysis showed that 4,227.72 ha of non-forest area would be transformed to rubber tree plantation (as an ARR activity). A rubber plantation is harvested and renewed every 25 year. Map 9 shows the stratification map of ARR activities under the baseline scenario. The dynamics of changes in the rubber plantation strata are presented in Table 12.

Table 12. Land cover changes strata in the baseline scenario for ARR

Strata	Planting Agent	Land use	Area (Ha)	Planting Start year
NF0Rbr1	Agent A	Community crops	1,004.37	2010
	Agent B	Community crops	1,018.52	2012
	Agent C	Community crops	2,204.82	2012
Total			4,227.72	

Map 9. Stratification of aboveground biomass in the baseline scenario for ARR



3.2.1.5 Baseline emissions from deforestation

Annual emissions from deforestation are estimated based on the carbon stock losses as a result of conversion of the original forest to acacia plantation area (103,715.55 ha), infrastructure (3,528.26 ha), and rubber tree plantation area (12,208.10 ha) by the three deforestation agents as described in Sub-section **Error! Reference source not found.** of the PD. The rate of conversion applied for acacia and rubber plantations is conservatively

estimated as the lowest rate of deforestation found in proxy area (3.91%) to determine $AA_{planned,l,t}$. GHG dynamics in the acacia baseline are determined based on the changes in land cover, the soil emissions related to these land cover changes, the emissions from drainage canals and emissions resulting from uncontrolled burnings. The changes in carbon stock in AGB are a result of the conversion of forest to acacia or other land uses, the plantings schemes (rotational and year-by-year) that are applied for the establishment of the acacia plantations and forest degradation as a result of various illegal threats such as illegal logging in undeveloped or conservation areas.

The predicted drainage layout and drainage density of each proportion of the converted land is estimated based on the predicted annual deforestation rate, local hydrotopographic conditions, common practice among acacia plantations and existing regulations. Existing regulations require acacia plantation operators to construct main canals along the concession borders. These canals must be constructed at an early stage of the plantation development, collect water from all other canals in the concession area, and discharge it to nearby rivers. Local topographic conditions play a role in the baseline agents' decisions in designing secondary canals which would act as the main outlets for tertiary canals. The canals need to be constructed with minimal flow resistance, hence positioning them perpendicular to general contour line is optimal. Common practice shows that acacia plantation operators do not necessarily layout tertiary canals perpendicular to the contour line, as long as all of them connect to secondary canals.

As a result of the spatial layout of the baseline deforestation activity, the remaining forest in the project area would have been converted as shown in Table 13 below.

Table 13. Projection of annual forest conversion in project area under the baseline scenario

Year	Forest (ha) deforested and converted to									TOTAL
	Acacia plantation			Infrastructure			Rubber tree plantation			
	Agent A	Agent B	Agent C	Agent A	Agent B	Agent C	Agent A	Agent B	Agent C	
2010	-	-	-	-	-	-	-	-	-	-
2011	1,589	-	-	423	-	-	133	-	-	2,146
2012	1,640	-	-	-	-	-	155	-	-	1,795
2013	1,646	1,527	2,052	-	374	406	181	130	213	6,529
2014	1,636	1,527	2,041	-	-	-	155	88	259	5,705
2015	1,655	1,517	2,022	189	-	-	150	173	255	5,961

Year	Forest (ha) deforested and converted to									TOTAL
	Acacia plantation			Infrastructure			Rubber tree plantation			
	Agent A	Agent B	Agent C	Agent A	Agent B	Agent C	Agent A	Agent B	Agent C	
2016	1,646	1,619	1,930	-	-	-	125	77	196	5,593
2017	1,656	1,575	2,017	-	158	207	175	207	82	6,076
2018	1,683	1,630	1,945	-	-	-	127	191	282	5,857
2019	1,719	1,518	1,949	189	-	-	179	75	181	5,811
2020	1,695	1,550	1,986	-	-	-	174	180	235	5,819
2021	1,650	1,519	1,996	-	145	190	195	170	66	5,930
2022	1,649	1,550	1,942	-	-	-	141	58	117	5,456
2023	1,629	1,666	2,097	161	-	-	57	34	83	5,727
2024	1,624	1,517	2,043	-	-	-	10	173	92	5,459
2025	1,608	1,540	1,819	-	168	192	24	155	81	5,585
2026	1,595	1,515	1,844	-	-	-	156	178	127	5,415
2027	1,658	1,544	1,955	182	-	-	92	106	60	5,598
2028	1,616	1,566	1,916	-	-	-	133	135	-	5,367
2029	1,655	1,578	1,935	-	157	204	85	158	64	5,837
2030	1,550	1,484	2,041	-	-	-	117	161	104	5,455
2031	-	1,323	1,962	-	-	-	-	146	136	3,567
2032	-	1,527	2,282	-	-	-	-	186	5	4,000

Year	Forest (ha) deforested and converted to									TOTAL
	Acacia plantation			Infrastructure			Rubber tree plantation			
	Agent A	Agent B	Agent C	Agent A	Agent B	Agent C	Agent A	Agent B	Agent C	
2033	-	-	-	-	-	-	-	-	-	-
2070	-	-	-	-	-	-	-	-	-	-
TOTAL	32,798	30,792	39,773	1,145	1,002	1,199	2,562	2,781	2,637	**114,690**
	103,364			**3,346**			**7,980**			

Per BL-PL, net carbon stock changes in the baseline are equal to pre-deforestation stocks minus the long-term average carbon stock in the post-deforestation land-use (acacia and rubber plantation),), as defined in the following equation 4.

$$\Delta C_{AB_{tree},i} = C_{AB_{tree_{bsl}},i} - C_{AB_{tree_{post}},i} \quad (4)$$

Where :

$\Delta C_{AB\ tree,i}$ = Baseline carbon stock change in aboveground tree biomass in stratum i; t CO2-e ha-1

$C_{AB\ treeBSL,i}$ = Forest carbon stock in aboveground tree biomass in stratum i; t CO2-e ha-1

$\Delta C_{AB\ treepost,i}$ = Post-deforestation carbon stock in aboveground tree biomass in stratum i; t CO2-e ha-1

Pre-deforestation stock is equal to the average carbon density estimated from biomass plots in the project area (98.38 tC/ha). Referring to the baseline stratification, long-term average carbon stock is dependent on the post deforestation land-use of acacia plantations and rubber tree plantations. For *Acacia crassicapa*, the long-term average carbon stock is calculated from the biomass dynamics of *Acacia crassicarpa* in plantations with the rotation of 5 years. For rubber tree (*Hevea brasiliensis*) plantations the long-term average carbon stockis estimated from the biomass dynamic of rubber tree plantation with a 25 year rotation cycle based on RSPO default value. Applying the VCS AFOLU guidance[8], calculation of the long-term

[8] AFOLU Guidance: example for calculationg Long Term Average Carbon Stock for ARR project with harvesting

average carbon stockof *Acacia crassicarpa* and *Hevea brasiliensis* was calculated as 17.66 tC/ha and 21.09 tC/ha, respectively. Carbon stock change ($\Delta AB_{tree,i}$ or EF) of forest convertion to *Acacia* plantation, rubber tree plantation, and infrastructure is 296.00 tCO_2-e ha^{-1}, 283.41 tCO_2-e ha^{-1}, and 352.81 tCO_2-e $ha^{-}1$, respectively. Table 14 provides an overview of the carbon stock changes and emissions within the project life time.

It is assumed that 100% of the deforested areas will be converted to plantations in the year of conversion. GHG emissions from fertilizer application and aboveground biomass loss due to fires are conservativelly excluded in the baseline.

Stock changes in aboveground biomass is accounted for at the time of deforestation, and is estimated using the following equation 5:

$$\Delta C_{BSL,i,t} = AA_{planned,i,t} * \Delta C_{ABtree,i} \quad (5)$$

Where :

$\Delta C_{BSL,i,t}$ = Sum of the baseline carbon stock change in all pools in stratum i at time t, t CO2-e

$AA_{planned,i,t}$= Annual area of baseline planned deforestation for stratum i at time t; ha

$\Delta AB_{tree,i}$ = Baseline carbon stock change in aboveground tree biomass in stratum i; t CO2-e ha-1

Total emissions from deforestation in the project crediting period are estimated as 34,037,000 tCO2 which is released from forest conversion from 2011 to 2031 (see Table 14 and Map 10 below).

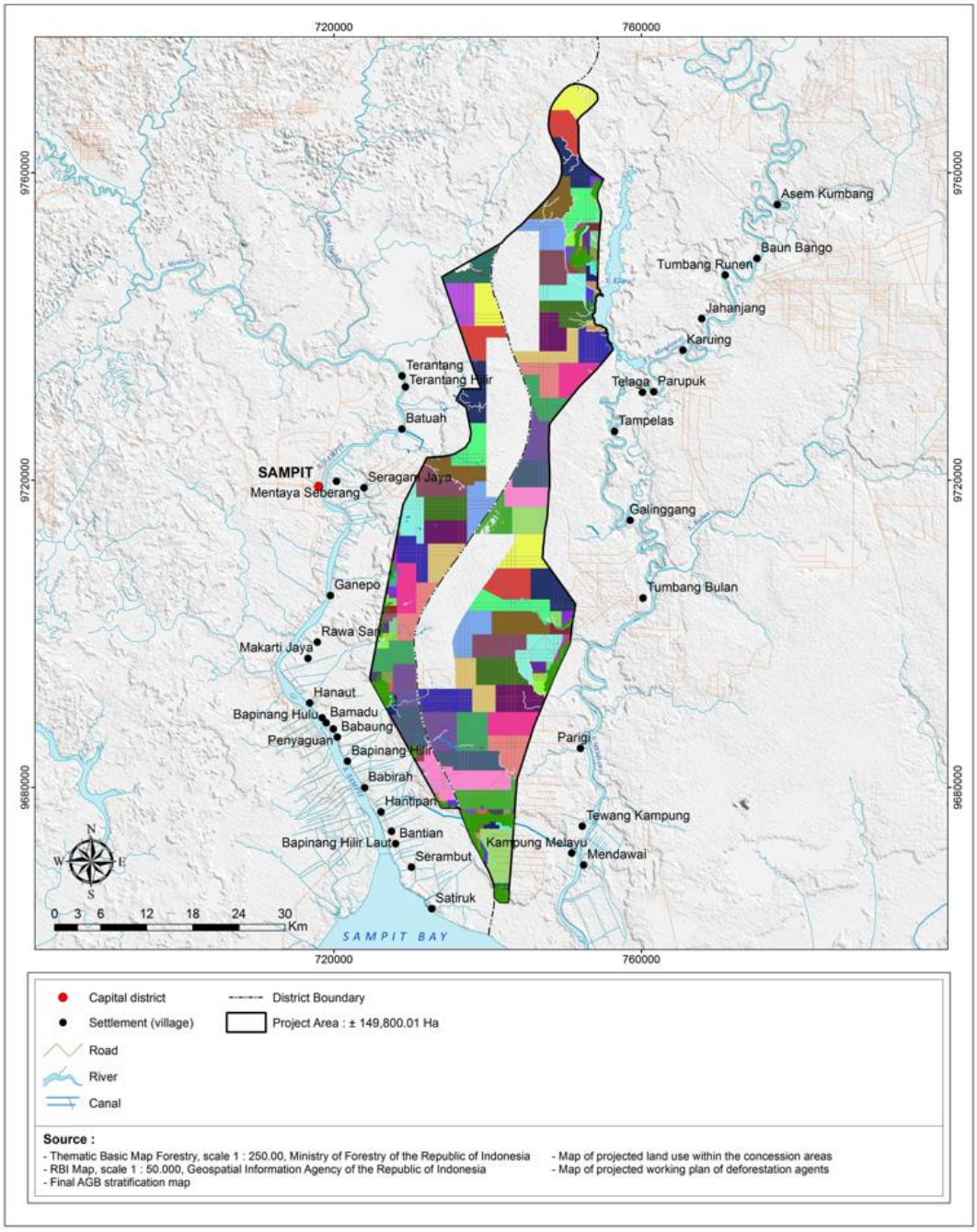
Table 14. Carbon stock changes and emissions from deforestation in project area within project life time

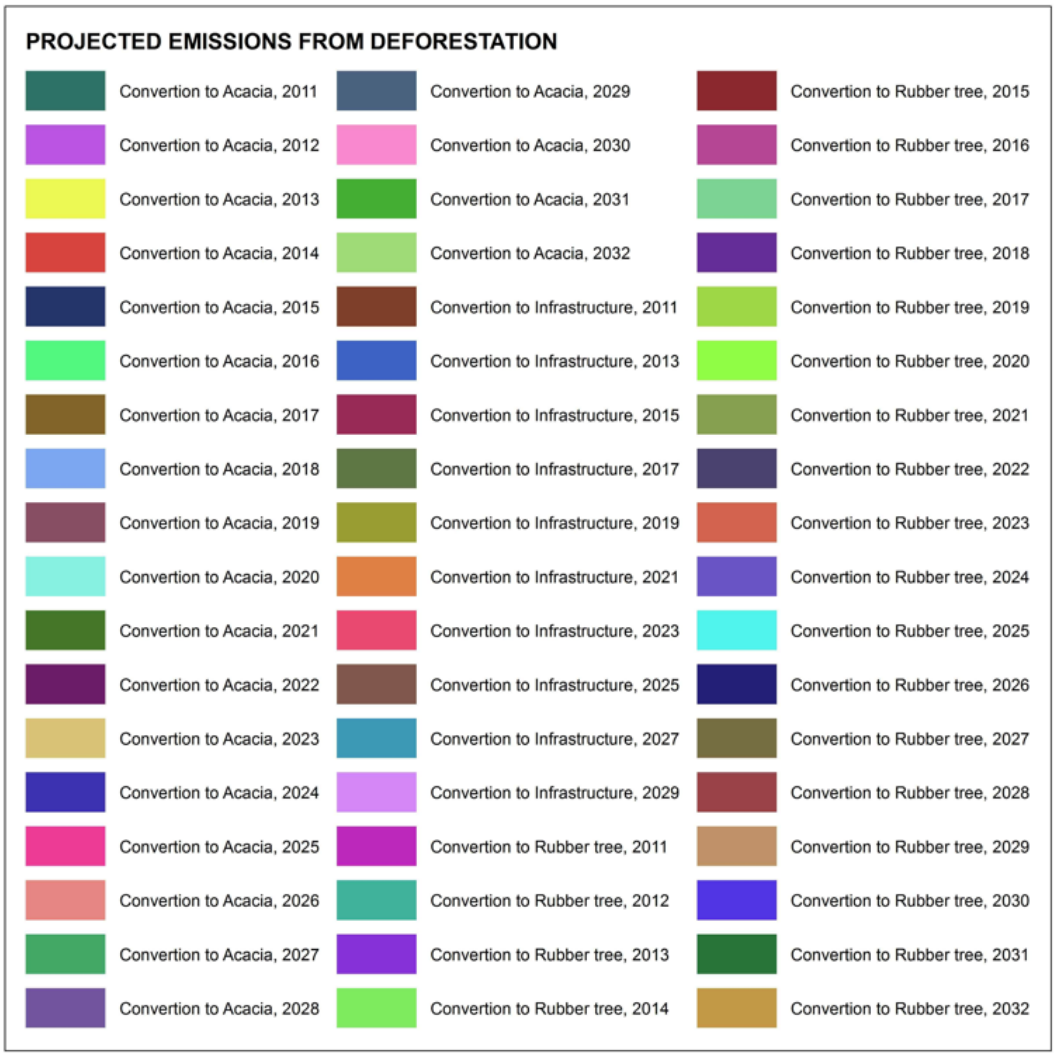
Year	Emission (x1000 tCO2-e) resulted from the conversion from forest to									TOTAL
	Acacia plantation			Infrastructure			Rubber tree plantation			
	Agent A	Agent B	Agent C	Agent A	Agent B	Agent C	Agent A	Agent B	Agent C	
2011	470	-	-	149	-	-	38	-	-	657
2012	485	-	-	-	-	-	44	-	-	529
2013	487	452	607	-	132	143	51	37	60	1,970
2014	484	452	604	-	-	-	44	25	73	1,682

Year	Emission (x1000 tCO2-e) resulted from the conversion from forest to									TOTAL
	Acacia plantation			Infrastructure			Rubber tree plantation			
	Agent A	Agent B	Agent C	Agent A	Agent B	Agent C	Agent A	Agent B	Agent C	
2015	490	449	598	67	-	-	43	49	72	1,768
2016	487	479	571	-	-	-	35	22	56	1,651
2017	490	466	597	-	56	73	50	59	23	1,813
2018	498	482	576	-	-	-	36	54	80	1,726
2019	509	449	577	67	-	-	51	21	51	1,725
2020	502	459	588	-	-	-	49	51	67	1,715
2021	488	450	591	-	51	67	55	48	19	1,769
2022	488	459	575	-	-	-	40	16	33	1,611
2023	482	493	621	57	-	-	16	10	24	1,702
2024	481	449	605	-	-	-	3	49	26	1,612
2025	476	456	538	-	59	68	7	44	23	1,670
2026	472	448	546	-	-	-	44	51	36	1,597
2027	491	457	579	64	-	-	26	30	17	1,664
2028	478	464	567	-	-	-	38	38	-	1,585
2029	490	467	573	-	55	72	24	45	18	1,744
2030	459	439	604	-	-	-	33	46	29	1,610
2031	-	392	581	-	-	-	-	41	39	1,052

Year	Emission (x1000 tCO2-e) resulted from the conversion from forest to									TOTAL
	Acacia plantation			Infrastructure			Rubber tree plantation			
	Agent A	Agent B	Agent C	Agent A	Agent B	Agent C	Agent A	Agent B	Agent C	
2032	-	452	676	-	-	-	-	53	1	1,181
2033	-	-	-	-	-	-	-	-	-	-
2070	-	-	-	-	-	-	-	-	-	-
TOTAL	9,708	9,114	11,773	404	353	423	726	788	747	34,037
			30,595			1,180			2,262	

Map 10. Projected emissions from deforestation in the project area





3.2.1.6 Baseline emissions from ARR activities

Under the baseline scenario, ARR activities are carried out in the non-forest community buffer areas of the three deforestation agents (timber plantation companies). Based on spatial analysis, in total 4,227.72 ha will be planted with rubber tree (*Hevea brasiliensis*); 1,004.37 ha by agent A, 1,018.52 ha by agent B, and 2,204.82 ha by agent C.

The annual planting rate is set equal to the deforestation rate that resulted from analyses in the reference region. For rubber, the plantation was assumed to operate on a 25 year rotation (i.e. harvested and replanted every 25 years). We assumed 3 planting times and 2 harvesting times within the project period. Activities and sequences associated with the establishment of rubber tree plantation under baseline scenario are summarized in Table 15 below.

Table 15. The assumed annual planting and harvesting under ARR activities within the project periode

	Planting									Harvesting					
Agent	Agent A			Agent B			Agent C			Agent A		Agent B		Agent C	
Year/ Rotation	1	2	3	1	2	3	1	2	3	1	2	1	2	1	2
2010	-														
2011	44														
2012	49			-			-								
2013	-			91			66								
2014	27			98			14								
2015	29			3			12								
2016	47			53			171								
2017	-			1			214								
2018	58			9			0								
2019	15			125			103								
2020	3			0			42								
2021	30			25			135								
2022	66			142			100								
2023	119			166			139								
2024	158			61			130								
2025	152			29			134								

2026	30			-			83								
2027	65			93			141								
2028	18			36			187								
2029	75			12			152								
2030	22			33			88								
2031	-			37			70								
2032	-			3			223								
2033	-			-			-								
2034	-			-			-								
2035	-	-		-			-			-					
2036	-	44		-			-			44					
2037	-	49		-	-		-	-		49		-		-	
2038	-	-		-	91		-	66		-		91		66	
2039	-	27		-	98		-	14		27		98		14	
2040	-	29		-	3		-	12		29		3		12	
2041	-	47		-	53		-	171		47		53		171	
2042	-	-		-	1		-	214		-		1		214	
2043	-	58		-	9		-	0		58		9		0	
2044	-	15		-	125		-	103		15		125		103	

2045	-	3		-	0		-	42		3		0		42	
2046	-	30		-	25		-	135		30		25		135	
2047	-	66		-	142		-	100		66		142		100	
2048	-	119		-	166		-	139		119		166		139	
2049	-	158		-	61		-	130		158		61		130	
2050	-	152		-	29		-	134		152		29		134	
2051	-	30		-	-		-	83		30		-		83	
2052	-	65		-	93		-	141		65		93		141	
2053	-	18		-	36		-	187		18		36		187	
2054	-	75		-	12		-	152		75		12		152	
2055	-	22		-	33		-	88		22		33		88	
2056	-	-		-	37		-	70		-		37		70	
2057	-	-		-	3		-	223		-		3		223	
2058	-	-		-	-		-	-		-		-		-	
2059	-	-		-	-		-	-		-		-		-	
2060	-	-	-	-	-		-	-		-	-	-		-	
2061	-	-	44	-	-		-	-		-	44	-		-	
2062	-	-	49	-	-	-	-	-	-	-	49	-	-	-	-
2063	-	-	-	-	-	91	-	-	66	-	-	-	91	-	66

2064	-	-	27	-	-	98	-	-	14	-	27	-	98	-	14
2065	-	-	29	-	-	3	-	-	12	-	29	-	3	-	12
2066	-	-	47	-	-	53	-	-	171	-	47	-	53	-	171
2067	-	-	-	-	-	1	-	-	214	-	-	-	1	-	214
2068	-	-	58	-	-	9	-	-	0	-	58	-	9	-	0
2069	-	-	15	-	-	125	-	-	103	-	15	-	125	-	103
2070	-	-	3	-	-	0	-	-	42	-	3	-	0	-	42
	1,004	1,004	268	1,019	1,019	380	2,205	2,205	580	1,004	268	1,019	380	2,205	580

According to module BL-ARR, GHG emissions and removal are estimated using the procedure provided in AR-ACM0003 Afforestation and reforestation lands except wetlands and associated pool. Net GHG removals under the ARR baseline scenario up to time t*; t CO2-e ($\Delta C_{BSL-ARR}$) is equal to the summation from t=1 to t* of the baseline net GHG removals by sinks in year t;(ΔC) in AR-ACM0003, as describe in equation 6:

$$\Delta C_{BSL-ARR} = \sum_{t=1}^{t^*} (\Delta C_{BSL,t\ ACM0003}) \quad (6)$$

Where:

$\Delta C_{BSL-ARR}$ Net GHG removals under the ARR baseline scenario up to time t; t CO2-e

$\Delta C_{BSL,t\ ACM0003}$ Baseline net GHG removal by sinks in year t (from AR-ACM0003) (t CO2-e)

t = 1,2,3,... t time since project start

$C_{TREE,BSL,t}$ Change in carbon stock in tree biomass under baseline scenario, in year t: tCO2-e

t = 1,2,3,... t time since planting start

Net GHG removals under the ARR baseline scenario within the project period are estimated at 445,017.19 tCO2-e. Annual GHG removals and emissions (carbon losses because of harvesting are subtracted) under ARR are presented in Table 16 below.

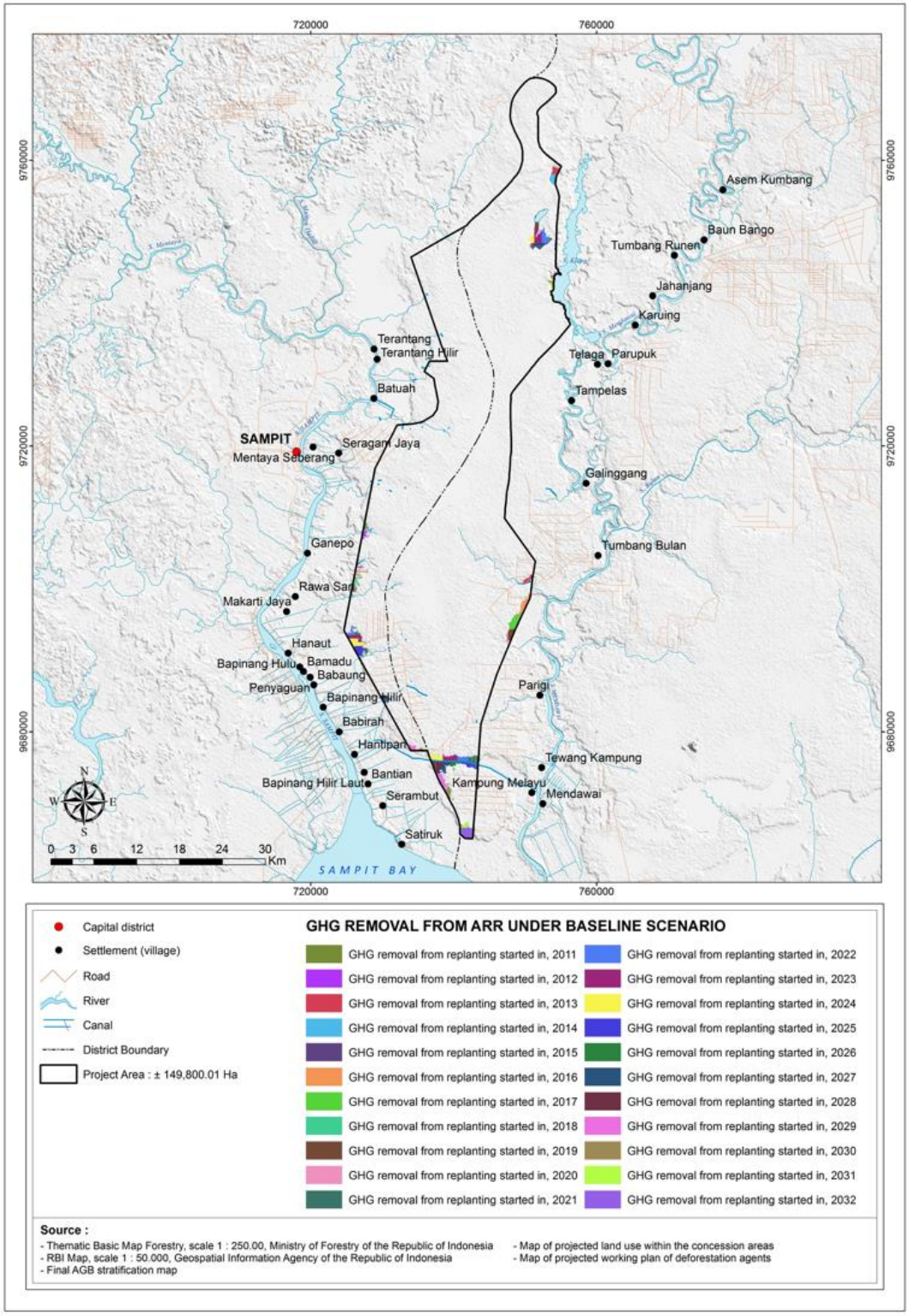
Table 16. Baseline net GHG removal from ARR activities in project area within project period

Year	NET GHG removal from ARR (tCO2-e)			
	Agent A	Agent B	Agent C	Total
2010	-	-	-	-
2011	295.26	-	-	295.26
2012	627.61	-	-	627.61
2013	627.61	614.85	443.25	1,685.71
2014	812.35	1,279.02	540.50	2,631.87
2015	1,005.45	1,297.58	620.71	2,923.75
2016	1,323.53	1,653.95	1,779.78	4,757.26
2017	1,323.53	1,663.70	3,226.08	6,213.31
2018	1,713.96	1,724.03	3,226.09	6,664.08
2019	1,813.52	2,567.54	3,924.44	8,305.51
2020	1,833.52	2,569.33	4,205.61	8,608.45
2021	2,033.10	2,739.54	5,119.77	9,892.42
2022	2,477.39	3,701.74	5,793.70	11,972.83
2023	3,278.98	4,823.03	6,736.93	14,838.95
2024	4,347.82	5,235.67	7,617.13	17,200.62
2025	5,375.53	5,432.88	8,522.22	19,330.64
2026	5,577.71	5,432.88	9,085.99	20,096.59
2027	6,017.45	6,064.77	10,041.17	22,123.40
2028	6,139.46	6,306.49	11,306.38	23,752.33
2029	6,646.71	6,389.04	12,332.16	25,367.91
2030	6,793.19	6,613.50	12,929.09	26,335.77
2031	6,793.19	6,865.32	13,403.43	27,061.94
2032	6,793.19	6,888.91	14,912.58	28,594.68
2033	6,793.19	6,888.91	14,912.58	28,594.68
2034	6,793.19	6,888.91	14,912.58	28,594.68
2035	6,793.19	6,888.91	14,912.58	28,594.68
2036	(588.25)	6,888.91	14,912.58	21,213.24
2037	(1,515.60)	6,888.91	14,912.58	20,285.89
2038	6,793.19	(8,482.22)	3,831.28	2,142.25
2039	2,174.59	(9,715.45)	12,481.34	4,940.47

Year	NET GHG removal from ARR (tCO2-e)			
	Agent A	Agent B	Agent C	Total
2040	1,965.67	6,424.92	12,907.27	21,297.86
2041	(1,158.68)	(2,020.40)	(14,064.16)	(17,243.23)
2042	6,793.19	6,635.45	(21,244.78)	(7,816.14)
2043	(2,967.52)	5,371.00	14,912.17	17,315.64
2044	4,304.02	(14,208.74)	(2,546.12)	(12,450.83)
2045	6,293.36	6,834.57	7,883.41	21,011.34
2046	1,803.53	2,623.70	(7,941.44)	(3,514.20)
2047	(4,313.97)	(17,175.85)	(1,935.69)	(23,425.52)
2048	(13,246.71)	(21,152.96)	(8,668.17)	(43,067.84)
2049	(19,927.74)	(3,436.77)	(7,092.32)	(30,456.83)
2050	(18,899.52)	1,751.51	(7,714.86)	(24,862.86)
2051	1,738.68	6,681.94	818.32	9,238.94
2052	(4,200.38)	(9,115.17)	(8,966.91)	(22,282.46)
2053	3,742.92	638.92	(16,717.48)	(12,335.64)
2054	(5,887.89)	4,618.14	(10,731.98)	(12,001.74)
2055	3,131.16	1,070.53	(10.63)	4,191.07
2056	6,793.19	386.43	3,053.91	10,233.52
2057	6,793.19	6,092.22	(22,816.09)	(9,930.68)
2058	6,793.19	6,681.94	14,912.58	28,387.71
2059	6,793.19	6,681.94	14,912.58	28,387.71
2060	6,793.19	6,681.94	14,912.58	28,387.71
2061	(588.25)	6,681.94	14,912.58	21,006.28
2062	(1,515.60)	6,681.94	14,912.58	20,078.92
2063	6,793.19	(8,689.19)	3,831.28	1,935.28
2064	2,174.59	(9,922.42)	12,481.34	4,733.51
2065	1,965.67	6,217.95	12,907.27	21,090.89
2066	(1,158.68)	(2,227.36)	(14,064.16)	(17,450.20)
2067	6,793.19	6,691.69	(21,244.78)	(7,759.90)
2068	(2,967.52)	5,183.53	14,912.17	17,128.17
2069	4,304.02	(14,446.78)	(2,546.12)	(12,688.88)

Year	NET GHG removal from ARR (tCO2-e)			
	Agent A	Agent B	Agent C	Total
2070	6,293.36	6,594.74	7,602.24	20,490.34
TOTAL	116,123.60	100,941.92	224,209.19	441,274.71

Map 11. Projected spatial GHG removal from ARR under baseline scenario



3.2.1.7 Baseline emissions from microbial decompositions of peat, peat burnings and water bodies in peatlands

3.2.1.7.1 Spatial and temporal variability

Quantification of GHG emissions from microbial decompositions of peat, peat burnings and water bodies in peatlands has been carried out by using a spatially and temporally explicit approach. Each baseline stratum as set out in Table 10 and accompanying sub-section was discretized into parcels of the smallest land or water body unit with relatively uniform combinations of spatial variables as given in Table 17. Temporal discretization has been used by sequencing the calculation into 1 year time-step, while temporal variables determine the sequence of strata changes, temporal variability of GHG emission parameters and temporal restrictions to GHG emissions as given in Table 17. The schematization provides an assurance of the proper use of GHG emission parameters at the correct spatial location and the correct time.

Table 17. Variables used in the schematization of quantification of GHG emissions from microbial decompositions of peat, peat burnings and dissolved organic carbon from water bodies in peatlands in the baseline scenario

Variables	Description
(A) Spatial Variables	
(A1) Soil Type	Distinction between peat or non-peat. This is used to exclude all non-peat parcels from GHG calculation
(A2) Initial peat thickness available for microbial decompositions and burnings	Derived from DEM, DEL and Peat Thickness maps as described in Section 4.4.1.3. These maps are used to determine the initial condition for subsequent calculations of the remaining peat layer available for microbial decompositions and burnings.
(A3) Initial stratum	Stratum of the corresponding parcel at the project start date (as derived in Annex 14 of the PD and Section 5.4.2.1 of the PD) before conversion into baseline stratum takes effect. This is used to determine the correct Emission Factor for the corresponding parcel for the duration before B1 and B2 (in this table, below) take effect.
(A4) Peat burning tag	This is used to identify whether the corresponding parcel has been marked as possible area for peat burning (PBA_{BSL}). All parcels without tag are excluded from peat burning calculation.
(B) Temporal Variables	
(B1) Year of drainage	Determines the onset of conversion from initial stratum to drained stratum and sets all the drainage related parameters/variables accordingly, such as initial consolidations, bulk density changes, etc. This does not take effect if the initial stratum of the parcel is already a drained stratum. Together with B2 this is used to determine the correct Emission Factor for the corresponding parcel
(B2) Year of deforestation/ planting of the baseline land cover	Determines the onset of conversion of initial stratum to deforested/planted stratum. Together with B1 this is used to determine the correct Emission Factor for the corresponding parcel
(B3) PDT	The PDT is the period of time that it takes to deplete the remaining peat layer by microbial decomposition and burning (conservatively will be assumed that PDT is reached once the remaining peat layer has reached 20 cm).

Variables	Description
	Once the PDT is reached in a given stratum all GHG emissions in that stratum are set to zero.
(B4) Year tag for burning	Determines whether the corresponding parcel has been marked to catch peat burning for the corresponding year, and counting the number of burn scars (and any repetitions) of the parcel since year 1. This is used to set the correct burn scar depth and other related burning parameters for the corresponding parcel accordingly.
(B5) Burning restriction	If the corresponding parcel has been marked for burning in the corresponding year (as being checked in B4), this restriction further checks whether GHG emissions from burning would still be possible based on variables: B1 (Year of drainage), B2 (Year of deforestation/planting) and B3 (Remaining peat thickness available for microbial decomposition and burning). Only drained-deforested parcels with >20 cm peat is categorized as available and would emit GHGs from burning.

3.2.1.7.2 Emissions calculations

Taking into account the spatial and temporal variability described in Section 5.3.4.1 and Appendix 7 of the PD, the net CO_2-equivalent emissions from the peat (microbial decomposition and burning) and water bodies were estimated following equation 7 from module BL-PEAT:

$$GHG_{BSL\text{-}WRC} = \sum_{t=1}^{t^*} \sum_{i=1}^{M} \left(E_{peatsoil\text{-}BSL,i,t} + E_{peatditch\text{-}BSL,i,t} + E_{peatburn\text{-}BSL,i,t} \right) \quad (7)$$

Where:

$GHG_{BSL\text{-}WRC}$	Net GHG emissions in the CUPP baseline scenario up to year t* (t CO_2e)
$E_{peatsoil\text{-}BSL,i,t}$	GHG emissions from the peat soil within the project boundary in the baseline scenario in stratum i at year t (t CO_2e yr^{-1})
$E_{peatditch\text{-}BSL,i,t}$	GHG emissions from water bodies in the baseline scenario in stratum i at year t (t CO_2e yr^{-1})
$E_{peatburn\text{-}BSL,i,t}$	GHG emissions from burning of peat in the base line scenario in stratum i at year t (t CO_2-e yr^{-1})
i	1, 2, 3 …M strata in the baseline scenario (unitless)
t	1, 2, 3, … t* times elapsed since the project start (yr)

For all strata i where the project duration exceeds the peat depletion time (PDT or t_{PDT}), for t > $t_{PDT-BSL,I}$ the following equations 8, 9 and 10 apply:

$$E_{peatsoil-BSL,i,t} = 0 \quad (8)$$

$$E_{peatditch-BSL,i,t} = 0 \quad (9)$$

$$E_{peatburn-BSL,i,t} = 0 \quad (10)$$

Where:

$t_{PDT-BSL,i}$	Peat Depletion Time in the baseline scenario in stratum i in years elapsed since the project start (yr)
$E_{peatsoil-BSL,i,t}$	GHG emissions from the peat soil within the project boundary in the baseline scenario in stratum i at year t (t CO_2e yr^{-1})
$E_{peatditch-BSL,i,t}$	GHG emissions from water bodies at year t (t CO_2e yr^{-1})
$E_{peatburn-BSL,i,t}$	GHG emissions from burning of peat in the base line scenario in stratum i at year t (t CO_2e yr^{-1})
i	1, 2, 3 …M_{BSL} strata in the baseline scenario (unitless)
t	1, 2, 3, … t* time elapsed since the project start (yr)

GHG emissions from peat soils comprise GHG emission as CO_2 and CH_4. Were calculated using the following equation 11:

$$E_{peatsoil-BSL,i,t}=E_{CO2-BSL,i,t}+E_{CH4-BSL,i,t} \quad (11)$$

Where:

$E_{CO2-BSL,i,t}$	CO_2 emissions from the peat soil within the project boundary in the baseline scenario in stratum i at year t (t CO_2e yr^{-1})
$E_{CH4-BSL,i,t}$	CH_4 emissions from the peat soil within the project boundary in the baseline scenario in stratum i at year t (t CO_2e yr^{-1})

3.2.1.7.3 Subsidence related to initial compression, microbial decomposition and burning of peat

The initial peat thickness in the baseline scenario is assumed equal to the initial peat thickness as mapped at the project start date minus the initial thickness loss due to compression resulting from initial drainage (see Annex 6 of the PD). GHG emissions from peat soils comprise GHG emission as CO_2 and CH_4 were calculated using the following equation 12:

$$E_{peatsoil-BSL,i,t}=E_{CO2-BSL,i,t}+E_{CH4-BSL,i,t} \quad (12)$$

Where:

$E_{CO2\text{-}BSL,i,t}$	CO_2 emissions from the peat soil within the project boundary in the baseline scenario in stratum i at year t (t CO_2e yr^{-1})
$E_{CH4\text{-}BSL,i,t}$	CH_4 emissions from the peat soil within the project boundary in the baseline scenario in stratum i at year t (t CO_2e yr^{-1})

On peatlands that were undrained and which would remain undrained during the project period (stratum P1L1D0CF) and peatlands that are already drained at the project start date (strata P1L1D1, P1L0D1) the compression is assumed to be absent, therefore $Depth_{peatloss\text{-}BSL\text{-}comp} = 0$.

As a result of the initial compression, the bulk density of peat increases proportionally with associated thickness loss. This is taken into account when quantifying peat carbon stock dynamics.

To maintain consistency between annual net CO_2-equivalent emissions and remaining peat carbon stock, annual rates of peat and carbon stock loss in the baseline scenario were quantified annually based on the rate of emissions from microbial decompositions of peat (CO_2 and CH_4 decomposition), burn scar depths (for areas where peat burning was projected to occur), bulk density of peat above water table, and a conservative carbon content value (48 $kg.kg^{-1}$ dry mass) as calculated using equation 13 as follows:

$$Rate_{peatloss\text{-}BSL,i,t}=D_{peatburn\text{-}BSL,i,t}+\left(\frac{12}{44}\times\frac{EF_{CO2,i,t}}{BD_{BSL,i,t}\times C_c\times 10}\right)+\left(\frac{1}{GWP_{CH4}}\times\frac{12}{16}\times\frac{EF_{CH4,i,t}}{BD_{BSL,i,t}\times C_c\times 10}\right) \quad (13)$$

Where:

$Rate_{peatloss\text{-}BSL,I,t}$	Rate of peatloss due to microbial decompositions and burning in baseline scenario of stratum i at year t ($m.y^{-1}$)
$D_{peatburn\text{-}BSL,i,t}$	Burn scar depth under baseline scenario in stratum i at year t (m)
$BD_{BSL,i,t}$	Bulk density of peat soil above water table in baseline scenario in stratum i at year t* ($kg.m^{-3}$)
$EF_{CO2,i,t}$	CO_2 emissions from microbial decomposition of peat in baseline scenario in stratum i at year t ($tCO_2.ha^{-1}.y^{-1}$). Equals CO_2 emission factor when peat available for decomposition > 20 cm, otherwise zero
$EF_{CH4,i,t}$	CH_4 emissions from microbial microbial decomposition of peat in baseline scenario in stratum i at year t ($tCO_2.ha^{-1}.y^{-1}$). Equals CH_4 emission factor when peat available for decomposition > 20 cm, otherwise zero
GWP_{CH4}	Global Warming Potential of CH_4
Cc	Carbon content of peat soil ($kg.kg^{-1}$)

Remaining peat thickness was assessed annually for the project crediting period based on the rate of peat loss due to microbial decompositions of and burning incidents using equation 14 as follows:

$$Depth_{peat\text{-}BSL,i,t}=Depth_{peat\text{-}BSL,i,t0}-\sum_{t=1}^{t=t^*}Rate_{peatloss\text{-}BSL,i,t} \quad (14)$$

Where:

$Depth_{peat\text{-}BSL,i,t}$	Remaining peat thickness in the baseline scenario in stratum i at year t* (m)
$Depth_{peat\text{-}BSL,i,t0}$	Peat thickness at the baseline scenario in stratum i at year t0 = project start date (initial peat thickness) (m)
$Rate_{peatloss\text{-}BSL,i,t}$	Rate of peat loss due (subsidence) due to microbial decomposition of peat and peat burning in the baseline scenario in stratum i in year t (m yr^{-1})
i	Strata

Peat carbon stock and its annual changes were calculated using equation 15 following annual peat carbon loss due to microbial decompositions and burning.

$$C_{stock\text{-}BSL,i,t}=C_{stock\text{-}BSL,i,t-1}-C_{loss\text{-}BSL,i,t-1} \quad (15)$$

Where:

$C_{stock\text{-}BSL,i,t}$	Remaining peat carbon stock in baseline scenario in stratum i at year t (t $C.ha^{-1}$)
$C_{stock\text{-}BSL,i,t-1}$	Remaining peat carbon stock in baseline scenario in stratum i at previous year (t $C.ha^{-1}$)
$C_{loss\text{-}BSL,i,t-1}$	Equivalent carbon stock loss from microbial decomposition of peat and peat burning in baseline scenario in stratum i at previous year (t $C.ha^{-1}$)

By tracking annual peat carbon stock and peat thickness in the baseline scenario it has been assured that there is no GHG emissions has been accounted for within any parcel of each stratum once available carbon stock/peat has been depleted. Conservatively, peat is assumed depleted once peat thickness available for decompositions and burning has been reduced to 20 cm.

A summary of the quantified GHG emissions from peat microbial decomposition, uncontrolled peat burning and water bodies under the baseline scenario are presented in Table 18, and the next Sub-subsections 3.2.1.7.4, 3.2.1.7.5 and 3.2.1.7.6 describe how Table 18 has been calculated.

Table 18. A summary of the annual GHG emissions from peat microbial decomposition, uncontrolled peat burning and water bodies in the Project area under the baseline scenario ($tCO_2e.y^{-1}$) since the start of the project in 2010

Year	CO_2 from peat microbial decomposition	CH_4 from peat microbial decomposition	CO_2 from peat burning	CH_4 from peat burning	CO_2 from DOC	Total
2011	872,262	80,618	113,627	13,693	2,779	1,082,979
2012	966,973	80,528	127,390	15,351	2,779	1,193,020
2013	2,292,138	49,284	205,515	24,766	6,052	2,577,755
2014	2,588,966	48,998	251,623	30,322	6,052	2,925,961

Year	CO_2 from peat microbial decomposition	CH_4 from peat microbial decomposition	CO_2 from peat burning	CH_4 from peat burning	CO_2 from DOC	Total
2015	2,910,708	47,418	244,700	29,488	6,314	3,238,629
2016	3,204,660	47,144	269,703	32,501	6,314	3,560,321
2017	3,628,150	42,686	313,518	37,781	7,012	4,029,146
2018	3,932,268	42,398	338,149	40,749	7,012	4,360,576
2019	4,307,185	39,805	349,520	42,119	7,370	4,746,000
2020	4,584,724	39,541	404,301	48,721	7,370	5,084,656
2021	4,973,666	36,356	382,934	46,146	7,965	5,447,067
2022	5,268,302	36,073	386,441	46,569	7,965	5,745,349
2023	5,631,354	34,002	403,044	48,569	8,275	6,125,244
2024	5,923,395	33,720	379,011	45,673	8,275	6,390,075
2025	6,308,103	29,970	388,991	46,876	8,890	6,782,830
2026	6,585,466	29,681	373,954	45,064	8,890	7,043,055
2027	6,906,267	28,391	411,579	49,598	9,127	7,404,961
2028	7,189,341	28,092	417,025	50,254	9,127	7,693,839
2029	7,614,737	23,607	423,444	51,028	9,821	8,122,636
2030	7,894,864	23,301	400,032	48,206	9,821	8,376,224
2031	8,081,433	23,087	379,649	45,750	9,821	8,539,740
2032	8,286,789	22,849	390,765	47,090	9,821	8,757,313

Year	CO_2 from peat microbial decomposition	CH_4 from peat microbial decomposition	CO_2 from peat burning	CH_4 from peat burning	CO_2 from DOC	Total
2033	8,278,593	22,832	387,157	46,655	9,821	8,745,058
2034	8,268,410	22,812	346,079	41,705	9,821	8,688,826
2035	8,262,373	22,797	309,556	37,303	9,821	8,641,850
2036	8,255,644	22,783	310,482	37,415	9,821	8,636,144
2037	8,248,377	22,766	310,670	37,438	9,821	8,629,072
2038	8,241,859	22,752	255,033	30,733	9,821	8,560,198
2039	8,234,741	22,737	288,620	34,781	9,821	8,590,699
2040	8,225,122	22,720	274,839	33,120	9,821	8,565,622
2041	8,217,806	22,704	276,610	33,333	9,821	8,560,273
2042	8,209,559	22,682	216,776	26,123	9,821	8,484,961
2043	8,202,803	22,667	228,318	27,514	9,821	8,491,122
2044	8,193,613	22,650	232,271	27,990	9,821	8,486,345
2045	8,185,905	22,633	214,734	25,877	9,821	8,458,970
2046	8,178,125	22,617	196,918	23,730	9,821	8,431,210
2047	8,170,001	22,598	202,848	24,444	9,821	8,429,712
2048	8,161,601	22,583	190,877	23,002	9,821	8,407,884
2049	8,154,522	22,567	176,446	21,263	9,821	8,384,618
2050	8,145,756	22,550	190,277	22,930	9,821	8,391,334

Year	CO_2 from peat microbial decomposition	CH_4 from peat microbial decomposition	CO_2 from peat burning	CH_4 from peat burning	CO_2 from DOC	Total
2051	8,138,962	22,537	183,798	22,149	9,821	8,377,267
2052	8,131,369	22,520	171,602	20,679	9,821	8,355,991
2053	8,123,480	22,506	170,305	20,523	9,821	8,346,635
2054	8,113,478	22,490	167,613	20,198	9,821	8,333,601
2055	8,105,756	22,477	149,992	18,075	9,821	8,306,120
2056	8,096,914	22,461	159,279	19,194	9,821	8,307,668
2057	8,086,643	22,444	150,819	18,175	9,821	8,287,901
2058	8,079,669	22,431	160,835	19,382	9,821	8,292,137
2059	8,069,217	22,414	150,511	18,137	9,821	8,270,101
2060	8,053,640	22,384	151,922	18,308	9,821	8,256,074
2061	8,041,789	22,367	154,261	18,589	9,821	8,246,826
2062	8,030,326	22,348	149,805	18,052	9,821	8,230,353
2063	8,017,565	22,326	152,702	18,402	9,821	8,220,815
2064	8,005,012	22,307	145,495	17,533	9,821	8,200,168
2065	7,993,522	22,289	134,659	16,227	9,821	8,176,517
2066	7,980,530	22,269	143,981	17,351	9,821	8,173,951
2067	7,965,650	22,246	130,055	15,672	9,821	8,143,443
2068	7,949,145	22,218	131,385	15,833	9,821	8,128,402

Year	CO_2 from peat microbial decomposition	CH_4 from peat microbial decomposition	CO_2 from peat burning	CH_4 from peat burning	CO_2 from DOC	Total
2069	7,936,436	22,197	133,213	16,053	9,821	8,117,720
2070	7,922,493	22,175	128,773	15,518	9,821	8,098,779

3.2.1.7.4 Emissions from peat microbial decomposition

It is assumed that the rate of conversion of undrained peatland to drained peatland in the baseline scenario is based on the rate of conversion of the forest by the deforestation agents as outlined in Sub-subsection 5.3.4 and Appendix 6 of the PD. The temporal variability of the emissions from peat microbial decompositions are therefore directly related to the land use and land use changes in the baseline. Table 19 below and Table 10 above provide details on the WRC related baseline stratification that is used and the area (ha) per stratum. Based on this data, the baseline GHG emissions for the different 'emission strata' were calculated using conservative and scientifically robust (TIER 1) IPCC default emission factors for each stratum i and procedured using equations 16, 17, and 18 defined by the VCS methodology VM0007 module BL-PEAT:

$$E_{peatsoil\text{-}BSL,i,t} = E_{peatsoil\text{-}BSL,CO2,i,t} + E_{peatsoil\text{-}BSL,CH4,i,t} \quad (16)$$

Where:

$E_{peatsoil\text{-}BSL,i,t}$ GHG emissions from the peat soil within the project boundary in the baseline scenario in stratum i at year t (t CO_2e yr^{-1})

$E_{peatsoil\text{-}BSL,CO2,i,t}$ CO_2 emissions from the peat soil within the project boundary in the baseline scenario in stratum i at year t (t CO_2e yr^{-1})

$E_{peatsoil\text{-}BSL,CH4,i,t}$ CH_4 emissions from the peat soil within the project boundary in the baseline scenario in stratum i at year t (t CO_2e yr^{-1})

i 1, 2, 3 …M_{BSL} strata in the baseline scenario (unitless)

t 1, 2, 3, … t* time elapsed since the project start (yr)

For each stratum, the CO_2 emissions from microbial decomposition of the peat within the project boundary were estimated as follows:

$$E_{peatsoil\text{-}BSL,CO2,i,t} = A_{i,t} \times EF_{CO2,i,t} \quad (17)$$

Where:

$E_{peatsoil\text{-}BSL,CO2,i,t}$ CO_2 emissions from the peat soil within the project boundary in the baseline scenario in stratum i at year t (t CO_2e yr^{-1})

$EF_{CO2,i,t}$ Emission factor for CO2 emissions corresponds to each stratum i, as provided by IPCC (t CO_2e ha^{-1} yr^{-1})

$A_{,i,t}$	Area of stratum i at time t (ha)
i	1, 2, 3 …M_{BSL} strata in the baseline scenario (unitless)
t	1, 2, 3, … t* time elapsed since the project start (yr)

For each stratum, the CH_4 emission from the peat soil within the project boundary were estimated as follows:

$$E_{peatsoil\text{-}BSL,CH4,i,t} = A_{i,t} \times GWP_{CH4} \times EF_{CH4,i,t} \quad (18)$$

Where:

$E_{peatsoil\text{-}BSL,CH4,i,t}$	CH_4 emissions from the peat soil within the project boundary in the baseline scenario in stratum i at year t (t CO_2e yr^{-1})
$EF_{CH4,t,t}$	Emission factor for CH_4 emissions corresponds to each stratum i, as provided by IPCC (t CO_2e ha^{-1} yr^{-1})
$A_{,i,t}$	Area of stratum i at time t (ha)
GWP_{CH4}	Global Warming Potential for CH_4
i	1, 2, 3 …M_{BSL} strata in the baseline scenario (unitless)
t	1, 2, 3, … t* time elapsed since the project start (yr)

Table 19. The stratification used for the calculation of GHG emissions per stratum, the area (ha) per each stratum and the CO_2 and CH_4 default factors used for the specific land use

Strata	Description	Area (ha)	IPCC default emission factor for CO_2 (t CO_2-eq ha-1 yr-1)	IPCC default emission factor for CH_4 (t CO_2-eq ha-1 yr-1)	IPCC default emission factor for Δ DOC (t CO_2-eq ha-1 yr-1)
Initial					
P1L0D0	Undrained deforested peatland	3,172	1.5	0.20	
P1L0D1	Drained deforested peatland	987	19.43	0.14	
P1L1D0	Undrained forested peatland	141,910	0	0.72	
P1L1D1	Drained deforested peatland	354	19.43	0.14	

WB	Water bodies (rivers and canals) present at the project start date	216			2.09
After conversion					
P1L0D1AC	*Acacia* on drained peatland	102,257	73.33	0.08	
P1L1D0CF	Conservation area (undrained peatland forest)	13,451	0	0.72	
P1L0D1CA	Community crops on drained peatland	11,028	51.33	0.20	
P1L0D1IF	Ground facilities on drained peatland	290	19.43	0.14	
P1L1D1IS	Indigenous species area and river buffer (drained peatland forest)	16,286	19.43	0.14	
WB	Water bodies (rivers and canals)	3,327			3.01

Note: Appendix 9 of the PD provides more details on the emission factors used and the references.

Calculated annual GHG emissions from microbial decompositions of peat in the baseline scenario is presented in Table 20.

Table 20. GHG emissions from microbial decompositions of peat in the baseline scenario in $tCO_2\text{-}e.y^{-1}$

Year	CO_2 from peat microbial decomposition	CH_4 from peat microbial decomposition	Total
2011	872,262	80,618	952,880
2012	966,973	80,528	1,047,500
2013	2,292,138	49,284	2,341,422
2014	2,588,966	48,998	2,637,964
2015	2,910,708	47,418	2,958,127
2016	3,204,660	47,144	3,251,804
2017	3,628,150	42,686	3,670,836
2018	3,932,268	42,398	3,974,666
2019	4,307,185	39,805	4,346,990

Year	CO_2 from peat microbial decomposition	CH_4 from peat microbial decomposition	Total
2020	4,584,724	39,541	4,624,265
2021	4,973,666	36,356	5,010,022
2022	5,268,302	36,073	5,304,374
2023	5,631,354	34,002	5,665,356
2024	5,923,395	33,720	5,957,115
2025	6,308,103	29,970	6,338,073
2026	6,585,466	29,681	6,615,147
2027	6,906,267	28,391	6,934,658
2028	7,189,341	28,092	7,217,433
2029	7,614,737	23,607	7,638,344
2030	7,894,864	23,301	7,918,165
2031	8,081,433	23,087	8,104,520
2032	8,286,789	22,849	8,309,637
2033	8,278,593	22,832	8,301,426
2034	8,268,410	22,812	8,291,222
2035	8,262,373	22,797	8,285,170
2036	8,255,644	22,783	8,278,427
2037	8,248,377	22,766	8,271,143
2038	8,241,859	22,752	8,264,611
2039	8,234,741	22,737	8,257,478
2040	8,225,122	22,720	8,247,843
2041	8,217,806	22,704	8,240,510
2042	8,209,559	22,682	8,232,242
2043	8,202,803	22,667	8,225,470
2044	8,193,613	22,650	8,216,263
2045	8,185,905	22,633	8,208,538
2046	8,178,125	22,617	8,200,742
2047	8,170,001	22,598	8,192,599
2048	8,161,601	22,583	8,184,185
2049	8,154,522	22,567	8,177,089

Year	CO_2 from peat microbial decomposition	CH_4 from peat microbial decomposition	Total
2050	8,145,756	22,550	8,168,306
2051	8,138,962	22,537	8,161,499
2052	8,131,369	22,520	8,153,889
2053	8,123,480	22,506	8,145,987
2054	8,113,478	22,490	8,135,968
2055	8,105,756	22,477	8,128,233
2056	8,096,914	22,461	8,119,375
2057	8,086,643	22,444	8,109,087
2058	8,079,669	22,431	8,102,100
2059	8,069,217	22,414	8,091,632
2060	8,053,640	22,384	8,076,024
2061	8,041,789	22,367	8,064,155
2062	8,030,326	22,348	8,052,674
2063	8,017,565	22,326	8,039,891
2064	8,005,012	22,307	8,027,319
2065	7,993,522	22,289	8,015,810
2066	7,980,530	22,269	8,002,798
2067	7,965,650	22,246	7,987,896
2068	7,949,145	22,218	7,971,363
2069	7,936,436	22,197	7,958,633
2070	7,922,493	22,175	7,944,667

3.2.1.7.5 Emissions from peat burning

This section explains in more detail how the numbers for peat burning in the Project area in Table 22 have been calculated.

Peatland fires in Indonesia are widely known as human induced events. Based on this fact it can be inferred that the probability of peat burning events increases according to the decrease in distance to human activity (roads, rivers, agriculture area, etc.). It is common in Kalimantan that local communities use rivers and canals extensively as transportation means. Observations in the project area showed that most burnings occur along the Hantipan canal where human activity is high. Burnt area in this location extended to about 1 km from the canal sides.

Per module E-BPB, GHG emissions from biomass burning can result from:

- Conversion of forest land to non-forest land using fire
- Periodical burning of grassland or agricultural land after deforestation
- Controlled burning in forest land remaining forest land
- Uncontrolled fire in drained peat swamp forest
- Uncontrolled peat burning in (abandoned) drained peat sites

Since it is illegal to clear forests on Acacia plantation it is assumed that the deforestation agents do not perform controlled peat burning during site preparation or (rotational) clearance for plantation/crop establishment. Therefore, only emissions from unintentional/uncontrolled burnings are accounted for in the baseline scenario. Furthermore, above ground biomass lost by combustion is conservatively omitted.

Procedures for quantification of GHG emissions from uncontrolled peat burnings follow the VCS methodology VM0007 module E-BPB using the following equation 19:

$$E_{peatburn-BSL,i,t} = \sum_{g=1}^{G}\left(\left(\left(A_{peatburn-BSL,i,t} \times P_{BSL,i,t} \times G_{g,i}\right)\times 10^{-3}\right)\times GWP_g\right) \quad (19)$$

Where:

$E_{peatburn-BSLi,t}$	Greenhouse emissions due to peat burning under baseline scenario in stratum i in year t of each GHG (CO_2, CH_4, N_2O) (t CO_2e)
$A_{peatburn-BSL,i,t}$	Area peat burnt under baseline scenario in stratum i in year t (ha)
$P_{BSL,i,t}$	Average mass of peat burnt under baseline scenario in stratum i, year t (t d.m. ha^{-1})
$G_{g,i}$	Emission factor in stratum i for gas g (kg t^{-1} d.m. burnt)
GWP_g	Global warming potential for gas g (t CO_2/t g)
g	1, 2, 3 ... G greenhouse gases including carbon dioxide, methane and nitrous oxide (unitless)
i	1, 2, 3 …M strata (unitless)
t	1, 2, 3, … t time elapsed since the start of the project activity (year)

The average mass of peat burnt for a particular stratum is estimated using the equation 20:

$$P_{BSL,i,t} = D_{peatburn-BSL,i,t} \times BD_{upper} \times 10^{-4} \quad (20)$$

Where:

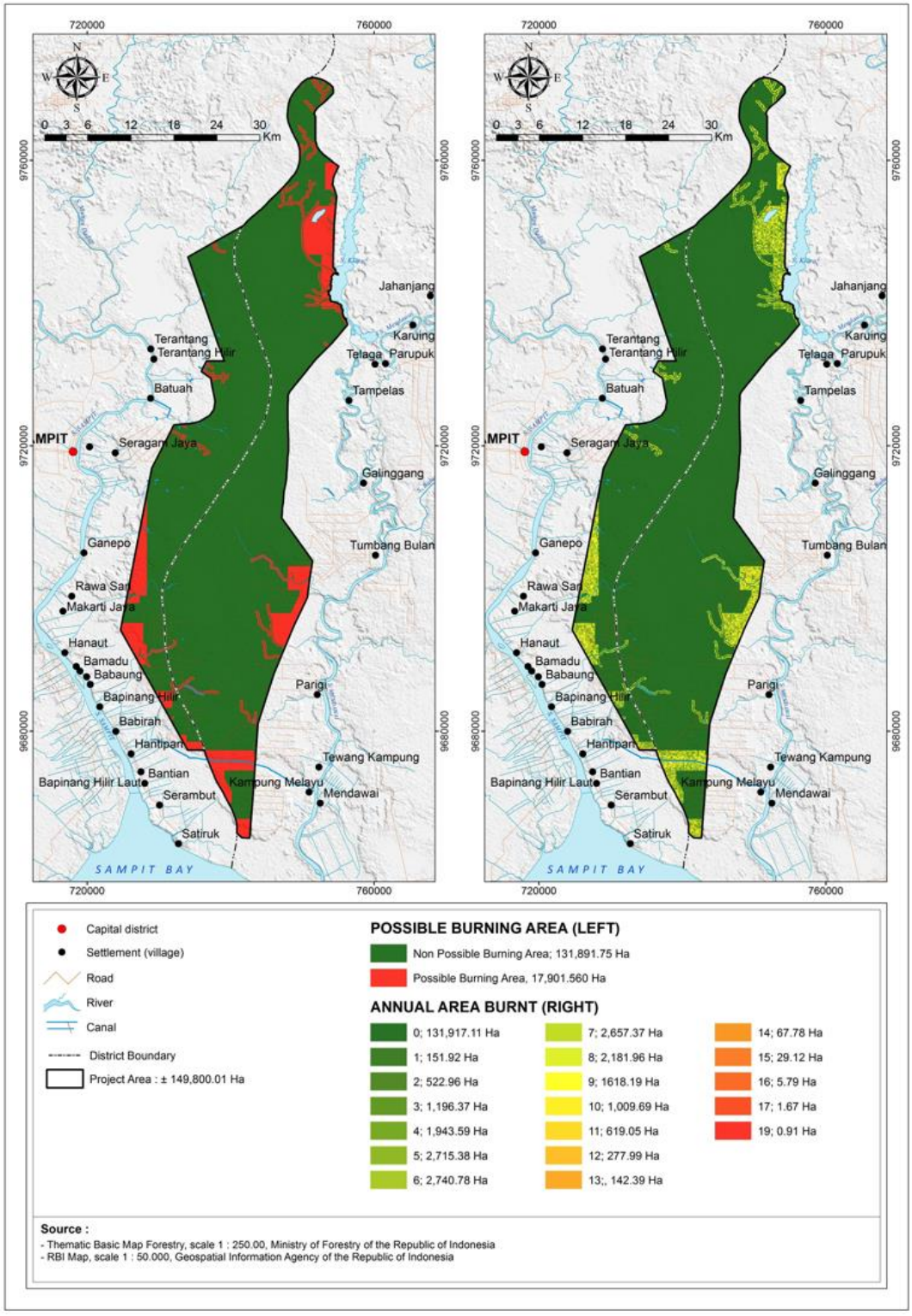
$P_{BSL,i,t}$	Average mass of peat burnt under baseline scenario in stratum i, year t (t d.m. ha^{-1})
$D_{peatburn-BSL,i,t}$	Average burn scar depth under baseline scenario in stratum i in year t (m)
$BD_{upper,i}$	Bulk density of the upper peat in stratum i (g cm^{-3})
i	1, 2, 3 …M strata

t	1, 2, 3, … t	time elapsed since the start of the project activity (years)

Emissions from peat burning in the baseline are thus calculated from the mass of peat lost by combustion and emission factors from scientific literature (see Appendix 6 of the PD for the default values that were used for the calculations of baseline carbon losses and emissions from burning).

Uncontrolled burnings in peatlands were assumed to repeat randomly on places that are 'high risk' areas. To determine where the 'high risk areas' are in the baseline of the project area, a hotspot intensity analysis was performed, and the spatial position of burning within the project boundary in the baseline scenario was simulated (details provided in Annex 12 of the PD). A water body network map from BIG 2008 (rivers and canals) was used to represent human activity variable. NOAA and NASA MODIS Fire hotspot data from 1997-2010 for Kalimantan were plotted on ArcGIS 10.1 and the distances to the nearest human activities (using rivers and canals as proxy) were calculated. Histogram analysis showed that the closer an area is to human activity the higher the probability is for a peat fire. Plotting percentages of hotspot numbers against distances to human activity resulted in a Burning Probability Density (BPD) model with an $R^2 > 0.9$ (Annex 12 of the PD). The resulted BPD model was used in creating a proportionally scaled down "Possible Burning Area" (PBA_{BSL}) map (Map 12) that shows the area with the highest burning probability (95 percent probability threshold) in the project baseline. This map does not show the "actual area burnt" in the baseline scenario, rather showing possible locations where peat burning can be expected to occur randomly.

Map 12. Map of possible burning area (left) and annual area burnt (right) in the baseline scenario



To assess the frequency and extent of uncontrolled peat fires in the baseline scenario, remote sensing data of the proxy areas was used, per VCS methodology VM0007 module BL-PEAT (see Annex 12 of the PD). MODIS fire pixels, which are recorded daily, were downloaded for the seven proxy areas and filtered as to only include the pixels with 100% confidence of the presence of a fire. To identify fires that occurred on bare soil all available Landsat data was subsequently downloaded for the 2000-2010 period, only selected data collected after the individual concession grant dates. When no cloud-free data was available within 2 months prior to the fire pixel acquisition date it was conservatively excluded. Each fire occurring on bare soil was conservatively assumed to have burnt 0.49 km^2 (Giglio, L., et al, 2006). Based on this data the average percentage of burnt area per proxy area was determined to be 1.44% per year. This value was used as a parameter in estimating "Annual Area Burnt Threshold" in the baseline scenario ($AABT_{BSL}$), according to the following equation 20:

$$AABT_{BSL}=1.44\%.y^{-1} \times A_{Project}=2,157\ ha.y^{-1} \quad (20)$$

Where:

$A_{project}$ Project area size (149,800 hectares)

The coverage of the Annual Area Burnt for each baseline stratum ($AAB_{BSL,i,t}$) was simulated as a subset of PBA_{BSL} by randomly selecting parcels in PBA_{BSL} annually over 100 years in such a way that the annual average area of the selected parcels approximately equals (but does not exceed) the area of $AABT_{BSL}$. Once a parcel was selected randomly in the first year the parcel is marked as "catching the 1st burning". If it was randomly selected again for the second year it is marked as "catching the 2nd burning", and so forth.

Given the random nature of the $AAB_{BSL,i,t}$ selection, and due to gradual land use change in the baseline scenario, $AAB_{BSL,i,t}$ varies by strata and year with increasing trend following land use change (Figure 5, Table 21). The project has assured that not every burning event would result in peat GHG emissions. At every burning event during the calculation, for the GHG emissions from peat burning to take effect, the corresponding "burnt parcel" must have been drained and deforested first, and that available peat for decomposition and burning exceed 20 cm. By applying these restrictions, net annual area burnt with positive net GHG emissions from peat burning has been calculated as given in Figure 6.

Figure 5. Annual area burnt in baseline scenario

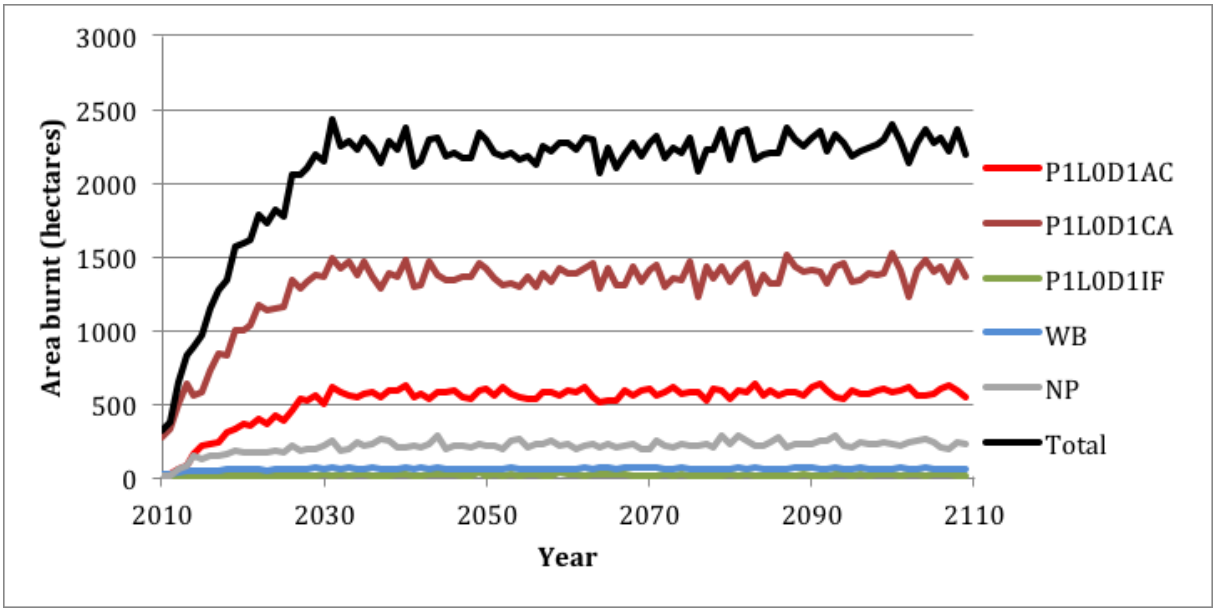


Figure 6. Annual area burnt with positive net GHG emissions from peat burning in baseline scenario

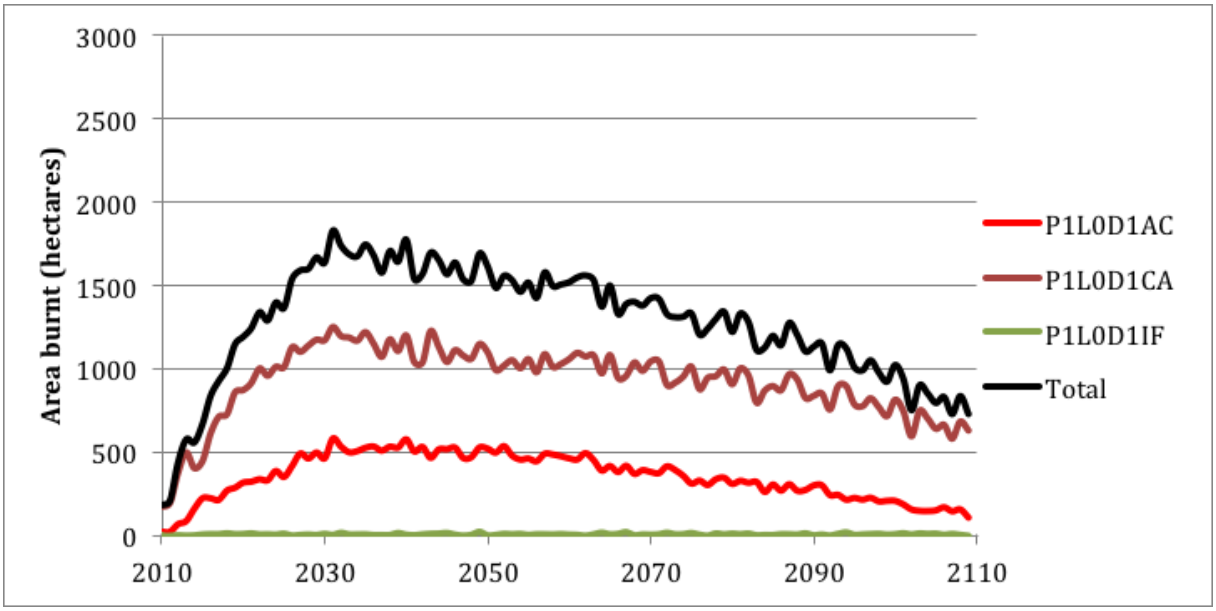


Table 21. GHG emissions from peat burning per stratum and per (repeated) burning

Strata	Strata Area	Total Area Burnt in 60 years	Average Burnt area in 60 years	GHG Emissions from peat burning in 60 years (tCO_2e)			
	(ha)	(ha)	($ha.y^{-1}$)	1st burning	2nd burning	≥3rd burning	Total
P1L0D1AC	102,257	28,631	477.2	1,865,786	1,101,649	1,600,247	4,567,683
P1L0D1CA	11,028	73,039	1,217.3	4,242,612	2,484,608	3,946,775	10,673,995
P1L0D1IF	290	626	10.4	40,996	24,101	36,479	101,575.4
P1L1D0CF	13,451	-	-	-	-	-	-
P1L1D1IS	16,286	-	-	-	-	-	-
WB	3,327	3,205	53.4	-	-	-	-
NP	3,162	11,321	188.7	-	-	-	-
Total	149,800	116,821	1,947	6,149,395	3,610,358	5,583,501	15,343,253

*See Appendix 6 of the PD for the defaults used.

Given the fact that there is a difference in burn scar depths between 1st, 2nd and 3rd burnings, calculations took into account the repetition of burnings. Burn scar depths of 18, 11 and 4 cm were assumed for the first, 2nd and 3rd burning respectively [9](see Appendix 12 of the PD for more details).

The peat burning baseline will be re-assessed every 10 years based on observations of burning frequency and extent in reference region and/or based on the latest scientific findings of 'repeated burnings' pattern.

Calculated annual GHG emissions from uncontrolled peat burning are presented in Table 22.

Table 22. GHG emissions from peat burning in the baseline scenario in tCO_2-$e.y^{-1}$

Year	CO_2 from peat burning	CH_4 from peat burning	Total
2011	113,627	13,693	127,320
2012	127,390	15,351	142,741
2013	205,515	24,766	230,281
2014	251,623	30,322	281,945

[9] Page, S., K. Tansey, P. Navratil, A. Hooijer, and N. Mawdsley. 2014. Measuring emissions from peat fire: Commentary on a proposed methodology for Indonesia. Report for the Indonesia-Australia Forest Carbon Partnership, IACP, Jakarta.

Year	CO_2 from peat burning	CH_4 from peat burning	Total
2015	244,700	29,488	274,188
2016	269,703	32,501	302,204
2017	313,518	37,781	351,299
2018	338,149	40,749	378,898
2019	349,520	42,119	391,640
2020	404,301	48,721	453,021
2021	382,934	46,146	429,080
2022	386,441	46,569	433,009
2023	403,044	48,569	451,613
2024	379,011	45,673	424,685
2025	388,991	46,876	435,867
2026	373,954	45,064	419,018
2027	411,579	49,598	461,177
2028	417,025	50,254	467,279
2029	423,444	51,028	474,472
2030	400,032	48,206	448,239
2031	379,649	45,750	425,399
2032	390,765	47,090	437,855
2033	387,157	46,655	433,812
2034	346,079	41,705	387,784
2035	309,556	37,303	346,859
2036	310,482	37,415	347,897
2037	310,670	37,438	348,108
2038	255,033	30,733	285,767
2039	288,620	34,781	323,400
2040	274,839	33,120	307,959
2041	276,610	33,333	309,943
2042	216,776	26,123	242,898
2043	228,318	27,514	255,831
2044	232,271	27,990	260,261
2045	214,734	25,877	240,611

Year	CO_2 from peat burning	CH_4 from peat burning	Total
2046	196,918	23,730	220,648
2047	202,848	24,444	227,292
2048	190,877	23,002	213,879
2049	176,446	21,263	197,709
2050	190,277	22,930	213,207
2051	183,798	22,149	205,947
2052	171,602	20,679	192,281
2053	170,305	20,523	190,828
2054	167,613	20,198	187,812
2055	149,992	18,075	168,067
2056	159,279	19,194	178,473
2057	150,819	18,175	168,994
2058	160,835	19,382	180,216
2059	150,511	18,137	168,648
2060	151,922	18,308	170,229
2061	154,261	18,589	172,850
2062	149,805	18,052	167,858
2063	152,702	18,402	171,103
2064	145,495	17,533	163,028
2065	134,659	16,227	150,886
2066	143,981	17,351	161,332
2067	130,055	15,672	145,727
2068	131,385	15,833	147,218
2069	133,213	16,053	149,266
2070	128,773	15,518	144,291

3.2.1.7.6 Emissions from water bodies in peatlands

This section explains in more detail how the numbers for emissions from water bodies in the project area in Table 18 have been calculated.

Except for drainage canals, it is assumed that the baseline agents do not create open water such as ponds and lakes. Hence the only type of open water body present in the baseline scenario are rivers and drainage canals. The area of canals in the baseline scenario is determined based on the rate of conversion, topography characteristics and common practice,

as set out in Sub-section 5.3.3 and 5.3.4 of the PD. In the baseline stratification, all area that is, or would be, water body during the project-life falls into the WB stratum.

Temporal stratification is being applied to this stratum by separating water bodies present at the project start date and drainage canals that would be constructed in later phases by the baseline agents during the project period. Therefore, part of the WB stratum would remain land before the conversion is completed. This situation has been taken into account by using a spatially and temporally explicit quantification approach, as set out in Sub-section 5.3.5 in the PD. In total 3,327 ha of the peatland area falls into the stratum WB in the baseline scenario. Details on area and sequence of changes from land strata to WB is given in Appendix 4 of the PD.

No default emission factors are yet provided by IPCC for CO_2 and CH_4 from water bodies. Therefore, IPCC default values for Dissolved Organic Carbon (Δ DOC) were used to calculate the difference in carbon losses between the project scenario and the baseline scenario.

From DOC values it cannot be explained 'how' this carbon will be lost: either transported to the sea, lost as CO_2 within or outside the project area, or lost as CH_4 in- or outside the area (which will be a considerable part). The 'carbon loss' can be calculated, but not the exact proportion of the GHG species CH_4 and CO_2, and therefore all carbon will be assumed to be lost as CO_2 which makes the approach conservative and any double counting will be avoided. Canals and rivers are treated similarly in the use of DOC values. The TIER 1 (IPCC) default annual values for DOC are 0.57 and 0.82 ton C per hectare, for natural and drained peatland respectively. Conservatively, the Hantipan canal (that presents at the project start date) is treated as of producing the same DOC value as that of a natural river despite being man-made water body. Default values used for calculations are given in Appendix 6 of the PD.

For the quantification procedure, the project used the approach as set out in the VCS methodology VM0007 module BL-PEAT by using the equation 21. ($E_{peatditch\text{-}CO2,i,t}$ + $E_{peatditch\text{-}CH4,i,t}$) found in the equation 7 in the module BL-PEAT was replace with DOC emission, translated into CO_2-equivalents.

$$E_{peatditch\text{-}BSL,i,t} = A_{ditch\text{-}BSL,i,t} \times EF_{DOC\text{-}BSL} \quad (21)$$

Where:

$E_{peatditch\text{-}BSL,i,t}$	GHG emissions from canals and other open water stratum i at year t in the baseline scenario (t CO_2e yr^{-1})
$A_{ditch\text{-}BSL,i,t}$	Total area of canals and other open water stratum i at year t in the baseline scenario (ha)
$EF_{DOC\text{-}BSL}$	IPCC emission factor of Dissolved Organic Carbon from canal and open in the baseline scenario (t CO_2e $ha^{-1}yr^{-1}$)
i	1, 2, 3 …M_{BSL} strata in the baseline scenario (unitless)
t	1, 2, 3, … t time elapsed since the project start (yr)

Projected annual GHG emissions from Dissolved Organic Carbon in water bodies in baseline scenario is presented in Table 23.

Table 23. GHG emissions from Dissolved Organic Carbon in water bodies in the baseline scenario in $tCO_2\text{-}e.y^{-1}$

Year	CO_2 from DOC
2011	2,779
2012	2,779
2013	6,052
2014	6,052
2015	6,314
2016	6,314
2017	7,012
2018	7,012
2019	7,370
2020	7,370
2021	7,965
2022	7,965
2023	8,275
2024	8,275
2025	8,890
2026	8,890
2027	9,127
2028	9,127
2029	9,821
2030	9,821
2031	9,821
2032	9,821
2033	9,821
2034	9,821
2035	9,821
2036	9,821
2037	9,821
2038	9,821
2039	9,821
2040	9,821

Year	CO_2 from DOC
2041	9,821
2042	9,821
2043	9,821
2044	9,821
2045	9,821
2046	9,821
2047	9,821
2048	9,821
2049	9,821
2050	9,821
2051	9,821
2052	9,821
2053	9,821
2054	9,821
2055	9,821
2056	9,821
2057	9,821
2058	9,821
2059	9,821
2060	9,821
2061	9,821
2062	9,821
2063	9,821
2064	9,821
2065	9,821
2066	9,821
2067	9,821
2068	9,821
2069	9,821
2070	9,821

3.2.1.8 Significant sources of baseline emissions

No significance tests were necessary since all carbon pools not included in the baseline and project have either been shown to increase more or decrease less in the project relative to the baseline scenario, or been conservatively excluded. All mandatory pools have been included and all sources of GHG emissions have either been included or conservatively excluded.

3.2.2 Project Emissions

3.2.2.1 General procedures and assumptions

Project emissions and changes in carbon stocks during this reporting period are calculated based on a combination of site-specific data, land-use proxies and (IPCC) default emissions factors. Emissions in the project scenario that were accounted for result from:

1. Above ground biomass stock changes due to REDD
2. Above ground biomass stock changes due to uncontrolled burning
3. Peat microbial decompositions
4. Dissolved Organic Carbon in Water bodies
5. Peat oxidation from uncontrolled burning

Emissions in the project scenario that were not accounted for during this reporting period, but which will be accounted for in future period result from:

1. Above ground biomass stock changes due to ARR activities
2. Above ground biomass stock changes from forest growth

Specific GHG sources included and excluded from project emissions calculations are listed in the PD in Section 5.4.1.

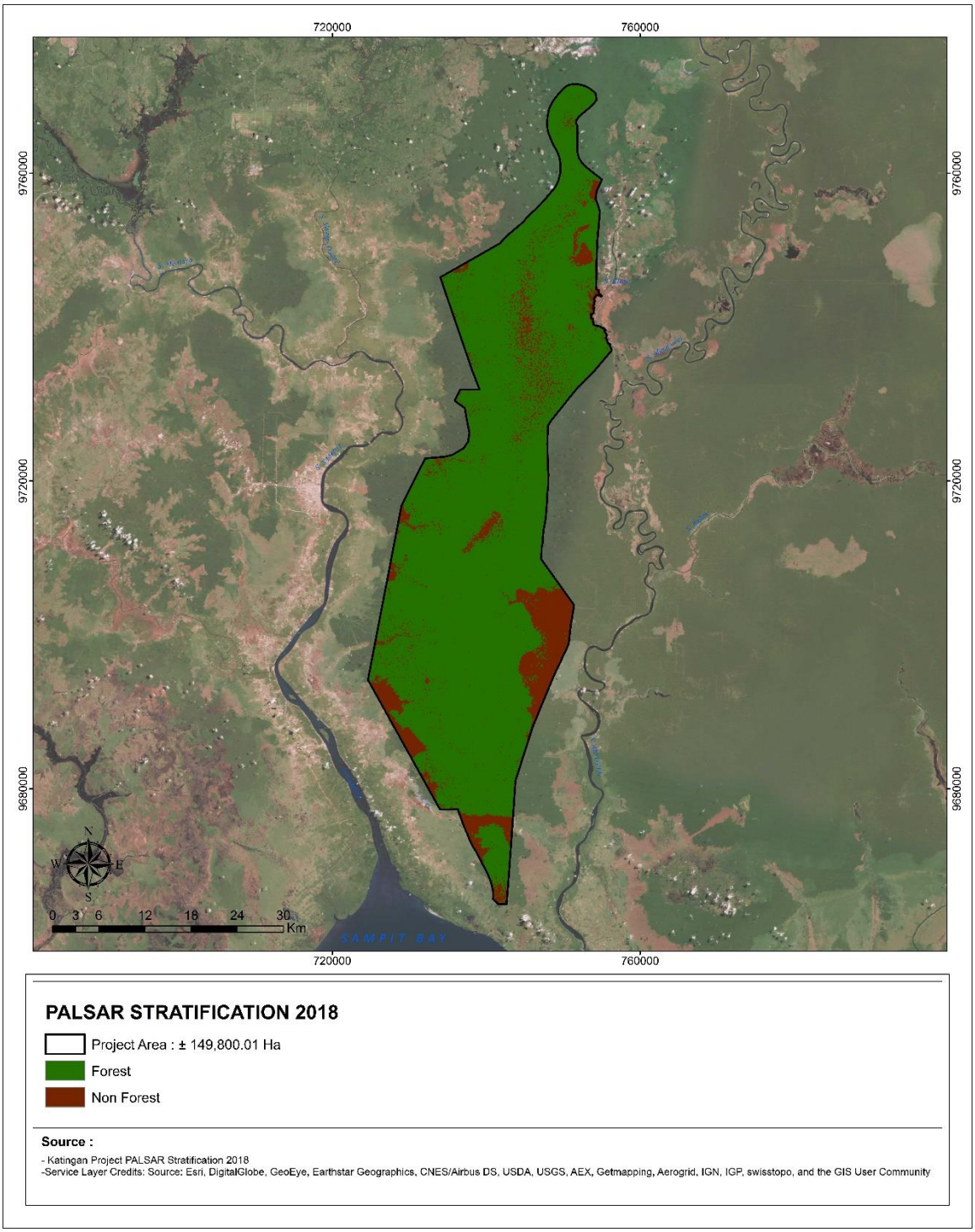
3.2.2.2 Project emissions from deforestation and forest degradation

3.2.2.2.1 Emissions from deforestation

Per the monitoring plan, multispectral satellite imagery was used to regularly monitor the project area and detect any land cover changes. Given the project area's frequent cloud cover, all available multispectral imagery was used, including Landsat, Sentinel 2 and PlanetLabs data. An unsupervised classification was run on a December 2017 PlanetScope mosaic, which detected some minor disturbances consisting of 4.08 ha of deforestation in the forest strata as well as 18.16 ha of deforestation in the area susceptible to degradation strata (see Table 24).

To confirm no other land cover changes occurred between the PlanetScope scene capture and the end of the monitoring period, a dual polarization (HH, HV) ALOS PALSAR 2 image from January 25th 2018 was processed per the methodologies described in Section 3.3.3.1 of the last MR. The PALSAR results showed no additional deforestation occurred and its classification accuracy was determined to be 97.93% and 98.30%, calculated using a confusion matrix and matrix union analysis respectively.

Map 13. ALOS PALSAR 2 classification results



The net carbon stock change as a result of deforestation ($\Delta C_{DefPA,u,l,t}$) is equal to the area deforested multiplied by the emission per unit area.

$$\Delta C_{DefPA,u,i,t} = A_{DefPA,u,i,t} * \Delta C_{pools,P,Def,u,i,t}$$

Where:

$\Delta C_{DefPA,u,i,t}$ = Net carbon stock change as a result of deforestation in the project case in the project area in stratum *i* at time *t*; t CO2-e

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

$C_{poolsP,Def,u,i,t}$ = Net carbon stock changes in all pools in the project case in land use *u* in stratum *i* at time *t*; t CO2-e ha-1

By applying the above equation to each strata, net carbon stock change as a result of deforestation ($\Delta C_{DefPA,u,I,t}$) was determined to be 7,430.80 tCO2-e.

Table 24. Emission from deforestation in project area within the current monitoring period

No	Strata (pre deforestation)	$A_{DefPA,i}$ (ha)	$\Delta C_{pools,P,Def,i}$ (tCO2-e/ha)	$\Delta C_{DefPA,i}$ (tCO2)
1	Forest	4.08	352.81	1,438.76
2	Area Susceptible to degradation	18.16	329.97	5,992.04
	Total	22.24		7,430.80

3.2.2.2.2 Emissions from forest degradation

To assess the forest degradation a Principle Rural Appraisal survey was conducted to quantify the penetration distance and calculate $A_{DegW,susc}$. Per the M-MON Module this survey is only required every 2 years so the survey conducted covered both the 2016 and 2017 calendar years.

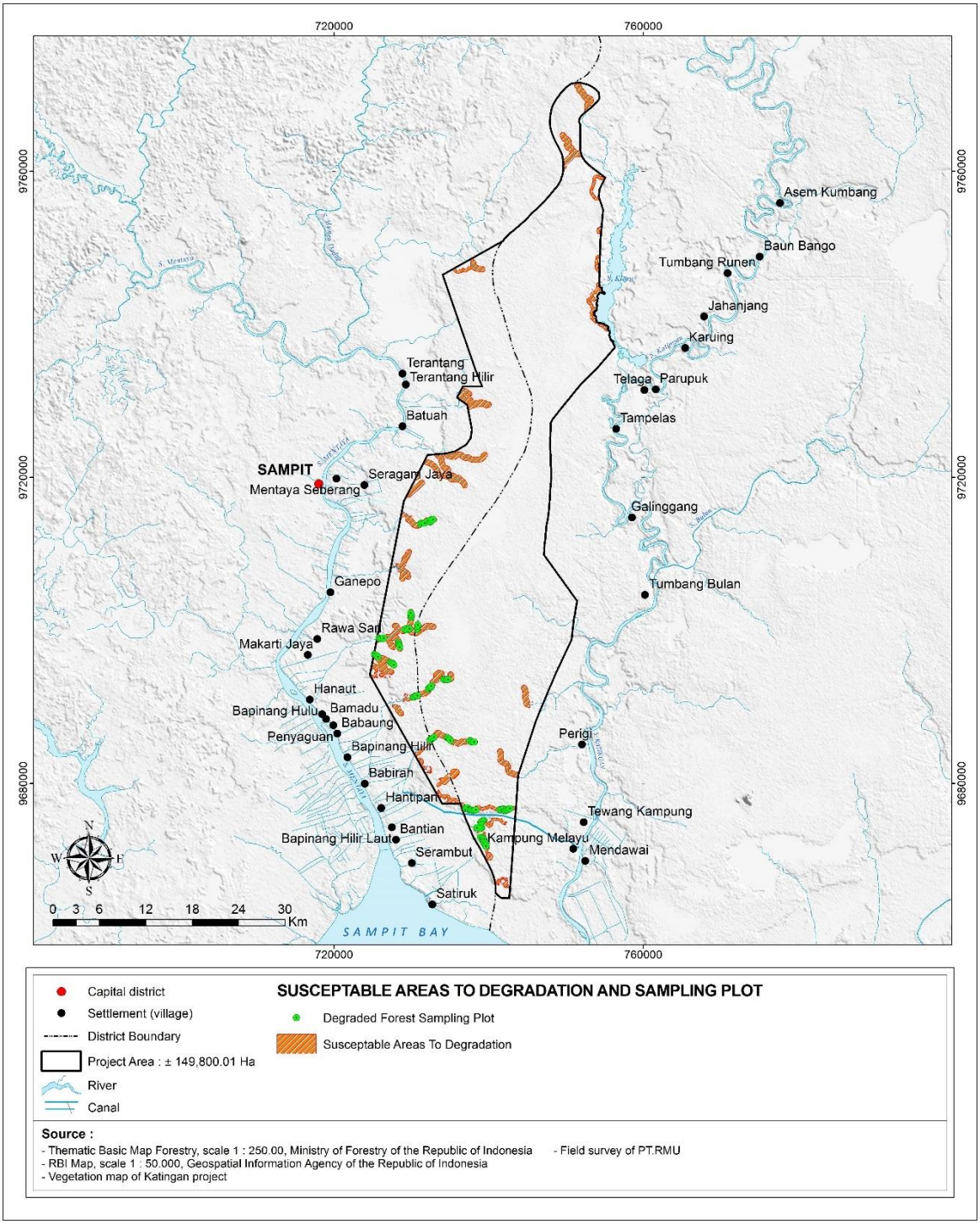
The PRA survey was conducted in November – December 2017 to re-assess the penetration depth of unplanned forest degradation caused by illegal logging in project area. During the PRA the project team interviewed 96 respondents from fourteen (14) villages surrounding the project area; all of which were either known or suspected to have been involved in illegal logging activities. This survey was not intended to be a complete survey of all people engaged in such activities, but rather to be a representative sample from which general characteristics of illegal logging activities could be ascertained, particularly regarding access and penetration.

Respondents were questioned as to the typical penetration distance travelled from major access points (boat accessible rivers or forest-non-forest boundaries). Responses showed a wide range of values (20m to 2,000m) but were heavily skewed to lower distances, significantly non-normally distributed, and included several extreme outliers. Due to this distribution, the median value of 350 m was taken as a representative value and following the M-MON module, it was used to create a buffer around all major access points identified by the PRA (boat-accessible rivers and canals, and forest-non-forest boundaries). As the deforestation analysis and canal detection analysis revealed a canal that is currently being used by illegal loggers, the 350m buffer was also applied to the canal and included in the updated area susceptible to degradation calculations. This process determined the updated area susceptible to degradation to be 9,384.28 ha *($A_{DegW,susc}$*; Map ssx).

In order to quantify carbon loss due to degradation, stump surveys were conducted in 190 plots (each measuring 300 m x 50 m). The plots were arranged no closer than 100 m from each other

and distributed with the long-side running perpendicular to the access point (river, canal or edge). With 190 plots covering a total sampled area of 285 Ha, this exceeding the minimum 3% (281 ha) sampling of $A_{DegW,susc}$ as mandated by M-MON. Further detail of this plot design is available in the corresponding Standard Operating Procedure (SOP). In the stump surveys, the age of stumps (year felled) was estimated based on information provided by ex-illegal loggers that accompanied the survey teams, combined with an assessment of the physical condition of stumps (to visually assess their age) and a machete test (to physically test the age of stumps).

Map 14. Map of susceptible areas to forest degradation in project area and sampling plots



The stump survey was carried out in two stages in 2017 (February-March) and 2018 (February-March). By extrapolating the sampled data, the total number of trees logged in susceptible areas to degradation within 2016-2017 was estimated to be 180,738.

Table 24. Stump count and tree loss data based on degradation strata

Year	Susceptible Area to degradation	
	Average / Ha	Total Count
2016-2017	19.26	180,738

Tree biomass loss was estimated from the stump data by using allometric equations specifically developed for mixed Peat Swamp Forest species using DBH as its parameter (Manuri *et.al*, 2015). This is the same equation that was applied to the biomass estimations in the baseline scenario and provided an estimate of the average biomass carbon of trees cut and removed due to illegal logging in degraded forest ($C_{DegW,i,t}$). To meet conservative principles, the stump diameter was assumed to be equivalent to the DBH, as suggested by M-MON.

Net carbon stock change as result from forest degradation ($\Delta C_{P,DegW,i,t}$) was then calculated by extrapolating the sampled loss by strata to all areas potentially subjected to degradation in each strata respectively and then summing the values.

$$\Delta C_{P,DegW,i,t} = A_{DegW,i} * C_{DegW,i,t}$$

Where:

$\Delta C_{P,DegW,i,t}$ = Net carbon stock change as a result of forest degradation in the project area at time t; tCO2-e

$A_{DegW,i}$ = Area of recorded forest degradation in stratum i; ha

$C_{DegW,i,t}$ = Biomass carbon of trees cut and removed through degradation; $tCO_2\text{-}e\ ha^{-1}$

By applying the above equation to each strata, net carbon stock change as a result of illegal logging in the areas susceptible to degradation ($\Delta C_{P,DegW,susc,t}$) was determined to be 110,352.02 tCO_2-e.

Table 26. Emission from forest degradation in project area within the current monitoring period*

Year	Susceptible areas		
	A_degW,I,t (ha)	C_degW,I,t (tC/ha)	C_deg_susc,I,t (tCO2-e)
2016-2017	9,384.29	3.21	110,352.02

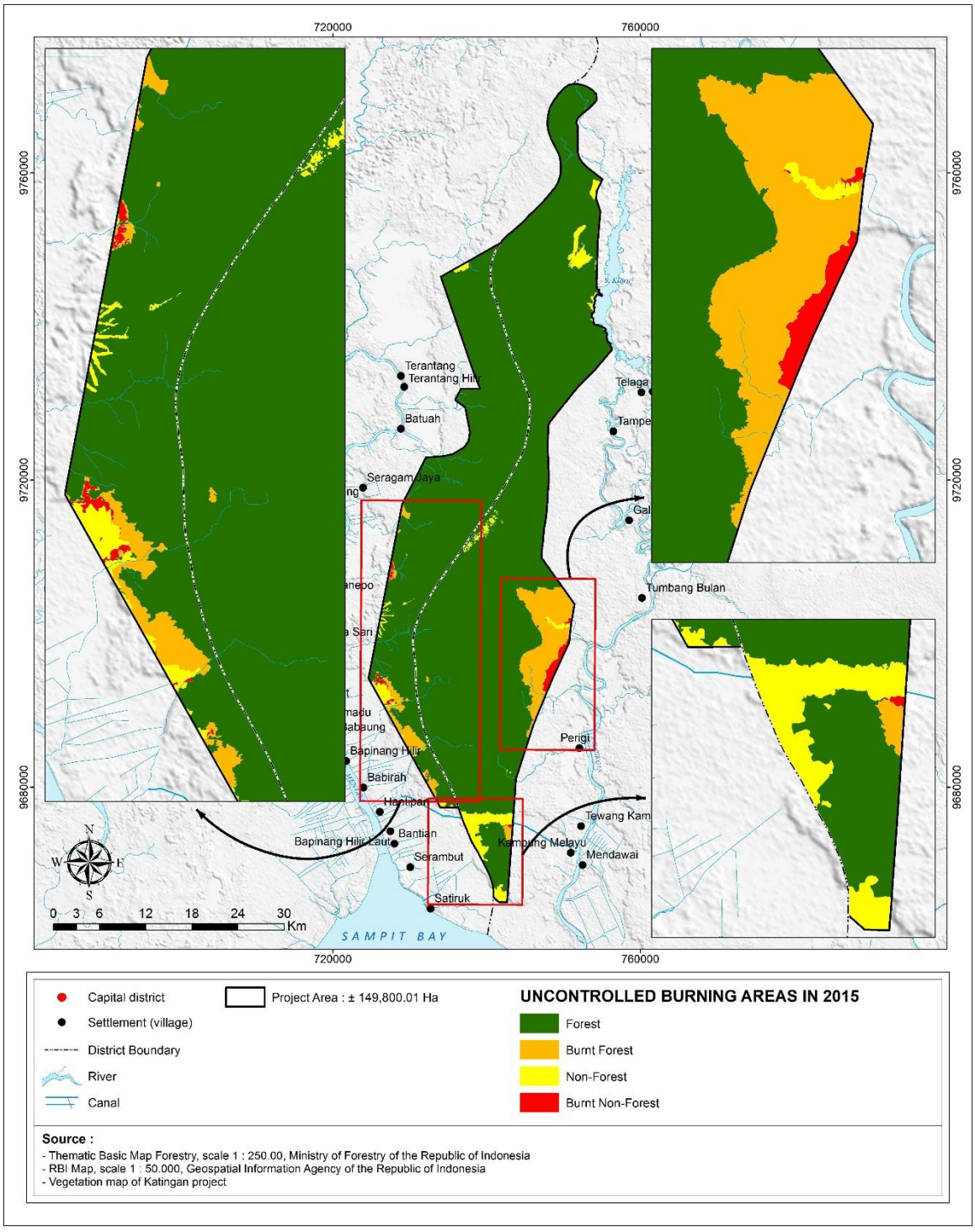
* The value includes carbon loss resulting from forest degradation which was not included in the first monitoring report (period: 1 November 2010 - 31 October 2015)

3.2.2.2.3 Emissions from uncontrolled biomass burning

No fire incident was recorded in the project area during this monitoring period, therefore no new emissions from biomass burning were reported. However, emissions from the decomposition of

biomass previously burnt in 2015 (8,368.93 ha of burnt forest) is reported in this monitoring report as dead wood decomposition. As described in the first monitoring report (Section 5.1.3.4), a drone survey and field survey was conducted to investigate the condition of forest in areas affected by fires in 2015. Since the UAV surveys from 2015 showed 11.4% of the fire affected area contained live standing trees (Section 5.1.3.4, Table 34 of the first monitoring report) the biomass decomposition emission calculations were applied to 88.6% of the fire affected area.

Map 15. Uncontrolled burnt areas in 2015



Emission from dead wood decomposition are calculated by using the following equation:

$$C_{DW_{decay,t}} = \left(EXP\left(-(t-1) \times k_{decay}\right) \times C_{DW,t0}\right) - \left(EXP\left(-t \times k_{decay}\right) \times C_{DW,t0}\right)$$

Where:

$C_{DW_{decay,t}}$	=	Annual carbon leaving the deadwood pool due to the decay in year t (tCO_2)
$C_{DW,t0}$	=	Carbon input to the deadwood pool before burnt (t0)
k_{decay}	=	Rate of decay of the deadwood pool
t	=	Year of monitoring period elapsed from fire incident (1,2,3,..)

By applying the equation above, deadwood decomposition GHG in this monitoring period were 191,374.75 tCO2-e. (see Table 27)

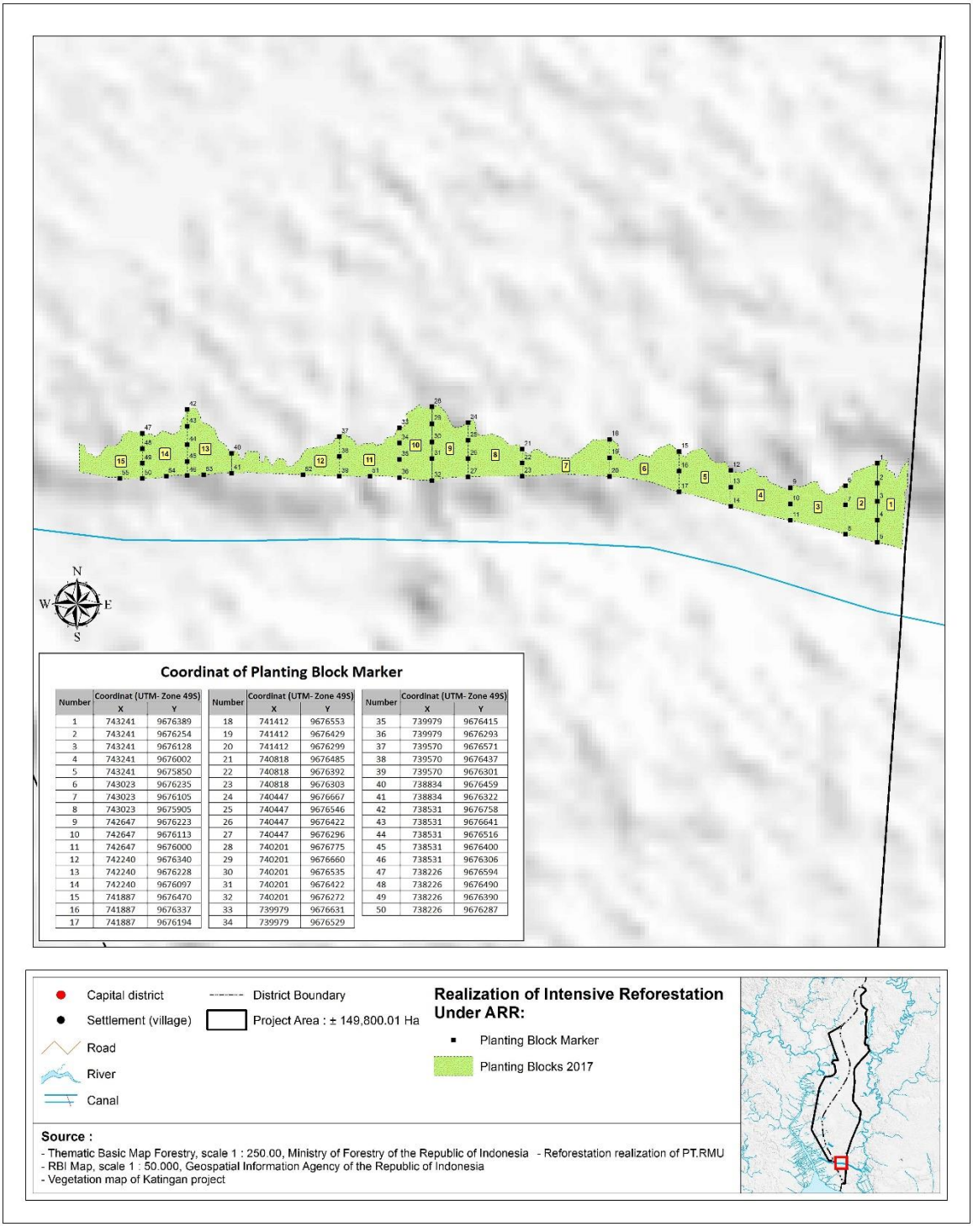
Table 27. Decomposition of burnt tree biomass

Year		F_burnt	F_dw	tC_remain	C_emmited	
					tC	tCO2-e
2015	0	8,368.93	1.000	364,737.55	-	-
2016	1	0	0.827	301,623.05	63,114.50	231,419.84
2017	2	0	0.684	249,429.94	52,193.11	191,374.75

3.2.2.2.4 Intensive reforestation

With the approval of the Annual Working Plan by the local government (*SK Kepala Dinas Kehutanan Provinsi Kehutanan No.522.1.300/1499/Dishut*), the project started its reforestation program. The program was initiated by delineating and marking a planting block in early January 2017. Based on the delineation, a planting area of 150 ha was divided into 15 planting blocks.

Figure 7. Map of planting block in reforestation program



Coordinat of Planting Block Marker

Number	Coordinat (UTM- Zone 49S) X	Y	Number	Coordinat (UTM- Zone 49S) X	Y	Number	Coordinat (UTM- Zone 49S) X	Y
1	743241	9676389	18	741412	9676553	35	739979	9676415
2	743241	9676254	19	741412	9676429	36	739979	9676293
3	743241	9676128	20	741412	9676299	37	739570	9676571
4	743241	9676002	21	740818	9676485	38	739570	9676437
5	743241	9675850	22	740818	9676392	39	739570	9676301
6	743023	9676235	23	740818	9676303	40	738834	9676459
7	743023	9676105	24	740447	9676667	41	738834	9676322
8	743023	9675905	25	740447	9676546	42	738531	9676758
9	742647	9676223	26	740447	9676422	43	738531	9676641
10	742647	9676113	27	740447	9676296	44	738531	9676516
11	742647	9676000	28	740201	9676775	45	738531	9676400
12	742240	9676340	29	740201	9676660	46	738531	9676306
13	742240	9676228	30	740201	9676535	47	738226	9676594
14	742240	9676097	31	740201	9676422	48	738226	9676490
15	741887	9676470	32	740201	9676272	49	738226	9676390
16	741887	9676337	33	739979	9676631	50	738226	9676287
17	741887	9676194	34	739979	9676529			

In this program, all seedlings were prepared by project staff in a permanent nursery located in the Hantipan canal. Prior to the planting time, project staff applied “hardening off” to adapt seedlings from nursery to planting site circumstances. This was simply done by reducing watering and shading until seedlings were ready for the real conditions in the planting site.

Figure 8. “Hardening off” applied prior to planting time

Project staff intentionally involved local communities in this program. Under the project team’s facilitation, they established 10 planting groups, each with 4-6 members of local villages. Planting was carried out throughout February 2017 which was done in two phases; 100 ha in the first phase and 50 ha in the second phase. In total there were 547 planting lines, with line spacing of 5m x 10m, that covered the whole planting area.

Planting was not done if there were natural wildlings within a 1m radius of the intended planting point (along the planting line). In total, 19,670 saplings of 14 native tree species were planted in this program. Among those species Jelutung had the biggest proportion (31.84%), followed by Belangeran (22.32%) and Pulai (19.40%). The detailed information on species planted in the reforestation program are provided in Table 28.

Table 28. List of species planted in intensive reforestation program

No	Species	seedlings planted	%
1	Belangeran (*Shorea balangeran*)	4,390	22.32%
2	Jelutung (*Dyera polyphylla*)	6,262	31.84%
3	Bintan (*Ctenolophon parvifolius*)	1,185	6.02%
4	Pulai (*Alstonia spatulata*)	3,815	19.40%
5	Rambutan hutan (*Nephelium sp.*)	161	0.82%
6	Tabaras/Kepot Bajuku (*Stemonurus scorpiodes*)	818	4.16%
7	Tumih (*Combretocarpus rotundatus*)	862	4.38%
8	Malam-malam / Kacapuri (*Dyospyros aerolata*)	943	4.79%
9	Hangkang (*Palaquium leiocarpum*)	64	0.33%
10	Mangkinang (*Elaeocaprpus mastersii*)	42	0.21%
11	Punak (*Tetramerista glabra*)	6	0.03%
12	Meranti (Shorea spp.)	165	0.84%
13	Kapurnaga Jangkar (Calophyllum sclerophyllum)	2	0.01%
14	Jambu-jambu (Syzygium sp.)	955	4.86%
	Total	19,670	100 %

Figure 9. The line prepared prior to planting (left); villager planting seedling in field (right)

3.2.2.2.5 Fire break plantation

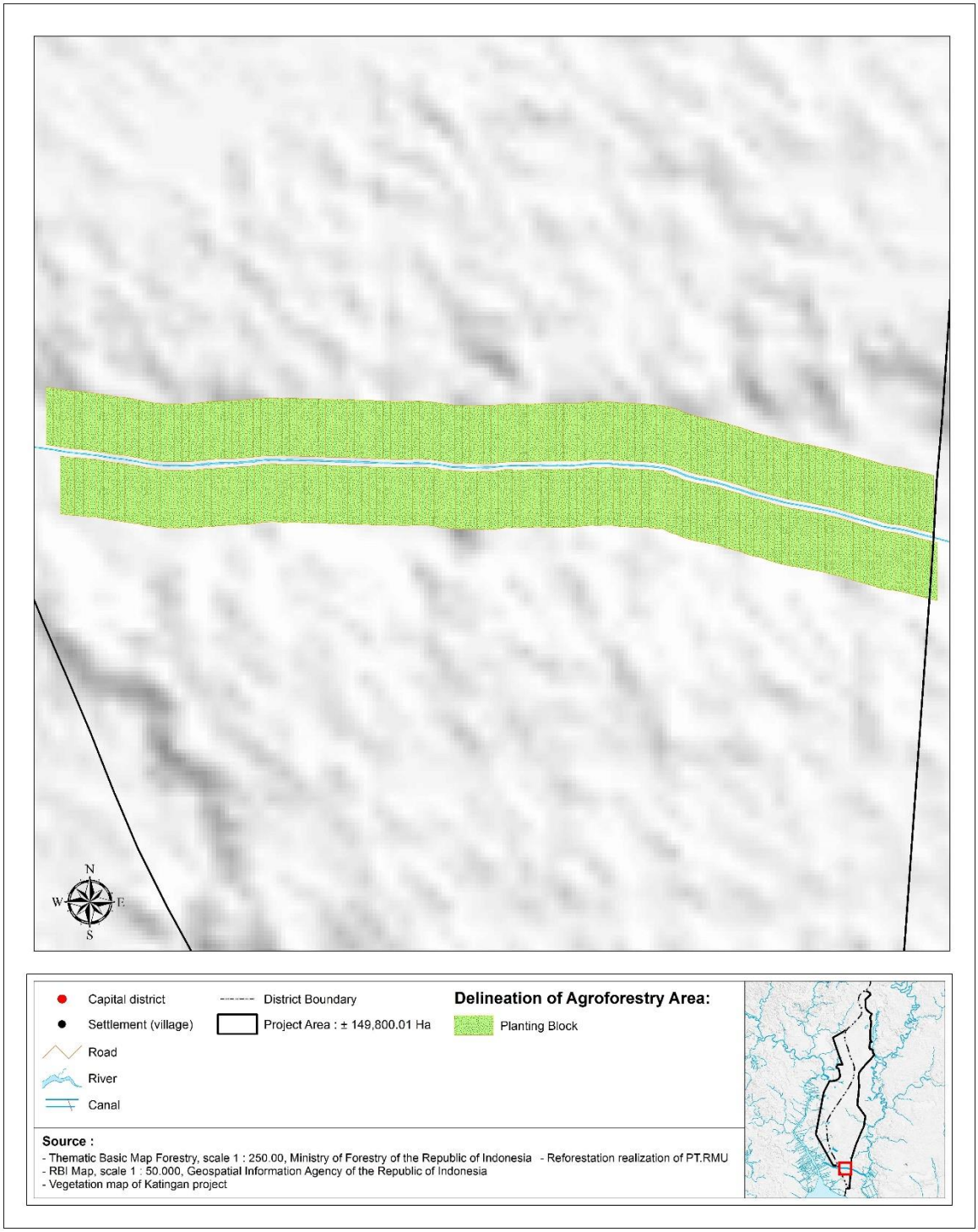
There was no new planting activity in this monitoring period. The existing saplings were monitored and maintained to support their survival rate and growth. As was reported in the previous monitoring report, the project planted 5,664 saplings across an area of 5.68ha. The local species planted were in the fire break were Kahui *Shorea belangeran*, Tumih *Combretocarpus rotundatus*, Pulai *Alstonia spp*, Gelam *Melaleuca cajuputi*.

3.2.2.2.6 Agroforestry program

During this monitoring period, the team continued socialization on agroforestry and intensified discussion with communities. There was good progress on the concept of agroforestry in which communities agreed to consider native species (Jelutung *Dyera Polyphylla*) as a main tree species, replacing the exotic species they previously proposed (primarily Rubber tree *Havea brasiliensis*). The project and communities are still discussing other native tree species to establish a heterogenic stand and agriculture commodity for agroforestry. In the next reporting period, the project expects to finalize the technical design of the agroforestry program and initiate its implementation.

In this reporting period, the project managed to complete the delineation of agroforestry areas. Based on this delineation, an area of 496 ha is available for this program; 250 ha of which is located on the north side of the Hantipan canal, with 246 ha on the southern side. Assuming one person manages two hectares, the agroforestry program will potentially involve 248 villagers.

Map 16. Area delineation of agroforestry program



The GHG removal from ARR are not reported and claimed in this reporting period. Biomass growth and GHG removals will be monitored and claimed in 2020.

3.2.2.2.7 Carbon enhancement from forest regrowth

Forests that are protected from planned conversion to timber plantations have significant potential for regrowth and hence are expected to accumulate biomass by removing CO2 from the atmosphere. However, in this reporting period the carbon enhancement was not monitored as the carbon plots were not re-measured. The carbon stock of unchanged strata were therefore conservatively assumed to have remained constant during the monitoring period. As scheduled, carbon enhancement from forest growth will be monitored and claimed in 2020.

3.2.2.2.8 Summary of stratification changes

Per the analysis described in section 4.2.2 some minor deforestation events occurred during this monitoring period. Therefore there were slight changes to the AGB stratification produced in the last monitoring period, as shown by Map 17.

Map 17. Stratification at the end of the monitoring period ending on the 31st of December 2017

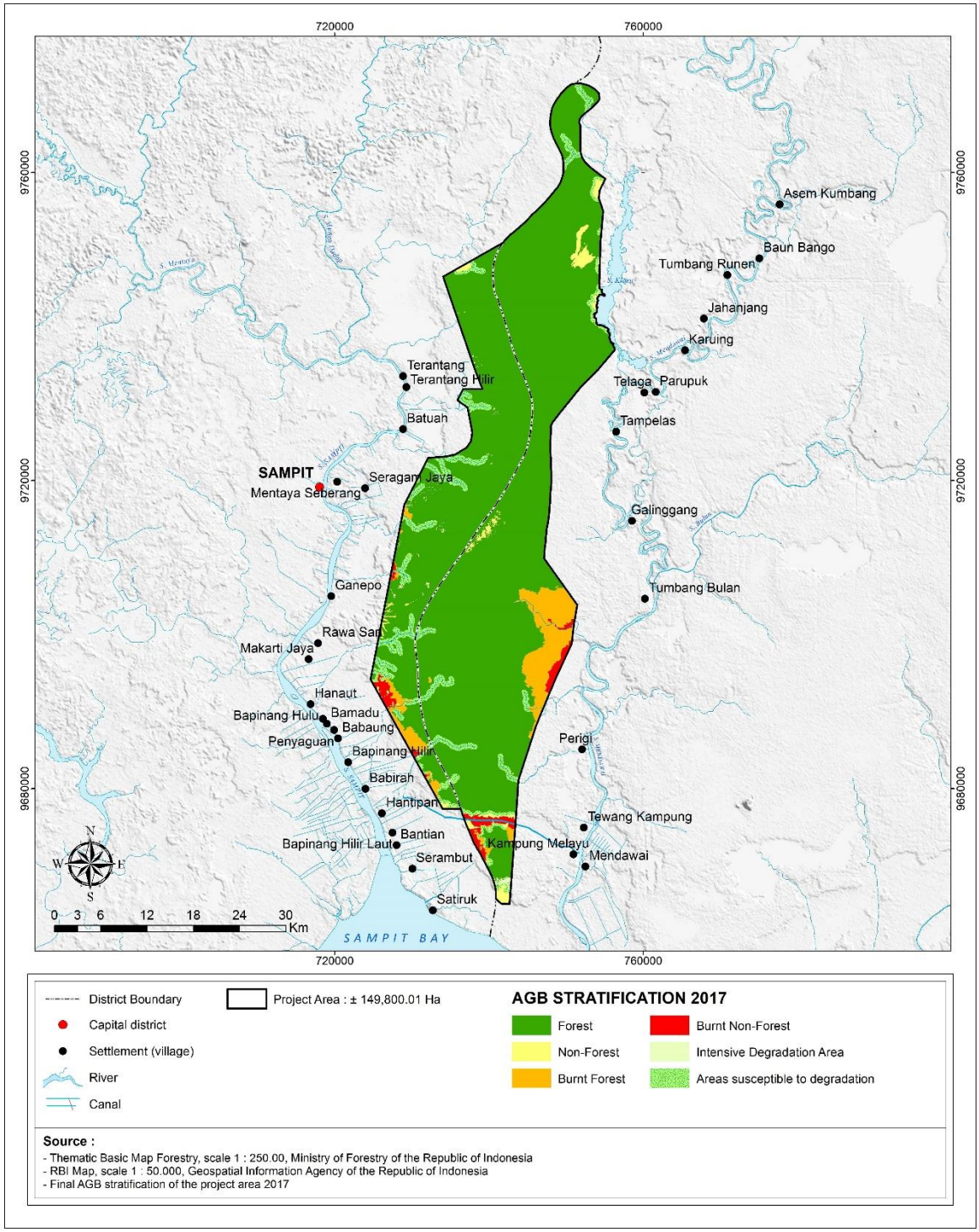


Table 29. 2017 Stratification classes and areas

No	2017 Stratification classes	Area (ha)
1	Forest	126.373,00
2	Non-forest	2.574,61
3	Area Susceptible to Degradation	9.384,29
4	Intensive Degradation	406,76
5	Burnt Forest	8.598,88
6	Burnt Non-forest	2.462,21
	Total	149.799,75

3.2.2.3 Project emissions from peat and water body

Relevant stratification for WRC activities are given in the PD (Section 4.4.1). The strata that are distinguished in the project scenario for the purposes of the calculation of emissions from peat and water bodies are as follows:

- Drained forested peatland (P1L1D1)
- Undrained forested peatland (P1L1D0)
- Drained non-forested peatland (P1L0D1)
- Undrained non-forested peatland, and (P1L0D0)
- Water bodies

As stated in Section 3.1.3.3.2 GHG emissions from microbial decomposition of peat were quantified by monitoring land use change in combination with the corresponding IPCC default GHG emission factors. As described in Section 3.1.3.3.3, GHG emissions from water bodies were monitored by using visual high resolution multispectral remote sensing imagery, coupled with ground surveys, to detect new canals or water bodies. This analysis revealed an increase in size of a canal south of the main Hantipan canal. This small canal has existed since before the project start date but used to be small, shallow and didn't drain water during the dry season, thereby not causing any significant drainage impact. However, as illegal logging activity has increased in the area, loggers have dredged and widened the canal, thereby making it sufficiently large to have a significant drainage impact and was thus included in the belowground stratification modelling. The method for estimating the area impacted by the canal's drainage followed the methods previously described Section 4.2.6 of the previous MR and are presented in Table 30.

Map 18. Stratitfication of the project area based on emission characteristics for microbial decomposition of peat and water bodies in 2016

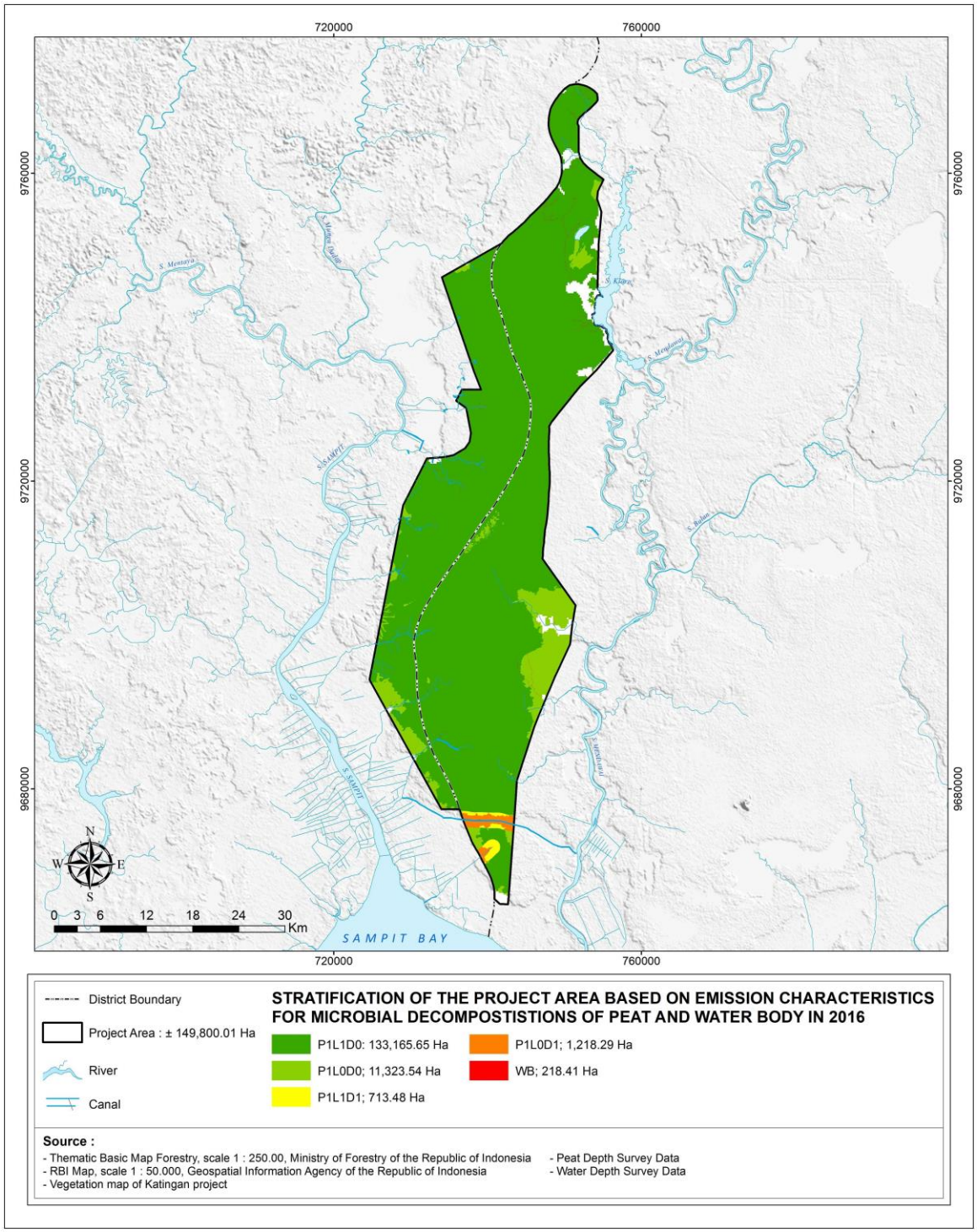
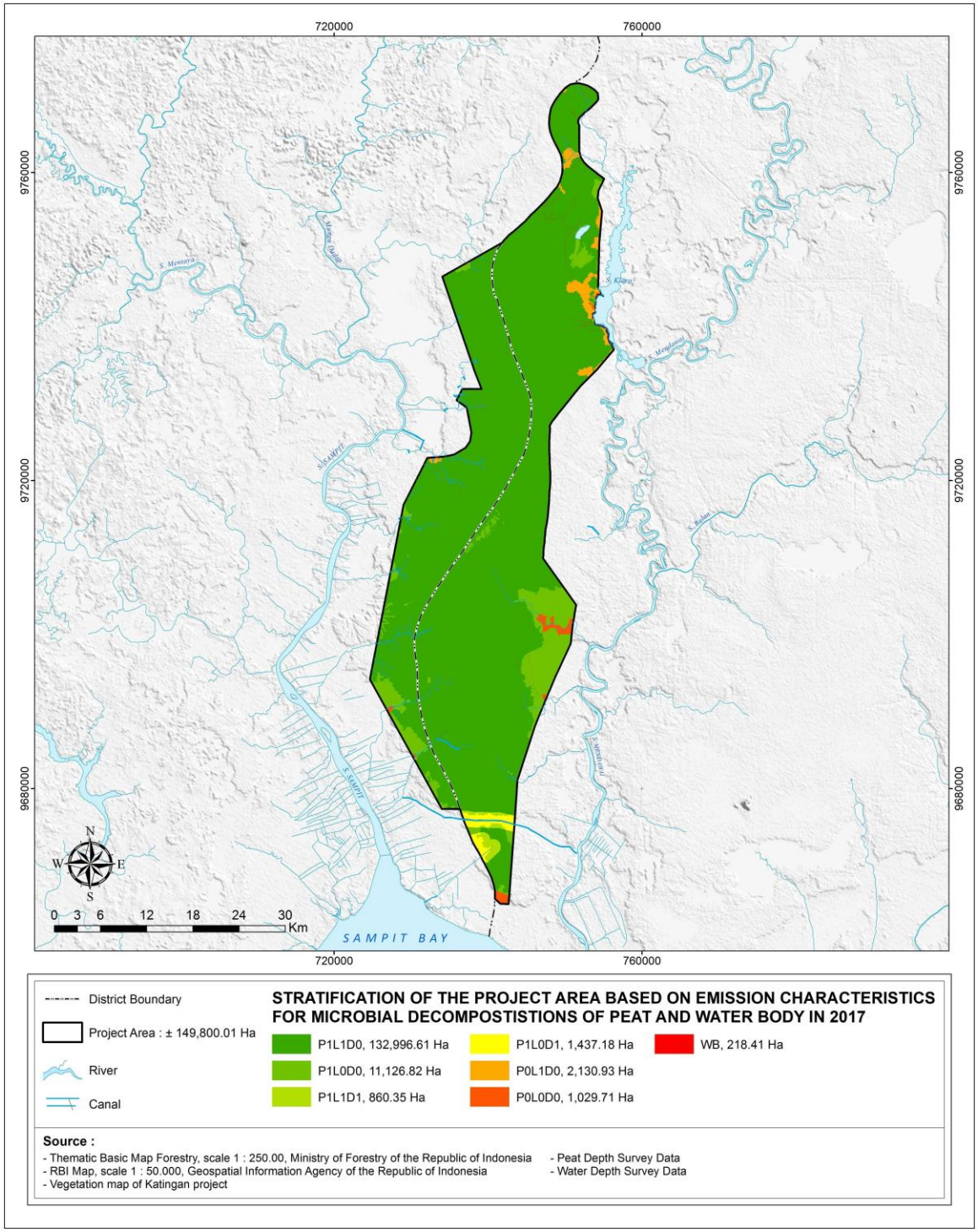


Table 30. Project area belowground stratification for peat and water body emissions 2017

Strata	Area (ha)	Changes from 2016 (ha)
P0 (Non-peat / Mineral soils)	3,160.65	0.00
P1L0D0 (Undrained deforested peatland)	11,126.81	-196.72
P1L1D0 (Undrained peatland forest)	132,996.12	-169.53
P1L0D1 (Drained deforested peatland)	1,437.18	+218.89
P1L1D1 (Drained peatland forest)	860.35	+146.87
WB (Water body)	218.41	0.00
Total	149,799.52	

Map 19. Stratitfication of the project area based on emission characteristics for microbial decomposition of peat and water bodies in 2017



3.2.2.3.1 Emissions from microbial decomposition of peat

For each land stratum, GHG emissions from microbial decomposition of peat soil was calculated using equation 22:

$$E_{peatsoil\text{-}WPS,i,t} = E_{proxy\text{-}WPS,i,t} \quad (22)$$

Where:

$E_{peatsoil\text{-}WPS,i,t}$	Greenhouse gas emissions from the peat soil within the project boundary in the project scenario in stratum i in year t (t CO_2e yr^{-1})
$E_{proxy\text{-}WPS,i,t}$	GHG emissions as per the chosen proxy in the project scenario in stratum i in year t, in this project, based on IPCC default values (t CO_2e yr^{-1})
i	1, 2, 3 …M_{WPS} strata in the project scenario (unitless)
t	1, 2, 3, … t* time elapsed since the project start (years)

While $E_{proxy\text{-}WPS,i,t}$ was estimated using equation 23:

$$E_{proxy\text{-}WPS,i,t} = A_i \times (E_{proxy\text{-}CO2,i,t} + E_{proxy\text{-}CH4,i,t}) \quad (23)$$

Where:

$E_{proxy\text{-}WPS,i,t}$	GHG emissions as per the chosen proxy in the project scenario in stratum i in year t (t CO_2e yr^{-1})
A_i	Total area of stratum I (ha)
$E_{proxy\text{-}CO2,i,t}$	Emission of CO_2 as per the chosen proxy in stratum i in year t, for TIER 1 approach this equals default CO_2 emission factor for stratum i (t CO_2e $ha^{-1}yr^{-1}$)
$E_{proxy\text{-}CH4,i,t}$	Emission of CH_4 as per the chosen proxy in stratum i in year t, for TIER 1 approach this equals default CH_4 emission factor for stratum i (t CO_2e $ha^{-1}yr^{-1}$)
i	1, 2, 3 …M_{WPS} strata[10] in the project scenario (unitless)
t	1, 2, 3, … t* time elapsed since the project start (years)

For the current monitoring period sufficient long-term, site specific direct measurements of peat related emissions are not yet available, therefore GHG emission factors provided in the PD were used as a conservative and scientifically robust alternative (TIER 1 IPCC default emission factors). Procedures followed the VCS methodology VM0007 modules BL-PEAT and M-PEAT based on annual strata area (Table 29), resulting in estimated annual GHG emissions from microbial decomposition of peat as presented below in Table 31.

[10] Note that different water table classes result in different strata.

Table 31. GHG emissions from microbial decomposition of peat by strata during the current monitoring period, in in tCO_2-e.y^{-1}.

Strata	Emissions (tCO2e)	
	CO_2	CH_4
P0	0.0	0.0
P1L0D0	16,690.22	2,225.36
P1L1D0	0.0	95,757.21
P1L0D1	27,924.43	201.21
P1L1D1	16,716.54	120.45
Total	61,331.20	98,304.22

3.2.2.3.2 Emissions from water bodies in peatlands

The water body stratum includes rivers and canals. During the current monitoring period no changes were detected in the extent of rivers and canals. Double accounting of water born losses was avoided by using DOC value only (TIER 1 IPCC values) as given in PDD.

GHG emissions through loss of dissolved organic content (DOC) via water bodies was calculated following procedures set out in the VCS methodology VM0007 module M-PEAT for each water body stratum, using the equation 24, resulting in the estimated annual GHG emissions presented below in Table 32.

$$E_{peatditch\text{-}WPS,i,t} = A_{ditch\text{-}WPS,i,t} \times EF_{DOC\text{-}WPS} \quad (24)$$

Where:

$E_{peatditch\text{-}WPS,i,t}$ GHG emissions from canals and other open water stratum i in year t in the project scenario (t CO_2e yr^{-1})

$A_{ditch\text{-}WPS,,i,,t}$ Total area of canal and other open water stratum i in year t in the project scenario (ha)

$EF_{DOC\text{-}WPS}$ IPCC emission factor of Dissolved Organic Carbon from canal and open in the project scenario (t CO_2e $ha^{-1}yr^{-1}$)

i 1, 2, 3 …M_{WPS} strata[11] in the project scenario (unitless)

t 1, 2, 3, … t* time elapsed since the project start (years)

[11] Note that different proxy classes result in different strata.

Table 32. GHG emissions from Dissolved Organic Carbon in water bodies in the project scenario scenario in tCO_2-e.y^{-1}.

Year	CO_2 from DOC
2017	456.47

3.2.2.3.3 Emissions from uncontrolled burning

There were no NASA FIRMS hotspots within the project area during this monitoring period, which was confirmed via regular fire patrols by the field staff. As there were no fires during the monitoring period the emissions from uncontrolled burning are reported as zero.

3.2.3 Leakage

Applicable leakage modules were determined according to requirements in the VCS methodology VM0007 REDD+ MF. As described in Section 4, the baseline activity is identified as planned deforestation and peatland drainage as a result of conversion to industrial acacia (pulp wood) plantations. The project is therefore categorized as a combination of Avoiding Planned Deforestation (APD) and Reforestation (ARR), in combination with Conservation of Undrained and Partially drained Peatland (CUPP) and Rewetting of Drained Peatland (RDP) activities. As a consequence, potential sources of leakage emissions stem from the displacement of planned deforestation activities and displacement of pre-project agricultural activities on non-forest land, and ecological leakage due to possible alterations of mean annual water table depth in adjacent areas. These potential sources are covered in the VCS Methodology VM0007 Modules **LK-ASP**, **LK-ARR**, and **LK-ECO** respectively, which are therefore identified as the applicable modules for the quantification of total leakage emissions (see Table 33).

Table 33. Applicability of leakage modules

Module	Applicability
Estimation of emissions from activity shifting for avoiding planned deforestation and planned degradation (LK-ASP)	Applicable. The project may cause activity shifting of avoided planned deforestation.
Estimation of emissions from activity shifting for avoiding unplanned deforestation (LK-ASU)	Not applicable. The project is not categorized as avoiding unplanned deforestation.
Estimation of emissions from displacement of fuelwood extraction (LK-DFW)	Not applicable. The project is not categorized as avoiding unsustainable fuelwood extraction.
Estimation of emissions from displacement of pre-project agricultural activities (LK-ARR)	Applicable. The project is categorized as afforestation, reforestation, and revegetation and may cause displacement of pre-project agricultural activities.
Estimation of emissions from market-effects (LK-ME)	Not applicable. The project does not reduce the production of timber, fuelwood, or charcoal.

Module	Applicability
Estimation of emissions from ecological leakage (LK-ECO)	Applicable. The project is categorized as WRC and may cause ecological leakage.

3.2.3.1 Estimation of emissions from activity shifting for avoiding planned deforestation and planned degradation

Activity shifting leakage was monitored against the leakage baseline defined in the PDD (Section 6). As per the methodology, and the steps defined in the PDD, 'area deforested by the baseline class of agents through the years in which planned deforestation was forecast to occur'($A_{defLK,i,t}$) was monitored and compared to the baseline leakage scenario (Step 3, as per Section 6 of the PDD), using the following method.

The most up-to-date data on active acacia (pulp wood) concessions in Indonesia, up to and including the current monitoring period, were obtained from Greenpeace since the official government data on such concessions is not publicly accessible (http://www.greenpeace.org/seasia/id/Global/seasia/Indonesia/Code/Forest-Map/en/data.html). The downloaded shapefile contains the spatial delineation of the concessions, the year each concession was granted, and the company that owns it (where known). In some cases the concession date is not listed, so these concessions were conservatively assumed to have been granted prior to 2010 (despite the fact that some may have been issued post-2010) so that any deforestation that occurred within them was included in the calculation of $NewR_{i,t}$. Prior to analysis, the concession data was reviewed to remove any listed areas that were not attributable to the baseline class of deforestation agent (acacia or other pulp wood plantations). This included the removal of a number of concessions (92) listed in the Greenpeace dataset as "candidate areas" ("Calon Areal") as such areas do not refer to active concessions. Similarly a number of concessions known to not to be associated with acacia or other pulp-wood plantations were removed: these included concessions known to be growing timber for plywood or biomass power generation as well as those growing non-timber crops such as rubber, oil palm, cloves or sagu. In total 166 such non-acacia plantations were removed, leaving a total of 557 known active acacia or other pulp wood plantations. This process was repeated during this monitoring period when an updated version of the Indonesia acacia concessions shapefile became available via the GlobalForestWatch (http://data.globalforestwatch.org/datasets/eca9f0db800a4d5c83bbf7f231c67949_0). In order to remain conservative, the concessions from the previous greenpeace dataset were added to any new concessions listed in the GlobalForestWatch dataset and all were assumed to remain active during the monitoring period.

Annual area deforested throughout all concessions during the monitoring period was quantified by using satellite imagery. Due to the large area and time-period, the best and most accurate dataset available is the Global Forest Watch data (http://earthenginepartners.appspot.com/science-2013-global-forest/download_v1.2.html). The major drawback of this dataset is that it doesn't quantify deforestation specifically; rather it quantifies tree cover loss. This means that any tree cover loss attributed to harvesting operations within the plantation are also included in the tree cover loss data, therefore significantly inflating the forest cover loss results. Despite the considerable drawbacks of the data and its overly conservative nature, the data was extracted for all concessions to quantify the annual deforested area by the class of deforestation agent throughout the monitoring period. In the future it may become possible to subtract forest gain data over the same periods to generate a net loss value more closely attributable to actual deforestation, however currently the GFW dataset only includes such data for 2000-2012, and warns against direct

comparisons. During this period the same set of concessions gained 1,530,482 ha of tree cover, a large proportion of which will relate to the plantations themselves, and subsequently be lost in harvesting. An alternative approach might be to model harvesting losses based on a set of assumed parameters.

Areas of deforestation and leakage were determined using equation 24. The area of deforestation attributable to peatland and non-peatland plantations was allocated following the approach described in the PDD, Section 5.5.1, whereby deforestation was assumed to occur at an equivalent rate within plantations on peat and in non-peat areas so was proportionally allocated based on the corresponding areas (20.5% and 79.5% respectively, see PDD Section 5.5.1 for more details). At the time of writing data from GFW for the calendar year 2017 was unavailable, so provisionally 2017 was conservatively allocated a deforestation rate equivalent to the highest rate observed in the preceding five years (the rate recorded for 2012). Results are shown in Table 34:

$$LKA_{planned,i,t} = A_{defLK,i,t} - NewR_{i,t} \quad (24)$$

Where:

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

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

$A_{defLK,i,t}$ 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)

Table 34. Monitored area of deforestation by the class of agent of deforestation (Acacia/other-pulpwood plantations) during the monitoring period

	$A_{defLK,i,t}$		$NewR_{i,t}$		$LKA_{planned,i,t}$	
Year	Peatland	Non-Peatland	Peatland	Non-Peatland	Peatland*	Non-Peatland*
2011	59,311.46	230,212.33	84,897.33	329,521.67	-25,585.87	-99,309.34
2012	83,297.77	323,313.10	88,254.15	342,550.85	-4,956.38	-19,237.75
2013	39,157.94	151,988.15	90,569.26	351,536.74	-51,411.32	-199,548.59
2014	48,967.20	190,061.94	94,023.17	364,942.83	-45,055.97	-174,880.89
2015	54,448.07	211,152.29	97,255.64	377,489.36	-42,807.57	-166,337.07
2016	75,277.58	291,930.11	100,685.55	390,463.46	-25,407.97	-98,533.35
2017	83,297.77	323,313.10	103,873.92	402,828.14	-20,576.15	-79,515.04

Since this analysis confirmed there was no leakage throughout the monitoring period (all values of $LKA_{planned,i,t}$ in Table 34 are negative), Steps 4 through 7 as described in the project description were not required.

3.2.3.2 Estimation of emissions from displacement of pre-project agricultural activities (LK-ARR)

The VM0007 Module LK-ARR requires the use of the latest version of the CDM tool "Estimation of the increase in GHG emissions attributable to displacement of pre-project agricultural activities in A/R CDM project activity" [12]. Step 1 of the CDM tool requires that the area subject to pre-project agricultural activities that is expected to be afforested/reforested (therefore the activities having to be displaced) be identified.

The project area includes only comparatively small areas of non-forest land which will be reforested in the project scenario. The vast majority of these areas are not forested as a result of uncontrolled burning that occurred prior to the project's start. Only a small fraction of area (< 2 ha) has some existing planted rubber trees, however this will be fully incorporated within a larger (262 ha) area of community-managed agroforest which will border the Hantipan canal area. As a result, no pre-project agricultural activities will be displaced by ARR project activities, and hence leakage from the displacement of pre-project agricultural activities did not, and will not, occur (Change_C_LK-ARR = 0).

3.2.3.3 Estimation of emissions from ecological leakage (LK-ECO)

During this monitoring period, and as per the project's implementation plan the project did not initiate rewetting activities. Therefore ecological leakage (LK-ECO) is deemed zero.

3.2.4 Net GHG Emission Reductions and Removals

Net GHG emission reductions from REDD, WRC, and ARR activities are calculated using equation (25). This section provides an overview of total net emission reductions and details activity specific calculations in sub-sections.

$$NER_{REDD+} = NER_{REDD} + NGR_{ARR} + NER_{WRC} \quad (25)$$

Where:

NER_{REDD}	Total net GHG emission reductions of the REDD project activity up to year t*; t CO_2-e
NGR_{ARR}	Total net GHG removals of the ARR project activity up to year t*; t CO_2-e
NER_{WRC}	Total net GHG emission reductions of the WRC project activity up to year t*; t CO_2-e

[12] UNFCC. (2013). A/R methodological tool 15. Estimation of the increase in GHG emissions attributable to displacement of pre-project agricultural activities in A/R CDM project activity: Version 02.0. URL: http://cdm.unfccc.int/methodologies/ARmethodologies/tools/ar-am-tool-15-v2.0.pdf.

3.2.4.1 Uncertainty Analysis

Per module X-UNC, uncertainties were calculated for the project's REDD and WRC components in both the project and baseline scenarios.

3.2.4.1.1 REDD Uncertainty

The REDD baseline uncertainty remained unchanged and was calculated per the methods described in the project description. Per the calculations the REDD baseline uncertainty was determined to be 10.61%. For the REDD project uncertainty, the uncertainty for each strata caused by degradation and other loss events in the project were calculated per the methods outlined in module X-UNC and was calculated to be 0.47%.

3.2.4.1.2 WRC Uncertainty

The WRC baseline uncertainty remained unchanged, at 0.82%, and was calculated per the methods outlined in the project description. For the WRC project uncertainty the proxyCO2, proxy CH4 and peatditchCO2 uncertainties were also calculated using the same assumptions used in the methods outlined in the project description using the updated areas for the respective strata. The WRC project uncertainty was calculated to be 2.41%.

3.2.4.1.3 Combined Uncertainty

The total uncertainty error in the project was calculated to be 0.90%. Considering the 15% uncertainty threshold, no VCU deductions were made due to uncertainty. Further detail on all calculations is provided in Annex 17 of the PD.

3.2.4.2 Total net GHG emission reductions of the REDD project activity

Net GHG emission reductions from REDD project activities are calculated by subtracting project emissions and emissions due to leakage from baseline emissions.

Table 35. Total net GHG emission reductions of the REDD project activity

Year	Baseline emissions or removals (tCO_2e)	Project emissions or removals (tCO_2e)	Leakage emissions (tCO_2e)	Net GHG emission reductions or removals (tCO_2e)
2017	1,813,345	117,783	-	1,695,562
Total	1,813,345	117,783	-	1,695,562

3.2.4.3 Total net GHG emission reductions of the WRC project activity

Net GHG emission reductions from WRC project activities are calculated by subtracting project emissions and emissions due to leakage from baseline emissions (see Table 36).

Table 36. Total net GHG emission reductions of the WRC project activity

Year	Baseline emissions or removals (tCO_2e)	Project emissions or removals (tCO_2e)	Leakage emissions (tCO_2e)	Net GHG emission reductions or removals (tCO_2e)
2017	4,029,146	160,092	-	3,869,054
Total	4,029,146	160,092	-	3,869,054

3.2.4.4 Total net GHG removals of the ARR project activity

In the monitoring period, no estimated project carbon removals from ARR are calculated. Therefore, the net GHG removal of the ARR project activities are calculated by subtracting the baseline removals from with project removals, accounting for any leakage (see Table 37).

Table 37. Total net GHG removals of the ARR project activity

Year	Baseline emissions or removals (tCO_2e)	Project emissions or removals (tCO_2e)	Leakage emissions (tCO_2e)	Net GHG emission reductions or removals (tCO_2e)
2017	6,213	-	-	(6,213)
Total	6,213	-	-	(6,213)

3.2.4.5 Total net GHG removals from uncontrolled burning

Net GHG emission reductions from uncontrolled burning are calculated by subtracting estimated project emissions from estimated baseline emissions (see Table 38).

Table 38. Total net GHG removals from uncontrolled burning

Year	Baseline emissions or removals (tCO_2e)	Project emissions or removals (tCO_2e)	Net GHG emission reductions or removals (tCO_2e)
2017	-	191,375	(191,375)
Total	-	191,375	(191,375)

3.2.4.6 Calculation of the VCS non-permanence risk buffer withholding

The combined non-permanence risk buffer for the project was determined as 10% (see Appendix 1). Per VCS methodology VM0007 modules REDD+ MF, the annual buffer withholding for all activities was determined as a percentage of the total carbon stock benefits including fire which excludes emissions due to leakage (see Table 39). As the project does not account for emissions from fossil fuel combustion, and direct N_2O emissions, these were also omitted from calculations.

Table 39. Annual non-permanence risk buffer withholding

Year	REDD total carbon stock benefits	WRC total carbon stock benefits	ARR total carbon stock benefits	Estimated carbon emission from Fire	Non-Permanence risk buffer (10%)
2017	1,695,562	3,869,054	(6,213)	(191,375)	536,703
Total	1,695,562	3,869,054	(6,213)	(191,375)	536,703

3.2.4.7 Calculation of Verified Carbon Units

VCU are calculated by subtracting the VCS non-permanence risk buffer withholding from the uncertainty adjusted net emission reductions for each project activity (see Table 40).

Table 40. Calculation of estimated verified carbon units

Year	NGR_{ARR}	$NER_{REDD+WRC+Fire}$	Adjusted $NER_{REDD+WRC+Fire+ARR}$	Non-Permanence Risk Buffer	Estimated VCU
2017	(6,213)	5,373,242	5,367,029	536,702	4,830,326
Total	(6,213)	5,373,242	5,367,029	536,702	4,830,326

3.3 Optional Criterion: Climate Change Adaptation Benefits

3.3.1 Activities and/or processes implemented for Adaptation (GL1.3)

3.3.1.1 Likely regional climate change

Regional climate change was projected using the SERVIR-based Climate One-Stop[13] portal. In summary, the project zone is likely to exhibit various effects of climate change over the next 50 years with greater weather anomalies. Temperatures will increase consistently over the years, and there will be a considerable shift in precipitation patterns, evapotranspiration rates, humidity, surface runoffs and soil moisture levels. Seasonal climate variability is expected to be greater, which suggests a substantial increase in rainfall and its intensity for the wet season (December to May), and warmer and longer dry months during the dry season (June to November). This is likely to pose a high risk of floods, surface runoffs, severe droughts and heat waves. Because of climate variability and anomalies, it will be difficult to predict weather and seasons in the project zone.

[13] Jointly developed by NASA, USAID, the National Science Foundation, the Institute for the Application of Geospatial Technology, the University of Alabama-Huntsville, and CATHALAC in Panama, Climate One-Stop uses NASA's SERVIR datasets and UNFCCC data and downscaled models to show average historical and projected climate information in many locations across the globe.

3.3.1.2 Likely impacts of regional climate change

Climate change will pose various impacts on the project zone's environment, economy and society, as it is likely to result in extreme weather conditions. The table below highlights most affected sectors and likely impacts on them.

Table 40a. Likely climate change impacts

Sector	Likely impacts
Environmental	Loss of aquatic biodiversity and fish population
	Damage to mangroves and peat swamp ecosystems
	Forest degradation and biodiversity loss
	Decreased quality and quantity of surface and ground water
Economic	Loss of rural productivity and infrastructure
	Loss of crop productivity and yields
	Loss of economic activities from forest/non-timber forest products
	Livestock deaths
	Increased burden from disaster management
Social	Spread of water and vector borne infectious diseases
	Reduced food security and loss of incomes
	Reduced quantity and quality of potable drinking water
	Increased number of human injuries and deaths
	Increased risk of cardiovascular and respiratory diseases

3.3.2 Climate change adaptation measures

The project-zone communities are extremely vulnerable to probable climate change impacts because their livelihoods and well-being are dependent on the healthy ecosystem of the surrounding peat swamp forest in the project area. Although some negative impacts of climate change are inevitable and beyond the control of the Katingan Project, the project has begun to strengthen community and biodiversity resilience by implementing adaptation options through various project activities. These include:

- Integrated fishery management through water management and improved aquaculture techniques.
- Restoration of peat swamp ecosystems and reforestation.
- Planning and designing of climate resilient infrastructural development.
- Agroforestry capacity building.
- Adjustment of agricultural calendars, crop patterns and planting practices. Further support and technical advice on agricultural planning has also been incorporated into activities related to sustainable forest management, animal husbandry, agroforestry and agricultural advice.
- Diversification of economic activities by introducing sustainable livelihood options.

- Capacity building for forest management and NTFP development.
- Improvement of animal husbandry practices.
- Integrated natural disaster management and prevention systems (e.g., early warning systems, monitoring protocols, and improved techniques and technologies).
- Improved access to public health care services.
- Disease prevention and control through early warning education and information dissemination.
- Improved access to clean water and sanitation facilities.
- Improved access to rain/river water collection systems.

4 COMMUNITY

4.1 Net Positive Community Impacts

4.1.1 Community Impacts (CM2.1)

The project area contains no permanent human settlements. This distribution is no accident, as the project area was essentially defined as the area that was not occupied by communities or was targeted for excision from the forest estate. The wider project zone outside of the project area, on the other hand, encompasses 34 village communities and a population estimated in 2010 to be 43,000 people living in 11,475 households. These villages fall under the territorial administration of Mendawai and Kamipang sub-districts of Katingan District, and Seranau and Pulau Hanaut sub-districts of Kotawaringin Timur District. These communities typically make their living from the land and from the rivers, predominantly relying on small-scale agriculture and traditional fisheries. Rice, rubber, coconut, rattan, fruits, non-timber forest products, and freshwater fish are among the most common livelihood commodities in the project zone.

During this monitoring period, many project activities were conducted with the communities in the project zone which had a net positive impact on all community groups. Additional details on the activities are detailed in the monitoring summary later in this section and in the Community MRV in Appendix 5. Three community groups were specifically targeted during this timeframe and are listed below.

Community Group	Women
Impact	Increased participation in project consultations; training; economic opportunities
Type of Benefit/Cost/Risk	Impacts listed are actual, direct benefits.
Change in Well-being	Increased participation in consultation – meetings are held in various manners to ensure active participation of women. In some cases, women only meetings are held and in others comments are taken from the participants alternating between genders to ensure women have the ability and opportunity to participate more fully

	Training and economic opportunity – women participate in various project training sessions and job opportunities including microfinance oversight and leadership positions

Community Group	Youth (recent graduates at risk of unemployment or relocation)
Impact	Job training and economic opportunity
Type of Benefit/Cost/Risk	Impact is an actual, direct benefit.
Change in Well-being	The project is actively seeking to identify job opportunities for youth returning to the community after completing their education. When necessary, job training is provided to help prepare the youth for their new positions. The project also sponsors youth internship opportunities.

Community Group	Community members with at-risk occupations (gold miners, illegal loggers)
Impact	Job training and economic opportunities
Type of Benefit/Cost/Risk	Impact is an actual, direct benefit.
Change in Well-being	Some community members had jobs prior to the project's start that are illegal or not consistent with the project's aims of protecting the forest. These members have been invited to participate in the initial new economic opportunities identified by communities for development, allowing them to maintain their income and quality of life in a sustainable enterprise.

Community Group	Elderly
Impact	Improved health care
Type of Benefit/Cost/Risk	Impact is an actual, direct benefit.
Change in Well-being	Health care programs targeting the elderly were implemented to promote access to and effectiveness of the care provided locally.

4.1.2 Negative Community Impact Mitigation (CM2.2)

Efforts to actively involve communities in a participatory planning process have led to activities being designed in the most beneficial and sustainable manner possible. Consultations discuss any possible negative impacts and plan how to avoid them. This process is consistent with the precautionary principle as all potential negative impacts are considered as part of the planning process even if some are not as well established scientifically.

Neither the monitoring data nor information obtained by the project team while working with the communities has indicated that any sub-group or HCV attribute has been negatively impacted by the project. The processes discussed previously in Section 2 for community involvement and feedback will continue to ensure the avoidance of or mitigation of any negative impacts which arise.

4.1.3 Net Positive Community Well-Being (CM2.3, GL1.4)

The project has had a net positive impact on all groups in the communities in the project zone and no high conservation values related to community well-being have been negatively affected. As can be seen from the data in Section 4.3.1, the project has had a clear net positive impact on the project zone communities.

The project has strengthened community and biodiversity resilience to the probable impacts of climate change through various project activities, including restoration of peat swamp ecosystems and reforestation, climate resilient infrastructural development, adjustment and diversification of agroforestry and agricultural practices, capacity building for forest management and non-timber forest product development, and the implementation of integrated natural disaster prevention and management systems. In addition, the project works with communities to ensure they have any available information that will allow them to adapt activities as needed in response to effects of climate change. For example, the project works with regional and national government organizations to ensure that documents regarding the optimum crop planting and harvesting dates based on the latest meteorological trends in the region are distributed to project zone communities. The project and the village of Kampung Melayu jointly established a 5-hectare agroecology demonstration plot so that the communities can benefit from the project research and development activities in climate smart agriculture practices.

4.1.4 Protection of High Conservation Values (CM2.4)

The project's activities that have focused on conserving the intact peat swamp forest, and the improved management of degraded and agricultural areas to lessen the threat of fire and improve the overall ecosystem, has ensured that the HCV areas important to communities are protected. The project fire prevention and mitigation activities leverage the village funds that have been allocated by communities for that purpose. Communities will therefore have access to areas that meet their needs, provide critical ecosystem services and are critical for maintaining their cultural identity and livelihoods.

4.2 Other Stakeholder Impacts

4.2.1 Mitigation of Negative Impacts on Other Stakeholders (CM3.2)

No offsite stakeholder impacts are anticipated. During the design phase of the project, potential offsite groups were identified, but none are considered likely to be impacted by the project. The Project Zone was designed to incorporate all those groups who were likely to be affected.

4.2.2 Net Impacts on Other Stakeholders (CM3.3)

As expected, no positive or negative impacts have been identified for offsite stakeholders. The project team has worked closely with regional and national government organizations regarding project planning and community engagement. This transfer of knowledge is expected to have an indirect positive impact on other similar projects and communities in Indonesia.

4.3 Community Impact Monitoring

4.3.1 Community Monitoring Plan (CM4.1, CM4.2, GL1.4, GL2.2, GL2.3, GL2.5)

To measure community well-being, the project adopted the measure of five key livelihood assets – human, social, financial, physical and natural capitals – as defined by the UK Department for International Development [14]. These assets are fundamental elements in achieving community benefits and are summarized below.

Table 41. Livelihood assets and key criteria

Livelihood asset	Criteria
Natural capital	Natural resource stocks (soil, water, air, genetic resources, etc.) and environmental services
Human capital	Education, health, physical capability, knowledge and skills possession
Social capital	Community cohesiveness, responsibility, affiliation and socio-political relations
Physical capital	Access to infrastructure (e.g., roads, transport, electricity), production equipment, shelter, and technology (e.g., communication systems)
Financial capital	Access to financing support and financial assets including cash, loans, savings and cattle

* Table adapted from references [15] and [16].

[14] DFID (1999). Sustainable Livelihood Guidance Sheets. United Kingdom Department for International Development: London.

[15] Margoulis, R. and N. Salafsky (1998). Measures of success: designing, managing, and monitoring conservation and development project. Island press, Washington DC.

[16] Henry, C., M. Sharma, C. Lapenu, and M. Zeller (2003). Microfinance poverty assessment tool. Washington DC: The World Bank.

Monitoring results as they relate to HCV areas and the five livelihood assets are presented below in Table 42. An updated Community MRV Tracker which contains greater detail on the range of parameters monitored and the methods used is presented in Appendix 5. The Community MRV Tracker has been modified during this monitoring period to better align the data with the high level categories meaningful to the project. The data collected has not changed, simply the reporting categories in order to ensure all data was being reported and tracked. A full spreadsheet showing the changes in categories (i.e. the new, mapped to the old) will be provided to the verifiers for review.

Community evaluations of monitoring results often take place at a program level when members of the community involved in a program meet with project team members to evaluate outcomes and determine the effectiveness of the program. This allows community members to be part of the adaptive management cycle and provide more immediate feedback. Evaluation of the overall monitoring results takes place during meetings where the formal monitoring results are presented and discussed. Community members are also free to provide feedback at any point through the communication channels discussed in Section 2.

Table 42. Summary of net positive community benefits, based on CCB critera

Criteria	Theme	Topic	Type	2016				2017			
				#Units	M	W	T	#Units	M	W	T
Natural capital, Human capital	Agriculture	Agroecology	Consultation	0	0	0	0	8	48	25	73
			Daily Labor		0	0	0		21		21
			Operational support		0	0	0		25	2	27
			Training	1	10	11	21	5	86	5	91
		Agroforestry	Consultation	28	433	55	488	13	115	10	125
			Daily Labor		0	0	0		17	0	17
			Operational support		0	0	0		7	0	7
			Awareness raising	0	0	0	0	1	40	15	55
			Training	0	0	0	0	3	82	6	88
Natural capital, Social capital, Human capital	Collaborative Management	Participatory Maps	Signed Map	1				0			
		PDD-MR	Consultation	51	234	18	252	0	0	0	0
			Awareness raising	6	173	16	189	0	0	0	0
		RMU MoU	Signed MoU	0				0			
			Consultation	0	0	0	0	7	6	0	6
		RMU Workplan	Consultation	5	24	0	24	11	271	24	295
			Awareness raising	0	0	0	0	7	89	5	94
		Socioeconomic baseline	Profile Report	0				0			
			Report	0				0			
			Consultation	0	0	0	0	9	40	7	47
		Village Boundaries	Signed Agreement	7				0			
			Consultation	0	0	0	0	1	4	1	5
		Village Forest	Consultation	1	15	0	15	4	50	4	54
			Formal Application	2				0			
			Awareness raising	0	0	0	0	2	23	1	24
		Village Public Support	Support Provided	7				29			

		Grievance Cases	Cases	7				16			
Human capital	Education	Higher Education	Internship (student)		0	2	2		1	4	5
			Research (student)		0	2	2		1	3	4
		Local Schools	Participant (local school)		21	24	45		15	27	42
Natural capital, human capital, Physical capital	Fire Prevention	Fire Prevention	Training	3	25	0	25	3	55	3	58
			Products	2				1			
			Consultation	1	8	0	8	4	38	7	45
			Awareness raising	38	765	132	897	38	1,333	173	1,506
		Fire Teams	Daily Labor		454	2	456		536	0	536
Human capital, Physical capital	Healthcare	Community Health Centers	Consultation	0	0	0	0	3	5	22	27
			Operational support		0	0	0		2	25	27
			Patient		0	0	0		86	87	173
			Awareness raising	0	0	0	0	1	0	0	0
Natural capital, Human capital	Project Activities	Biodiversity Surveys	Daily Labor		83	0	83		69	0	69
		General Operations	Daily Labor		18	0	18		45	0	45
		Reforestation	Daily Labor		16	0	16		55	0	55
		Rewetting	Daily Labor		0	0	0		36	0	36
Human capital, Physical capital	Sustainable Energy	Bio-gas	Consultation	0	0	0	0	1	18	2	20
			Consultation	1	24	3	27	1	13	3	16
		Solar Lighting	Households	0				0			
Natural capital, human capital, Social capital, Physical capital, Financial Capital	Sustainable Livelihoods	Business Units	Consultation	0	0	0	0	3	45	7	52
		Chickens	Consultation	0	0	0	0	3	25	7	32
		Coconuts	Consultation	9	43	9	52	27	101	51	152
			Financial Support		10	5	15		7	6	13
			Training	1	19	0	19	4	19	1	20
		Ecotourism	Daily Labor		13	3	16		3	1	4
		Fiber Bags	Payment for bags		0	0	0		2	34	36
		Fish Farming	Consultation	0	0	0	0	20	205	53	258
		Livestock	Consultation	0	0	0	0	9	128	18	146
			Training	0	0	0	0	1	2	1	3
		Microfinance	New agreements	1				1			
			Consultation	0	0	0	0	10	65	68	133

			Money (IDR, new)	45m				32m			
			New recipients	0	0	39	39	0	17	10	27
		Rattan	Groups	0	0	0	0	1	0	0	0
			Consultation	0	0	0	0	1	7	1	8
		Rice	Consultation	0	0	0	0	2	26	14	40
		Tree Nurseries	Consultation	0	0	0	0	2	7	10	17
			Payment for seedlings		2	7	9		5	6	11
		Income	Average Income	ND				ND			
		Salvage Wood	People		0	0	0		0	0	0
Human capital, Physical capital	Water & Sanitation	Latrines	Support for latrine		0	0	0		21	3	24
			Consultation		0	0	0	2	17	8	25
Total					2,390	328	2,718		3,934	760	4,694

4.3.2 Monitoring Plan Dissemination (CM4.3)

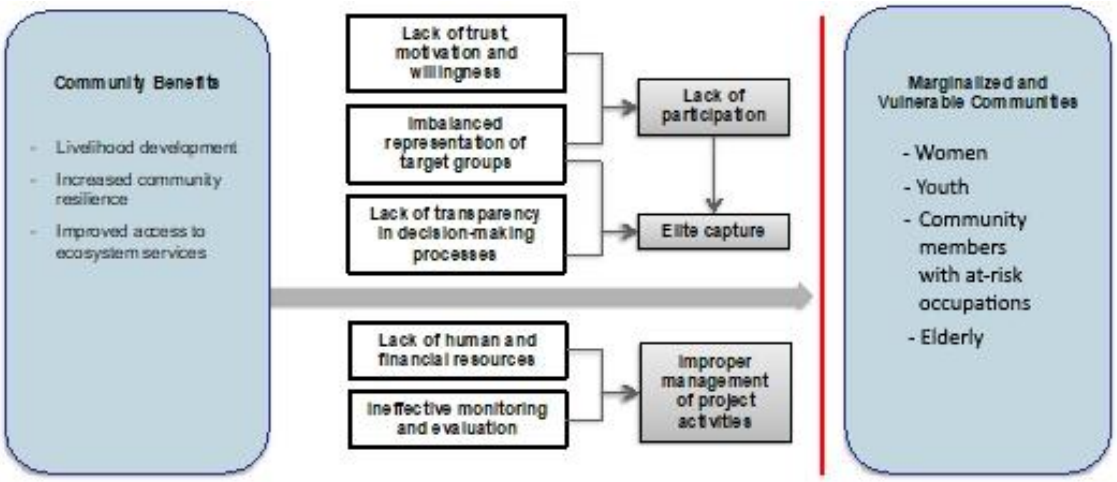
The Project's Monitoring Report is posted online during the CCB public comment period and in the VCS Database following verification.

Summaries of the Monitoring Report in the local language are provided to all communities each time a report is generated. Project team members present the results in local meetings and answer questions as they arise as discussed in Section 2. Full copies in English are available to all stakeholders electronically or hard copy upon request.

4.4 Optional Criterion: Exceptional Community Benefits

The success of community programs is largely dependent on participation, transparent decision-making processes based on mutual trust, and proper management of project activities. Three main potential barriers to community benefits in reaching the marginalized and/or vulnerable communities were identified, and mitigation measures were implemented as discussed below (also see Figure 10).

Figure 10. Potential barriers to benefits reaching the marginalized and vulnerable communities



Lack of participation: The marginalized poor communities tend to live remotely away from village centers, and often lack the means or time required to attend community meetings, due to distance and other constraints. Also, it is common for the project-zone communities that are marginalized to feel discouraged to voice their opinions in front of dominant groups. This can trigger mistrust toward other community members, and leads to lack of motivation and willingness to participate. Also, unbalanced or misrepresented target groups for certain project activities could entail non-participation of the poorer and marginalized community members. The Katingan Project has and will continue to encourage all community stakeholders, particularly the poorer and marginalized, to participate in project activities through differentiated approaches. Our participatory planning processes enables all project-zone communities to be involved in decision-makings. Understanding barriers to meaningful participation to the project, socialization, information dissemination and community meetings

take place at various locations and times by considering the needs of the marginalized. For example, some meetings are facilitated only for women, and take place at their houses in the evening when they usually have spare time. Community message boards, booklets, flyers and videos, and local radio programs have also been used to reach our target audience effectively.

Elite captures: A lack of participation and transparency in decision-making processes generally creates an opportunity for elite captures in which dominant groups can steer decisions to their favour, while hindering the flow of benefits to the marginalized households. When making decisions regarding an infrastructural development project such as road construction, for example, community board members may choose a location based on their personal benefits, rather than communal benefits as a whole. Without transparent decision-making systems and well-represented board of communities in place, community programs may be manipulated to satisfy the personal interests of certain individuals and may not produce overall positive impacts on the marginalized households. In order to address the risk of elite captures, the Katingan Project has encouraged the poorer and marginalized communities to participate (see above) and aimed to enhance the balance of community representation. To increase transparency in decision-making processes, meeting records and decisions have been maintained and made publically available. A mixed representation of community members, including the marginalized groups, will reinforce more equitable and democratic distribution of benefits, thereby placing checks and balances on decision-making processes and safeguarding the interest of communities as a whole.

Improper management of project activities: Another potential barrier to anticipated project benefits reaching target community members is improper management of project activities due to the lack of human and financial resources and effective monitoring and evaluation systems. The implementation and progress of project activities should be regularly monitored in order to assess the impacts of these activities on the marginalized households, to ensure appropriate allocation and use of community funds, and to enforce rules. Without a stringent system of checks and balances, the risk of the elite capture of benefits, ineffective performance and misappropriation of funds remains high. The Katingan Project seeks to remove this barrier by supporting the project-zone communities to have access to sufficient resources which are necessary to carry on project activities. Proper training has been and will continue to be provided to build the capacity of local people. Community-based adaptive management will reinforce checks and balances on decision-making processes and lead to a form of democratic natural resources governance.

Monitoring parameters to continue evaluating the mitigation strategies, such as participation of women in microlending and trainings on financial planning and management, are included in the monitoring results presented earlier in this section and Appendix 2.

4.4.1 Short-term and Long-term Community Benefits (GL2.2)

Short-term net positive well-being is demonstrated through the monitoring results outlined in this report. Long-term, the project aims for the communities to become more independent and self-sufficient so that the positive impacts are not reliant on the project or other outside organizations. The project's design ensures that appropriate training and financial support is provided as communities and families identify their short and long-term goals for an independent, sustainable future.

4.4.2 Marginalized and/or Vulnerable Community Groups (GL2.4)

The Katingan Project has provided benefit to communities through a variety of socio-economic activities which also target the most vulnerable and marginalized community members. This includes youth, women, community members with at-risk occupations, and the elderly. The project aims at reaching these poorer and marginalized communities through a variety of socio-economic programs that would otherwise be unavailable to them. These programs are designed to lift the poorest out of poverty by engaging them in community-based business development such as microfinance, women's empowerment, sustainable agroforestry, renewable energy development, and NTFPs. The project has already and will continue to create a multitude of positive economic effects from these programs, as they increase employment opportunities, crop yields, access to markets and revolving finances, and new business and investment opportunities building on the communities' self-defined goals. Therefore, the Katingan Project directly delivers benefits to a large proportion of the vulnerable and marginalized people and bring about positive impacts on the overall economy of the area.

Community Group	Women, youth, elderly, and community members with at-risk occupations
Net positive impacts	As discussed previously in this section, activities targeting all of these sub-groups were conducted during this monitoring period and net positive impacts resulted.
Benefit access	The possible barriers and mitigations were discussed earlier in this section.
Negative impacts	Potential negative impacts have been identified and addressed as outlined in Section 2 and earlier in this section. The most significant potential negative impact is the decrease in income for gold miners and illegal loggers. This has been addressed by including them in the training and formation of community-identified new economic opportunities.

4.4.3 Net Impacts on Women (GL2.5)

The project's net positive benefits for women are demonstrated in the monitoring summary above, the full Community MRV in Appendix 5 and discussed throughout this section. In addition, women's participation in decision making is discussed in both Section 2 and 4.

4.4.4 Benefit Sharing Mechanisms (GL2.6)

The project shares benefits through the support of or implementation of community identified programs and projects. The monitoring summary and the full Community MRV in Appendix 5 highlight the implementation during this monitoring period.

4.4.5 Governance and Implementation Structures (GL2.8)

The project's governance and implementation structures enable full and effective participation of community members through strategic planning of the meeting structure, participants, location and language as discussed throughout Section 2 and earlier in this section.

4.4.6 Smallholders/Community Members Capacity Development (GL2.9)

The project develops the capacity of community members through a variety of trainings, workshops, and other interactions as described in Section 2, and documented in the monitoring results, and presented in full in both the Community MRV at Appendix 5 and the list of community events at Appendix 2.

5 BIODIVERSITY

5.1 Net Positive Biodiversity Impacts

5.1.1 Biodiversity Changes (B2.1)

The Katingan Project seeks to protect 149,800ha of largely intact peat swamp forest from conversion to industrial agricultural plantation and drainage. It is categorized as a Key Biodiversity Area by multiple criteria (see Section 5.4.1). Due to the nature of the project – essentially seeking to *maintain* already existing very high levels of biodiversity – change in biodiversity is largely limited to the potential for *loss*. As an intact system, there is far less scope for increase, due to natural biologically limiting factors.

During the current monitoring period, no significant *change* in biodiversity was detected. Some deforestation was experienced within the project area, but was very minimal (22ha, <0.01% of the project area, see Section 3). Similarly, the area affected by varying degrees of degradation from illegal logging increased somewhat (by 1510ha, 1% of the total project area), however neither are anticipated to have had a material effect on populations of forest dependent species over the wider area during this reporting period. In support of this, hunting surveys showed an apparent *drop* in the number of people actively hunting within the project area, and the number of animals caught by them (but with some methodological issues, see Section 5.1.3 below). This suggests that the relative increase in degradation does not appear to have been coupled with an increase in hunting pressure as might have been anticipated. Camera trap surveys also indicated the continued presence of the range of species that would be expected (including Sunda Pangolin) and Orangutan nest surveys also showed that orangutan densities remain very high, at least in parts of the project area (see Section 5.1.3 below). In the absence of any detected change, or any circumstantial evidence that would indicate such a change may have occurred undetected, Table 43 is left empty.

Table 43. Changes in biodiversity

Change in Biodiversity	None apparent
Monitored Change	Not applicable
Justification of Change	Not applicable

5.1.2 Mitigation Actions (B2.3)

During this monitoring period no negative impacts on biodiversity, or HCV attributes related to biodiversity, were recorded, and so no measures were necessary to mitigate such impacts beyond the routine operation of the project.

5.1.3 Net Positive Biodiversity Impacts (B2.2, GL1.4)

The project continues to have a significant net positive biodiversity benefit in relation to the baseline. During this reporting period the project successfully implemented a range of activities to minimize forest loss due to man-made fires, to mitigate the effects of illegal and unsustainable hunting, and to improve forest resiliency to climate change by maintaining the site's natural habitat and hydrology (for further details see Section 3).

Under the baseline scenario, during this monitoring period, it is predicted that around 11,669ha (8%) of the project area would have been deforested and drained as a result of plantation development activities; and 33,805ha (23%) since the project's start. This loss would have also resulted in a commensurate rise in hunting and fire risk due to the increased ease of access and lowered water table. Such a loss of habitat would have had a significant negative impact on the biodiversity of the area. A full list of the flora and fauna in the project area is included in Appendix 6.

Specific parameters monitored for biodiversity are given below in Section 5.3.1, Table 50. However, several aspects of the project's performance, merit further consideration:

Forest loss to fire: No fires were recorded in the project area during this monitoring period (see Section 3). This is a remarkable and almost unprecedented result. This was achieved through rigorous measures to prevent the outbreak of fire and to monitor and respond immediately to any suspected fire outbreak near the project area. To illustrate how notable this result is, the incidence of fire within the project area since its inception is now 25 times less than in the adjacent Sebangau National park, and 50 times less than in other areas of Protection Forest (*Hutan Lindung*) within peat land in Central Kalimantan.

Population and distribution of key species: Direct assessment of species population level and spatial distribution is extremely challenging. Typically, the level of accuracy of population estimates associated with even with the most intensive survey effort is such that repeat surveys are unlikely to be able to detect significant over short periods beyond cataclysmic loss or unprecedented increase. At the project's inception, initial population estimates were made for several key primate species, and it is the project's intention to repeat these surveys within a 10-year interval. However, in order to monitor population status in the interval, a combination of a proxy indicator and a measure of flux was used. The extent of intact forest cover remains the best proxy indicator, as all key species present at the site are forest dependent, while hunting off-take was monitored to measure flux. During this monitoring period the project only recorded a very small amount of forest loss (<22ha, <0.01% of the total project area, see Section 3) which would have had no material effect on the populations of forest dependent species.

By the end of this monitoring period the total number of species recorded within the project area increased to 192 bird species, 68 mammal species, 57 herptiles, 111 fish, and 312 plants. Data on further species groups will soon be added.

Camera trap pilot surveys: During 2016 and 2017 the project piloted camera trap monitoring within the southern area of the project. This pilot was intended to test the methodology, to train staff, and to collect preliminary data that would inform the design of a wider more systematic monitoring program. A sampling frame of 1km x 1km grid cells was overlaid over the project area, and the survey team positioned a single camera in a selected spot within each cell, attached to a tree at a height of ± 50 cm from the ground. Cameras were then left in place for around a month (min 27 days, max 35 days) before being collected and repositioned. As only 10 cameras were available for this pilot, only 10 grid cells could be surveyed per round (see Map 20). However, during the implementation, not all camera worked properly, so within the 4-month survey period only 32 grid cells were covered in total. Result of the survey are shown in Table 44, and a collection of photos are shown in Figure 11.

Map 20. Showing camera trap locations during the pilot survey. All camera traps were situated in the southern part of the project area (see inset).

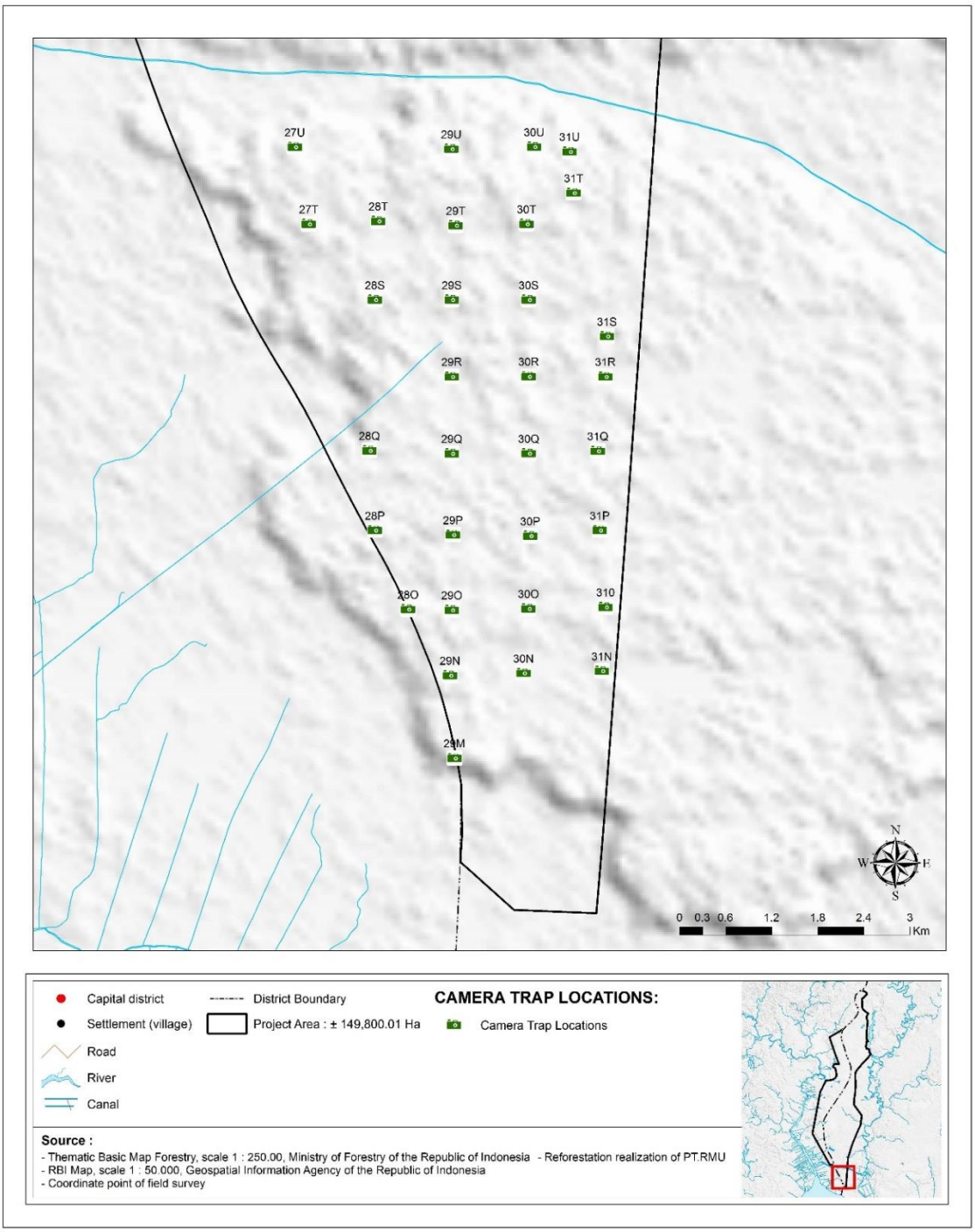


Figure 11. A selection of camera trap images taken during the monitoring period

The most commonly encountered species were squirrels (Tupidae; 55 independent events per 1,000 trap days; 36% of locations), Wild Pig (*Sus barbatus*; 28/1000 trap days; 36% of locations), Lesser Mouse Deer (*Tragulus kanchil*; 28/1000 trap days; 36% of locations), Southern pig-tailed macaque (*Macaca nemestrina*; 8/1000 trap days; 18% of locations) and Sambar Deer (*Rusa unicolor*; 5/1000 trap days; 14% of locations),

Notable records included Storms Stork (*Ciconia stormi*, 1/1000 trap days; 4% of locations), Sunda Pangolin (*Manis javanica,* 1/1000 trap days; 4% of locations), Bornean Orangutan (*Pongo pygmaeus,* 3/1000 trap days; 11% of locations) Western/Horsfield's Tarsier (*Tarsius bancanus,* 1/1000 trap days; 4% of locations), Malayan Sun Bear (*Helarctos malayanus,* 2/1000 trap days; 7% of locations), Marbled Cat (*Pardofelis marmorata,* 1/1000 trap days; 4% of locations), Leopard cat (*Prionailurus bengalensis,* 1/1000 trap days; 4% of locations) and Banded Linsang (*Prionodon linsang,* 6/1000 trap days; 11% of locations).

Based on these preliminary results a comprehensive survey is now being planned, utilizing 150 additional camera traps that have already been obtained. This survey will be based on 2+ cameras per 2x2km grid cell, with a longer period of time in position, and complete coverage of the site achieved within 12 months. Results collected by the survey will be analyzed both based on encounter rate, and also within an occupancy framework that allows a probability of detection to be calculated based on trap days. This can then be used to calculate the likelihood that any give grid cell is occupied by each species, corrected by probability of detection, allowing us to make a robust estimation of distribution and relative abundance of species across the site. This will be used as a basis for future monitoring of trends.

Also planned for 2018 is a specific sub-set of camera trapping for Hairy Nosed Otter *Lutra sumatrana*, which is anticipated to be present in the project area, but as yet unrecorded. This otter is among the rarest otter species in the world, and confirming its occurrence in the project area is a high priority (see also Section 5.4.1 below).

Table 44. Species recorded during 2016-17 pilot camera trap survey

Species	Locations	Photo		Max group	Encounter rate	
		Total	Independent		/1000 days	%Location
Macaca fascicularis	3	11	4	4	4.6	11%
Macaca nemestrina	5	22	7	3	8.0	18%
Presbytis rubicunda	1	3	1	1	1.1	4%
Rusa unicolor	4	46	4	2	4.6	14%
Ciconia stormi	1	3	1	1	1.1	4%
Chalcophaps indica	1	3	1	1	1.1	4%
Centropus rectunguis	3	75	3	1	3.4	11%
Pardofelis marmorata	1	2	1	1	1.1	4%
Prionailurus bengalensis	1	3	1	2	1.1	4%
Pongo pygmaeus	3	7	3	1	3.4	11%
Manis javanica	1	4	1	1	1.1	4%
Rat/Mouse spp.	4	26	10	1	11.5	14%

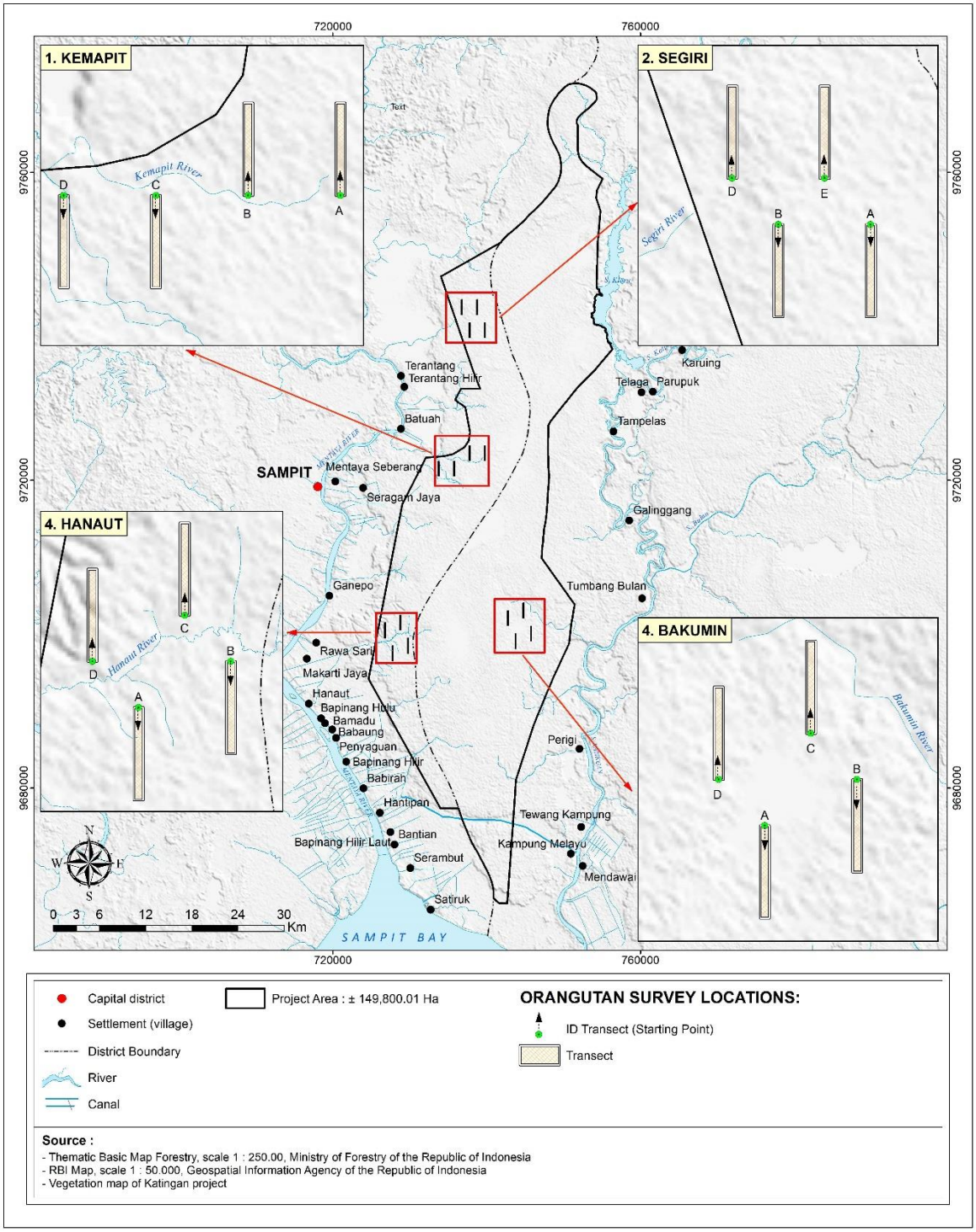
Pellorneum capistratum	4	17	5	2	5.7	14%
Prionodon linsang	3	8	5	1	5.7	11%
Pycnonotus goiavier	1	4	2	1	2.3	4%
Pycnonotus sp	1	3	1	1	1.1	4%
Rhipidura javanica	1	4	1	1	1.1	4%
Callosciurus notatus	4	22	9	1	10.3	14%
Sus barbatus	9	112	24	3	27.6	32%
Tarsius bancanus	1	4	1	1	1.1	4%
Stachyris nigricollis	1	2	1	1	1.1	4%
Trichastoma rostratum	2	8	4	1	4.6	7%
Tragulus kanchil	10	70	24	1	27.6	36%
Tupaia sp.	10	100	48	1	55.2	36%
Helarctos malayanus	2	5	2	1	2.3	7%
Varanus salvator	1	12	3	1	3.4	4%
Arctogalidia trivirgata	3	15	5	1	5.7	11%
Unidentified	3	3	3	1	3.4	11%
Total	**32***	**594**	**175**			**96%****

* total number of camera trap locations
** overall percentage of traps that recorded at least one species

Orangutan nest count surveys: A number of preliminary orangutan nest count transects were conducted in 2016 and 2017. The main purpose of these transects was not to determine a new population estimate, but rather to test and familiarize staff with the methods, and to generate data that would allow us to determine sampling variances, with a view to planning a fully stratified random design to be implemented in 2018 onwards. Despite this limited objective, the data nevertheless reveal some interesting results.

Four transects of 2,000m were conducted in four different areas; totaling 32km of transects (see Map 21). The perpendicular distance of any nest located was measured from the transect line, and then the data was used in conjunction with the analytical tool Distance (Buckland *et al*. 2004; Thomas *et al*. 2010) to calculate nest density estimates adjusted for detectability. Nest density can then be converted into an estimate of orangutan density by incorporating parameters for the frequency with which nests are built by individual orangutans, the proportion of the population that makes nests, and the average age that a nest remains detectable. A number of different estimates exist for each of these parameters (Husson *at al.* 2009; Smith 2010; Santoso & Rahman 2012), and a comparison was made of the results based on each.

Map 21. Showing the location of transects used during the pilot orangutan nest survey.



The results showed a marked difference in density between the surveyed regions of the project area. This varied from relatively low, to exceptionally high (summarized in Table 45), and spanned the average density estimate used in previous population estimates. While the result does not allow us to directly conclude anything about the overall population, it does confirm that orangutans remain present in the project areas, and shows that in places their

density is extremely high. The results also clearly demonstrate that the distribution of orangutan is far from uniform across the project area, but the factors that determine their density remain unknown. These results will now be used to plan a more comprehensive stratified random sample of orangutans across the project area, such that the resulting data can be used to establish a robust population estimate, and to identify the factors that influence the distribution. This in turn will allows conservation management measures to be developed to enhance the population in areas where it is currently low, and additional protection measure to be focused on those areas where density is very high.

Table 45. Summary of orangutan nest count pilot survey

Location	Transect (m)	Nests	Nest/km^2	CV (%)	95% CI	Orangutan/km^2*
1. Kemapit	8,000	52	410	15	258-652	1.48
2. Segiri	8,000	31	176	38	55-560	0.64
3. Bakumin	8,000	209	1080	36	354-3297	3.91
4. Hanaut	8,000	133	762	15	482-1206	2.76
Total	32,000	292	607	17	375-982	2.20

* based on parameters of Santoso and Rahman, 2012

Towards the end of the monitoring period an independent assessment of orangutan populations range-wide was published (Utami *et al.* 2016; Santika *et al.* 2017). This used an entirely modelling-based approach to estimate populations and local trends. The report presented an estimate derived from this modelling approach for the 'Rimba Makmur Utama' area, of 4,020 individuals, and determined that the population was subject to a 'declining' trend. However, no original field data was used to derive this conclusion, and the modelled estimate lies firmly within the range of previous population estimates (3,600 and 5,800 individuals; Harrison *et al.* 2010; Marchant *et al.* 2014; presented in full in earlier project reporting), so the 'declining' trend reported has no empirical basis and may refer to a wider period of time (i.e. including pre-project changes). It therefore should be treated as inconclusive with respect to the period the project has been active.

Additional pilot surveys: During this monitoring period smaller trials were also undertaken of bird survey methodologies, herpetofauna, mist net (for birds and bats), fire impact to vegetation and tree phenology. These pilots were small-scale, and the results are still undergoing analysis with a view to improving the design of future surveys.

Hunting interview survey: In 2016 the project conducted a village-level survey of 14 villages to determine the extent of hunting and the species targeted. This survey interviewed 105 individuals, of which 90 were specifically targeted as previously identified hunters.

In the current monitoring period, this survey was repeated to get a second measure of hunting pressure. Surveys of this nature are notoriously difficult to conduct, and to collect accurate data from. However, lessons were learned from the first survey and the design improved. The number of villages was expanded to 18, and a similar number of known hunters were targeted (106). In addition, a sample of villagers who professed to not hunt was interviewed as to their perception of the level of hunting by others in the village. Also, in the recent survey, the survey enumerators themselves made an evaluation of the wildlife being kept in the village, rather than relying on information provided by survey respondents.

As part of the survey, the enumerators were trained on ways to ask questions and to record answers, to avoid a recurrent problem in the previous survey where there was considerable

ambiguity as to the period that estimated offtake referred to (per year, per month, per trip, plus how many month/trips per year, etc). In the recent survey they specifically asked for *annual* offtake estimate, to avoid (more!) confusion. These differences in approach make the results hard to compare directly with the previous survey, but they hopefully provide a better baseline for the future. Nevertheless, they are quite revealing.

Of the 106 potential hunters questioned, 32 confirmed that they regularly hunted within the project area, while the remainder travelled to other areas (for convenience and to hunt specific species) so were not considered further. Extrapolating the number of identified hunters identified within the sampled villages (18 of 34) suggests that approximately 60 hunters could be active in all the villages surrounding the project area. This represents a drop in comparison to the last survey (117 hunters). As this figure is unrelated to the survey design issue (of 'offtake' estimation; as above), it appears to suggest an actual drop in the number of people actively hunting in the project area. The result was further supported by the sample of non-hunters, whose estimate of people involved in hunting in the respective villages closely matched the number interviewed.

Of those hunters interviewed, around 60% said they hunted on a monthly or annual basis, while the remained did so on a weekly basis or less. The most common reason given for hunting was to trap animals for sale (93%) while the second largest reason given was for consumption (59%), this was a slight shift from the previous survey, where equivalent results recorded 85% hunting for sale, and 71% for food. In contrast, the number that said they were simply hunting as a hobby rose from 44% to 55%. It is hard to make any definitive conclusion based on the data, but it is at least consistent with a trend of improved livelihood, whereby less hunting is subsistence based, and more is undertaken simply for pleasure.

The following tables (46 and 47) show the offtake identified by the survey. This is divided into 'illegal hunting' (hunting of protected species) and 'legal hunting' (permitted hunting of unprotected species). Data is presented as the average *annual* catch predicted from *all* villages. In cases where 'no data' is given, either no confirmed cases were identified, or offtake numbers were not provided, however the species are listed here for completeness, and where relevant discussed further below.

Table 46. Protected Species (illegal hunting), showing predicted annual offtake. See text for noted caution in comparing results between years.

English Name	Scientific Name	2015	2017
Heron sp.	*Ardea sp.*	73	0
Mouse Deer sp.	*Tragulus sp.*	134	0
Sambar Deer	*Rusa unicolor*	784	38
Sunda Pangolin	*Manis javanica*	no data	2

Table 47. Unprotected Species (legal hunting), showing predicted annual offtake. See text for noted caution in comparing results between years.

English Name	Scientific Name	2015	2017
Asian Box Turtle	*Cuora amboinensis*	no data	0
Asian Water Monitor	*Varanus salvator*	no data	0

Black-headed Bulbul	*Pycnonotus atriceps*	117	0
Blue-crowned Hanging Parrot	*Loriculus galgulus*	2,459	45
Blue-winged Leafbird	*Chloropsis cochinchinensis*	874	0
Green Imperial Pigeon	*Ducula aenea*	219	91
Hill Myna	*Gracula religosa*	2,459	0
Leafbird spp.	*Chloropsis spp.*	7,524	79
Lesser Whistling Duck	*Dendrocygna javanica*	73	0
Magpie Robin	*Copsycus saularis*	2,188	42
Pink-necked green pigeon	*Treron vernans*	30,524	4,030
Reticulated Python	*Python reticulatus*	no data	0
Snake spp.	*Snake sp.*	no data	0
Soft-shell Turtle spp.	*Amyda cartilaginea?*	no data	0
Spotted Dove	*Streptopelia chinensis*	330	0
White-breasted Waterhen	*Amaurornis phoenicurus*	5,508	0
White-rumped Shama	*Copsychus malabaricus*	1,979	17
White-vented Myna	*Arcidotheres javanicus*	no data	0
Wild Pig	*Sus scrofa*	1,935	30
Yellow-vented Bulbul	*Pycnonotus goiavier*	8,580	0

In addition, the survey recorded incidences of species being kept in captivity, shown in Table 48. As noted above, this made used of an improved methodology, and so the results, despite being presented alongside previous results, are not directly comparable. As with the tables above, data from the survey is extrapolated into a prediction for the incidence across all villages.

Table 48. Species recorded being kept in captivity (indicating protected status). See text for noted caution in comparing results between years. 'Status' shows those species legally protected ('P').

English Name	Scientific Name	Status	Incident		Total
			2015		2017
Heron sp./Lesser Adjutant	*Ardea/Leptoptilos sp.*	P	2	0	0
Proboscis Monkey	*Nasalis larvatus*	P	2	0	0
Asian Glossy Starling	*Aplonis panayensis*		2	4	4
Blue-crowned Hanging Parrot	*Loriculus galgulus*		5	9	28
Flowerpecker spp	*Dicaeum spp.*		0	2	2
Green Imperial Pigeon	*Ducula aenea*		5	0	0
Hill Myna	*Gracula religosa*		7	4	4
Javan mynah	*Acridotheres javanicus*		0	4	4

Leafbird spp.	*Chloropsis spp.*		19	87	140
Lesser Whistling Duck	*Dendrocygna javanica*		2	0	0
Long-tailed Macaque	*Macaca fascicularis*		5	8	8
Long-tailed Parakeet	*Psittacula longicauda*		2	2	2
Long-tailed Shrike	*Lanius schach*		2	0	0
Magpie Robin	*Copsycus saularis*		19	45	57
Purple heron	*Ardea purpurea*	P	0	4	6
Raptor spp	*Unknown*	P	0	2	4
Sambar Deer	*Rusa unicolor*	P	0	2	4
Slow Loris	*Nycticebus coucang*	P	0	2	4
South Asian box turtle	*Cuora amboinensis*		0	4	66
Pig-tailed Macaque	*Macaca nemestrina*		2	0	0
Pink-necked green pigeon	*Treron vernans*		2	6	8
Slender-billed Crow	*Corvus enca*		2	0	0
Spotted Dove	*Streptopelia chinensis*		10	8	8
White-breasted Waterhen	*Amaurornis phoenicurus*		2	0	0
White-rumped Shama	*Copsychus malabaricus*		17	40	59
White-vented Myna	*Arcidotheres javanicus*		7	4	4
Yellow-vented Bulbul	*Pycnonotus goiavier*		5	0	0

As can be seen from the tables, the incidence of hunting remains varied between species, but overall levels were during this survey were significantly lower than the previous survey. The extent to which this is a result of the improved (hopefully more accurate) survey design, or a drop, cannot be concluded, but the latter is assumed to have had a large effect.

As before, a relatively low level of hunting was recorded involving protected species (illegal hunting) and the vast majority of these cases involved deer for which there is generally both a low awareness of its protected status under Indonesian law, and a long-standing tradition of exploitation. In future the project will seek to address this. In one case the hunting of Pangolin was acknowledged, whereas previously it was only suspected. The project will continue to stress the illegality of such hunting, in an attempt to put an end to the practice. It remains extremely difficult to enforce however, given the biology of the species, the size of the area, and the covert nature of the trade.

In terms of legal hunting, the distribution of species trapped remains typical. The bulk either relates to species caught for food (pigeons, pigs) or for the pet bird trade (Blue-crowned Hanging Parrot, leafbirds, Hill Myna, White-rumped Shama, Yellow-vented Bulbul). Controlling such remains difficult for the project, as it is both fully legal and typically conducted on land outside of the core project area for which a degree of control is available. The project will continue to seek to reduce the offtake of such hunting by education and outreach, and by monitoring access to the core project area. The suggestion of a drop in both numbers and offtake is at least consistent with this work being partially successful.

In terms of species kept in captivity, the number rose considerably from the previous survey, but this is also largely an artefact of the improved survey design. The *range* reflected the same range of species trapped, but with the addition of a number of thankfully restricted cases of keeping primates as pets. As above, the project will continue to work to educate local communities regarding the risks and costs of such practices in an attempt to reduce them further.

Based on two repeat hunting surveys we now have further experience with which to refine the methodology used. This will hopefully lead to greater confidence in the accuracy of the data collected, but in the short terms it may lead to results that, as here, make a robust comparison between years difficult.

5.1.4 High Conservation Values Protected (B2.4)

No negative impacts of the project on HCV values related to biodiversity were encountered. The project will continue to monitor and will propose and implement mitigation measures if needed.

5.1.5 Invasive Species (B2.5)

Species used in the rehabilitation of degraded areas within the project area during this monitoring period are non-invasive and native to Central Kalimantan.

5.1.6 Impacts of Non-native Species (B2.6)

Species used in the rehabilitation of degraded areas within the project area during this monitoring period are native to Central Kalimantan.

5.1.7 GMO Exclusion (B2.7)

No genetically modified organisms were used by the project.

5.1.8 Inputs Justification (B2.8)

Fertilizers, chemical pesticides, biological control agents and other inputs used by the project, and their potential adverse effects, are shown in Table 49.

Table 49. Fertilizers, chemical pesticides, biological control agents and other inputs used.

Name	Organic Fertilizer (mulch, compost, concentrate)
Justification of Use	Used to support small-scale agricultural crop development within existing community agricultural areas of the Project Zone, with a maximum applied area of just over 6 ha (63,000 m3)
Adverse Effect	None anticipated. This activity is entirely restricted to existing agricultural areas, and mirrors existing practice by local communities. Any effects are likely to be net positive, as the use of organic, rather than chemical fertilizers is being encouraged to replace the practice of stubble burning

	(which often leads to wildfires), and in addition, it improves livelihoods by reducing costs, and further reduces pollution and health risks.

5.2 Offsite Biodiversity Impacts

5.2.1 Negative Offsite Biodiversity Impacts (B3.1) and Mitigation Actions (B3.2)

All project activities were designed to deliver positive biodiversity impacts. As such, no offsite biodiversity impacts were anticipated or detected during this monitoring period, and no mitigation measure were therefore required.

5.2.2 Net Offsite Biodiversity Benefits (B3.3)

For reasons stated above in Section 5.1.1, no significant offsite biodiversity benefits were anticipated, or recorded, with the potential exception of reduced fire risk in the wider surroundings, relative to the baseline, and resulting from the project's activities to raise awareness of fire prevention measures.

5.3 Biodiversity Impact Monitoring

5.3.1 Biodiversity Monitoring Plan (B4.1, B4.2, GL1.4, GL3.4)

The results of the project's biodiversity monitoring, reported against the agreed monitoring criteria are given below in Table 50.

Table 50. Biodiversity MRV parameters. Showing recorded results in 2010-2015 (previous reports) and 2016-2017 (current reporting period).

Biodiversity criteria	Baseline scenario	With-project scenario	Relevant Monitoring Parameter:	2010 data	2015 data	2016 data	2017 data
Globally, regionally or nationally significant concentrations of biodiversity values (**HCV1**) Globally, regionally or nationally significant large landscape-level areas where viable populations of most if not all naturally occurring species exist in natural patterns of distribution and abundance (**HCV2**). Threatened or rare ecosystems (**HCV3**)	Under the baseline scenario (see Section **Error! Reference source not found.**) almost the entire project area (149,800 ha) would be cleared, drained and converted to industrial acacia plantations. This would have a catastrophic effect on the biodiversity value of the area as almost all of the key species present at the site are dependent on the presence of large blocks of undisturbed intact forest (see below). The continued presence of these species would become untenable. Outside of the project area, within the wider project	Under the project scenario the entire project area (149,800 ha) will be protected, and any degraded areas restored. This will ensure the long-term survival of the habitat and the species supported by it. Outside of the core project area, within the wider project zone, project activities will seek to protect and conserve all remaining intact forest areas, despite the project not having legal management rights. This will include working with communities, government and industry to maintain and enhance all current biodiversity values through sounds planning and by promoting	Number of incidence of illegal hunting	No data	26 hunters reported (63 predicted). 4 species.	No data	15 hunters reported (28 predicted). 2 species.
			Number of incidence of illegal logging	29	34	33	73
			Number of stump due to illegal logging	25,980 (Av 0.17/ha)	36,990 (Av 0.25 /ha)	83,207 (Av 8.9/ha)	97,531 (Av 10.4/ha)
			Volume of timber logged	5,532 m^3	4,451 m^3	14,626 m^3	18,215 m^3
			Number of flora and fauna hunted and kept	No data	48 hunters reported (117 predicted). 31 species. Number trapped/kept varying widely by species (see table)	No data	32 hunters reported (60 predicted). 20 species. Number trapped/kept varying widely by species (see table)
			Area of ecological disturbance (Encroachment, Illegal logging, etc.)	7,844 ha	7,844 ha	9,384 ha	9,384 ha
			Number of fire cases	8	165	0	0
			Area of fire scars	501 ha	9,794 ha	0 ha	0 ha
			Area of fire break	0 ha	1.2 ha	5.68 ha	0 ha
			Number of key species population	See section 8.3	See section 8.3	See section 5.1.3	See section 5.1.3
			Number of species	157 birds, 67 mammals, 49 herptiles, 111 fish, 312 plants	167 birds, 67 mammals, 49 herptiles, 111 fish, 312 plants	See 2017	192 birds, 68 mammals, 57 herptiles, 111 fish, 312 plants
			Distribution of key species	144,778 ha of suitable habitat	135,779 ha of suitable habitat	135,779 ha of suitable habitat	135,757 ha of suitable habitat

	zone, further degradation is also inevitable, including small-medium scale conversion of forest to agriculture, including oil palm plantations and drainage. Fire risk would remain very high. The negative effect of these impacts in terms of biodiversity would be multiplied by the loss of the core project area leaving only isolated fragments of natural habitat remaining none of which are likely to be able to support long terms viable populations of key species.	sustainable agricultural practices. As a result the project is anticipated to provide net positive benefits within the wider project zone both directly, through these activities, and indirectly through the complete protection of the core project area and the viable source populations of biodiversity contained within it.		(forest dependent species)	(forest dependent species)	(forest dependent species)	(forest dependent species)
			Number of trees planted in degraded forest areas	0	0	0	0
			Total area reforested in degraded forest areas	0 ha	0 ha	0 ha	0 ha
			Number of trees planted in agroforestry areas	0	97,000 (Project Zone)	0	595 (Project Zone)
			Total area reforested in agroforestry areas	0 ha	194 ha (Project Zone)	0 ha	5 ha (Project Zone)
			Number of trees planted in swampy areas	0	600 (Project Area)	0	19,670 (Project Area)
			Total area reforested in swampy areas	0 ha	1.2 ha (Project Area)	0 ha	150 ha (Project Area)
			Water level	Not planned this period	Not planned this period	Not planned this period	Not planned this period
			Area of peatland restored	Not planned this period	Not planned this period	Not planned this period	Not planned this period

5.3.2 Biodiversity Monitoring Plan Dissemination (B4.3)

Results of the biodiversity monitoring have been made publicly available on the internet through the routine publication of monitoring reports on the websites of CCBA, VCA and the Katingan Project. All monitoring reports have been made publicly available throughout the project zone, including English language summaries.

5.4 Optional Criterion: Exceptional Biodiversity Benefits

The project has generated exceptional biodiversity benefits based on multiple achievement of the criteria defined in the CCB Standards Third Edition. The project area also qualifies as a Key Biodiversity Area based on multiple criteria, following *Langhammer et al. (2006)*.

5.4.1 Trigger Species Population Trends (GL3.3)

During the reporting period, the project area supported five Critically Endangered species, 11 species listed as Endangered, and 36 species listed as Vulnerable (IUCN 2018). In almost every case the project area is likely to support considerably in excess of 30 individuals or 10 pairs; the criteria that would make the site a Key Biodiversity Area on grounds of 'vulnerability' following *Langhammer et al. (2006)*. Of these, in the case of two species, Orangutan and Proboscis Monkey, prevailing population estimates suggest the project area holds over 5% of the entire global population, far exceeding the 1% threshold that would define the site as a KPA on grounds of 'Irreplaceability' for a site that contains a 'globally significant source population' and also passing the 5% population threshold for species with a 'large but clumped population' following *Langhammer et al. (2006)*. It is likely that the site is of equivalent importance for a range of other species, but given the current lack of accurate population estimates for the more species, this cannot be determined with certainty. However, given that the project area represents around 3.6% of the remaining virtually intact peat swamp forest in Borneo, any species restricted in range to this habitat type is likely to qualify over the '1%' threshold. This included peat specialist species such as Bornean Southern Gibbon (Hylobates albibarbis), Hairy-nosed Otter (Lutra sumatrana), Malayan/False Gharial (Tomistoma schlegelii), and Red Balau Tree (Shorea balangeran).

Based on the KPA criteria, the project therefore contains a minimum of 52 species that qualify as Trigger Species (i.e. those triggering the KPA criteria). In the table below information is restricted to the 16 species that are listed as either Critically Endangered or Endangered. Those species listed as Vulnerable have been omitted to avoid excessive repetition, as the range of with- and without-project impacts are encompassed by those species listed.

Table 51. Trigger species population trends (only CR- and EN- listed species are included in the table, to avoid undue repetition).

Status	Species	Baseline	Status during 2016-2017 monitoring period
CR	Bornean Orangutan (*Pongo pygmaeus*)	Threatened by forest habitat loss and hunting. Population would be drastically reduced under the baseline scenario,	Core forest habitat has remained intact. Some habitat loss due to fire and illegal logging likely to have had a local effect, but as a mobile species the impact should

		further exacerbated by a likely rise in hunting of any remaining individuals, as usually accompanies commercial conversion.	be limited. Importantly no evidence was found of hunting, or of conflict between animals and farmers over crops, suggesting the local population should have remained stable. One incident of an animal being kept as a pet was recorded and is being addressed. For further details on population surveys, see Section 5.1.3 above.
CR	Sunda Pangolin (*Manis javanica*)	Threatened by loss of forest habitat and unsustainable hunting, mainly for the Chinese medicine market. Under the baseline such hunting pressure would likely increase as isolated forest fragments became more accessible.	Core project area has remained intact. Some circumstantial evidence of hunting, and one acknowledged report amongst 106 interviewed hunters. The project will continue to raise awareness of the illegality of hunting pangolin, and remain vigilant to the threat. It will work with the relevant authorities if and when cases are identified.
CR	White-shouldered ibis (*Pseudibis davisoni*)	Threatened by habitat loss, disturbance and hunting pressure. Under the baseline scenario this species is unlikely to survive.	Core project area has remained intact. No evidence of hunting offtake. This species has remained elusive during the entire project period, with still no confirmed sighting in the project area or zone.
CR	Kahui/Red Balau (*Shorea balangeran*)	Threatened by commercial over-extraction and general forest loss. This species would be lost from the project area and remain over-exploited within the wider project zone.	Core project area has remained intact. Likely to have suffered proportional loss from illegal logging, but not to extent of baseline scenario.
CR	Helmeted Hornbill (*Rhinoplax vigil*)	Threatened by habitat loss, disturbance and hunting pressure. Under the baseline scenario this species is unlikely to survive.	As a forest-dependent species the core project area has remained intact for this species, although sightings remain elusive. No evidence of hunting pressure, either anecdotal or confirmed, was found.
EN	Proboscis monkey	Threatened by habitat loss and disturbance, particularly along forested	The project has continued to protect the riverine forest areas used by this species, and the

	(*Nasalis larvatus*)	river borders. Such areas would be amongst the most negatively affected under the baseline scenario.	hunting survey found no evidence of ongoing hunting pressure, and no incidence of an animal being kept as a pet (compared to one incident in the last survey).
EN	Bornean Gibbon (*Hylobates albibarbis*)	Threatened by forest habitat loss. Population would be drastically reduced under the baseline scenario.	Core area has remained intact with no evidence of hunting offtake suggesting the population should have remained stable during this reporting period.
EN	Hairy-nosed Otter (*Lutra sumatrana*)	Threatened by forest habitat loss and hunting. Both likely to increase under the baseline scenario.	Forests and riverine habitat has been protected and no evidence of hunting offtake was detected. A survey specifically designed to collect data on this species will be implemented in 2018.
EN	Bornean Clouded Leopard (*Neofelis diardi borneensis*)	Threatened by forest habitat loss and hunting. Any remaining population would be drastically reduced under the baseline scenario.	Protection of forest within the core project area and wider zone will have ensured continued high population presence. No evidence of hunting offtake was detected.
EN	Flat-headed Cat (*Prionailurus planiceps*)	Threatened by forest habitat loss and hunting. Any remaining population would be drastically reduced under the baseline scenario.	Protection of forest within the core project area and wider zone will have ensured continued high population presence. No evidence of hunting offtake was detected.
EN	Storms Stork (*Ciconia stormi*)	Very vulnerable to forest loss, fragmentation and disturbance. This species would likely become locally extinct under the baseline scenario.	Core forests habitat has remained protected, particularly along small river and waterways, safeguarding the local population. No evidence of hunting offtake was detected. The species was recorded during the pilot camera trap survey (see Section 5.1.3 above)
EN	Bornean River Turtle (*Orlitia borneensis*)	Threatened by habitat loss and unsustainable hunting for food and the pet trade; both likely to increase under the baseline scenario.	Core project area including the species habitat has remained stable. No evidence of systematic hunting which is the key threat to this species.
EN	Spiny Hill Turtle (*Heosemys spinosa*)	Threatened by habitat loss and unsustainable hunting for food and the pet trade; both likely to increase	Core project area including the species habitat has remained stable. No evidence of systematic

		under the baseline scenario.	hunting which is the key threat to this species.
EN	White-rimmed Stingray (*Fluvitrygon signifier*)	This fish species inhabits freshwater areas. Increase of chemical use, sewage, and waste, as well habitat loss and overfishing are the major threats to its existence. All are likely to increase under the baseline scenario	The inland freshwater system in the project area remain protected from habitat loss and pollution. Overfishing is also being managed through an active patrol system, and the increased promotion of fish farming as an alternative.
EN	Asian Arowana (*Scleropages formosus*)	Used to be threatened mainly by overfishing for the ornamental fish trade, but now the threat has shifted to habitat loss and degradation (particularly fire), but likely to increase under the baseline scenario.	The inland freshwater system in the project area remain protected from habitat loss, fire and pollution. Overfishing is also being managed through an active patrol system, and the increased promotion of fish farming as an alternative.
EN	Meranti Semut (*Shorea teysmaniana*)	Threatened by commercial over-extraction and general forest loss. This species would be lost from the project area and remain over-exploited within the wider project zone.	Core project area has remained intact. Likely to have suffered proportional loss from fire and illegal logging, but not to extent of baseline scenario.

6 ADDITIONAL PROJECT IMPLEMENTATION INFORMATION

No additional project implementation information is necessary.

7 ADDITONAL PROJECT IMPACT INFORMATION

No additional project impact information is necessary.

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